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# Journal of • Virtual Worlds Research

Volume 2, Number 1.

Pedagogy, Education and Innovation in 3-D Virtual Worlds.

ISSN 1941-8477

**Vol. 2. No.1**  
**“Pedagogy, Education and Innovation in 3-D Virtual Worlds”**  
**April 2009**

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This issue was sponsored, in part, by the Singapore Internet Research Centre,  
the Department of Radio, TV & Film at the University of Texas at Austin,  
and the Texas Digital Library Consortium.

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jvwresearch.org ISSN: 1941-8477

Vol. 2. No.1

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## **Beyond the game:**

### ***Quest Atlantis as an online learning experience for gifted elementary students***

By Jackie Gerstein, Kaplan University, Argosy University

## **Abstract**

*Quest Atlantis (QA) is a learning and teaching project that uses a 3D virtual environment to immerse children, ages 8-15, in educational tasks. It allows users to travel to virtual places to perform educational activities known as Quests. The core elements of QA are: 1) a 3D multi-user virtual environment (MUVE), 2) inquiry learning Quests and unit plans, 3) a storyline involving a mythical Council and a set of social commitments, and 4) a globally-distributed community of participants (Barab, Arici, & Jackson, 2005). These inherently engaging environments are natural motivators for this age-level student, who can be considered members of the Club Penguin generation. To determine the perspectives of the users, themselves, a survey was conducted with a group of 35 gifted elementary students. The results, gathered through both closed and open-ended questions, identified the strengths and limitations of this media as a viable pedagogy for teaching more traditional content area subjects. Teacher observations of student behavior both in the real life classroom and in the online environment present additional insights how digital natives engage in and interact with this media. Implications for using virtual worlds such as Quest Atlantis for distance learning of upper elementary students are proposed.*

**Keywords:** virtual learning; elementary students; online learning; virtual worlds; Quest Atlantis.

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## **Beyond the game:**

### ***Quest Atlantis as an online learning experience for gifted elementary students***

By Jackie Gerstein, Kaplan University, Argosy University

Even though multi-user virtual environments (MUVE) are commonplace to gamers, this type of interface is rarely utilized for substantive teaching and learning, especially for students under 13-years-old (Dieterle & Clarke, in press). A few MUVEs have been developed for educational rather than entertainment purposes. One example is Quest Atlantis. Quest Atlantis (QA) is a learning and teaching project that uses a 3-D virtual environment to immerse children ages eight to fourteen in educational tasks. It allows these young users, called Questers, to travel to virtual places to perform educational activities known as Quests. These inherently engaging environments are natural motivators for this age-level student.

To determine the perspectives of the users themselves a survey was conducted with a group of thirty gifted elementary students from a school in southern Arizona. Student perceptions about the strengths and weaknesses of Quest Atlantis were gathered through both closed and open-ended questions. Teacher observations of student behavior both in the real life classroom and in the online environment, using Quest Atlantis and other learning technologies, provided additional insights how digital natives engage in and interact with this media. Implications and suggestions for using 3-D virtual worlds as a viable pedagogy for distance learning of upper elementary students are proposed.

#### **Quest Atlantis Overview**

As a learning and teaching project, Quest Atlantis combines findings from educational research with strategies from the gaming industry to immerse children ages eight to fourteen in educational tasks embedded within a 3-D multi-user environment. The students, called Questers, visit virtual worlds, perform educational activities, text-chat with other students and teachers, and develop virtual identities. The virtual space is organized into different 3-D worlds. By using their avatars, students move through these virtual worlds, meet the avatars of other students, participate in virtual activities, and explore different quests. By moving their avatars through the immersive environment, students travel to virtual worlds where they can read about and listen to the themes of these worlds, complete quests, and submit their responses as essays, slideshows, and art projects (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005).

Quest Atlantis possesses the characteristics of 3-D multi-user virtual environments in that it enables multiple simultaneous participants to: access virtual contexts, interact with digital artifacts, represent themselves through “avatars”, communicate with other users, and take part in experiences similar to those in real world contexts (Dede, Nelson, Ketelhut, Clarke, & Bowman, 2004). As an educational-based MUVE, Quest Atlantis has some unique properties: (a) inquiry-based learning Quests and unit plans, (b) a storyline involving a mythical Council and a set of social commitments, and (c) a globally-distributed community of participants (Barab, Arici, & Jackson, 2005).

