Development of High School and Community College Students' Contemporary Learning Abilities in Globaloria-West Virginia

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ABSTRACT

Research into the cognitive and learning processes that occur during video game play is growing in prominence. Digital literacy and media literacy advocates and practitioners have long emphasized the importance of media *production* experiences in building learners' awareness of media influences, modes of production and ownership. Further, Constructionist-learning researchers have long emphasized the epistemological value of *programming games* for learning and cognition. This study explores the abilities that emerge among high school and community college students who participated in a year-long program of game design and Web 2.0 activity in the Globaloria-West Virginia project of the World Wide Workshop Foundation. Findings suggest that students at “TTC” HS and “CMMC” community college were able to successfully create functioning web games throughout their semester- and year-long participation, and that in both groups, participation in the program overall contributes to the development of 6 contemporary learning abilities in cognitive, affective and behavioral dimensions. We propose that game *design* activity contributes to the growing discourse on "gaming literacy" and “digital media and learning” (DML), and that Constructionist design and construction of games in online wiki and lab-based workshop settings can engender contemporary abilities necessary to be successful in today’s knowledge-based economy and professional work cultures.

INTRODUCTION

Research into the cognitive and learning processes that occur during video game play is a growing field of research. Scholars are addressing the nature of cognitive and emotional development, literacy practices, and thinking and learning in a range of gameplay environments (e.g., Gee, 2007, Steinkuehler, 2008a; Squire, 2006; Shaffer, 2006; Hayes, 2008). Much of this research focuses on games released commercially for entertainment purposes (e.g., World of Warcraft, Grand Theft Auto, Quake, Dance Dance Revolution, The Sims, Second Life), and edutainment (e.g., Civilization, Spore, Carmen Santiago, Quest Atlantis). Leading game scientist Jim Gee has proposed that cultures of gaming cultivate certain new types of learning in players (2007). His research finds there to be a great deal of learning while gaming, which brings about a gaming literacy. With his colleagues he has developed a framework for gaming literacy, and presents a range of learning principles that are inherently built into the design of games that lead to new types of learning in game players. It has become clear through such research that in good games, learning and system thinking is transferred to those who play them, stemming from user action and interaction with the game features and other players in the designed environment.

Potentially adding to the growing "digital media and learning" (DML) scholarly discourse is research into the role of game designing, programming and building by young learners. Media literacy advocates and practitioners have long emphasized the importance of media production experiences in building learners' awareness of media influences, modes of production and ownership (e.g., Potter, 2004). Further, Constructionist-learning theorists and practitioners have long emphasized the epistemological value of student programming and creating of games and other complex digital artifacts for learning and meta-cognitive development (e.g., Harel & Papert, 1990; Harel & Papert 1991; Harel, 1991; Kafai, 1995; Bruckman & Resnick, 1995; Kafai & Resnick, 1996; Urrea, 2001; Ackermann, 2002, 2004; Cavallo, 2004; Kafai, Y. B. & Ching, C. C., 2004; Kafai, 2006; Kafai, Peppler & Chin, 2007; Klopfer, 2008; Reynolds, 2008).

This paper shares empirical findings on the outcomes of student learning as a result of engagement in the Globaloria program (www.globaloria.org) of the World Wide Workshop Foundation -- an innovative new program of learning that invites students and educators to master the tools of social media technology through creation of original interactive web games with a social and educational purpose. Globaloria was established to help close the digital literacy gaps that exist in the United States and worldwide by empowering youth, educators, and education professionals to create interactive games, collaborate, contribute, learn and lead in today's digital and globalized world. Globaloria participants learn how to build a web game by actually doing it, working individually and in collaboration with others within an activity-driven, networked social media community of learning.

The first large-scale pilot initiative, Globaloria-West Virginia was implemented in the summer of 2007 and implemented in the 2007/2008 school year with 89 students and 14 educators.[1] The overarching goal for Globaloria-WV in the first pilot year was to continue advancing an effective and successful educational model for a statewide network for 21st century learning – MyGLife.org. We believe that engagement in the comprehensive Globaloria program of learning can result in Constructionist digital literacy – empowering participants to understand that they can play games, as well as design and construct games themselves.

[1] In partnership with the West Virginia Office of the Governor and the Claude Worthington Benedum Foundation, a regional philanthropy serving West Virginia and southern Pennsylvania.

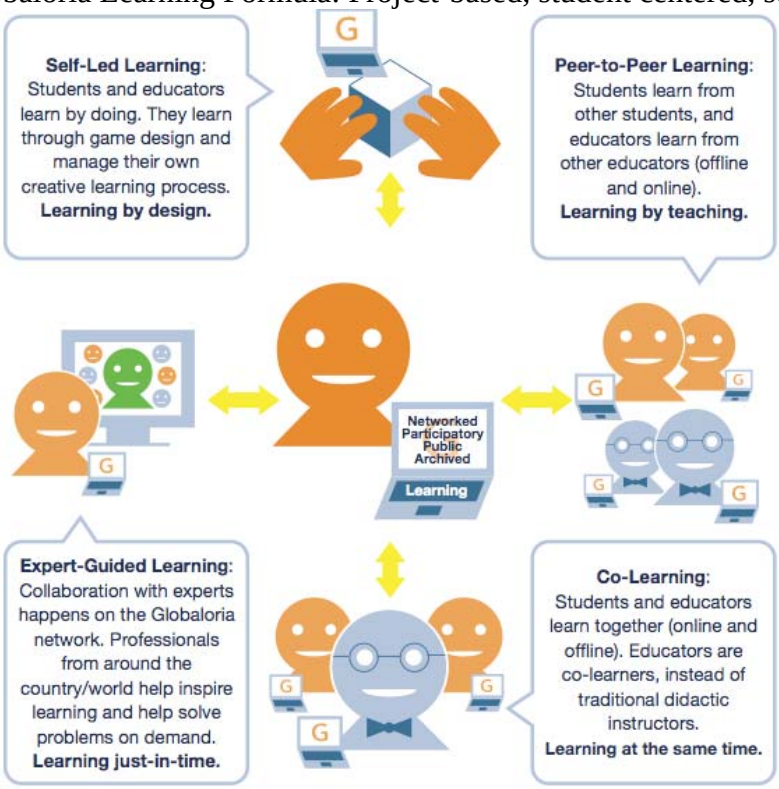
In this paper we address findings from the Globaloria-West Virginia pilot, focusing in on student engagement in the program at two schools -- one technical high school and one technical community college -- during Pilot Year One. The study addresses student performance in game design and Web 2.0 activity, and their development of six contemporary learning abilities at both the individual case study, and group levels of analysis. Our research provides support for expanding the current conception of "gaming literacy" in the field of "digital media and learning," beyond the learning that occurs just through game play --- to include the rich learning experiences that occur during youth game design and creation.

LITERATURE REVIEW

The Globaloria program applies "Constructionist" principles to bring about learning and digital literacy development, through participants' construction, interaction, and play using Web 2.0 tools. Constructionism is a philosophy and framework for learning and educative action developed by Seymour Papert and colleagues at the MIT Media Lab in the 1970's and 1980's – in the early days of personal computers. Previous Constructionist learning interventions have involved student engagement in project-based design work, using technology and other tools to develop a creative artifact that represents a given knowledge domain (the subject or theme represented in the project). In the Constructionist "framework for action" (diSessa and Cobb, 2004), it has been proven over decades of research that learners' conscious construction of a computational artifact, as a technologically-mediated public entity, builds knowledge and meaning for the learner and his or her peers (Harel & Papert, 1991a, p.1). Such interventions have been found to advance learning and meta-cognition in participants, among other positive outcomes (e.g., Harel, 1991; Kafai, 1995; Bruckman & Resnick, 1995; Kafai & Resnick, 1996; Urrea, 2001, 2002; Ackermann, 2002, 2004; Cavallo, 2004; Kafai, Y. B. & Ching, C. C., 2004; Kafai, 2006; Peppler, Kafai & Chin, 2007; Klopfer, 2008; Reynolds, 2008).

Globaloria is a Constructionist game-making network that employs updated Web 2.0 creative media for learning. The program provides a virtual design studio with a curriculum that directs students to learn by doing. Learners collaborate with others to build original web-games and simulations using social-media technologies. Digital skills are learned in context through purposive work towards a real, sharable, playable finished product. These are sophisticated and complex skills, required for students to be productive, successful, 21st-century citizens. The Globaloria program is unique in that it is the first to situate and prioritize Constructionist game design within a social, wiki-based learning environment, and to introduce it to students and educators as a program for building overall digital literacy. The following figure represents the flow of learning that occurs in Globaloria.

Figure 1. Globaloria Learning Formula: Project-based, student centered, social learning



In this model, students and educators learn together. Students learn on their own through exploration of resources, and, from each other and their educators through online and face-to-face interactions. Finally, students and educators learn from experts to whom they are put in contact through the World Wide Workshop Foundation – in real-time virtual Webex and face-to-face training sessions. Details of the Globaloria learning innovation are provided in Reynolds & Harel, 2009.

Rationale for West Virginia implementation

A primary reason we chose an initial pilot implementation in West Virginia was to test our learning innovation with a population experiencing the effects of the digital divide. A large program of research is underway in education and the social sciences, exploring the extent and nature of the digital divide phenomenon. One recent study (Hargittai & Hinnant, 2008) of US 18-24 year olds finds that women are more likely to report lower levels of self-reported digital skills, as are those who use the internet infrequently. The study finds that the higher the level of education, the greater the self-reported digital skill. And, the same study finds that those with higher levels of self-reported skill are more likely to visit the types of Web sites that may contribute to improving their life chances and from which their human and financial capital may benefit. This finding highlights the extent to which digital literacy initiatives may impact equality and opportunity more broadly.

Contexts of technology access and use for younger individuals comprise mostly home and school. Socio-economic considerations clearly play a role in home access, due to the cost of hardware and network access. But what technology affordances exist for youth in the school context? At the national level, a 2008 report of the National Education Association presents

findings of a large national survey of US educators on the state of technology integration in U.S. schools (2008) and reports that school technology integration and use in pedagogy is minimal.

As a rural and mountainous state with a higher poverty level than most of the country, WV residential broadband diffusion has been challenging, due to both infrastructure and cost. This is evident in the lack of broadband coverage for rural, under-served communities located in poorer, remote pockets of the state.

