

A Cross Case Analysis of Two Out-of-School Programs Based on Virtual Worlds

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ABSTRACT

There is renewed interest in out-of-school programs for informal learning as a way to complement or supplement formal classrooms. Compelling evidence of learning in the context of virtual worlds is emerging, but few empirically detailed comparisons of programs based on such technologies exist. This article presents a cross-case analysis conducted on two out-of-school programs based on virtual environments involving Global Kid's "I Dig Science" situated in the virtual platform Teen Second Life and Games, Learning & Society Program's "Casual Learning Lab" based on the massively multiplayer online game World of Warcraft. Ethnographic methods were used for data collection across both in-game and face-to-face contexts at both sites with virtual and face-to-face data collection techniques used in combination. Analysis involved a code set of eleven a priori themes based on the shared goals of each program, resulting in 44 codes total. In this paper, the authors detail contrasts between the two programs in terms of argumentation, problem-solving, information literacy, and workplace skills, highlighting differences between the two programs in terms of their contrasting "locus of intentionality" (designer versus participant) and concluding with a set of "petite generalizations" in the form of design heuristics for future virtual worlds based programs.

Keywords: *Cross-Case Analysis, Intentionality, Massively Multiplayer Online Games, Out-of-School Programs, Virtual Platforms, Virtual Worlds*

INTRODUCTION

There is renewed interest in out-of-school programs for informal learning as a way to complement (if not supplement) formal learning in classrooms (Afterschool Alliance, 2004;

"Home Alone," 2009). Recent calls from the White House for an expansion of effective after-school programs (Obama, 2009) coupled with an increased desire to not simply do "more of the same" (Smerconish, 2009) have led to increased attention to innovative informal spaces, including those leveraging new technologies for learning. One technology of particular interest

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has been 3D multi-user environments, including both massively multiplayer online games (MMOs) and virtual worlds. In the next ten years, 22% of global broadband users will have registered to inhabit at least one such world online (“Virtual worlds projected to mushroom,” 2008). Additionally, in a recent report it is forecasted that there will be around 500 virtual worlds in existence by the end of 2011 (KZero, 2011). Commercial worlds such as *Second Life*, *There.com*, and *World of Warcraft* – along with intentional learning environments such as *River City* (Nelson & Ketelhut, 2008), *Quest Atlantis* (Barab, Arcici, & Jackson, 2005), and *Whyville* (Fields & Kafai, 2009) – have become “evocative objects” for educators interested in using technology as a means for fostering social interaction, increasing motivation and engagement, and enabling quasi-authentic scientific inquiry in the context of virtual environments instead of real ones. Compelling evidence of learning in the context of virtual worlds is beginning to emerge, but few empirically detailed descriptions of programs based on such technologies exist to date, let alone comparisons among the varying approaches taken in terms of structure, methods, or participant outcomes.

This article presents a cross-case analysis conducted on two such out-of-school programs based on virtual environments. The sites studied in this work – Global Kid’s (GK) “I Dig Science” curriculum in the context of the virtual platform *Teen Second Life* and Games, Learning & Society Program’s (GLS) “Casual Learning Lab” based on the massively multiplayer online game *World of Warcraft* – were selected for their comparable use of technology platform (i.e., virtual world) and desired pedagogical outcomes yet contrasting approaches to instructional design. Using a shared theoretical framework based on the instructional goals of both programs to analyze ethnographic data from both sites, we attempt to tease out the similarities and differences in the forms of learning that took place in each context and their relationship to the instructional context of each case. In what follows, we present an overview of the research literature on programs

for learning based on virtual worlds, detail the data collection and analysis methods used, and discuss our cross-case findings in terms of the two programs’ shared goals. We conclude with an overview of the “petit generalizations” (Stake, 2003) we draw from this work and potential considerations for future educators interested in leveraging virtual worlds for intentional learning.

LITERATURE REVIEW

Virtual worlds are online persistent digital worlds inhabited online by participants via digital characters (avatars) that represent a physical environment, either fantastical or real. *Narrative virtual worlds*, such as massively multiplayer online games like *World of Warcraft* (WoW), are virtual spaces crafted to represent some coherent fictional environment (typically science fiction or fantasy based); *non-narrative virtual worlds*, such as *Teen Second Life* (TSL), are more-or-less realistic looking virtual spaces where players can engage in a variety of activities that range from social interaction to content creation to entrepreneurial business development. Both have a perceptive visual space, in-world natural laws (e.g., gravity, object permanence), and avatar movement and communication; however, whereas the former tends toward game type environments, the latter tends toward simulations. Yet, both have dual status as both designed object and emergent culture (Steinkuehler, 2006), functioning, on the one hand, as technological platforms with particular affordances yet, on the other hand, as cultural spaces with their own shared understandings, practices, and worldviews. Productive research on virtual worlds and learning tends to locate at this intersection, examining the knowledge and practices afforded by a given technological platform but made meaningful the people who use it.

Previous research on virtual worlds includes studies of identity development and representation (Beals & Bers, 2009; Boyd, 2008; Raessens, 2006), race and gender (Devane &

Squire, 2008; DiSalvo, Crowley, & Norwood, 2008; Hayes, 2007; Heeter, Egidio, Mishra, Winn, & Winn, 2009; Higgin, 2009), collaborative problem solving (Steinkuehler, 2005, Sefton-Green, 2004) and forms of apprenticeship (Steinkuehler, 2004). Their potential for learning in particular has been documented across several domains including literacy (Lowood, 2006; Steinkuehler, 2006, 2007, 2008; Black & Steinkuehler, 2009), informal science reasoning (Steinkuehler & Chmiel, 2006; Steinkuehler & Duncan, 2009), mathematics (Steinkuehler & Williams, 2009), computational literacy (Postigo, 2007; Steinkuehler & Johnson, 2009), information literacy (Martin & Steinkuehler, 2010), and social/ethical reasoning (Consalvo, 2009; Lastowka, 2009; Martey & Galley, 2007; Simkins & Steinkuehler, 2008). In response, educational researchers and designers have begun leveraging them in both in-school and out-of-school programs. Here, we briefly highlight research on the leading virtual worlds based out-of-school programs to date.

Whyville

Funded by both MacArthur and the National Science Foundation, Kafai and colleagues established an after-school club based on the commercial virtual world *Whyville*, a 2D narrative platform built in 1999 to engage young people in pro-social activities and a range of academic practices including science, mathematics, and civics. This online game features text-based chat for social interaction, character design, and a suite of academically oriented tasks that users complete for in-game currency called “clams.” Students can, for example, solve angular momentum problems using in-game science simulations, visit the Getty Museum, write for the town newspaper, or just chat over a friendly game of checkers. Kafai and colleagues conducted a seven-week program in a local elementary school using *Whyville* as the basis for engaging kids in scientific problem solving and avatar creation/virtual identity play. Ten boys and ten girls from a diverse ethnic and economic background participated. At the end

of the seven week program, results indicated that participation in the *Whyville* program had fostered financial and scientific literacy as well enculturation into the shared community values of the populations within the virtual culture (Kafai & Fields, 2009; Fields & Kafai, 2009; Neulight, Kafai, Kao, Foley, & Galas, 2007).

Tech Savvy Girls

In a similar vein, Hayes and colleagues at Arizona State University use the non-narrative, commercial virtual world *Teen Second Life* (TSL) as a venue for developing girls’ digital literacy skills. Begun in 2006, the *Tech Savvy Girls* program is designed to better understand how gameplay can serve as a starting point for the development of digital skills, tech-savvy identities, and 21st century learning skills for adolescent girls by engaging participants in content creation using in- and out-of-game digital tools. As part of their activities, students develop their own product lines, create their own businesses, and socialize with peers. Findings from this work demonstrate how core practices associated with virtual worlds such as TSL can be leveraged for the development of digital and technical fluencies, functioning as a gateway for girls in domains such as programming, 3D design and behavioral modeling (Hayes & King, 2009).