Quest Atlantis situates this academic learning in the context of important social issues and aesthetically-rich dramatic play—establishing both a use and entertainment value for the learning activities. Only a few other virtual worlds have been developed with the intentional

goal of being educational platforms and that can be used by students under the age of thirteen: Whyville, River City, and McLarin's Adventures. A review of these MUVes can be found in Czarnecki (2008).

### ***Pedagogy and educational foundations***

Underlying the learning tasks, curricular units, and experiences of Quest Atlantis is a participatory framework that stresses hands-on action and reflection as components central to the learning process. This learning process is based on: experiential learning, inquiry-based learning, and portfolio assessment (Barab, Arici, & Jackson, 2005). In addition, all of the lessons, or quests, adhere to state academic standards and reinforce important information-literacy skills (Lau Whelan, 2005).

### ***Previous research***

The developers of Quest Atlantis from Indiana State University conducted a long-term study to explore the efficacy of Quest Atlantis. All of the 153 fourth- and fifth-grade boys and girls surveyed rated Quest Atlantis as more enjoyable than any learning activity in their lives. The researchers also found that students participating in Quest Atlantis showed significant increases over time in their learning retention levels. The researchers found that “The fact that we found statistically significant learning gains with respect to science, social studies, language arts, and metacognitive skills does indeed suggest that academic learning was occurring alongside of or in the process of the experience of playing.” (Barb et al., 2005, p. 19).

### **The Purpose of this Study**

The intent of this current research is not to explore the efficacy of Quest Atlantis, as Barab et al. (2005) demonstrated its usefulness as a learning tool. Instead, this study explores how upper elementary gifted students interact with Quest Atlantis to discover the specific elements that can lead to enhanced learning. Additional observations about student use of in-class and online media also provided insights on how virtual worlds can be developed to meet the learning and developmental needs of the upper elementary school population. New Media Consortium (2009) suggests, “The success of game-based learning strategies owes to active participation and interaction being at the center of the experience, and signals that current educational methods are not engaging students enough.” These observations provided insights by which to make recommendations for using virtual worlds as online learning venues.

Current research of Quest Atlantis and other educational 3-D virtual learning environments indicated positive results in terms of student engagement and achievement (River City Research Team, n.d.). In order to increase efficacy and develop credibility, these learning venues need make concerted efforts to identify those individual learning components and elements that resulted in the increased achievement. As de Freitas (2008) explains, “It is important that we ready ourselves for the wider spread of learning in immersive worlds and identify, and where necessary, develop the best methods for use, evaluation, validation and accreditation in our institutions” (p. 6).

## The Population

Gifted third through fifth grade elementary students from a school district in Arizona receive gifted services through a pull-out program. Students from the district's three elementary schools come to a single location for one day per week of gifted programming. Fifty-five students receive services with fourteen fourth and fifth graders on Mondays, another group of sixteen fourth and fifth graders on Tuesdays, twelve third and fourth graders on Wednesdays, and thirteen third graders on Fridays. Afternoons are devoted to computer-based learning of which Quest Atlantis is a component. Participation in Quest Atlantis is voluntary. The students were provided with a formal introduction to Quest Atlantis through the legend video, and a mini-tour of the virtual world by the teacher.

## Survey of Student Beliefs

The subjects included thirty of the thirty-five students who voluntarily participated in Quest Atlantis. The survey group took a ten-item online survey using PollDaddy. Their responses were anonymous. The demographic data included their gender and age. This group consisted of fifteen boys and fifteen girls with two 9-year-old boys, eleven 10-year-old boys, two 11-year-old boys, two 9-year-old girls, eight 10-year-old girls, and five 11-year-old girls.

When asked to rate Quest Atlantis on a scale from one to five, thirteen (or 43 percent) of the students rated it as five – “It is one of the best learning games I've ever played”; twelve (or 40 percent) of the students rated it a four – “It is a lot of fun”; and five (or 16 percent) of the students rated it as a three – “It's fun - not the greatest, but fun.” No students rated it with the lowest ratings of two or one. The previous research by Barab et al (2005), discussed earlier, indicated a 100 percent high satisfaction rate with Quest Atlantis. The discrepancy between their research results and this one may be due to the rapidly occurring technology advances with major companies like Disney and McDonalds producing virtual worlds for kids. The 3-D virtual worlds have highly sophisticated interfaces. Quest Atlantis, when it was conceived made use of the best technologies of its time, but now may lack the sophistication that these young people expect. This will be further discussed in the Implications and Recommendations section.