Demographics of the pilot communities from Year One addressed in this study, TTC technical high school and CMMC technical community college are provided in Table 1.

Table 1. 2007 Census data[2]

Pilot Location	Broadband Available at Home	% Students Considered Low Income	Pop-ulation	Average Income	WV Avg Income	National Avg Income
TTC	Yes	36.14%	7,000	$25,710	$33,993	$44,334
CMMC	Yes	NA	51,475	$23,234		

The U.S. state of West Virginia has a lower median household and per capita income and higher poverty level as a percent of the population in comparison to figures for the nation as a whole. The 2007 income levels for both pilot communities fall below the state and national average income. Overall, we expect that broadband diffusion and socio-economic barriers in West Virginia increase the likelihood of digital divide effects being present in the state, at both the first and second levels (access, and sophistication of use), thereby limiting technology knowledge development by young learners in the home context due to cost and access. We propose that the Globaloria program can help schools and communities bridge first and second-level divides, educating students (and educators) in a *full range* of life skills competencies that are critical for building contemporary digital literacy, and enhancing their own and their state's competitive posture in the world of tomorrow.

Contemporary Learning Abilities Framework

The following table outlines six "Contemporary Learning Abilities" (CLAs) we hypothesize our program helps to cultivate, and specifies the Globaloria activities related to the abilities. We initially hypothesized and roughly scoped the first draft of the CLAs framework while developing our research design for Globaloria-West Virginia, prior to the launch of pilot year one in the Summer of 2007. This draft framework helped inform our research design and instrumentation. See Reynolds and Harel Caperton (2009) for further details on the framework's development. Throughout Pilot Year One, and ongoing, the framework has served as conceptual model to guide the impact research in the project.

[2] Demographic data for pilot location communities was derived from data provided on the U.S. Census Communtiy Factfinder website, http://factfinder.census.gov/home/saff/main.html?_lang=en. Demographic data for % low income students was provided on the West Virginia Education Information System website, http://wveis.k12.wv.us/nclb/pub/

Table 2. Globaloria PROMOTES DEVELOPMENT OF SIX CONTEMPORARY LEARNING ABILITIES (6 CLAs)

6 CLAs	Activities representing each CLA, and how they are articulated and integrated in Globaloria
1. Invention, progression, and completion of an original digital project idea (for an educational web-game or interactive simulation)	Brainstorming and developing game and simulation ideas and storylines (using Web2.0 tools such as wikis and blogs) Choosing and researching a subject for a game design project Developing an original approach to teaching the subject in an educational game Writing an original game narrative and a proposal to explain it Generating creative ideas for designs to express the subject of the game and the user experience Planning game design execution using paper prototyping Programming a game demo that illustrates the original game design and functionality Programming and completing a final game Developing knowledge of the game's domain or topic through game invention and creation
2. Project-based learning through online project management in a wiki-based networked environment	Coordinating the design, creation and programming of the game elements and managing the process of building it Managing the project's execution using a wiki (creating wiki pages, organizing and forM.C.ing the wiki, sharing project assets, and progress updates) Managing the team work (defining and assigning team roles, coordinating tasks, and executing one's role within the team) Project troubleshooting for self and others Gaining leadership experience through the project management of all game production elements (e.g., design document, user flow, budget, schedule, introduction, overview, treatment, competitive analysis, teamwork, planning, managing implementation process)
3. Publishing and distribution of self-created digital media artifacts (using wikis, blogs, websites)	Creating a wiki profile page and project pages Integrating and publishing text, video, photos, audio, programming code, animations, digital designs on the wiki pages Posting completed assignments for each course topic to wiki Posting game design iterations and assets to wiki Posting notes and reflections about own projects Developing a blog
4. Social-based learning, participation and exchange in a networked environment (cross age, cross expertise)	Collaborating by using Web2.0 tools, such as posting to wikis, blogs, open source help forums, Instant messaging Exchanging and sharing feedback and resources with others by posting information, links, source code questions and answers Reading and commenting on blogs and wiki pages of others Presenting final digital projects for others – virtually in game galleries and in person in live game demonstrations
5. Information-based learning, purposeful search, exploration	Searching the Web (using Google, wikipedia and other sources) for answers and help on specific issues related to programming games Searching and finding resources on MyGLife.org network, website, and wiki Searching the Web for new Flash design, animation and programming resources Searching for information in support of the game's educational subject M.C.er and storyline
6. Surfing websites and experimenting with web applications and tools	Surfing to MyGLife.org starter kit site and other game sites and playing games online Keeping track of and bookmarking surfing results that are relevant to projects Browsing Web2.0 content sites such as Youtube, Flickr, Blogs, Google Tools

We believe that the 6-CLAs develop in parallel, contribute to each other, and are best achieved in an integrated way through constructive, project-based activities that engage learners in a wide spectrum of technology uses. This framework is a new learning innovation, and represents a departure from many traditional digital literacy initiatives in place today.

Research Questions

In presenting Globaloria as a possible model for a state-level technology learning intervention, we seek a better understanding of the processes and outcomes afforded to students who engage in this innovation. Based on the framework, we established several main research questions to guide our research. The present study addresses the following two.

RQ 1. To what extent does the current implementation of Globaloria in Pilot Year 1 enable students' development and publishing online of functioning web games?

Students' performance in game design, and the extent of their wiki activity, are key behavioral outcomes that will provide evidence of support for this research question. In our research we use coding schemes to content analyze wiki activity and to evaluate games (see Appendix B). In this study, we present game evaluation findings only, but Wiki metrics data are available upon request and are under review for another conference.

Game design can be considered a behavioral variable because it reflects the outcome of user actions. The extent and complexity of the game artifacts also reflects actual knowledge gained by participants (a cognitive variable). Findings on student performance in their game creation are important descriptive outcomes data for Year-1, and also reflect students' enhanced contemporary learning abilities.

RQ2. To what extent does student participation in Globaloria cultivate the abilities highlighted in the Six Contemporary Learning Abilities framework (6CLAs)?

Individual students bring varying prior experiences, motivations, interests, and technology knowledge to the program. To address this question, our research focuses on behavioral, affective, and cognitive dimensions for each of the 6-CLAs. Specifically, to measure change from pre- to post-program in each abilities category, we focused in our surveys on three self-report variables – *frequency (behavioral)*, *motivation (affective)*, and *knowledge (cognitive)*, all operationalized to measure the activities that represent the CLAs in the table above. We expect that these dimensions, across all CLAs, will become newly developed as a result of students' participation.

Frequency dimension. Frequency is a standard variable within new media research that indicates media adoption and diffusion within and across populations. It is a variable common to almost all media research. Increases in frequency of engaging in activities representing the CLA categories from pre- to post-program would provide support for development in this behavioral dimension.

Motivation dimension. In the self-determination theory of E.L. Deci and R.M. Ryan, motivation is directed *towards* various activities, and having motivation towards something indicates a tendency toward repeat engagement with it over time (Deci & Ryan, 2000; Ryan & Deci, 2000a; Ryan & Deci, 2000b; Brophy, 1998). *Intrinsic (or self-determined) motivation* is composed of the individual's perceptions of 1) competence (confidence), 2) autonomy (freedom of choice) and 3) social relatedness (feelings of connectedness and sharing with others). These qualities are inherent in the individual, but can also be supported by the environment. Constructionist learning environments cultivate intrinsic motivation and support self-determination by providing opportunities to increase competence, exercise autonomy and share

with others (Reynolds, 2008). Increases in motivation toward activities representing the CLA categories provide support for the affective (emotional) dimension of CLA development. Motivation is considered an enduring quality that under normal circumstances remains quite static. Therefore changes are considered to be of particular significance, because we hypothesize that they may signal longer-term effects.

Knowledge dimension. Knowledge is typically defined as information, understanding, facts and ideas acquired by study, investigation, observation, or experience. Our project focuses on building participants' knowledge of how to engage constructively in Web 2.0 communications, project management, and game design, to build and share a game that bears a purpose. Participants do so in a productive year-long workshop setting that espouses a culture of expression, collaboration and sharing. We hypothesize that building students' immediate knowledge of Globaloria activities, in our unique workshop and experiential context, strengthens students' overall abilities and knowledge in the categories reflected above. We hypothesize that down the line, these abilities will be transferable and students will be able to apply them in new contexts to further their learning.

Immediate-term increases in students' self-reported knowledge of the activities engaged in would provide support for the cognitive dimension of CLA development. It is important to note that increases in self-reported knowledge may also reflect affect (e.g., confidence towards a given activity), and in this case self-reports of knowledge are worthwhile to reflect, but not as valid as an actual knowledge test. Currently, no validated knowledge test exists reflecting the full range of CLA categories. We are in the process of contracting with a 3rd party educational consulting firm in West Virginia, Edvantia, to develop a performance-based evaluation that may test student knowledge. In the meantime, we also refer to actual game design and level of wiki activity to represent actual cognitive knowledge gains because these artifacts are the direct behavioral performance outcomes of actual student knowledge gained.

METHOD

Implementation Contexts

In response to the two research questions above, this paper presents results from two pilot locations from Pilot Year One of the Globaloria-West Virginia project: "TTC" and "CMMC." Globaloria was implemented at the 2 vocational training schools as an experimental, integrated course for a grade and course credit, and offered daily. At "TTC" high school, the program was offered as "Game Design I" from September 2007 – January, 2008. Here, in the fall semester, 20 students opted to take the class, and worked in teams to create 8 final game projects. In this present study, we focus only on the activity of the group of 20 students in Semester One.[3]

At CMMC (CMMC), Globaloria was offered in a higher education context in both the Fall and Spring semesters, as "Game Design I," and "Game Design II," to 8 students in the school's undergraduate IT program. All eight students continued for the entire year, and were joined in Semester 2 by the 5 TTC senior male high school students.

The following figure presents further details about the implementation contexts.

[3] Five senior male students continued in the Spring 2008 semester as a single game design team, enrolling in "Game Design II" offered by the RTC educator as an independent study course, in conjunction with the community college CMMC.