Quest Atlantis

The *Quest Atlantis* project, led by Barab and colleagues at Indiana University, is the one of two successful, private virtual worlds designed specifically for learning. *Quest Atlantis* is a narrative virtual world based international project of considerable scale (25,000 participants at last report) based on the virtual world platform *ActiveWorlds*. The curriculum bridges online and off-line learning activities and is designed to engage children ages 9-16 in “transformational play”—play that position students as active protagonists in a fictional world through engaging storylines about key social and scientific topics of interest. Findings indicate that participants engage in collaborative problem solving ac-

tivities of social consequence, often adopting roles not commonly available to them in real life (e.g., water quality expert) (Barab, Arcici, & Jackson, 2005; Barab et al., 2009; Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005).

River City

A second, successful narrative virtual world based program is *River City*, which uses a multi-user virtual environment researched and developed by Dede and colleagues at Harvard University. The goal of *River City* is to teach scientific inquiry and 21st century skills to middle school students, particularly among populations who are disengaged from school and unmotivated by more traditional pedagogical means. Research on the program focuses on engagement and higher order thinking processes including the inquiry process itself. Results demonstrate that embedding science inquiry curricula in such virtual worlds can enhance students' science learning and self-efficacy while simultaneously providing instructors and researchers important tools for assessment, that enable individually tailored instruction (Dede, Ketelhut, & Ruess, 2003; Ketelhut, 2007; Ketelhut, Dede, Clarke, Nelson, & Bowman, 2007).

Focus of This Research

The research presented is the result of a year long distance collaboration between two such virtual worlds based out-of-school programs: the Global Kid's (GK) "IDig Science" program and the Games, Learning & Society Program's "Casual Learning Lab" program. The research mentioned in the literature review demonstrates the beneficial outcomes that a successfully implemented virtual worlds based out-of-school program might generate. In light of the previous research, we aim to demonstrate an overall comparison of two programs that were isomorphic in terms *pedagogical context* (out-of-school programs steeped in online digital technology), *technological platform* (3D virtual worlds), and *educational goals* (with particular focus on the development of digital literacy, science inquiry, and civic engagement). However, in

terms of actual implementation, the two were suggestive contrasts, with GK structured as a more intensive two-week "intervention" in the non-narrative world of *Teen Second Life* — a simulation game — and GLS structured as a more casual "club" in the narrative space of the massively multiplayer online game of *World of Warcraft* — a massively multiplayer online game (MMOG). Based on these similarities and differences, our research questions were (a) What is the nature of learning in each context as defined by the shared instructional goals of both programs? (b) What similarities and disparities exist between the two in terms of learning? and (c) Are there structural choices along the way that shape participants' trajectories of learning and participation?

The goal of this report is not to make conclusive statements at the level of theory or as broad generalization — for example to designate some program features as those that "work" versus others as those that don't or to deem one virtual world as "good" or "bad" in terms of some specific learning outcome. Rather, our goal is to contribute an explanatory account of two contrasting cases of virtual worlds based programs based on a close, data-driven examination of each as a way to forward the conversation in the field of "learning and media" more generally. This paper is the product of a kind of cross-project collaboration and data sharing that is rare in much academic scholarship. Individually, the analytic findings related to each program offer a plausibility argument or "proof of concept" for virtual world programs for learning. When placed in respectful juxtaposition to one another for critical comparison and contrast; however, they offer, we hope, a useful "worked example" (Gee, 2010) at both the level of *theory*, in terms of illustrating and conceptualizing how sometimes previously vague learning outcomes like "twenty-first century skills" or "cross cultural fluency" might be operationalized, and at the level of *evidence*, in terms of making claims about what will count as evidence of those theoretical constructs and how that evidence should be used to warrant claims. As such, in

Figure 1. One of the “I Dig Science” groups posing with their final exhibit



place of claims of validity and reliability, we hope to make claims of “plausibility, resonance, and subsequent engagement” (Barab, Dodge, & Gee, 2010, p. 2).

CASE ONE: GK’S “I DIG SCIENCE”

GK’s “I Dig Science” unit was designed to address a number of ambitious learning objectives—from increasing students’ understanding, knowledge and appreciation of paleontology, conservation, ecology, and scientific methodology to developing their intercultural understanding through music, dance, art, games and awareness of global human rights issues (Figure 1). TSL was chosen as the virtual world platform for activities based on its open-ended and flexible nature, enabling the creation of immersive instructional materials in 3D that might replicate crucial aspects of a paleontologist’s day-to-day work while, at the same time, functioning as a distance education tool through which the two primary sites (New York, Chicago) could collaborate in joint activity. Figure 2 provides a glimpse of the two-week activities of the unit.

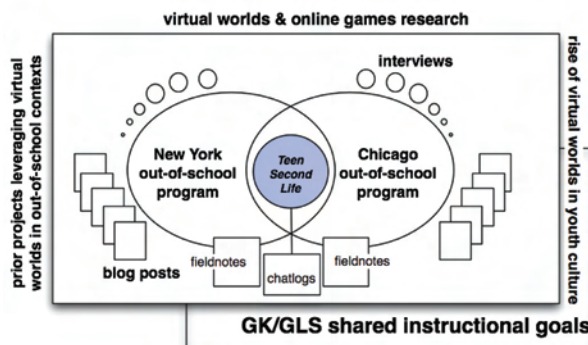
Staff at both sites functioned as facilitators and mentors during in-world and out-of-world activities, organizing discussions, managing the group work activities and facilitating phone

conversations with paleontologists. After the initial introduction to the technology, the TSL environment itself became just one aspect of the curriculum with other aspects, such as content learning and hands-on activities, made the focal point of student engagement and group discussions. Both science and cross-cultural learning objectives were distributed across separate lesson plans each day using activities designed to be appropriate given students’ background and prior knowledge. Figure 3 provides an overview of the GK individual case study structure including its positioning within a broader research context, the intersection between the program and the virtual world environment, and the forms of data gathered.

Participants

The program was targeted toward high school age youth in New York City and Chicago who were identified as at-risk, although a number of the participants from Chicago came from upper middle class backgrounds. Few of the students had prior experience with TSL, though a number indicated interest in the use of such technologies, and most had positive overall attitudes towards school. Engagement in the program was quite high with both sites reporting over 90% attendance rates for the course of its duration.

Figure 3. Diagram of the GK “I Dig Science” individual case study structure



game-related indigenous online communities (Jenkins, 2006b; Steinkuehler & Duncan, 2009), the program was designed to encourage distributed expertise and collective intelligence (Levy, 1999) in place of standardization as well as peer-to-peer learning in the form of modeling and networked apprenticeship.

WoW's in-game "guild" structure was used as the basis for organization in the program so that the majority of the regular, weekly contact time occurred within the virtual world and on a private online guild forum. Additional monthly face-to-face meetings ("Saturday events") on the University campus in the Games, Learning & Society Program's "Casual Learning Lab" games lab facility were also used for more structured intentional learning activities, data collection, and assessments. During the week, participants and research staff gamed together as a loose community, with undergraduate volunteers and graduate assistants acting as virtual ethnographers and mentors – a practice that eventually came to be known on the research team as "life-guarding" – and participants focused on in-game activities and forum-based discussions. The lifeguarding calendar (Figure 5) was communicated to participants and their parents so that they could choose their gaming hours appropriately, although they were not restricted to gaming only when staff was present. The program officially launched in October 2008 and ran for eight

months, through May 2009. Figure 6 provides an overview of the case structure including its positioning within a broader research context, the intersection between the program and the game environment, and the forms of data gathered.

Participants

The target audience was students identified as chronically disengaged (or "at risk") in school yet highly motivated by games. This focus on boys was deliberate given research demonstrating that males are both the main consumers of videogames and performing substantially worse than females in school (Gilbert & Gilbert, 1998; Greene & Winters, 2006; Lee, Grigg, & Donahue, 2007; Rowan, Knobel, Bigum & Lankshear, 2002). Twenty-two adolescent males between the ages of 12-18 were recruited from the local community to participate in the program. Although some participants in the program achieved passing grades in school, all reported in interviews disliking school and generally finding little relevance in school activities. A core group within the program became very active, gaming nightly or nearly nightly, while others remain engaged but more on the periphery. Participation remained overall high, however, with approximately 80% attendance at Saturday events.