When asked the open ended question, “What do you like best about Quest Atlantis?,” the most cited response was going on Quests (N = 12), followed by a reference to talking and interacting with others (N = 10), learning new things (N = 7), earning clothes and cols (N = 4) and saving the world (N = 2).

Some of the most valuable and interesting responses came from the question, “What is the one BIG thing you learned from Quest Atlantis?” Responses included:

- *Caring and Stewardship*: “I think it has taught me a little bit about caring for the world.” “To keep the world safe.” “I learned that it is good to recycle, and help out.” “How to help the environment.” “To be more of a environmentalist.”
- *Respect for Others*: “No teasing.” “That you shouldn't be mean to other people and treat things with respect.” “To be nice to others.”
- *Going Beyond Self-Perceived Limitations*: “That I can do things that I think I can't. Like there were a few missions I kept saying I couldn't do then I did it!”

- *Creativity*: “It’s fun to learn about art when you are in the creative expression project.” “I learned about being creative.”
- *Computer Skills*: “The internet can be a good thing.” “That computers CAN be fun. Before quest, I didn't really understand computers.”
- *Commitment*: “That commitments are VERY important.” “I learned about Social Commitment.”

These learnings identified and generated by the students were congruent with the goals of Quest Atlantis developers.

The most cited response when asked, “What is the worst thing about Quest Atlantis?” related to its difficulty – “The directions are hard to understand,” “The worst thing about Quest Atlantis is that it is really difficult to figure out things if you do something wrong,” “It’s hard to find places,” “Getting lost,” and “Getting where you want to go.”

Finally, the students were asked, “If games like Quest Atlantis were used by all teachers to help teach your school subjects, what advice would you give to the game designers?” Their response included the following:

- *Interactions with Teachers*: “Tell about school subjects (math, writhing, language arts, etc.) and make classrooms where a teacher is in each and they give you a school subject quest.” “To let teachers interact with students online.”
- *Difficulty Level*: “You would have to make it easier for those that can’t really think out side of the box and that are younger.” “Try making it a little bit easier for kids.” “To make more quests that are hard, and to make it so it seems educational.” “Better directions.” To maybe make it a little easier because some kids who aren't in gifted may have a hard time with it.” “I would just say to maybe make different levels of difficulty so that maybe more advanced Questers are able to really enjoy the game and be challenged at the same time.”
- *Content Based*: “To make the games just like this with more reading and math.”
- *Online Safety*: “You should have monitors to prevent someone saying their address, phone number, or email.” “Create chat censors.” “I would tell them to block bad talking.”
- *Virtual World Environment*: “To make better graphics (no offense) so people will go on more.” “Let the children completely customize their avatars.” “To put things that help you learn but have fun, too.” “To make a lot of extra things.”

### Observations of Student Behavior

Previous research by Barab et al. (2005) about Quest Atlantis was survey and outcome-based. This study was unique in that the students’ daily interactions with learning mediums were directly observed. Observations included Quest Atlantis, use of Web 2.0 tools, and hands-on activities. For a one month period, the teacher/researcher would record student comments and behaviors while they interacted with these media.

Naturalistic observations of student behavior as they interacted with and within this virtual world were accessible due to the learning environment. First, as stated earlier, participation was voluntary. Second, except for providing a time during the school day to participate in Quest Atlantis, no other restraints, guidelines, or restrictions for participation were

given. In fact, students working side by side with other students were permitted to ask one another for assistance if they ran into difficulties. These “face-to-face” student-to-student, real-time interactions while they worked on their own quests and missions allowed for teacher observations as they interacted with the media and with one another.

Consistent from student-to-student and class-to-class were the following findings.

### *Age and developmentally appropriate*

Even though Quest Atlantis has been designed for 8- through 14-year-olds, all of the third grade students, ages eight and nine, and some of the older students had difficulty with the program – noting that these are gifted students. Both the student surveys and classroom observations confirmed this. The difficulty level was mentioned by five (or 16 percent) of the students in the open-ended responses about the worse thing about Quest Atlantis. Understanding the written directions presented in the missions and then following through with these directions proved difficult for this age group. Similar difficulties were observed when this age group attempted to build Lego robotics following the direction books, a task much easier for the fifth graders, ages ten and eleven.