	2007-2008				Semester 1 Implementation		Semester 2 Implementation	
Pilot Location	Total # of Educators Trained	Student Grade Level	Total # of Unique Student Participants	School Type	Type of Program Offered	Individual or Team Work	Type of Program Offered	Individual or Team Work
TTC	2	High School	20	Technical Vocational Education	For credit (Business Curriculum) 5 mtgs/wk 90 mins/mtg	Individual and Team projects	For credit (Business Curriculum) Virtual class with MCTC 5 mtgs/wk 90 mins/mtg	Team projects
CMMC	2	Community College	12	Technical Jr. College Education	For credit (IT Program) 4 mtgs/wk 2 hrs/mtg	Individual projects	For credit (IT Program) 4 mtgs/wk 2 hrs/mtg	Team projects

Figure X. TTC and CMMC implementation context details

Please see Appendix A for greater details on the local implementation at both TTC and CMMC.

Design-based research method.

Research literature in the field of the learning sciences has provided support for the validity of the design-based research methodological paradigm, which calls for investigation into the relationships present among learning variables in individuals, groups, environments and technology innovations, towards advancing learning theory and instructional design (e.g., Barab & Squire, 2004; Wang & Hannafin, 2005). In this initiative overall, we are following design-based research principles, implementing a learning innovation across time, defining and iteratively developing the innovation in situ based on observations and findings, and reporting on the changes to the innovation and the learning outcomes and impact on students, educators, and groups.

In this paper, we have relied on pre and post-program online surveys, along with game design evaluation coding schemes for students at the TTC and CMMC pilot locations[4]. We have achieved parental, educator and administrative consents for all student participants in the program, and student participation is entirely voluntary. We conducted online surveys for all Globaloria sites in West Virginia as follows: a Pre-Program Survey on October 4, 2007, and a Post-Program Survey on January 17, 2008. We distributed the surveys to educators by email and Wiki Homepages. Teachers shared the Web links to the surveys with students.

[4] For in-depth qualitative case study results presenting findings for 3 TTC high school students from semester one, 3 CMMC community college students from semester one, and a group of 8 CMMC students from semester two during pilot year one, see World Wide Workshop Foundation internal research report #2 entitled "The Globaloria Program at TTC in West Virginia: Preliminary Results From Pilot-Year-1" and research report #3, entitled "The Globaloria Program at CMMC in West Virginia: Preliminary Results From Pilot-Year-1" – available at http://www.worldwideworkshop.org.

To measure change in contemporary learning abilities, from pre- to post-program in each CLA category, in our online surveys we focused on three behavioral, affective and cognitive self-report dimensions for each contemporary learning ability – *frequency*, *motivation*, and *knowledge*.

Motivation is an affective (emotionally-oriented) disposition, operationalized in past surveys as confidence and interest/enjoyment in certain activities. We address motivation or affective impact by conducting pre- and post-program surveys on self-perception and motivation towards CLA-related activities. Motivation was measured using a 5-point scale developed and validated by Deci and Ryan (2000). We asked students to assess their levels of confidence and enjoyment in specific CLA-related activities. In our data analysis we combined the variables of confidence and enjoyment into a single variable labeled *motivation*, for each CLA category. See Appendix C for details on survey itemization, and combinations of motivation items to reflect the CLAs.

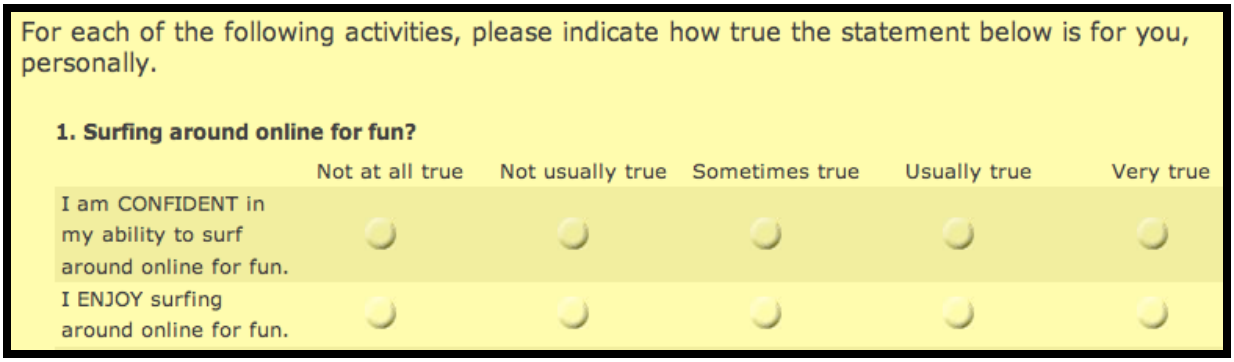


Figure 1. Survey question on students' motivation towards 6-CLAs (screenshot)

Frequency is a behavioral measure. To measure frequency we used criteria employed by the Pew Internet and American Life Project[5] in their national surveys of media and technology use. Our surveys measured frequency of technology use across the 6-CLAs. See Appendix C for details on survey itemization, and combinations of frequency items to reflect the CLAs.

Increases in technology use at school due to Globaloria participation are to be expected. Increases in technology use at home on students' own time would indicate that the Globaloria program was having an impact on the way that students are spending their free time, and whether they are becoming more productive computer users in their home technology use. At this time, our frequency measures combine both at-home and at-school technology activity. Increases indicate composite, overall impact on students' technology use frequency. We measured frequency of technology use for a range of activities representing each CLA category, before and after Globaloria by asking students to indicate on a 7-point scale how often they participated in these activities. In our data analysis we additively combined several activities into a single frequency variable for each CLA category. Increases in frequency across the CLA categories may indicate adoption of the skills learned in Globaloria.

[5] See www.pewinternet.org

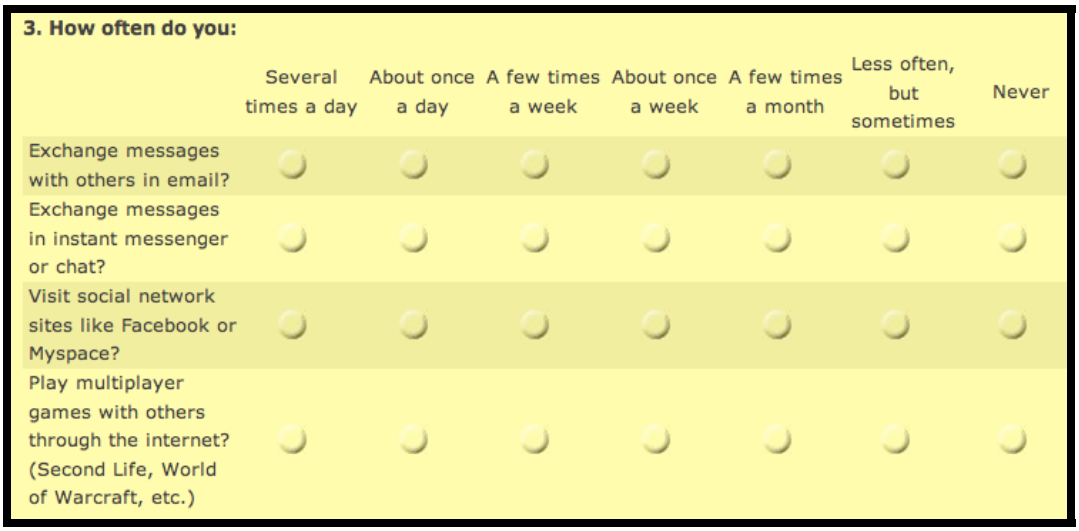


Figure 2. Survey question on students' frequency of engagement in Six CLAs (screenshot)

Knowledge. To measure knowledge we analyzed self-reported digital knowledge items using a variation we have made upon a measure validated as predictive for actual knowledge by Hargittai (2005).[6] The question for self-reported knowledge on the Pre-Program Survey presented a list of 21 technology terms that were chosen to reflect a broad range of CLA activities. Student responses for all the terms were combined into a composite variable.[7] Self-reported knowledge data are available for TTC only, where students completed a different post-program survey in January versus the other locations' post-program survey in May (which we abbreviated to reduce response fatigue of a lengthy survey).

[6] Hargittai offers a validated set of survey items for the concept of "digital literacy" as she defines it that can stand in as a proxy for peoples' actual technology skills in survey research. She operationalizes the "perceived knowledge" proxy survey instrument as follows: "How familiar are you with the following Internet-related items? Please choose a number between 1 and 5 where 1 represents having 'no understanding' and 5 represents having 'a full understanding' of the item. (none, little, some, good, full)." Among a random sample of U.S. adults Hargittai's composite optimal index of internet-related items achieved a Cronbach's alpha of .89, with a predictive power (adjusted R^2) of .321 for actual internet competence, measured by a knowledge test of digital task completion -- the highest among all quantitative indices of digital literacy published. This finding indicates that other researchers who use Hargittai's survey measures in a different survey of adults' technology knowledge, can expect that this new survey will be predictive of their subjects' *actual knowledge* at a level of 32% (a predictability quite high for survey methods).

[7] Composite reflected a Cronbach's alpha reliability statistic of over $\propto$=.9.

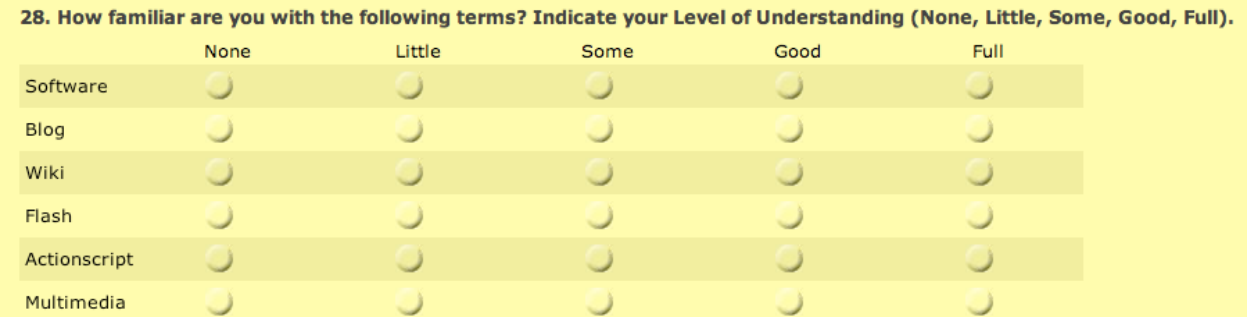


Figure 3. Self-Reported Technology Knowledge

See Appendix C for more details on survey operationalization for each CLA.