Table 1. The features of TSL as a platform for learning, their affordances and constraints

	Affordances	Constraints
Commercially successful virtual world	Able to provide staff support to sequestered teen space & educational projects in that space	Graphically similar to game spaces popular with youth can lead to false expectations relating to narratives or goal structures
Pre-existing teen “in-world” culture	Participants can engage with broader community outside of structured program	Broader culture/practices have to be negotiated within bounded space of educational intervention
Open-ended environment (no set narrative)	Enables incorporation of customized narratives & experiences that can map to highly specific content areas	Narratives and experiences must either be created from scratch or leveraged from existing groups & spaces
Built in 3D content creation tools	Complete customization of content to program needs, ability to engage participants in content creation activities	Necessity to build/find existing assets to match curriculum, requiring 3D modeling skills by staff or contractors, participant content creation contingent on fluidity w/ content creation interface
Ability to stream audio/video, import text & images	Enables incorporation of topically related materials from the web directly into virtual environment	Myriad forms of data integration into a virtual environment lead to more demanding technical requirements for computers
Anytime/anywhere access to persistent shared collaborative space	Users can engage with an educational space & broader culture outside of scheduled events, ability to collaborate over long distances	Persistent virtual worlds tend to privilege synchronous interaction resulting in only certain times being valuable to log on
Interactions mediated through highly customizable avatar	Avatar manipulation can be incorporated into curricular design	Avatar manipulation, once introduced, can compete for student attention over scaffolded activities
Varying levels of communication (person to person, group, conference)	Variety of modalities for synchronous and asynchronous communication and facilitation	Difficult for users to monitor and facilitate interactions across multiple channels

Virtual World Platform

WoW was selected because it provided a high interest, very popular MMO space coupled with an active user community affording a broad spectrum of literacy practices. As such, the game space and surrounding community provided a context seen as naturally conducive to an attempt to “grow” various academically oriented practices through gameplay. Table 2 outlines the features of WoW as an environment and the perceived affordances and constraints of each feature based on its use in GLS.

CROSS-CASE COMPARISONS

Table 3 summarizes the similarities and differences of the GK and GLS programs. Both

programs combine time spent in the virtual world with time spent in face-to-face group meetings on location; however, the GK program embeds all virtual interaction entirely within the face-to-face sessions while, in the Games, Learning & Society Program’s “Casual Learning Lab”, virtual interaction occurs not only during monthly meetings on site but also between meetings on a voluntary basis. The stated instructional goals of each project are quite similar, focusing primarily on literacy, inquiry and issues with civic engagement (discussed below). The general rhythm of the face-to-face program is roughly the same at each site; however, the GK “I Dig Science” program lasted an intensive two weeks while the GLS was spread out over thirty weeks with informal gaming between monthly face-to-face

Figure 4. Photo taken at a GLS Saturday session



meetings. Number of participants and the ratio of staff to participants is again roughly the same, although the demographics of the youth involved stands in sharp contrast: While the GK program focused on urban youth of color and mixed gender, GLS focused primarily on rural working-class youth, exclusively targeting boys.

METHODS

Data Collection

Ethnographic methods for data collection (Hammersley & Atkinson, 1986) were used across both in-game and face-to-face contexts at both sites with virtual data collection techniques paired with face-to-face data collection techniques to best document the key behavior and practices in which participants engaged. Table 4 details the forms of data collected across the two case contexts. At both sites, fieldnote observations and group/guild chatlogs from the virtual environment were taken to capture participants' in-game activities and interactions. In addition to in-game data collection, fieldnote observations, photos, and individual interviews were collected during face-to-face meetings to capture participants' out-of-game activities

and interactions. Documents and artifacts created by participants in both contexts were also collected, including daily reflective blogposts written by GK participants and sporadic forum posts written by GLS participants. The resulting data corpus representing both cases included over 1000 separate text documents, images and video files for a combined total just over five gigabytes.

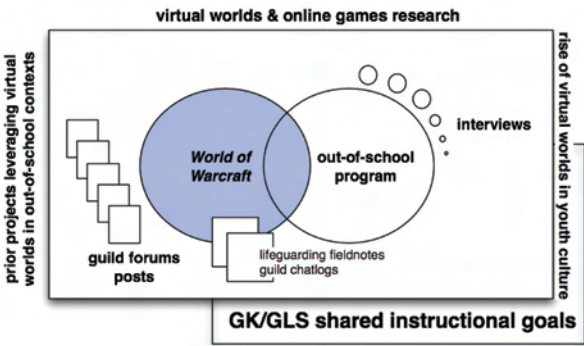
Data Analysis

The coding scheme used for this analysis was constructed at the intersection of the instructional goals of the two programs, particularly in terms of *digital literacy* (not only reading but also information literacy, design thinking, and more contemporary digital media literacy skills such as visualization, remixing, and transmedia navigation), *argument and inquiry* (such as collaborative and collective problem solving, model based reasoning), and *civic engagement* (attitudes, cross cultural fluency, workplace literacy). Additional codes were used to capture attitudes toward knowledge and learning in school versus games/virtual worlds and forms of teaching and apprenticeship (sociocultural learning). Leaders from both programs collaborated during the initial phase of this investigation

Figure 5. An example of a typical “lifeguarding” schedule for in-game data collection at the GLS “Casual Learning Lab” based on WoW

Today November 2008 Refresh									
Sun	Mon	Tue	Wed	Thu	Fri	Sat	Nov 1		
1p Minh LG 2p Gina LG	4p Aysegul LG 5p Sarah LG 7p Esra LG	4p David LG 5p Gabriella LG 7p Beth LG	4:30p Yoonsin LG	5p Tyler LG	4p Clinton Library 7:30p Aysegul LG	3p Jonathan LG			
2	3	4	5	6	7	8			
1p Minh LG 2p Gina LG	4p Aysegul LG 5p Sarah LG 7p Esra LG	4p David LG 5p Gabriella LG 7p Beth LG	4:30p Yoonsin LG	4p Tyler LG	4p Clinton Library	8:30p Jonathan LG			
9	10	11	12	13	14	15			
1p Minh LG 2p Gina LG	4p Aysegul LG 5p Sarah LG 7p Esra LG	4p David LG 5p Gabriella LG 7p Beth LG	4:30p Yoonsin LG	new WoW expansio 4p Tyler LG	4p Clinton Library	1p MMO Lab Gaming 3p Jonathan LG			
16	17	18	19	20	21	22			
2p Gina LG 10p Minh LG	4p Aysegul LG 5p Sarah LG 7p Esra LG	4p David LG 5p Gabriella LG 7p Beth LG	4:30p Yoonsin LG	4p Tyler LG	9p Constance LG	3p Jonathan LG			
23	24	25	26	27	28	29			
1p Minh LG	4p Aysegul LG 5p Sarah LG 7p Esra LG	4p David LG 5p Gabriella LG 7p Beth LG	4:30p Yoonsin LG	12p NO LG due to Th 4p Tyler LG	9p Constance LG	3p Jonathan LG			
30	Dec 1	2	3	4	5	6			
12:05p Uthgarde Kee 1p Minh LG 2:30p Dire Maul Run	4p Aysegul LG 6p Sarah LG 7p Esra LG	3p David LG 5p Gabriella LG	4:30p Yoonsin LG	4p Tyler LG 7p Beth LG	9p Constance LG	3p Jonathan LG 7p Blackfathom Dee			

Figure 6. Diagram of the GLS individual case study structure



to develop a mutually satisfactory framework for tracing the development of key practices, capacities, and dispositions at each site. Codes were piloted on a subset of data then refined through cross-program conversation into a final set of 11 main analytic themes total with 44 codes nested within theme shown in Table 5.