This difficulty may be attributed to their development level. According Jean Piaget, most of these students are functioning in the concrete operational stage of development with the younger students just entering into this stage. Learning experiences, during this stage, are associated with personal experience in concrete situations. The limitation of the concrete operation stage of cognitive development is that operations are only carried out on concrete objects, and limited to two characteristics at the same time (Lin, 2002). Following multi-step and complex directions is difficult for the concrete operational thinker.

### *Hands-on and concrete learning experiences*

In the survey, the students were provided with a series of learning activities and asked to choose which one would prefer to do during class time. These choices were (1) play Quest Atlantis, (2) do other online activities, (3) make something with art materials, (4) play board games, or (5) use the Legos. Seventeen of the students stated “play Quest Atlantis,” twelve identified one of the real life hands-on activities, and one stated another online activity. Interestingly, a discrepancy was seen between their reported behavior and their actual classroom behavior. In any given task in which a choice is given to do that task as a hands-on or a computer-based activity, the students almost always selected the hands-on activity. These results – the preference for hands-on, real life activities – are congruent with the characteristics of the concrete operational learner in that they learn through logical and systematic manipulation of symbols related to concrete objects (Huitt, & Hummel, 2003). McAnarey (1978) believes, “Piaget’s research clearly mandates that the learning environment should be rich in physical experiences. Involvement, he states, is the key to intellectual development, and for the elementary school child this includes direct physical manipulation of objects” (p. 33, as cited in Haury & Rillero, 1994).

### ***Personal identity***

The students immediately and strongly connected with their avatars. Examining their initial avatars was the first thing they did upon their first entrance into the virtual world and seeing their avatar names over their heads created great joy and excitement. Quest Atlantis gives all entering students the same avatar only differentiated by genders. After completing their initial quests, they can modify their avatars giving them some personalized features and clothing. This is a great motivator and accomplishment for the students. This need for personalization continued as students went on quests and did “jobs” in order to buy more clothes and personal items for their avatars. These observations were consistent to the Quest Atlantis designers’ experiences. Their virtual persona has been shown to be a powerful motivator for engaging participation in online worlds (Barab, Arici, & Jackson, 2005).

### ***Working for the rewards – Missions completed and cols earned***

By completing Quests, students earn cols, the in-world currency. These points can be exchanged at the Trading Post for items such as QA stationery, stickers, and pins, and even trading cards about famous people (Barab, Thomas, Dodge, Cardeaux, & Tuzun, 2005).

As shown in the student survey, all students checked that they liked earning cols. Their real time discourse as they worked side by side in Quest Atlantis often included explanations about how to earn cols. For example, when one student learned how to jobs for cols in Quest Atlantis, the students eagerly began showing each other how to do so.

### ***Low tolerance for frustration but high ability for persistence***

This is the generation of instant gratification. While participating in the Quest Atlantis activities, students expected to be able to move easily through the learning activities, interface, and virtual world. If one of these areas proved difficult, most students moved quickly to another task. Problems finding an in-world object or location led to loudly expressed frustration and an avatar running in all directions. These frustrations were not due to the learning tasks themselves but to lack of understanding the tasks, the inability to find objects and locations, and/or technology problems. Almost paradoxically, though, when students were able to progress through their learning tasks, they did so with great concentration for long periods of time.

### ***Students as mentors***

The instructional model used in this classroom during most of the learning activities revolves around students seeking understanding from one another. It is a students-as-mentors model. As self-pacing is built into Quest Atlantis and encouraged by the teacher, the students easily shared their expertise with one another. This student behavior is consistent with what Jenkins, Clinton, Purushotma, Robison and Weigel (2006) describe as the participatory culture of the twenty-first century. A characteristic of a participatory culture is some type of informal mentorship whereby what is known by the most experienced is passed along to novices (Jenkins et al., 2008).