RESULTS

Descriptive data

TTC. At TTC, pre-program survey data were collected about two weeks after students gained access to the Globaloria Starter Kit Website and wiki platform for learning. Students were asked to respond based on their technology use prior to participating in Globaloria. For the pre-program survey, N=20; for the post-program survey, N=19. Average age of TTC participants was 16.5 (SD=1.1). Average grade level was 11.0 (SD=.94, min=10, max=12). Fifteen males and five females completed the pre-program surveys.

Pre-Globaloria computer use. Prior to Globaloria, it appears that most TTC students use a computer several times a day, both at home and at school. Students at TTC have access to technology at home and school, and, they use it in both locations regularly.

9. How often do you:

	Several times a day	About once a day	A few times a week	About once a week	A few times a month	Less often, but sometimes	Never
Use a computer, in total?	**94.7% (18)**	5.3% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
Use a computer at home?	**57.9% (11)**	15.8% (3)	15.8% (3)	0.0% (0)	5.3% (1)	0.0% (0)	5.3% (1)
Use a computer at school?	**57.9% (11)**	36.8% (7)	5.3% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
Use a computer somewhere else?	15.8% (3)	5.3% (1)	10.5% (2)	21.1% (4)	5.3% (1)	**36.8% (7)**	5.3% (1)

Figure 4. Frequency of Computer Use*

*Most students who used a computer "elsewhere" gave "friend's house" as the other location.

Prior experience with the more constructionist CLAs. While they report high access and regular technology use, the results in the Figure below indicate that that prior to Globaloria, students at TTC had little experience in ever having engaged with the more Constructionist activities our program focuses on (invention, progression, and completion of an original project idea; project-based learning and project management in a networked environment; and publishing and distribution of digital media). Most students had not ever used a wiki, designed a graphic, developed an interactive game, put together a design team, used programming software, posted creative files or worked on a digital design team online. At this technical location, around half of students had used a blog and designed graphics, thought up ideas for a game project and posted creative files online. A smaller number of students had prior computer programming experience.

10. Before Globaloria, have you ever:		
	Yes	No
Used a wiki?	31.6% (6)	**68.4% (13)**
Used a blog?	**52.6% (10)**	47.4% (9)
Designed graphics on a computer?	31.6% (6)	**68.4% (13)**
Thought up an original idea for a game project?	**63.2% (12)**	36.8% (7)
Developed an interactive game from beginning to end?	5.3% (1)	**94.7% (18)**
Put together a team to make it happen?	15.8% (3)	**84.2% (16)**
Done any computer programming?	31.6% (6)	**68.4% (13)**
Posted creative files like graphics, animations or games, to the internet?	47.4% (9)	**52.6% (10)**
Worked in a team on a digital design project, online?	10.5% (2)	**89.5% (17)**

Figure 5. Prior Constructionist Computer Activity

The 6 students who report previous use of a wiki was somewhat surprising. It is possible that students interpreted *used a wiki* as having visited wikipedia as a source of information in an online inquiry search. Or, since they completed the survey after starting the program, it may be that students responded based on their use of the wiki in Globaloria. Continued survey instrumentation will a) be conducted prior to student engagement in the project, and b) distinguish between basic informational reading of wikipedia content and project-based contribution of original content in the Globaloria wiki platform environment. Finally, the

question “Have you ever developed an interactive game from beginning to end?” was followed by “Have you ever put together a team to make it happen*?*” Some students missed the connection, answering “no” to the interactive game experience and “yes” regarding teamwork. This item also will be clarified in future surveys.

CMMC. CMMC implementation differed in several ways from the other locations. A total of eight students who participated fully at the CMMC pilot location for the entire year’s duration completed the pre- and post-program surveys. Students range in age from 20 to 39. The class consisted of five males (ages 21, 21, 27, 28, 36) and three females (ages 20, 38, 39), for a mean age of 28.8 (SD=8.0). In the post-program survey, students report having worked an average of almost 3.5 hours (205 minutes) per week on Globaloria projects during their regularly scheduled class time. They report having worked an average of about 4.5 hours (260 minutes) per week on Globaloria projects, *outside* of class time.

CMMC Pre-Globaloria computer use. Prior to Globaloria, it appears that most CMMC students use a computer several times a day, both at home and at school. Students at CMMC have access to technology at home and school, and, they use it in both locations regularly.

1. How often do you:

	Several times a day	About once a day	A few times a week	About once a week	A few times a month	Less often, but sometimes	Never
Use a computer, in total?	**87.5% (7)**	12.5% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
Use a computer at home?	**87.5% (7)**	12.5% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
Use a computer at school?	**62.5% (5)**	25.0% (2)	0.0% (0)	12.5% (1)	0.0% (0)	0.0% (0)	0.0% (0)
Use a computer somewhere else?	14.3% (1)	14.3% (1)	0.0% (0)	0.0% (0)	14.3% (1)	**28.6% (2)**	**28.6% (2)**

Figure 6. CMMC Students’ Frequency of Computer Use

Prior experience with the more constructionist CLAs. The tables that follow present descriptive data for CMMC students’ prior experience with activities reflecting the 6 contemporary learning abilities. Prior to Globaloria, most CMMC students had never used a wiki, developed an interactive game, put together a design team, or worked on a digital design team online. Most students at this technical location had experienced blogging, designing graphics on a computer, and programming computers. Students were close to evenly divided in their experiences thinking up game ideas, and posting graphics online.

2. Before Globaloria, have you ever:		
	Yes	**No**
Used a wiki?	12.5% (1)	**87.5% (7)**
Used a blog?	**75.0% (6)**	25.0% (2)
Designed graphics on a computer?	**87.5% (7)**	12.5% (1)
Thought up an original idea for a game project?	**50.0% (4)**	**50.0% (4)**
Developed an interactive game from beginning to end?	12.5% (1)	**87.5% (7)**
Put together a team to make it happen?	12.5% (1)	**87.5% (7)**
Done any computer programming?	**75.0% (6)**	25.0% (2)
Posted creative files like graphics, animations or games, to the internet?	**50.0% (4)**	**50.0% (4)**
Worked in a team on a digital design project, online?	37.5% (3)	**62.5% (5)**

Figure 7. CMMC Students' Prior Constructionist Computer Activity

Average Game Evaluation Scores, By Location

To address RQ1 and 2 (specifically, cognitive and behavioral process and outcomes in students that reflect CLA development), here we highlight results of our game evaluation for students from these two pilot locations.

CMMC and TTC's educators encouraged students in Semester One to complete a final game that could be graded and posted online. In Semester One, students at CMMC created a total of 7 games working individually, and TTC students created a total of 8 games, working in teams. In Semester Two, students created one team game at CMMC.

Game Evaluation Scoring. To evaluate games on a common scale, we coded and scored each team game using an evaluation coding scheme we developed with the help of an expert Flash game design consultant (Appendix B, *Web Game Evaluation Coding Scheme*). This coding system contains 80 possible elements that might be included by a beginning/intermediate Flash game designer. Game elements are tallied for their presence only (Yes/No) and scored with a 1 if they exist in the games. Total scores reflect total elements included.

Games for all pilot locations were coded by a team of five young evaluators (Globaloria summer interns entering college) who achieved inter-coder agreement by applying the coding schemes to the two most advanced games from Semester Two (TTC and CMMC). Interns engaged in a process of initial individual coding of a common game, score comparison, discourse on discrepancies, revision of some coding categories, re-coding of games with new categories, and attainment of consensus (with this small sample, statistical inter-coder reliability was not attempted). The coding scheme we are using is still being piloted, and we are continuing to refine it in Pilot Year 2 to ensure that it contains relevant, age-appropriate categories for the populations and age groups of students we work with.

Game Results by Pilot Location, Semester One

TTC. Students at TTC worked individually for the first month of the course completing assignments on their own. The class then broke into teams of 2 or 3 and began to brainstorm team game subjects. After choosing their subjects and conducting a competitive analysis to identify the existence of other similar games online, the students individually created and submitted full game proposal design documents, mailing them to the World Wide Workshop. They started their design process with simple Flash file proposals containing portions of text and some minimal graphics outlining their game plans, then began actual design and development of their games.

All team games at TTC in Semester One featured quiz content, in which different choices made by the player for a set of questions resulted in varied game outcomes. Although case study teams chose different educational subjects and themes, they used a similar quiz-based format of multiple-choice questions to represent what they thought of as educational content. Students may have adopted similar modes of representing educational games as quizzes due to the social nature of the workshop setting cultivated by the educator, or the social nature of the wiki as an environment to which students published, shared, and reviewed each others' game files, plans and proposals.

See Appendix D-1 for a case study of two team members in a TTC group called "The Demented Trio." The team consisted of three 10^{th}-grade students (two girls, one boy). The game reflects an educational theme based on a local environmental issue and science topic -- the preservation of salmon. Up until recently many rivers in WV were stocked with Coho salmon, which is now under consideration by many states for placement on endangered species lists.

The game depicts quiz questions and several graphics reflecting the game theme. In connecting their quiz question content to the subject of their game, they demonstrate an understanding that the educational nature of their game could be integrated into the action – a connection that most of the other groups do not make. The students receive a final score of 16 out of a total possible score of 80 possible points, when coded using the game evaluation coding scheme. This team's score overall was actually lower than the TTC class mean of 20 for the total set of Semester One games. The low score is largely due to the lack of animation or interactivity present in the game, which the students had planned to incorporate but ran out of time. The game reflects a base level of functionality achieved in most students' Pilot Year 1 games, while also demonstrating advancement of a creative game narrative tied to local and environmental themes.

CMMC. The individual games created at CMMC in Semester One all included an educational or social theme in a choose your own adventure decision tree structure, and included and featured buttons, some animation, and in a few cases, a small amount of interactivity. Game narrative themes included spelling, travel, astronomy, work etiquette, survival in nature, and

making sound life choices. Students programmed response screens that varied based on each decision made and button clicked by the player. One student included a video clip in his game, and some students integrated objects in motion crossing screens. On the whole, both the TTC and CMMC games from Semester One resembled cartoon-like slide presentations. The CMMC class mean for game evaluation was 20 in Semester One.

Game Results by Pilot Location, Semester Two

CMMC. At CMMC, the Semester Two game was created by a team of the same eight community college students who had created individual games in Semester One. CMMC students' teamwork in developing the "Adventure West Virginia" game was inventive on many levels. The game was created to serve as a multimedia infotainment PR platform, promoting the state of WV for the purposes of economic development. The game's themes demonstrate entrepreneurship, a value for economic development in the region, and business knowledge that adventure tourism is a burgeoning industry in West Virginia, which presents a marketing opportunity that the students leveraged in the design of their promotional environment.