A team of eight doctoral researchers with previous experience in research on virtual worlds and learning coded the entire data corpus in NVivo (Richards, 2005; Bazeley, 2007) with two researchers assigned to each theme. For each theme, we then compared the coding of the two members assigned to one another

Table 2. The features of WoW as a platform for learning, their affordances and constraints

WoW Features	Affordances	Constraints
Commercially successful videogame	High interest from participants, automatically engaging	Foregrounds WoW game culture at the expense of local goals & local culture of program
Open ended environment	Provides multiple trajectories for interest driven play	Difficult to encourage key practices that were <i>not</i> interest driven
Narrative world	Creates shared context, language, lore	Constrains literacy work within genre given; cannot appeal to everyone
Anytime/ anywhere access	Allows participation as a natural part of everyday routine & not just scheduled “in person” events	Difficult to track participation let alone regulate or shape it
Robust fandom community	Cultural norms already encourage literacy, inquiry, argument (i.e., academically valued practices)	Not all fandom cultural values are ones a given program might care to promote
Avatar mediated interaction	Allows teens to participate on equal footing with adults (acted as a leveler)	Shrouds important demographic factors, at times leading to miscommunications
Robust network of on-line fandom resources	Ample materials to augment gameplay already created	Difficult to trace (let alone regulate) what resources participants use, their content, or quality
In-game guild structure	Provided convenient data capture methods	Could only detect activity within guild, not beyond it (e.g., quiet participants under-represented)

and to the principal investigator to establish interrater reliability on a randomly selected 10% of the data, which was 98%. The entire data corpus was then divide roughly in half by alternating dates (so as to avoid ordering effect) and assigned across all eight doctoral researchers.

FINDINGS

Code Saturation

Figure 7 shows the degree of content code saturation of the two cases – the proportion of the data corpus of each case to which nine of the eleven thematic categories of codes were applied. Codes for attitude and sociocultural learning are excluded from this initial overview since they are thematically different and not based on explicit program goals. Overall, the percentages between the two data sets are quite similar; suggesting that both programs

managed to address the themes overtly targeted as instructional goals within the respective programs. GK has a slightly higher saturation of problem solving, information literacy, cross-cultural fluency, and workplace literacy while GLS has a slightly higher saturation of argument, reading, and digital media literacy. Problem solving, cross-cultural fluency, and workplace literacy were all stated goals of GK and were actively included in the design of the program. Argument and workplace literacy are the categories showing the greatest contrast between contexts, yet even here the proportional difference is roughly only 4%. Perhaps what is most striking, then, is the quantitative similarity between the two programs despite their structural differences. The display of the data in a quantitative manner highlights the broader similarities in the two programs but masks the differences that are illuminated through the qualitative analysis. In what follows, we present contrasting examples drawn

Table 3. Structural comparison of the two case contexts investigated

	Global Kids “I Dig Science”	Games, Learning & Society’s “Casual Learning Lab”
Virtual Setting	<i>Teen Second Life</i>	<i>World of Warcraft</i>
Physical Setting	Training room at GK office & conference room in [name removed]; remote participation from home	Game lab on college campus; remote participation from home
Additional Technologies Used	Internet-based media (search engines, databases, Youtube videos), blogs, Skype	Internet-based media (search engines, databases, Youtube videos), forums, VOiP
Stated Goals of Program	Science Literacy Digital Media Literacy Cross cultural fluency Peer education Global citizenship Problem solving Public speaking Direct positive community change Conceptualization Career awareness	Collective problem solving Informal science literacy Digital media literacy Computational literacy Collaborative learning Pop-cosmopolitanism
Typical Face-to-Face Activity	Group discussion, then designed inquiry activity in TSL (using specially made virtual assets), then individual blog reflections	Group discussion, then coordinated collaborative gameplay, then individual interviews/other data collection
Number of Participants	20 (11 NY, 9 Chicago)	25
Demographics of Participants	Urban youth, mixed gender	Rural / small town youth, Males only
Program Duration	Two weeks (July 6-17, 2009)	Thirty weeks (October 2008-May 2009)
Program Schedule	Daily face-to-face meetings in NY and Chicago for 4 hours daily, including virtual meetings between sites Mon-Thurs	Monthly face-to-face meetings, flexible gaming schedules during intervening weeks
Number of Staff	4-6 staff, 1 science expert	6-8 staff

from each case context as a way to tease out qualitative differences such gross proportions tend to obscure.

Argument

Being able to construct and deconstruct warranted arguments is a fundamental goal of education, with “sound reasoning” virtually synonymous with “sound argument,” yet such skills are difficult to master both individually and dialogically in groups (Rourke & Kanuka, 2007). In this analysis, we primarily relied on the work of Kuhn (1991, 2005) and Erduran, Simon,

and Osborne (2004) to trace the coordination of claims with evidence, counterclaims with counterevidence, and rebuttals representing the ways in which other people’s arguments against us becomes a vehicle for strengthening our own. In this analysis, our main goal was to determine the extent to which individual and group argumentation arose and, when it did, what general degree of sophistication characterized it. As Figure 7 shows, argument arose more often in the GLS than GK; however, when it did arise in GK, it was generally more sophisticated as a result of the conversational strategies used

Table 4. Profile of the data corpus detailing the forms of data collected at each site

Data Type	Global Kids “I Dig Science”	Games, Learning & Society’s “Casual Learning Lab”	TOTAL# artifacts
Fieldnotes	all activities, both NYC & CHI	6 / week on average, monthly meetings	227
Guild/Group Chatlogs	all activities	6 / week on average, monthly meetings	200
Forum/ Blog Posts	Daily blog posts	Sporadic forum posts	675
Interviews	19 participants & 1 staff	19 participants & 1 staff	52

by GK facilitators. The following contrasting examples illustrate.

Argument in GK

In this example, students work to assemble the bones they have virtually excavated into fossil specimens, they debate the animal their fossil represents based on bone characteristics. Beth¹, one of the main facilitators that day, shape’s the team’s discussion by focusing their attention to the more productive clues to be found in their specimen and coordinating their claims so that they might begin to construct a single, reasonable explanation. Using “revoicing” (O’Connor & Michaels, 1996) strategies, Beth restates one student’s claim, then uses warranted inference – a restatement of one students claim beginning with “so” (Schiffrin, 1987) – to create a conversational space for the student to accept or rebut her reformulation. Such techniques, frequently found in productive classroom discussions, function to coordinate students claim within a framework of alternatives.

Joseph [A]teen: it had a big belly for pray
Beth [staff]: so it looks wide to you?
Tina [A]teen: large ribs for stomach
Joseph [A]teen: yup
Beth [staff]: look at all the ribs
Beth [staff]: are they all the same size?
Tina [A]teen: no, some are smaller
Vick [A]teen: ya I think its towards the end

Cory [A]teen: the spine has spike or [something] on it

Soren [A]teen: no

Sara [A]teen: I think it only ate grass, because of how low it was to the ground so it was a herbivore

Joseph [A]teen: I’m not sure

Soren [A]teen: I think it was aquatic

Beth [staff]: how can you tell that from the ribs?

Soren [A]teen: no sorry

Beth [staff]: it’s ok!

Cory [A]teen: it looks like an aquatic animal

Cory [A]teen: look at the skull shape

Beth [staff]: ok so we have large and small ribs

Argument in GLS

In contrast, argumentation appeared much more regularly as a natural part of gameplay and gaming culture in GLS yet it often consisted of a collective pooling of contrasting claims with little structural coherence beyond their sequential ordering. Participants debate, as a natural and frequent part of their gameplay, everything from in-game design choices to player norms, from the relative value of online game information resources to preferred types of pancake, from whether game lore books are harder to read than real history to which current box office movies are the coolest. With no designated facilitator present to structure their discussions, however, debates would, more often than not, devolve into a simple back-and-forth among competing claim with little connective