## Virtual Worlds As Online Learning: Recommendations and Future Research

This study provided observable and detailed information about how upper elementary students interact with a virtual world containing strong instructional content. What began as a simple survey to explore how one group of gifted elementary students perceived the value of Quest Atlantis evolved into a more naturalistic study about how these students interact with this media as well as with other technological and non-technological instructional media in the classroom. These observations coupled with my ten year background teaching online college courses provided some insights and related recommendations about how 3-D virtual worlds can be used as a powerful media for online learning by upper elementary students. Given the age and developmental characteristics of this age group, recommendations include the following:

### *Pedagogy before technology*

Sarah Robbins has stated that the pedagogy should come first then the technology. Concerning this generation of students, she says, “If we can bring our learning pedagogy to closer to where they choose to be voluntarily, we’ll get then closer to where we (the teachers) want them to be. It is easier to go where they are and bring them back to where we want them to be” (Robbins, 2008). Barab et al. (2005) echo that thought in their discussion of Quest Atlantis, “Our goal is not to rid the educative experience of hard work or even traditional learning practices. However, we believe that hard work should and can occur in the context of an activity to which the student is already engaged” (p. 19).

Anderson (2008) believes that the use of virtual worlds as learning environments will require a pedagogical shift by educators, writing that, “Content-rich curriculum can be developed using virtual worlds but it will require the teacher to make a pedagogical shift. This shift will necessitate a move away from reliance on heavy direct instruction to a more constructivist learning environment where students work at their own pace and instruction is tailored to the individual” (p.8).

This constructivist and student-centric educational philosophy represents powerful pedagogy, whether in the classroom or in a virtual world with principles that include:

- Knowledge is constructed, emergent, situated in action or experience, distributed;
- Reality is a product of mind;
- Meaning reflects perceptions and understanding of experiences; and
- Symbols are tools for constructing reality. (Jonassen, Peck, & Wilson, 1999).

The developers of Quest Atlantis were very intentional about designing their learning environments and tasks around a constructivist methodology. Developers of MUVes as learning platforms would gain valuable insights about these foundational pedagogies by reviewing the works of Sasha Barab and his colleagues.

Given their student population and content area, teachers will need to develop a foundational pedagogy to promote optimum ways to enhance the learning experience (deFreites, 2008). As with any learning task, then, the educator needs to determine first the desired outcome; second, the type of pedagogy that would increase the chances of those outcomes being achieved; and finally, those tools that would best serve that pedagogy. Villano (2008) suggests,

“The reality is that the responses to these options will be different for every educator in just about every subject. It’s up to each instructor to discover how the new technologies will serve his or her curriculum best”. Although seductive in nature, the tools themselves should never take precedence over the goals of learning. While MUVES are excellent venues for bringing together the use of a range of different media (e.g., streamed video and audio, email, live chat, social network software, and mind mapping software), questions remain as to how best to integrate these media to support enriched learning experiences (de Freitas, 2008). The 3-D virtual world itself, along with all the tools available within that world should be used very strategically to achieve specific goals and outcomes.

Marzano and Pickering (2004) wrote *Classroom Instruction That Works*, a collection of effective strategies culled from a meta-analysis of decades of research on what works in classrooms to improve student learning and increase student achievement. These were not proposed for virtual worlds but have application for these environments. They provide a framework around which some sound instructional practices and pedagogy can be built. What follows are their nine essential strategies along with examples of possible technology tools that can be used in virtual worlds to support these strategies.

<b>Essential Nine</b>	<b>Technology: Example Tools</b>
Identifying Similarities and Differences	<ul style="list-style-type: none"> <li>• Use of interactive and 3-D Graphic Organizers such as Exploratree.</li> <li>• Group chats.</li> <li>• Creating own audio and video recordings.</li> </ul>
Summarizing and Note Taking	<ul style="list-style-type: none"> <li>• In-world note taking with the use of tools such as inventory notecards, virtual sticky notes.</li> <li>• Blogs, Wikis, and Ning Networks.</li> </ul>
Reinforcing Effort and Providing Recognition	<ul style="list-style-type: none"> <li>• Effort and recognition provided through a reward system for completing assignments.</li> <li>• With Quest Atlantis, by completing Quests, students earn cols as the in-world money, get lumens that increase status in world.</li> </ul>
Homework and practice	<ul style="list-style-type: none"> <li>• The use of Quests or the learning tasks require independent work and practice.</li> <li>• Submission of assignments for review by the teacher.</li> </ul>
Nonlinguistic representations	<ul style="list-style-type: none"> <li>• In-world simulations.</li> <li>• Creating photo essays of in-world experiences.</li> <li>• Creating “builds” symbolizing most significant learning experiences.</li> </ul>
Cooperative Learning	<ul style="list-style-type: none"> <li>• Co-Questing.</li> <li>• In-world collaborative projects.</li> </ul>
Setting Objectives and Providing Feedback	<ul style="list-style-type: none"> <li>• Self-selection of Quests and learning tasks.</li> <li>• Student electronic profile, learning record and artifacts. In Quest Atlantis, this is the Q-Pod.</li> <li>• In-world voting tools and polls.</li> </ul>
Generating and Testing Hypotheses	Through strategically designed in-world simulations and Quests Quest Atlantis examples include Taiga: Water Quality, Virtual Mesa Verde, Plague World, Biological Indicators, Two Cells, One World Mission (Quest Atlantis Teacher Resources).
Questions, Cues, and Advance Organizers	<ul style="list-style-type: none"> <li>• In-world maps, mind maps, notecards, signs.</li> <li>• In-word multimedia mash-ups.</li> </ul>