See Appendix D-2 for a case study of the Adventure West Virginia team. CMMC students adopted a unique approach to the navigational structure of their game. They used the opportunity presented through Globaloria to leverage the timing of the economic growth cycle for adventure tourism in the region by choosing this topic for their interactive game. They drew many Web 2.0-type connections and recognized that placing such a resource online could lead to a greater level of visitation by tourists who encounter the information, and that the platform could serve as a viable marketing environment to sell space to businesses local in the region. The game also reflects a highly local connection in the overall theme to the cultural region of origin, as students anticipate the appeal of local culture to outsider communities who may travel in West Virginia. The game scores a 49 out of 80 total possible points, the same score calculated for the TTC game.

Game Evaluation Results Summary. The average game scores increase for CMMC from 20 in Semester One to 49 in Semester Two, indicating that at this technical location, older students advanced in their game design and development across the year. Five TTC high school students completed a game together in semester two, working in an independent study in collaboration with CMMC. These high school students also achieved a team game score of 49 out of 80 possible points in their work in Semester Two (versus an average score of 20 for TTC after Semester One), it appears that for both HS and community college students, implementing Globaloria in the context of a year-long, integrated game design course resulted in improvements and continued learning across this timeframe. It may be that planning and creating simple initial games in the first semester was a beneficial activity allowing students to further advance their game design ideas and execution later in the year.

The data above are ambiguous regarding the extent to which *individual* versus *team* game design contexts might yield more advanced and complex games. This question is likely to be case-specific, dependent on several factors including level of expertise of the game designers. Individual advancement and outcomes in the context of team work is an area of exploration in Pilot Year 2.

Students' increases in six contemporary learning abilities as a result of participation in the Globaloria program

TTC Pre- and post-program survey results. Table 9 below presents paired t-test statistical results for the pre- and post-program survey at TTC for frequency of engagement and

motivation towards activities representing the CLAs. See Appendix C for more details on survey operationalization for each CLA.

Table 3 Increases in TTC Students' Frequency and Motivation for Engaging in Activities Reflecting the 6 Contemporary Learning Abilities, Due to Participation in Globaloria

Activity	**CLA Number**	**Change in Frequency (mean, 7-point scale)**		**Change in Confidence/ Enjoyment (mean, 5-point scale)**	
		Pre-survey	Post-survey	Pre-survey	Post-survey
Surfing	SIX				
Surfing for information	6a	4.6	5.2	4.6	4.6
Surfing for gameplay	6b	4.8	4.9	4.4	4.5
Information-seeking	FIVE	***5.1***	***5.7**** t(17)= -2.7	4.1	4.4
Social-based learning, participation and exchange	FOUR	***4.3***	***5.1**** t(16)= -2.3	4.1	4.4
Publishing and distribution of self-created digital media artifacts	THREE	3.5	3.9	***3.1***	***3.7 **** t(17)= -2.2
Project-based learning through online project management in a wiki-based networked environment	TWO				
Creating with digital media	2a	***2.3***	***3.6**** t(16)= -3.2	3.4	3.7
Collaborating with team members online	2b	***1.6***	***4.0***** t(16)= -6.3	3.9	4.0
Invention, progression, and completion of an original digital project idea (for an educational web-game or interactive simulation)	ONE	4.5	4.5	3.8	4.0

* $p<.05$
** $p<.001$
Only asterisked results achieved statistical significance
[1] See Table 2 for examples of activities representing the 6-CLAs

For frequency of engagement in activities representing the CLA *prior to Globaloria*, it appears that TTC high school students' pre-program engagement was greater for CLAs 4, 5 and 6, than for CLAs 2 and 3 before participating. The same trend appears to hold true for motivation prior to Globaloria participation. This finding supports our belief that without the benefit of interventions like Globaloria, students engage less frequently and are less motivated towards the beneficial constructionist activities (found in prior studies to result in positive

metacognitive learning gains) than more standard activities like surfing, information-seeking and socializing, when engaging on their own and in schools under the status quo.

After participating in Semester One of the Globaloria project, the results presented indicate an increase in TTC students' *frequency* of engagement in the CLA activities of information-seeking (5), online socializing (4), creating with digital media (2), and collaborating with team members online. *Creating with digital media* and collaborating with digital media are more Constructionist activities, and this result provides us with quantitative evidence of a behavioral increase in activities associated with Globaloria. These results support our expectation for an increase in each of the CLAs in the behavioral dimension of frequency in some categories.

Further research is needed to explain why students did not report statistically-significant increases in frequency of activities representing CLAs 1 and 3. One possible explanation for CLA 1 could be that the survey item operationalizations did not capture the breadth of the construct (they asked students about their frequency for having game ideas and having ideas about digital design projects – and we believe the measures need to reflect CLA 1 more broadly than simply "having ideas"). We are revising these items in pilot year 2 to reflect a broader range of "invention". Another possible explanation for CLA 3 is that the small N did not allow for achievement of significance even though the means do suggest a trend in the positive direction.

As for motivation, the results for confidence/enjoyment yielded only one statistically significant result; online publishing (CLA 3) was statistically significant. However, data trends in the table above indicate that the full group of TTC students reported *apparent* increases in their confidence/enjoyment towards the CLAs of information-seeking (CLA 5), online socializing (4), online publishing (3) and creating with digital media (2) – the latter two being more Constructionist dimensions of our contemporary learning abilities framework.

Motivation is considered an enduring quality that under normal circumstances remains quite static across time. The survey results for confidence and enjoyment suggest that the Globaloria program appears to have *possibly* been effective in changing qualities of motivation toward CLAs 5,4, 3, and 2, from the time of the pre-program survey to the time of the post-program survey. Apparent increases in this variable are noteworthy. We need to further explore this result with larger samples of students. We take this result as an early indicator of the program's impact on students' affective tendency towards these more constructionist abilities — after just one semester of intensive engagement in Globaloria at TTC.

Self-reported knowledge. In our comparative analysis of pre and post program change for students' self-reported knowledge, the mean increased from 3.3 to 3.8 ($t=3.19$, $p<.01$), as measured by our composite self-reported technology knowledge variable that combines items reflecting the whole range of the CLAs, combined. This result presents initial evidence of a possible cognitive impact. Further research is needed to explore the predictive validity of this self-report measure for actual technology knowledge among youth.

While some of the apparent increases did not achieve statistical significance, overall, these results provide initial evidence for the extent of impact that Globaloria participation may have in high school students' CLAs as a result of participating. It is important to note that this study is a "non-experimental design," in that we did not employ control groups. Therefore we cannot fully rule out alternative explanations such as natural maturation. We believe it probable however that the CLA increases we charted are likely to have resulted from students' engagement with technology in Globaloria. We can confirm that students in these locations did not engage in any alternative technology program at the school. We were the only one available.

Post-Globaloria: TTC students' home engagement in Globaloria activities.

After participating in Globaloria, as indicated in the table below, a majority of TTC students reported regularly using the class wiki, blogs, and social network sites *from a home computer* and a large number said they used the home computer to design graphics, think up original ideas for an interactive game project, and post creative files to the Internet. Prior to Globaloria most students had never engaged in these activities. These changes indicate that Globaloria was effective in prompting self-directed constructive engagement with technology. Of note – because Flash software was not typically installed at home, except for the free 30-day trial period, students could not use their home computer for game design.

Table 4. TTC home computer use for engagement in activities representative of the more complex CLAs 1 – 3, after Globaloria participation.

If you have a computer AT HOME, do you use it for any of the following activities?	**Yes**	**No**
Using a wiki?	55.6% (10)	44.4% (8)
Using a blog?	50.0% (9)	50.0% (9)
Using Flash?	23.5% (4)	76.5% (13)
Using Photoshop?	17.6% (3)	82.4% (14)
Designing graphics?	35.3% (6)	64.7% (11)
Thinking up an original idea for an interactive game project?	38.9% (7)	61.1% (11)
Developing and creating an interactive game?	16.7% (3)	83.3% (15)
Working with a team on a digital design project, online?	22.2% (4)	77.8% (14)
Programming (e.g., in Actionscript)?	16.7% (3)	83.3% (15)
Posting creative files like graphics, animations or games, to the internet?	33.3% (6)	66.7% (12)
Using social network sites like MySpace or Facebook?	77.8% (14)	22.2% (4)

TTC students' future intention to engage in Globaloria activities. Further, results presented in the table below indicate that TTC game design students enjoyed the new experience offered by Globaloria. About half of the class said they intended to regularly participate in all of the activities related to CLAs 1, 2, and 3. Several students indicated an intention to continue computer programming and online digital design, reflecting their adoption of the practices learned and an inclination to apply their new skills moving forward.

Table 5. TTC Students Intending to Engage in Activities Related to the More

MOVING FORWARD, do you think you will participate in the following activities with computers on a regular basis?	**Yes**	**No**
Using a wiki?	66.7% (12)	33.3% (6)
Using a blog?	61.1% (11)	38.9% (7)
Using Flash?	50.0% (9)	50.0% (9)
Using Photoshop?	50.0% (9)	50.0% (9)
Designing graphics?	50.0% (9)	50.0% (9)
Thinking up an original idea for an interactive game project?	44.4% (8)	55.6% (10)

Developing and creating an interactive game?	44.4% (8)	55.6% (10)
Working with a team on a digital design project, online?	38.9% (7)	61.1% (11)
Programming (e.g., in Actionscript)?	33.3% (6)	66.7% (12)
Posting creative files like graphics, animations or games, to the internet?	44.4% (8)	55.6% (10)
Using social network sites like MySpace or Facebook?	77.8% (14)	22.2% (4)

TTC results summary. TTC students in Semester One achieved a beginner-level of creation of web games (with an average score of 20 in Semester One), and their wiki activity appeared from site metrics to be highest among all locations. The survey results for TTC students' self-reported behavioral, affective and cognitive dimensions of the CLAs (i.e., frequency, motivation and self-reported knowledge) lend support to the positive behavioral findings from the wiki activity and game evaluation analysis for Semester One students. Results for home internet use and future intention provide further support to the program's impact upon student motivation to engage in activities representing the CLAs. The results for future intention may provide support for the possibility of their future transfer of achieved CLAs into new realms.