Table 5. The full analytic framework used in the cross-case analysis

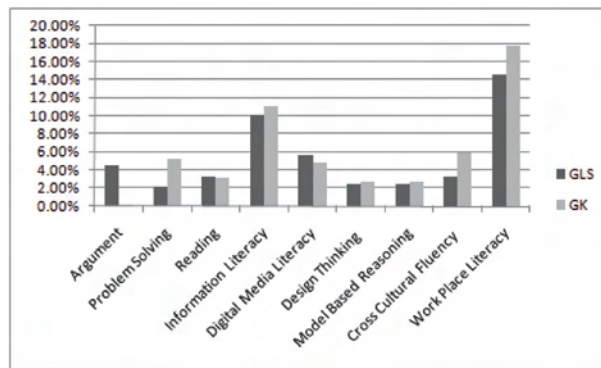
ARGUMENT	Claim: A statement about the real/virtual world that begins some form of oppositional conversation or debate (Erduran, Simon, & Osborne, 2004).
	Evidence: Reason or data to warrant ones claims (Kuhn, 1991).
	Counter Claim: A refutation or contradiction directed at the original “claim” initiating the conversation (Erduran, Simon, & Osborne, 2004).
	Counter Evidence: Reasons or data to warrant one’s refutation of the initial claim (Erduran, Simon, & Osborne, 2004).
	Rebuttal: Refutation of a counter claim (either imagined or stated) in support of the original claim (Kuhn, 1991).
	Other: An argument move not included in above codes: agree/disagree, concession/dismissal, compromise, qualification, clarification.
PROBLEM SOLVING	Finding a solution to a problem where the solution is not given or simply looked up in a resource (Halpern, 2002).
READING	Reference to reading something within or outside the game (Steinkuehler, King, & Compton-Lilly, 2009).
INFORMATION LITERACY	Seeking Info: To locate relevant information for the task at hand (AASL, 1998; ACRL, 2000).
	Evaluating Info: To evaluate the reliability and credibility of different information resources (AASL, 1998; ACRL, 2000)
	Interpreting Info: To identify significant information from less significant information, determine or infer its meaning, and draw appropriate and meaningful conclusions from it (AASL, 1998; ACRL, 2000).
	Synthesizing Info: To combine information from multiple resources into a coherent whole (AASL, 1998; ACRL, 2000).
	Disseminating Info: To seek out and use appropriate distribution channels for one’s own info production (AASL, 1998; ACRL, 2000).
DIGITAL MEDIA LITERACY	Visualization: The creation of visual representations of information for problem-solving purposes (not teaching/communicative purposes).
	Remixing: Meaningful sampling and remixing media content (Jenkins, Purushotma, Clinton, Weigel, & Robison, 2006).
	Transmedia Navigation: The ability to follow the flow of stories and information across multiple modalities (Jenkins et al., 2006).
	Multitasking: Simultaneous engagement in virtual & outside world, showing ability to scan environs & shift focus as needed (Jenkins et al., 2006).
	Pop Culture References: In situ references to pop culture, evidencing convergence of multiple “narrative arcs” within the given media context.
DESIGN THINKING	Appraise Design: Stating an opinion or stance toward a particular designed object or design choice (Steinkuehler & Johnson, 2009).
	Argument (for Appraisal): A rationale for an opinion on a given design that justifies the critique in some way (Steinkuehler & Johnson, 2009).
	Alt Design/Fix: Offering an alternative design or a fix to some existing designed object or design choice (Steinkuehler & Johnson, 2009).
	Prediction (for Alt Design/Fix): A justification of some alternative design or fix in the form of a prediction or thought experiment of what would happen if you designed it as suggested (Steinkuehler & Johnson, 2009).
	Design: The development (real or abstract) of an original design or a novel redesign justified on its own terms (Steinkuehler & Johnson, 2009).
MODEL BASED REASONING	Working with a Model: Any interaction with a model with interacting components that represents some system within the virtual/real world (AAAS, 1993; Steinkuehler & Duncan, 2009).
	Judging Model Based on Prediction: Judging the usefulness of a model by comparing its predictions to actual observations in the virtual/real world (AAAS, 1993; Steinkuehler & Duncan, 2009).

continued on the following page

Table 5. continued

ATTITUDES	Nature of Knowledge: Overt comment about the nature of knowledge.
	Nature of Learning: Overt comment about the nature of learning.
	Attitudes Toward School: Overt comment conveying the speaker's attitudes toward school (Joseph, 2008).
	Attitudes Toward Games: Overt comment conveying the speaker's attitudes toward games or gaming (Joseph, 2008).
	Attitudes Toward Program: Any overt comment conveying the speaker's attitudes toward the GK or GLS program respectively.
	Attitudes Toward Civic Empowerment: Overt comment conveying the speaker's beliefs about his/her ability to make a difference in their community or world (Santo, 2007).
SOCIO-CULTURAL LEARNING	Collaborative Problem Solving: Joint problem solving within a small, bounded group (Steinkuehler & Duncan, 2009).
	Collective Problem-Solving: Large-scale problem solving within a knowledge-working community (Steinkuehler & Duncan, 2009).
	Tool & Artifact Creation: Creation of teaching tools or artifacts.
	Didactic Teaching: "Teacher directed" explicit instruction.
	Apprenticeship: Teaching through engagement in joint activity between a mentor and learner (Steinkuehler, 2004).
	Modeling: Demonstration of how to do something as a form of teaching.
CROSS CULTURAL FLUENCY	Adopt Alternative Perspective: Adopting an alternative perspective or opinion for the purpose of understanding (Joseph, 2008; Kuhn, 1991; Steinkuehler, 2006a).
	Connect Global to Local: Evidence of understanding the connection between the global world and one's local world (Joseph, 2008).
	Politics & Current Affairs: Discussion of politics, current events, or other pressing affairs happening in the "real world."
	Ethical Reasoning: Thinking about issues of social equity, rights & responsibilities, or right & wrong behavior toward one another (Joseph, 2008; Simkins & Steinkuehler, 2008).
	Social Norms & Rules: Negotiation or discussion of social norms and/or rules such what is or is not acceptable behavior in the virtual world (Martey & Galley, 2007).
	Conflict Resolution: Helping to resolve a dispute or disagreement.
WORKPLACE LITERACY	Goal Setting: Setting specific objectives or targets for oneself as a way to make and/or mark progress (ASTD, 2006; Conference Board, 2006).
	Time Management: Monitoring and managing time efficiently (Conference Board, 2006).
	IT Skills: Using or otherwise demonstrating understanding of technology beyond the virtual world or gaming platform itself (ASTD, 2006; NCEE 2008).
	Financial Literacy: Thinking about money management, economics, financial values, or other economic dynamics within the virtual space (Gottstel, 2009; Lehman & Bell, 2006).
	Job Knowledge: Thinking about post-graduation options and/or what specific professions entail (Feller, 2003; Gordon, 2005; P21, 2009).
	Public Speaking: Demonstrated ability to speak comfortably in public (P21, 2009).

Figure 7. Proportion of the data corpus to which codes for the nine content themes were applied



tissue between them to help drive the debate toward resolution. For example, consider the following conversation in which participants in the guild discuss whether or not a “feral druid” in one participant’s “pick up group” (or PUG) should have not rolled “need” on items earned during their collaborative hunt. The conversation begins with a troubles-telling and quickly evolves into lively debate.

Mariobro: stupid feral druids needing Band of Renewal [item for spell casters] AND Crystalfire Staff [item for spell caster]

Illusiontech: thats a nice staff

*Roarton: wtf? [what the f*ck] why did they need both?*

Roarton: MAYBE one would be understandable
Mariobro: cuz he was a kid that shouldn't be playing

Mariobro: he's feral LOL [laugh out loud] he shouldn't have needed either when there was a mage

Illusiontech: druids can use the staff

Mariobro: look at it

Illusiontech: ya

Mariobro: it's all spell power

Illusiontech: ik [I know] I had it b4 [before]

Illusiontech: so druids don't use spells?

Mariobro: FERAL

Illusiontech: even they can use spells

Mariobro: why would u want a spell power staff with int [intelligence, a particular bonus characteristic that items can have]

Mariobro: when ur in cat form [special character form that increases melee damage but does not allow spell casting] the whole time

Mariobro: think about it

Illusiontech: what ever

In this example, participants do indeed make claims backed by evidence, offer counterclaims to one another, and even present somewhat sophisticated rebuttals to counterarguments (including even rebuttals to previous rebuttals). However, rather than resolve the dispute at hand, participants allow the discussion to simply trail off, transitioning to a new (albeit related) topic with a dismissive “what-ever.” While their argumentation is certainly “authentic,” driven toward clear individual goals that participants are personally invested in (Bereiter, 2002), their discussion does little to yield to richer understanding of the topic other than a pooling of positions (in contrast to, say, a coordinated framework of contrasting and parallel positions within a given debate).