(Adapted from Sandler, n.d.)

Interestingly, the students observed using Quest Atlantis were naturally drawn to or developed strategies that paralleled Marzano and Pickerling's (2004) research-based strategies. One student, in his survey response about how to make Quest Atlantis better, stated, "There is no map. I would make a map." He needed a cue, an advance organizer of sorts. Also, as described earlier, this group of students created their own collaborative experiences within Quest Atlantis even though formalized in-world venues for collaborative learning did not exist.

### *Drawing knowledge from higher education distance learning*

Distance online learning in higher education has a longer and broader history than K-12 virtual learning. Several higher education practices can be applied to using virtual world learning for upper elementary students.

- *Online Learning is Not for Every Student.* Villano (2008) explains that, "Not every student embraces virtual learning environments, and experts warn that educators must be careful not to abandon traditional teaching methods as they embrace MUVes". With all the press on digital natives, what follows may be an assumption that all kids use and enjoy twenty-first century technologies. This is not the case. There are still students growing up in a world of technology who do not enjoy nor use computers and the internet, especially for learning. Just as with adult learners, the face-to-face, in class learning environment, with only limited and supplementary technology, is the best choice for this population of elementary-aged students.
- *Submitting Assignments Via an Online "Dropbox."* A unique aspect of Quest Atlantis that does not exist in other MUVes is that the students' work on quests is submitted directly to the instructor through an interface integrated with the client software. In other words, all completed quests go directly into the teacher's toolbox with no additional steps required by the student nor the teacher. Interestingly, as part of the back story, students believe that their quest assignments and reflections are being submitted to the Atlantis Council for review. Both the content-based findings and the personal, process-oriented reflections are assessed by the teacher (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005). This allows for specific feedback to be provided to the students regarding the quality of their work. The instructor then has the option to accept the assignment or request a revision, a built-in aspect of this interface. This is a similar structure used in online college courses. Students submit assignments via the "dropbox" or discussion board. Feedback is provided and the college student has the option to revise. Both of these venues support mastery learning, a model based on feedback being growth-promoting.
- *Discussion Boards.* The typical college online class promotes student-to-student interaction and feedback. Quest Atlantis has a real time chat board and email capabilities, but it is structured more for social, rather than educational, networking. Students cannot easily view and discuss one another's Quests or assignments. Quest Atlantis and similar learning platforms could be enhanced by including a type of dropbox and discussion area whereby students could view and discuss one another's work. The discussion board or chat area then becomes a venue for discussing the content and quality of the work rather than one used for socializing. This supports a key finding of this research in that students enjoy mentoring one another.

### ***Real time social interaction***

One of the key draws to the twenty-first century technology is social networking. Online learning's capacity to foster interaction and collaboration among a diverse and geographically dispersed group of students is among its most positive attributes (Watson & Gemin, 2008). This is supported by the survey findings in that several students referred to the social aspects of Quest Atlantis as being the best thing about Quest Atlantis, stating, "You can interact with other people" and "It's a fun place to hang around and with your friends."

Calongne (2008) noted that one of the benefits of virtual world learning over traditional classroom learning is the emphasis on interaction, real-time discussion, and shared experiences, with the addition of back-channel communication features such as with chats and instant messaging. As such, it is recommended that Quest Atlantis and similar learning venues include a more strategic use of real time discussions and chats.