For TTC technical high school students, the following context factors may have contributed to positive results: participating in the Globaloria program fully in this integrated daily context, working for credit and a grade over a condensed 5- month timeframe, and working with a highly enthusiastic educator and with actively involved peers engaging in teamwork. Interestingly, at the end of the first semester, the TTC educator stated, "I'll never have another class of students like this one, they set a high bar -- they were just a really good group." This comment reflects a recognition from the educator that the program was successful. As the educator herself continues forth, it will be interesting to see how her attitudes and ways of observing student outcomes are refined in future implementations.

CMMC Pre- and post-program survey results. Statistical significance was not achieved on the CMMC results likely due to the small N of 8, so results for change from pre- to post-program for CMMC are provided for descriptive purposes only in the table that follows.

Table 6. Increases in CMMC Students' Frequency and Motivation for Engaging in Activities Reflecting the 6 Contemporary Learning Abilities, Due to Participation in Globaloria

Activity	**CLA Number**	**Change in Frequency (mean, 7-point scale)**		**Change in Confidence/ Enjoyment (mean, 5-point scale)**	
Surfing	SIX				
Surfing for information		2.1	1.4	4.7	4.8
Surfing for gameplay		3.3	3.8	4.3	4.5
Information-seeking	FIVE	1.5	2.9	4.8	4.6
Socializing and communicating online	FOUR	3.4	3.1	4.3	4.4

Publishing and distribution of digital media	THREE	5.5	5.4	3.8	3.8
Project-based learning and project management	TWO				
Creating with digital media		5.4	5.8	3.4	3.6
Collaborating with team members online		5.1	4.0	3.6	3.8
Invention, progression, completion of project idea	ONE	4.3	3.7	3.9	3.6

Overall, for frequency, after participating in Globaloria, CMMC students appear to report *decreases* from pre- to post-program in CLA 6 (surfing) and 4 (online socializing), and, decreases in CLA 2b (online collaboration), and CLA 1 (having creative ideas). Students report apparent *increases* in their frequency of CLA 6b (interactive gameplay), CLA 5 (information-seeking), and CLA 2a (creation of digital artifacts).

For motivation, students appear to report slight decreases in their confidence/enjoyment for CLAs 5 (information seeking) and 1 (operationalized as "having game ideas"). They report apparent slight increases in their confidence/enjoyment toward surfing, gameplay, socializing online, creation of digital artifacts, teamwork and online publishing. Due to the minimal nature of the changes and the small N, we cannot say with certainty whether results lend support to or contrast our expectations.

The apparent decreases in frequency of CLAs 4 and 6a may be explained by a displacement and shift in time spent during involvement in our program -- from these more basic activities, to more constructive activities of creation as they engaged in Globaloria. However, the apparent decreases in frequency of online collaboration and having creative ideas were somewhat surprising and we are exploring possible explanations. CMMC students are all enrolled in the IT program at CMMC, and thus are likely to have a high motivation and frequency of engagement in technology activities already, so for several CLAs there may have been a ceiling effect, with little room for increases. It may be that because these students were self-selected with a career interest in IT and web development, their time spent reflects shifts in technology activities based on other coursework at CMMC. For this older group of students, it is also possible that they held a more measured and conservative tendency in their responses to the program.

Post-Globaloria: CMMC students' home engagement in Globaloria activities. After Globaloria, as indicated in the table below, a majority of CMMC students reported regularly using Photoshop, thinking up an original idea for an interactive project, and using social network sites from home outside of regularly scheduled time with Globaloria. Most CMMC students did not use wikis or blogs, design graphics, work with teams on projects, or post creative files to the internet from home. Students were divided in their engagement from home with Flash, game development, and programming. It appeared that much of the work CMMC students did for Globaloria was in school. Of note – because Flash software was not typically installed at home, except for free 30-day trial period, students could not use their home computer for game design.

These older students had different home circumstances than the high school students and several had part-time jobs. A lesser amount of available free time for older non-traditional

students may have posed as a barrier to home use for some of these students. Because the home use results appear less dramatic than those for TTC, it is also possible that age may be playing a negative role in motivation and interest in the Globaloria program. Or, that these students' older age makes their attitudes towards technology less pliable.

Table 7. CMMC students' outside computer use for engagement in activities representative of the more complex CLAs 1 – 3.

OUTSIDE of regularly scheduled time with Globaloria, did you do any of the following activities?	**Yes**	**No**
Using a wiki?	37.5% (3)	62.5% (5)
Using a blog?	37.5% (3)	62.5% (5)
Using Flash?	50.0% (4)	50.0% (4)
Using Photoshop?	75.0% (6)	25.0% (2)
Designing graphics?	25.0% (2)	75.0% (6)
Thinking up an original idea for an interactive game project?	62.5% (5)	37.5% (3)
Developing and creating an interactive game?	50.0% (4)	50.0% (4)
Working with a team on a digital design project, online?	25.0% (2)	75.0% (6)
Programming (e.g., in Actionscript)?	50.0% (4)	50.0% (4)
Posting creative files like graphics, animations or games, to the internet?	25.0% (2)	75.0% (6)
Using social network sites like MySpace or Facebook?	87.5% (7)	12.5% (1)

CMMC students' future intention to engage in Globaloria activities. While CLA results were inconclusive for CMMC, when participants were asked whether they will participate in the range of Web 2.0 activities they learned in Globaloria regularly moving forward, they are highly positive in their responses, as indicated in the following table.

18. MOVING FORWARD, do you think you will participate in the following activities regularly?			
	Yes	No	Response Count
Using a wiki?	**50.0% (4)**	**50.0% (4)**	8
Using a blog?	**50.0% (4)**	**50.0% (4)**	8
Using Flash?	**87.5% (7)**	12.5% (1)	8
Using Photoshop?	**87.5% (7)**	12.5% (1)	8
Designing graphics?	**75.0% (6)**	25.0% (2)	8
Thinking up an original idea for an interactive game project?	**75.0% (6)**	25.0% (2)	8
Developing and creating an interactive game?	**75.0% (6)**	25.0% (2)	8
Working with a team on a digital design project, online?	37.5% (3)	**62.5% (5)**	8
Programming (e.g., in Actionscript)?	**71.4% (5)**	28.6% (2)	7
Posting creative files like graphics, animations or games, to the internet?	**50.0% (4)**	**50.0% (4)**	8
Using social network sites like MySpace or Facebook?	**75.0% (6)**	25.0% (2)	8

Figure 8. CMMC Students' Future Intention to Engage in Activities Learned in Globaloria

It appears that CMMC game design students enjoyed the new experience afforded by Globaloria. This table indicates that most students are positive in their intention to participate in almost all activities presented. The respondents are split regarding future use of a wiki, a blog, and posting of creative files to the internet. Five out of eight are less inclined towards working with a team on a digital design project online. These results shed further light on the results for the CLAs above, indicating that some of these older students may have held somewhat negative impressions of the online collaboration experience they engaged in within the Globaloria project using the wiki and possibly in engaging in team work in Semester Two.

More research is needed to explore this result, which could have been based in dissatisfaction with the wiki environment, the pedagogical strategy of the educator, the teamwork dynamic of the class, or something else. It is worth exploring in future research, the extent to which gender may also have played a role in the negative results for collaboration, to the extent that females' contributions may have been overlooked in the team game development (a phenomenon with a long history of research support). Overall, however, it appears from these

results that the older students are generally positive regarding their experience in Globaloria using Flash, programming, and designing a game.

Summary of results, TTC and CMMC.

In Semester One at CMMC, six out of eight individual students each created a functioning beginner web game. The CMMC post-program survey was implemented at the end of Semester Two, after CMMC students' entire year of participation following an entirely new context of teamwork in which eight students collaborated together to create a single game, Adventure West Virginia. In Semester One at TTC, eight teams of students created web games at a similar level. The TTC post-program survey was implemented in January after Semester One. High school students at the TTC pilot location evidenced several statistically-significant increases in their six contemporary learning abilities in the behavioral (frequency), affective (motivation) and cognitive (self-reported knowledge) dimensions. Survey results for CLA change among CMMC technical community college students appeared to be less dramatic on the whole than TTC, but the N was too small to gain support for any results at CMMC statistically.

DISCUSSION

In our Pilot Year-1 research we have identified several variables of importance in further explaining the overall results, presented in the list below. The purpose of identifying these variables is to enable us to draw associations among them in our continued research, in order to better understand the mechanisms by which student development of the CLAs occurs, and to understand the possible extended outcomes that may result, beyond the immediate Globaloria experience. A better understanding of the relationships among these variables is key to contributing to learning theory, and to designing and refining a more effective platform and curriculum.

- Intervention/innovation variables: Students engaged with common set of curricular and technology tools and resources including--
    - MyGLife.org web platform
    - Flash as game design software
    - Sequential game design and game development curriculum
    - Educator scaffolding enhanced by Foundation training of the educators
    - Direct Foundation support to students through live expert resources
- Implementation context factors that varied:
    - School community / regional demographics such as SES
    - School grade level (i.e., college vs. high school),
    - Technical vs. non-technical locations (this report highlighted 2 technical locations)
    - More formal integrated contexts for grade/credit, vs. informal after-school contexts (this report highlighted only integrated contexts)
    - Hardware, software and networking technology affordances present in the schools
    - Types of supplementary and free open source online resources students and educators utilized to support their learning, in addition to those provided by Foundation
    - Amount of time spent per week by students in integrated vs. after-school contexts, and duration of program (one semester or full year)
    - Level of expertise and motivation of the educators working with the students in technical vs. non-technical settings

- Individual-level student variables (short list):
    - Demographics (age, gender, socio-economic status, race/ethnicity)
    - Learning styles, interests, motivation
    - Disabilities
    - Prior school achievement
    - Prior home technology access and experience
- Outcomes:
    - CLAs (Frequency of engagement, motivation, knowledge, as reflected by multiple data sources)
    - Extension / transfer of abilities
    - Other outcomes

To begin to explore and identify relationships among these variables, in Pilot Year-1, our strategy prioritized observing, measuring and reporting on student performance outcomes, as evidenced in their created game artifacts, wiki activity to gain a greater understanding of the actual achievements of students as a result of their participation. We also sought to preliminarily test our contemporary learning abilities model using pre- and post-program surveys, and determine the extent to which student attitudes might support the findings we observe in their productivity and output. In segmenting our pre- and post-program survey results into groups (technical high school, technical college in this report) we are able to address apparent differences in the degree of change reflected between varying implementation contexts. We drew further from our own experience interacting with students and educators during on-location site visits, interviews, and video data collection as well – all of which contributed to the several case studies similar to those in Appendix D.