Problem Solving

Problem solving ranks high on the list of “twenty first century skills” that NCEE (2008) and other institutions claim students graduate without having really mastered, yet recent research highlights the contribution of digital media toward just such ends. Games are particularly apt catalysts for such skills given that they are, at root, based on a “functional epistemology of

doing” (Squire, 2008, p. 5) that goads players to test the structure and boundaries of the underlying game system in order to discover its underlying rules. Strategies range from early trial and error learning to more systematic, iterative cycles of inquiry including hypothesis creation, testing and revision (Steinkuehler & Duncan, 2009). In virtual worlds, “cross-functional teamwork” (Steinkuehler, 2008; Parker, 2002) is commonplace with individual collaboration toward a common goal accomplished by each group member contributing their specialized area of expertise. In this analysis, we focused on individual and collaborative problem solving exclusively in novel contexts, requiring the development of new strategies that went beyond simply finding the right piece of information. Our main goal was to identify what forms of novel problem solving arose in each context, their similarities and their differences. With this definition in place, we found that novel problem solving occurred with greater frequency in the context of GK than GLS yet problems in the former context were typically well-defined (typically, a priori by the facilitator or curricular design) with a single right answer while problems in the latter context were ill-defined with no one necessarily “correct” solution.

Problem Solving in GK

Consider, for example, when an activity in GK designed to engender empathetic understanding (Gee & Hayes, 2009) of paleontology as practiced in the field by simulating not only the job tasks and communication challenges that field workers experience but also the kinds of ambiguity and inherent challenges involved in determining the fossil record and inferring from it the animal it represents and its characteristics. However, given the nature of the simulation and the fact that ambiguity in the fossil model was difficult to build into the 3D model design, students oriented quickly toward the notion of lining up the parts “like a puzzle” in order to arrive at the single right answer – ostensibly, the one the teacher or facilitator has. For ex-

ample, as one student later wrote in their daily reflection blog:

“I pretty much treated the fossil like a jigsaw puzzle. I put the specimen together as best as I could by eye, then kept rearranging the leftover pieces until it looked decent. It was easy to tell if the fossil placement was incorrect, but not always so easy to fix it. I think this might be one of the rare cases that the Second Life task is more difficult than the real life one!” (blog post)

The result, despite all good efforts, is a curriculum in which a scientist’s work becomes reduced to “puzzle solving” in order to match one’s final result to one already known – an activity that is not only *not* science, but indeed stands directly in opposition to it (Chinn & Malhotra, 2002).

Problem Solving in GLS

In comparison, while novel problem solving in the GLS was less frequent, it also often entailed more ill-defined problems with no single solution, often requiring problem conceptualization before potential solution strategies could be generated. In this context, problem solving typically served as a means toward more pragmatic, “good enough” solutions to the challenge at hand, few of which had any clear “best” solution or “right answer” available. One of the more common scenarios was when participants attempted to successfully complete in-game “instance” content requiring productive cross-function teamwork. Consider, for example, the following excerpt in which a more experienced participant (Monarch) is, during a collaborative “instance,” forced to manage a less experienced program peer, a novice program staff member, a seasoned program peer, and a seasoned stranger through navigational problems, massive disparities in group member knowledge and experience, communication problems, chaffed egos, and repeated setbacks. After several unsuccessful group attempts at mastering the game content leading to organizational breakdown, Monarch

resolves the problem by turning the failure into a teaching opportunity:

Monarch: basic philosophy of a dungeon

Monarch: number one rule

Monarch: NEVER walk ahead of the tank

Monarch: that's me

Dooickey: dont tell me how to heal because

*I can heal on my main [character] in H
nax [Heroic Naxxramas - a high-level,
expert instance]*

GrimlyBear: sure u can

Monarch: number 2. no %^&!ing at the healer,
because then he won't heal you*

Monarch: and we will all die

*Monarch: number 3. if you are getting at-
tacked, run TO the tank, not away, again
the tank is me*

Monarch: that's it

GrimlyBear: I know retard

*Monarch: do those 3 things, and we will all be
okay, or die for a completely valid reason*

GrimlyBear: i know your the @#\$%in tank

GrimlyBear: for the 50th time

While not well received, his advice, in effect, resolves the worst of the issues the group faces, allowing them to accomplish at least a version of the goal they had originally set out to accomplish despite imbalances in personnel, communication issues, and, for some members, ignorance of content-specific strategies and in-game group norms. Such problems are, by their nature, ill defined—even when based on nested, well-defined and programmed game “instance” content and their solution is a matter of finding a pragmatic, “good enough” solution to a problem of resource and knowledge constraints in contrast to the problem solving found in GK in which students quickly converge on a single “right” answer of a problem that is, by design, well-defined.

Information Literacy

In an era where information is perpetually accessible, increasingly portable, progressively reproducible and remixable, and ubiquitous in

both home and workplace, information literacy shifts from privilege to necessity. Skills in information seeking, evaluating, interpreting, synthesizing, and disseminating are not only necessary practices in formal academic environments but in fact fundamental components of basic citizenship (AASL, 1998; ACRL, 2000). Thus, as programs leveraging online digital technologies for learning, both GK and GLS had a keen interest in, if not improving youth information literacy skills, at least developing a better understanding of kids' current online information practices, especially in participatory culture contexts such as online games and virtual worlds. In this analysis, based on standards articulated by the American Association of School Librarians [AASL] (1998) and the Association of College and Research Libraries [ACRL] (2000), we examined the information literacy practices of participants in each program ranging from simple information seeking and dissemination to more complex forms of information evaluation, interpretation, and synthesis. Again, the two programs are relatively equivalent in terms of quantity but not quality.

Information Literacy in GK

In GK, information literacy practices were often coordinated by the activity design with staff functioning as a source for both information seeking strategies and information itself. For example, at the beginning of an activity on the relationship elephants and acacia trees, students were directed by the facilitator to a specific page (on elephants) within a specific online resource (the Encyclopedia of Life, <<http://www.eol.org/>>) and are asked specific questions related to information within the source in ways that direct students attention to information considered important or necessary. Information seeking in such activities is therefore highly scaffolded (Bruner, 1975) and information evaluation is monitored and assisted throughout the activity from beginning to end. As a result, information flow (information seeking and information giving) follows a “hub and spoke” type pattern with the facilitators functioning as hub with

connections radiating like spokes out from the hubs to the individual students. Information interpretation, synthesis, and dissemination arise primarily in the context of group discussion, student products (such as their TSL fossil exhibits), and student-authored reflective blogs. The reflective blog writing component of the daily program played a crucial role in pushing students beyond information exchange and into more sophisticated forms of information literacy practice.

Information Literacy in GLS

In contrast, in GLS, information literacy practices were thoroughly peer-to-peer with information access and dissemination distributed across in- and out-of-game social networks. Here, the pattern of information flow is a characteristically flatter, more distributed network in all directions with staff researchers positioned as nodes generally having the same status as participants themselves. Here, the culture of the program reflected the cultural norms of the WoW community (and other MMOs like it) in that information trade and exchange was deeply tied to social and cultural capital. Take, for example, the following transcript of an exchange between Smyrna, a high status person outside the game due to age and social position (a visiting scholar from abroad), and a much younger program participant.

Smyrna [visitor]: I have a question. I have an "infantry tunic of the whale" - it says "binds when equipped" what does this mean?

Roarton: it means u cant take it off and sell it to another player smyrna

Roarton: once u equip it that is

Smyrna [visitor]: can't I change it after when I get a better one??

Steamroller: it means once u wear it there's no give-seys back-seys

Coldcuts: whispers: yah you can change it anytime

Smyrna [visitor]: ok thanks

Roarton whispers: u can take it off and sell it to a vendor, u just cant give it to another player thru trade, guild bank, or ah

Despite her higher out-of-game status, Smyrna is positioned as the learner in this virtual context with participants positioned as information resource, an inversion of the very pattern found in GK. In GLS, the virtual world functioned as a sort of "leveler" (Steinkuehler & Williams, 2006; Oldenberg, 1999), with "real world" social status replaced by knowledge of in-world dynamics in the calculus of the proverbial pecking order. Participants were quick to share information with each other when peers displayed interest or need, and the ability to do so was deeply tied to cultural capital, distributed in reciprocal fashion across the social network (Martin & Steinkuehler, 2010).