A key highlight of this research was the richness of student-to-student interactions when working on their missions in the same physical environment. An increase in student use and enjoyment of Quest Atlantis occurred when students worked side-by-side interacting with one another simultaneously in person and in the virtual worlds. Their expressed joy in their Quest Atlantis experience increased when they shared their experiences and did troubleshooting problems with one another. A very exciting and entertaining student-to-student interaction occurred was when students arranged to have their avatars meet up in the virtual world so they could lead one another to various in-world locations - avatars following each other in-world while conversing about it in the real world.

Virtual worlds as online learning experiences can be enhanced if groups of students can work together in real time in the same physical workspace and/or if the online platform had more immersive workspaces for real-time interactions. A possible solution could be giving students their own individualized learning areas similar to the virtual office space found at Meetsee, where the avatars have the capacity to showcase their work, and interact with other student avatars in their own personalized learning home areas.

### ***Collaborative projects***

Quest Atlantis has the capacity for co-questing – the ability to work together on Quest responses – but the Quest team admits that it is complicated and that they are working on a simpler system. The Quest Atlantis developers are headed in the right direction by creating the means for students to work together on their Quests. When given the opportunity to work alone or with other students, students in this age group almost always choose to work with others. Recommendations for 3-D virtual learning platforms include setting up collaborative, project-based learning experiences or quests. Examples include Virtual World Webquests whereby each student in the group takes a different role in order to successfully complete the Quest (see Anderson, 2008).

### ***Rich and timely feedback guidance***

Cavanaugh (2008) noted that the heart of technology-mediated teaching and learning is the interactions that happen within a virtual learning environment, "Just as in the classroom,

online learning is enhanced when teachers are actively involved in the learning process. In the absence of meeting face-to-face at established times, frequent communication, feedback, and scheduled tutoring or skill checks are needed". In the survey results, several students expressed the desire to have interactions with teachers in Quest Atlantis. This actually means more work for teachers, as they are required to support students undertaking quests and review student work (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005).

### ***Rich immersive interactivity***

Virtual worlds for kids have become big business. More than 150 virtual world sites focused on the 18-and-under youth market sprang up in the last couple of years, according to research from Virtual Worlds Management (Keefe, 2008). The rapidly emerging virtual worlds are increasingly becoming more sophisticated. In other words, these big companies keep "upping the ante" in order to attract this young age group. Quest Atlantis, which was very unique at the time of its development, appears to have an older interface based on the perspectives of the students. One student commented that Quest Atlantis could be improved by, "making better graphics so people will go on more." The overriding recommendation, then, is that any 3-D virtual learning environment will need to reflect the trends being spearheaded by the business industry. These advances will not only keep the interest and motivation of the student, but also ensure that the best learning technologies are available to the learner. These more advanced technologies can help in the evolution and development of rich and immersive simulations that have the potential for advanced learning.

### ***Hands-on and movement activities***

Based on the work of Piaget and confirmed by this research, students aged eight to twelve still prefer hands-on activities to computer-based ones. This is developmentally appropriate for this age group. Huitt and Hummel (2003) state that, "It is recommended that teachers use a wide variety of concrete experiences to help the child learn (e.g., use of manipulatives, working in groups to get experience seeing from another's perspective, field trips, etc)". Dede (2009) stated that "the more a virtual immersive experience is based on design strategies that combine actional, symbolic, and sensory factors, the greater the participant's suspension of disbelief that she or he is "inside" a digitally enhanced setting" (p. 66). This is especially relevant for the concrete learning style characteristic of this age group. In order to address movement needs, 3-D virtual world environments could include actual physical movement in real life – possibly with some form of very popular and age appropriate Wii Fit – a peripheral movement-based tool that is integrated with the client software.

In order to address their need and desire for hands-on activities, students can complete real life, hands-on projects and showcases their activities within the virtual world. Quest Atlantis has integrated some real world activities into some of the Quests. Some quests require that students participate in the real world through conducting environmental field studies, interviewing families and friends, researching community problems, examining current events, writing autobiographical anecdotes, producing advocacy media, or developing real world action plans (Barab et al., 2005). It is recommended that developers also include additional kinesthetic activities.