Wiki activity metrics and game design content analysis results evidence increases in several categories of students contemporary learning abilities, to the extent that these artifacts are the products of students' activity. These results indicated that technical college and technical high school students demonstrated apparent similarities in their productivity and output, as measured in Semester One and Semester Two with game evaluation and wiki statistics. Interestingly, both locations reflected an average game score of 20 in semester one, and an average of 49 in semester two[8]. Both high school and college students achieved successes in game design and the Globaloria program was effective with both age groups in bringing about successful interactive Flash game design implementations in the year-long timeframe (even if it had a lesser impact on the college students' technology attitudes).

Given the differing results on attitudes towards technology between high school students and college students, it appeared therefore that the main implementation context variables that played a role in student outcomes were student age, prior technology experience, and having already self-selected into a technology career in the case of CMMC students.

[8] The TTC semester two score is for the group of 5 high school students (the Experimental Ninjas team) who enrolled in "game design II" and engaged in distance learning with the Adventure West Virginia group at CMMC, using virtual conferencing and online training resources provided by the CMMC instructor S.P.

With our small sample, we were unable to run cross-sectional statistics to explore relationships among variables (for instance, the extent to which frequency of engagement and motivation might correlate directly with actual productivity (as measured by coding schemes). In some other analysis we have conducted, it appears that the wiki metrics results are related to the game evaluation results – that is, locations highest in wiki activity also scored highest in game design, and same with second-highest and third-highest. Wiki use may be a positive contributor to game design, and vice versa. Further exploration of such findings at the individual level (e.g., correlating game evaluation scores with wiki metrics) is needed in a larger sample.

Overall, appears that in the context of our program, when one domain of CLAs was leveraged (cognitive, affective, behavioral), others were enhanced as well– signaling possible relationships and associations among these domains, and across the CLAs. These results begin to provide support for our claim to the value of the *integrated nature* of this program of project-based learning, in which students engage in activities that cultivate all of the CLAs simultaneously, and in parallel, through complex game design and social media use. Further research is needed to better understand the inter-workings of the 6-CLA categories, and, the extent to which they complement each other.

Further, more research is needed regarding the ways in which the environmental pedagogical supports provided through MyGLife.org tutorials, peers, and educators play a role in and improve support for this learning. The research in Year-1 did not explicitly address individual versus teamwork, nor did we yet conduct in-depth ethnographic research on the actual processes of programming and design at the individual and case level to enough of an extent. We propose that these considerations should be addressed further in continued research by on-site researchers in West Virginia who work directly with the students. As we continue refining the intervention and advancing our findings on the program as a whole, we intend to implement quasi-experimental research involving control groups.

Overall, it appears that the Globaloria program was effective in addressing two facets of the digital divide for our West Virginia participants: technology access (level 1), and sophistication of use (level 2). Through their participation, students were given a new reason to access the technologies already present in their school setting, and to use these technologies in a fuller capacity. As students engaged in a program of purposive, project-based game design in a Web 2.0 environment through Globaloria, they gained a broad range of technology skills, and experienced new forms of problem-solving in digitally-mediated environments.

CONCLUSION

Contribution to gaming literacy research. We propose that game *design* activity contributes to the growing discourse on "gaming literacy" and “digital media and learning” (DML). We propose that design should be a facet of the “gaming literacy” models and frameworks under development (e.g., Gee 2007). We further propose that Constructionist design of games in Web 2.0 environments can more broadly engender in learners the contemporary abilities necessary to be successful in today’s knowledge-based economy and professional work cultures. We propose that contemporary learning abilities are those enabling learners to successfully navigate, contribute to, work within, and benefit from, today’s cultures of

knowledge creation and sharing in networked environments. Our model of contemporary learning abilities is focused on project-based problem-solving in technology environments, more so than functional “technology skills.” We believe it is the students’ comprehensive experience in the Globaloria program that brings about new contemporary learning abilities.

We propose that the CLAs are transferable and applicable towards constructive work contexts learners will encounter in the future. Our continued longitudinal research should address the question of transfer, and explore the broader outcomes that result from the development of these abilities, especially among populations for whom the digital divide is most pronounced.

APPENDIX A

Further details on implementation contexts

TTC Educator and Environment. S.D. was the female educator at TTC, age 46, who teaches business education to students in grades 9-12. Prior to Globaloria S.D. was knowledgeable about software, hardware, blogs and graphic design and had some understanding of *Flash* and *ActionScript* but had not used a wiki, engaged in game design or worked in a design team online. She had little prior understanding of social network sites or online gaming. Most of her training was "*Learn it while you teach it.*" She had attended conferences and workshops and the TTC principal paid for her to take online basic Adobe training. She helped write the state content standards for digital imaging and Web design classes. TTC was the first school in WV to add these courses to the business curriculum. Out of all the high school and middle school educators in Pilot Year-1, S.D. was the most eager to participate and enthusiastically engaged in the program overall. Along with many of her students, S.D. was a model Globaloria learner.

TTC has a computer lab, with about 25 recent-model desktop Mac computers. Most students who took game design took additional classes at TTC in the lab that year.

Globaloria was implemented as an elective course called *Game Design,* offered for credit during school hours to students in grades 9 through 12 and integrated with the Business Education curriculum for the 2007/2008 school year. Game Design was offered in the fall semester to a full class, and offered as an independent study course in the spring to five students. No high school classes about game design, Web 2.0 activities or social networking had previously been offered at TTC

Twenty students enrolled in Game Design at TTC,[9] fifteen boys and five girls, 7 sophomores, 5 juniors and 8 seniors. Students represented the full range of school performance levels. The class included three students with learning disabilities, several students who were taking honors/college courses and all abilities in between. All students were white. Most TTC students have roots in the local rural community and have attended public school in Elkins for their entire school career. One student was born in England but had lived in West Virginia for several years.

CMMC Educators and Environment. The CMMC course was co-taught by two male educators. The older tenured professor J.R. refers to himself as taking on an administrator role and S.P. the young 28-year old adjunct adopted a more active role in instructing the students in Flash and game design. Across the duration of Pilot Year-1, we observed how S.P.'s teaching approach transforms, from a traditionally instructional one in which the educator lectures students daily, to a more fluid, facilitative role where he becomes more connected to his students' needs and abilities. We attribute this shift in part to his active participation in several educator trainings, and his interaction with the World Wide Workshop team, who advocate for and model the Constructionist philosophy that values a guided mentorship approach where the educator provides support at each student's individual level of learning, rather than lecture and top-down instruction.

The CMMC students earned a total of 6 credit hours for their Fall Gaming I and Spring Gaming II classes. The educators opted to teach Gaming I and II as experimental courses under the "Special Topics" category in their program of study, which indicates these are not regular classes but are under development. No community college classes about game design, Web 2.0

[9] Initially 20 students enrolled at RTC, but one student moved out of state.

activities, or social networking had ever been offered prior to the launch of this course. The course started during the week of October 8, 2007 and was offered on an eight-week cycle in the Fall of 2007for 3 credits, and 3 credits in the Spring of 2008. In future semesters, the course will be open to the full CMMC student population.

J.R. suggests he recruited and selected the students who had an interest in gaming and whose background he felt would add to the establishment of the class. The students were primarily chosen from two IT Programs: web development; and programming. A total of 8 students completed the course in Semester 1, and the same in Semester 2. Four additional students participated partially in Semester 1, but received grades of "Incomplete."

The class at CMMC was offered four times per week in both Semesters 1 and 2 in the computer lab, for 2 hours per session. Because of the diverse range in ages, schedules, and part-time status of the students, the educators offered students the option to attend the class as a workshop on a somewhat open basis, provided that they attended at least 2 of the sessions each week. S.P. was available for the scheduled two-hour timeframe daily in the computer lab.

A few students suggested in interviews that they spent significant time working from home using the 30-day free trial version of Flash, or worked from other locations on campus with the Adobe site license version of CMMC.[10] In Semester One, the educators report having provided 72 total hours of course instruction, with an estimated 45 hours of self-teaching by students on their own using online resources. Students presented their individual projects from Semester 1 for the first time during our Dec. 4 site visit when we interviewed students as they presented their games and gave them feedback. Students then presented their Semester 1 final projects again on a Jan. 16 site visit for a panel of judges comprised of WWWF team and Advisory Board members. Several of our case study findings derive from these presentations and interviews. During this same New Year timeframe, the educators gained confirmation from all 8 students that they would continue on in Semester 2.

In Semester Two, the educators report having provided 60 total hours of course instruction. In Semester 2, J.R. and S.P. opted to engage students in the second half of the Globaloria syllabus in the context of a team project assignment, in which students would have an opportunity to choose and negotiate team roles and work together on a Flash project that reflected the collaborative effort of the team. During this semester, the CMMC students were joined virtually by a team of 5 students from the TTC in Elkins during instructional lessons by S.P. on Webex.

[10] MCTC has the Adobe Site License in all of its computer labs across campus, so students were able to access Flash and save files to a network folder from any location on campus.