Workplace Literacy

A common criticism of in-school programs is that the emphasis on standardized testing does not help students develop the full spectrum of literacies necessary for success in the fiercely competitive, internationally engaged workplace (Gee, Hull, & Lankshear, 1996), not only handicapping individual students but also placing the U.S. at a distinct competitive disadvantage globally (Friedman, 2006). Recent research on naturally occurring practices in online gaming practices reveals an array of "twenty-first century literacies" (P21, 2002) that are efficacious for workplace literacy, such as technology skills (Hayes & Games, 2008; Hayes & King, 2009; Steinkuehler & Johnson, 2009) leadership (Beck & Wade, 2004; Reeves & Malone, 2007), team and collaborative practices (Ducheneut, Yee, Nickel, & Moore, 2006) and problem solving (Steinkuehler & Duncan, 2009; cf. Brown & Duguid, 1991). Inherent in these broad-based practices are soft skills that the contemporary business place finds lacking among younger workers (NCEE, 2008) including goal setting and efficiency (ASTD, 2006), self-directedness (SHRD, 2008), personal career management techniques (Casner-Lotto & Silvert, 2008), and essential lifelong learning practices (Casner-Lotto, Rosenblum, & Wright, 2006).

Using such constructs as the basis for this analysis, we found notable differences in workplace literacy related skills between GK and

GLS, with GK evidencing far greater frequency of such practices. In GK, workplace literacy practices were mostly related to paleontology and therefore domain-specific in nature. By design, GK focused on career paths in or related to paleontology, giving students the opportunity to participate directly (albeit virtually) in the functions and working situations involved in this vocational pursuit. By engaging students to take up the role of such experts in the virtual world of TSL, the program encouraged students to explore career landscapes and workplace literacies that they may not have previously considered. In the context of GLS, workplace literacies were not an explicit part of the program or game content; however, workplace skills did emerge nonetheless albeit with less frequency. When they did arise, such skills were domain general in nature, including goal setting, time management, and efficiency skills. When explicit discussion of specific vocations did arise, it was in relation to interested already “taken up” by participants on their own.

CONCLUSION

Table 6 presents the four main analytic themes highlighting the main contrasts between GK and GLS. One pattern that emerges consistently across these observations regardless of analytic theme is that the more important distinction between the two contexts is not the *technology used* or even the disparate *activity design* per se but rather the *disparate overall approaches* to learning taken between the two cases in terms of whether the program leaned more toward “intentional” learning or “interest-driven” learning. Looking across the contrasts drawn in Table 6, one can get a sense for how the *locus of intentionality*—designer intentions in the case of GK or participant intentions in the case of GLS—enables and affords some intellectual work while constraining other types. Of course, in practice the two are always in conversation with one another, either literally (through user testing, design research, and iterative prototyping) or metaphorically (in the work that designers do

in attempting to anticipate the goals, needs, and desires of the people who will engage with their designs). Yet this persistent motif throughout the data corpus is hard to ignore. While neither program frames their activities in such terms overtly and neither staff nor researchers use the discourse of intentionality to explain or describe their facilitatory or design work. The intentions and epistemology of the designers of these two programs influence the functioning of the program whether the views are expressed by the staff or not. This analysis indicates that GK is centered more on the enculturation of participants into the practices and dispositions embedded in the design of the curriculum (ranging from the virtual content built in TSL to daily group activities carefully coordinated by designers and staff) while GLS is centered more on the incubation of participants’ own interests (with content and activities following participants’ interests over extended periods of time and access to resources tailored at the individual rather than group level). Figure 8 illustrates our broad conceptualization of the two contrasting cases in these terms.

Locus of Intentionality: Corroborating Evidence

Triangulation through analysis of participants’ and the forms of sociocultural learning practices that did (or did not) emerge in each context corroborates this interpretation. In addition to the nine content themes used in our analytic framework that were based on instructional goals shared between the GK and GLS, we also included codes to capture data that might reveal (a) students attitudes toward knowledge, learning and the program, and (b) sociocultural learning practices such as collaborative problem solving, modeling, and apprenticeship. Qualitative review of the data coded for both themes revealed additional evidence for our theoretical interpretation of the main program contrast falling in terms of the locus of intentionality.

Analysis of students’ attitudes in each program revealed that participants in the two programs respectively used radically different

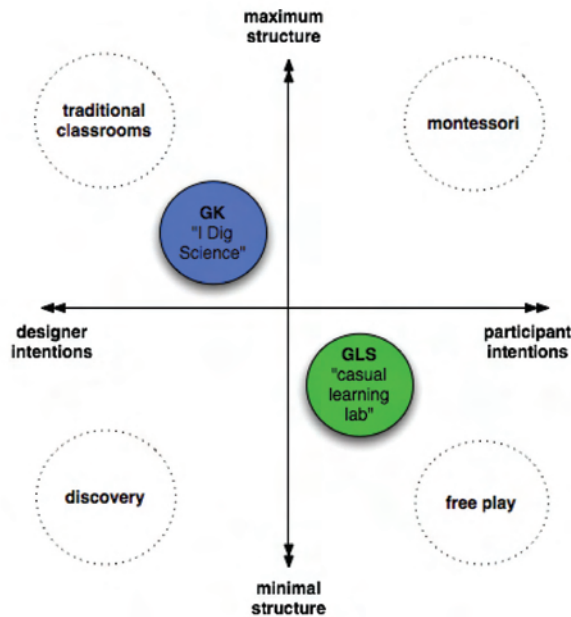
Table 6. Main contrasts between the two cases based on the analytic framework used

Analytic Theme	Global Kids “I Dig Science”	Games, Learning & Society’s “Casual Learning Lab”
Argument	Re-voicing techniques used by staff to coordinate claims within a framework	Collective, little structural coherence beyond sequential ordering of claims
Problem-Solving	Getting the answer right (e.g., matching fossil findings to the teacher’s model)	Finding a pragmatic, “good enough” solution
Information Literacy	Staff are main resource; evaluation, interpretation, and synthesis evidenced in reflective blogposts	Peers are main resource; dissemination tied to social/cultural capital
Workplace Literacy	Domain Specific (i.e., paleontology related)	Domain General (e.g., goal setting, time management)

points of comparison in their assessment of the respective out-of-school virtual worlds based curriculum. Among GK participants, the *traditional classroom* setting was their main point of comparison. In both conversation and blogposts, students discussed GK not in relation to play but in relation to school – and positively evaluate GK in comparison. For example, in one blogpost a student wrote, “GK has been really hands on. When in a classroom you’re listening to lectures, with GK you’re working with other people and feel more involved and I prefer that to just sitting in school.” In contrast, among GLS participants, *unstructured gaming* was their main point of comparison. For example, when one participant was asked during an interview what he hoped to get out of his participation in the program, he responded, “Make some friends. Mmm.... of course, game.” Program activities beyond games such as interviews or more structured data collection activities were perceived as “worksheets” and dismissed as “boring.” Thus, the attitudes of the program participants at each site are well aligned with our conclusions drawn in Figure 8, with GK most aptly compared to classrooms and GLS most aptly compared to free play. To be sure, this is not to claim that GK is a classroom and GLS is free play. The relationships are by analogy, not equivalence.