### ***Student directed learning***

As deFreitas (2008) has noted, “the opportunities for learners to meld and define their learning experiences or pathways, using the virtual mediations within virtual worlds, has the potential to invert the more hierarchical relationships associated with traditional learning, thereby leading to more learner-led approaches based upon activities” (p. 6). Based on classroom observations, this appeared to be one of the best attributes and biggest draw for this group of students. They liked working through the Quests at their own pace, choosing which ones they wanted to completed, and choosing other Quest Atlantis related activities such as building, chatting, and emailing one another.

### ***Students as co-producers of content, interface, and the virtual world***

Students have an active role in Quest Atlantis as a form of digital media in which they are positioned as the true producers (Dodge et al., 2008). Beyond a simple curriculum, Quest Atlantis engages them in a set of participatory opportunities in which they were both producers and consumers of the environment. The example that Dodge et al. (2008) provide is that students can produce content that is used by other children. This takes the form of suggestions for Quests.

With the advancements in technology, the role of the student as a producer has to be re-conceptualized in terms of applications to virtual learning. Recent developments in emerging technologies have given young users the ability and skills to also produce the virtual-based interfaces. They can help build and populate the virtual world itself. Students can produce media that includes (but are not limited to) blogs, wikis, RSS, tagging and social bookmarking, music-photo-video sharing, mashups, podcasts, digital storytelling, virtual communities, social network services, virtual environments, and videoblogs (Reinhart, 2008). As Robbins (2008) suggests, “We need to learn to embrace more participatory pedagogy if we’re to make the most of the technologies that are available to us”.

The research group was observed embracing programmable technologies such as Scratch and Pico Cricket, with excitement and full engagement. During computer time, these 9- to 11-year-olds also made movies, created electronic books, and developed their own online games. The skills and passion of the Club Penguin generation should become part of their learning experiences in virtual worlds. This is taking the students-as-a-producer, proposed by the developers of Quest Atlantis, one step further. They should be permitted and encouraged to produce some of the more technical content. The learner then becomes a producer of content with control over how the environment looks and how social interactions are supported. They become further invested in their learning process. deFreites (2008) explains that, “For learners, the future holds a vision of increased interactivity with virtual environments and more engaging learning experiences relating to production of content as well as information access” (p. 33). Dede (as cited in Pruitt, 2005) sums it up nicely “Instead of synthesizing information, neomillennial learners will synthesize and process experiences. Instead of being taught passively, kids will learn actively, using experiences online and in the real world. They will help to design their own virtual learning environments, and sometimes even ask the questions they must answer”.

## Conclusions

We are living in a mash-up world of highly immersive, quickly developing types of media. As the New Media Consortium (2009) explains, “A recent survey by the Pew Internet and American Life Project found that massively multiplayer and other online game experience is extremely common among young people, is rich and varied, and that games offer opportunity for increased social interaction and civic engagement among this group”. The majority of young people under 18-years-old are coming to school using immersive kinds of applications daily and therefore have different expectations about how education should be delivered to them. deFreites (2008) suggests, “With the proliferation of virtual worlds, more educational uses and dedicated education-based virtual worlds will continue to emerge supporting different and more specialized learning scenarios, enabling the formation of conceptual skills and greater reflection” (p. 30).

Observation of this group of gifted upper elementary students demonstrated that they easily adapt to new technologies, find those that are engaging, and move quickly from those they do not. The literature shows and the students demonstrate a propensity towards situated and immersive learning environments, although hands-on, real world experiences are still preferred by these students. Even though they are growing up digital, the developmental needs of the eight to twelve age group include the use of concrete and hands-on experiences.

The course and content developers of these online programs need to continually assess how to use technologies in order to make the virtual worlds simulate real life learning. Technology-based pedagogies need to address these students as active users and producers of their content, who learn best by movement and hands-on experience. Developers of programs such as Quest Atlantis have to find ways of incorporate tactile, kinesthetic, and sensory experiences into their 3-D learning experiences as these technologies continue to evolve.

Much press has been given to this generation as digital natives. This term does not fully describe the Club Penguin generation who are experiencing and who are expecting rich, realistic, engaging, and immersive technologies. Quest Atlantis has a well-conceptualized and actualized foundational pedagogy based on social responsibility and inquiry-based learning. But the developers of 3-D virtual learning environment will have to continually assess the developmental characteristics, user-patterns, and expectations of this generation, as well as stay current with the 3-D virtual technologies targeted at this population.

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