In terms of sociocultural learning practices, again we find evidence to support this theoretical framing. The patterns of communication and concomitant social network type in GK are reminiscent of classroom type patterns whereas the communication pattern and network type in GLS are reminiscent of play spaces. In GK, facilitators were typically the conversational hub. As discussed earlier, students’ statements and reflections were often shaped by the strategically guided questions that instructors pose. The net effect is a communication structure that sometimes resembles a common pattern to classrooms called IRE, which stands for “[teacher] initiation, [student] response, teacher evaluation.” Such communicative patterns take the shape of a wheel with the main facilitator or teacher at the center (i.e., the hub) and students as nodes out from that center. In contrast, in GLS, the primary pattern of social interaction is among players – both participants and research staff – as equal nodes in a flat social network structure with connections among all nodes based on communicative intent. The pattern that emerges is much more parallel to a common in-game guild structure than the typical classroom, at least in terms of knowledge sharing and learning, and can largely be seen as one positive byproduct of the fact that there was little to no conversational facilitation per

Figure 8. Location of two case contexts in terms of locus of intentionality (designer versus participant) and degree of structure provided



se. Of course, the downside should again be mentioned as well: with no facilitation, the group's discussions devolved at times into a meandering "opinion sharing" in place of discursive argument. Still, the sociocultural forms of learning that emerged at each site again corroborate our previous theoretical interpretation (Figure 8), with the patterns of communication and concomitant social network types in GK versus GLS recapitulating this pattern of *enculturation* versus *incubation*. In the former program, activities and materials and mentoring staff collectively act as fodder for the gradual inculcation of youth into the knowledge, practices, and dispositions of the designers and experts on staff. In the latter program, resources are fodder for the development of youth's own burgeoning interests, resulting in a model more akin to community organizing efforts (which begin with the question "what

does the community want?") than instruction in any traditional sense.

HEURISTICS FOR FUTURE OUT-OF-SCHOOL VIRTUAL WORLD BASED PROGRAMS

The goal of this analysis was to create a compelling worked example in terms of both how theory and argument. Abstract learning goals like "digital media literacy" and "twenty-first century skills," can be made tangible and empirically illuminating when operationalized and grounded in the details of human (inter) action. In turn, such empirical details can and should become the basis on which we build more robust pedagogical models, allowing us to ground heady terms like "enculturation" and "incubation" in the details of actual human learning. While we make no claims to broad

generalization beyond our two case contexts, we do argue that there are “petit generalizations” (Stake, 1995, 2006) that can be asserted – conclusions we can draw that remain situated in the specific contexts studied yet arguably relevant to a broader range of contexts as well (Barab & Squire, 2004) that detail the structural choices along the way that shaped participants’ trajectories of learning and participation in the two contexts examined herein.

Balance Standardization with Customization

The first and most obvious heuristic to emerge from these findings is that designers of out-of-school environments like GK and GLS that leverage virtual worlds for learning must take seriously the need to balance standardization with customization. There is a continual tradeoff between equal outcomes for every student, on the one hand, and the development of individuated expertise – a necessary component to “collectively intelligent” (Levy, 1999) communities – and participant intentionality on the other. A program leaning more toward the “designer intentions” end of the spectrum offers structured learning goals with equal outcomes for all but only at the risk of alienating students from their own preferences, play styles and intellectual aspirations. On the other hand, a program leaning toward the “participant intentions” end of the spectrum affords students the opportunity to pursue their own interests, thereby cultivating engagement, but only at the risk of narrowing their exposure to wholly new concepts and activities that may be outside their immediate field of involvement. Finding a productive “middle ground” between the two may mean encouraging students to engage in the same set of broad content at some points in the curricula (for example, toward the beginning of the program) but then enabling “customization” of content at other points. Well-established instructional models such as “jigsawing” (Aronson & Patnoe, 1997) capitalize on just such dynamics. Other examples of

reaching the middle ground would be problem based learning (e.g., Savery & Duffy, 1995).

Position Staff as Nodes in the Social Network

One way to foster productive discussion among participants is to position program staff as nodes of more or less equal status in the social network of the given participant group rather than hubs. Instead of making them the source of information or the evaluator of an answer’s quality or fit, out-of-school programs might position their staff members as fellow learners of a sort, albeit at times learners who are further along their developmental path toward expertise than those individuals formally enrolled in the program itself. When peer groups are able to develop systems of individual expertise in which the sharing of knowledge and skills is not only allowed but encouraged, the social network as a whole can function as the thinking apparatus – again, to borrow Levy’s (1999) term, as a “collectively intelligent” entity. Virtual worlds are particularly apt contexts for such sociotechnical designs given their function as “levelers” (Oldenberg, 1999). As Steinkuehler and Williams (2006) write:

“This sense of moratorium from stratified daily social life enables MMOs to function as kind of level playing field and, in part, may explain some of their popular appeal: Like sports, MMOs appeal to people in part because they represent meritocracies otherwise unavailable in a world often filled with unfairness (Huizenga, 1949). Players are able to enter a world in which success is based not on out-of-game status but on in-game talent, wit, diligence, and hard work. This is not to claim that no social stratifications exist within virtual worlds. Such stratifications do exist, the most common being a disparity between elite “power gamers” and those who play casually (Jakobson & Taylor, 2003; Taylor, 2003). However, MMO players expect an equal distribution of opportunity (although not necessarily outcomes) regardless of out-of-game status and roles. This assumption is part of the

ideological framework into which newcomers are tacitly enculturated (Steinkuehler, 2004) and harks back to the culture of early video game arcades: "It didn't matter what you drove to the arcade. If you sucked at Asteroids, you just sucked." (Herz, 1997, pp. 7-8)

Thus, such spaces are naturally inclined toward a flatter hierarchy with differentiated roles and status tied to in-world individuated expertise (i.e., each person a relative expert on their own topic of interest) rather than real-world role or status. One productive design strategy may be to play to just these strengths. For this to be effective, however, participants need to have enough background knowledge in the subject matter to take on a role of "expert" (however limited) and the program needs to have had enough time for such peer to peer connections to develop. An alternative to this view would be to view staff as serving a meta-facilitation role. This role would include observing the development of the network – where nodes exist, what node might be needed, and encouraging students to develop expertise in specific nodes.

Structure Discursive Argument

Positioning program staff as equals in an effort to promote the development of sociocultural forms of learning, peer discussion and collaboration, however, does not mean leaving discussion entirely freeform, especially if that discussion includes group argument. Regardless of where one's program design lands on the spectrum from enculturation to incubation, the facilitation of participant discussions using revoicing techniques (O'Connor & Michaels, 1996) appears important for fostering and sustaining more sophisticated forms of discursive argument. Confirming previous findings, this work shows that revoicing strategies can create productive participant frameworks (Goodwin, 1990) that enable students to position their claims within a framework of competing ones and, in so doing, crucially aid the collective construction of understanding.

A second, means for enriching developed group argument may be the use of *models*. Across both case contexts, models appear to function productively for discursive argumentation by helping students' coordinate their claims in terms of a shared (abstract or digital/material) representation of the group's conceptual understanding of a given system. In this way, they may very well function in the same manner as revoicing techniques, helping to coordinate individuals' contributions toward social knowledge construction through provision of a common frame or reference point. Such findings corroborate previous research that demonstrates the positive effects of scripts and other representational tools (Nussbaum, Winsor, Aqui, & Poliquin, 2007; Schwarz & De Groot, 2007; Schwarz & Glassner, 2007; Stegmann, Weinberger, & Fischer, 2007). Virtual world platforms like TSL and WoW are, at root, simulations; incorporating models into learning activities based on such platforms seems only a natural extension of this defining characteristic.

Build in Reflection

Finally, one simple yet powerful activity that both programs implemented to varying degrees was to have participants write reflections on their virtual world activities. In GK, students answered 2-3 questions about their activities at the end of each afternoon in the form of a blog post. In GLS, participants wrote "after action reports" on the program forums about their gaming activities following Saturday events on campus. In both cases, the basic act of having students reflect on what they know, what they need to know, what their goals are, and what strategies they are using toward those ends proved invaluable for both staff and participants. For the former, it functioned as a way to engage in informal formative assessment; for the latter, it provided opportunity for more complex forms of metacognitive processing. GK is the most persuasive example; here, reflective blog posts enabled and fostered more sophisticated information literacy practices including evaluation,

interpretation, and synthesis. Similar programs, in our assessment, would do well to add a reflective writing component to their daily activities, ideally at the end of each natural segment of activity (e.g., each day, in the case of GK; each Saturday, in the case of GLS), these reflections could also include multimedia iterations such as YouTube videos, machinima, voice threads, mashup.

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