APPENDIX B

Coding Scheme for Web Game Evaluation, Globaloria Program (DEVELOPMENT IN PROGRESS)

Student Designer Name(s): **Game Title:**

Reviewer(s): **Date:**

CATEGORY	CRITERIA	0 = No; 1= Yes; DK = Don't Know	Notes:
Game Concept	Did the students post a design document (Word Document) to the wiki, outlining the PLAN for the game?		
	Was the pre-planning and design document complete?		
	Did the students create a Paper Prototype?		
	Was the Paper Prototype complete?		
	Did the students create a game proposal in *Flash*?		
	Is the game objective clear from the final implementation of the game and your play of it?		
	How many genres does the game reflect? (e.g., Quiz, Interactive Adventure [With Game characters, etc.], Side-Scrolling but no active gameplay, Linear Decision Tree [Slide Presentation], Informational Presentation)		
	Does the game present an educational topic or social issue that is appropriate for the target audience?		
	Does the game subject present a cultural theme related to the locality of the designers?		
	Does it appear that students did research into the content and material presented in the game?		
	Was the game free of errors about the educational theme presented?		
	Does it appear that the designers learned something NEW about the content of the game?		
	Does it appear that the player will learn something NEW in playing the game?		
	Will the game advance the students' *substantive* knowledge, to the extent that it could be used in a classroom?		
	Do the dynamics of the game feel immersive?		
	Does the Final Game include a narrative / storyline / dramatic arc that fits with its educational goal? (e.g., beginning, middle, end)		
	Is the game narrative cohesive / logical?		
	Does the purpose of the game carry throughout the gameplay?		
	Does the game provide a context for the gameplay, either as a *Flash* introduction that is part of the game, or on the wiki surrounding the *Flash* file?		
	Does the game feature denouement / resolution / closure / post mortem?		
	Does the game's construction appear complete? [I.e., no unfinished portions in the game implementation]		
	Did the final game meet the original goals stated in the design document? (0 if no design doc)		
	Did the final game meet the original goals stated in the paper prototype? (0 if no design doc)		
Design/User Interface	Are there instructions / Help button on how to manipulate and play the game?		
	Is there a general consistency to the interface design throughout the game?		
	In all instances, are buttons and controls grouped together and in a consistent location as navigational tools of the		

	game?		
	In all instances, is it clear that the buttons are an interactive piece of the screen?		
	Do any buttons have a rollover change?		
	When a player clicks a button is it obvious that something has changed on the screen?		
Artwork	Does the game design include any original graphic design artwork for characters?		
	Does the game include any imported graphic design elements?		
	Does the game include original video clips?		
	Does the game include imported video clips?		
	Do any of the graphic design elements include references to pop culture?		
	Does the game design include original artwork for background/environment?		
	Does the game offer proper attribution and credit for borrowed or purchased artwork?		
	Does the game reflect motion across space?		
	Are there any animated/*Flash*ing images in the background?		
	Are the images of clear quality? (No blurriness or 'fringing' around the graphics, stretching, blurring, outlines)		
Interactivity and Gameplay:	Does the game offer feedback to the user based on their decisions and actions? (e.g., quiz game provides feedback on correct/incorrect response; in a side-scrolling game with a Character on a Quest, when a character dies the screen provides a message)		
	Is there a main character or object in the game (e.g., spaceship)?		
	Does the main character object move when using the keyboard and/or Mouse to control ?		
	Are there other Non Player Characters? (NPCs)		
	Are the NPCs moving?		
	Does the character include frame animation? (e.g., walking with moving limbs)		
	If moving, do the main characters encounter NPCs that are obstacles?		
	Do the main character objects detect collisions? (e.g., does colliding with an NPC kill the character?)		
	Did collisions (object interactions) register within the game as you would expect them? [I.e., no "missed" shots; objects bump each other and behave appropriately]		
	Are the NPCs programmed to have some awareness of the state of the game in play, and alter their behavior as result? (e.g., the NPC changes trajectory based on colliding with the character; the NPC speeds up or slows based on health or score of the main character)		
	Does the game feature a Timer?		
	Is the purpose of the Timer in the game narrative clear?		
	Does the game feature a Score?		
	Is the purpose of the Score in the game narrative clear?		
	Does the game feature Health?		
	Is the purpose of the Health in the game narrative clear?		
	Does the game feature different Levels?		
	Is the purpose of the Levels in the game narrative clear?		
	Do the Levels enhance the dramatic impact?		

	Is there clear indication that the game is progressing, such as indication of what level you are, and how many levels exist?		
	Does the game feature escalation, such as higher scoring at higher levels?		
Functionality	WHAT bugs did you find? (bugs include things like Mute button that mutes but doesn't un-mute; when character dies, the game puts you back at very start, instead of the current level game; broken button link)	NA	
Sound Design	Does the game feature background music?		
	Is the background music original?		
	Does the game feature more than 1 background music file, for instance at different levels?		
	Does the game feature sound effects based on game events?		
	Are sound effects original?		
	Does the *Flash* file provide proper credit for borrowed Sound files?		
Game and Presentation File	Did the students post specific game assets from their game to the wiki while the work was in progress?		
	Did the students post final .SWF file to the wiki?		
	Did the students post final .FLA file to the wiki?		
	Did the students post their final presentation PPT file to the wiki?		
	Subtotal		
FOR TEAM GAMES			
Collaboration and planning	Are team members' roles apparent in game credits in *Flash*?		
	Are team members' roles apparent on the wiki?		
	Did the students use the wiki to track the overall game project schedule?		
	Did the students use the wiki for final game file management?		
	Did the students use the wiki to communicate about game design process together?		
	TOTAL SCORE		
FOR INDIVIDUAL GAMES			
Project management	Does the game indicate designer Credits in *Flash*?		
	Does the game indicate designer Credits in the wiki?		
	Did the student use the wiki to track the overall game project schedule?		
	Did the student use the wiki for final game file management?		
	Did the students use the wiki to communicate in text about game design process with other individuals?		
	TOTAL SCORE		

APPENDIX C

Survey Variable Composites: CLAs

To begin to validate our theoretical categorization of the 6-CLAs, prior to combining constructs we applied factor analysis to the pre-program survey items representing each CLA category, within the full WV dataset (N=81).

Several items were asked for each category (see the tables below for survey items). Exploratory factor analysis results confirmed 8 factors, instead of 6. The factor analysis confirmed CLAs 1, 3, 4, and 5, plus 2 factors for CLA 6 (*surfing* and *gaming* separately), and 2 factors for CLA 2 (*creating with digital media* and *collaborating with team members online* separately). We therefore performed additive combinations for the set of items in each CLA identified (four single factors, and two factors separated into two sub-factors). Survey items that did not factor into categories were excluded from the final combinations. Of note – the CLAs need further investigation and analysis with a larger random sample.

After combining the items into CLA constructs for the full dataset, we segmented the survey data specific to our technical locations of TTC and CMMC as separate from the non-technical locations. We further analyzed results for TTC high school students separately from CMMC college students.

CLA 6

Survey Items for *FREQUENCY*

CLA 6. Surfing websites and web applications How often do you… 7-point scale: 1=Never, 2=less often but sometimes, 3=a few times a month, 4=about once/week, 5=a few times/week, 6=about once/day, 7=several times/day	
Activities (2 Sub-Factors)	**SPSS variable names, pre- and post-survey**
Sub-Factor 1: Surfing online	
Surf online for fun	surfonlinefunfreq / postsurffreq
Listen to music online	listenmusiconlinefreq / postlistenmusiconlinefreq
Watch video online	videoonlinefreq / postvideoonlinefreq
Sub-Factor 2: Gaming	
Play internet games	internetgamesfreq / postintgamefreq
Play software games on a computer	softwaregamesfreq / postsoftgamesfreq

Survey Items for *MOTIVATION*

CLA 6. Surfing websites and web applications How true are the following statements for you, personally? 5-point scale: 1=Not at all true, 2=Not usually true, 3=Sometimes true, 4=Usually true, 5=Very true	
Activities (2 Sub-Factors)	**SPSS variable names, pre- and post-survey**
Sub-Factor 1: Surfing online	
I am confident in my ability to surf online for fun.	surfconf / postconfsurf
I enjoy surfing online for fun.	surfenjoy / postenjsurf
I value surfing online for fun.	surfvalue / postsurfvalue

Sub-Factor 2: Gaming	
I am confident in my ability to play internet games.	intgameconf / postconfintgames
I enjoy playing internet games.	intgameenjoy / postenjintgames

CLA 5

Survey Items for *FREQUENCY*

CLA 5. Information-based learning, purposeful search and exploration	
Activities (1 Factor)	**SPSS variable names, pre- and post-survey**
Using a search engine	searchenginefreq / postsearchenginefreq
Using wikipedia	wikipediafreq / postwikipediafreq
Finding online resources to solve a specific problem	infoseekfreq / postinfoseekglobprojfreq

Survey Items for *MOTIVATION*

CLA 5. Information-based learning, purposeful search and exploration	
Activities (1 Factor)	**SPSS variable names, pre- and post-survey**
Confidence in searching for and using online resources	infoseekonlineconf / postconfinfoinqiry
Enjoyment of searching for and using online resources	infoseekonlineenjoy / postenjinfoinquiry

CLA 4

Survey Items for *FREQUENCY*

CLA 4. Social-based learning, participation and exchange in a networked environment	
Activities (1 Factor)	**SPSS variable names, pre- and post-survey**
Using email	emailfreq / postemailfreq
Sending instant messages	Imchatfreq / postimchatfreq
Using online social networking sites like Facebook and MySpace	socnetfreq / postsocnetfreq

Survey Items for *MOTIVATION*

CLA 4. Social-based learning, participation and exchange in a networked environment	
Activities (1 Factor)	**SPSS variable names, pre- and post-survey**
Confidence in socializing online	onlinesocconf / postconfsoconline
Enjoyment of socializing online	onlinesocenj / postenjsoconline

CLA 3

Survey Items for *FREQUENCY*

CLA 3. Publishing and effective distribution of digital media	
Activities (1 Factor)	**SPSS variable names, pre- and post-survey**
Posting to a blog	blogpostfreq / postblogpostfreq
Posting to an online social network	socnetpostfreq / postsocnetpostfreq
Posting to a wiki	wikipostfreq / postwikipostfreq
Posting photos online	photopostfreq / postphotospostfreq
Posting digital video online	digividpostfreq / postdigividpostfreq
Posting graphics and animations online	graphicspostfreq / postgraphicsanipostfreq

Survey Items for *MOTIVATION*

CLA 3. Publishing and effective distribution of digital media	
Activities (1 Factor)	**SPSS variable names, pre- and post-survey**
Confidence in publishing multimedia files online	publishmultimediaconf / postconfpublishwiki
Enjoyment of publishing multimedia files online	publishmultimediaenj / postenjpublishwiki

CLA 2

Survey Items for *FREQUENCY*

CLA 2. Project-based learning and online project management in a wiki-based networked environment	
Activities (2 Sub-Factors)	**SPSS variable names, pre- and post-survey**
Factor 1: Creating digital media	
Remixing digital music	remixmusicfreq / postremixmusicfreq
Digitizing video on a computer	digivideofreq / postdigivideoeditfreq
Programming	programfreq / postcompprogfreq
Creating multimedia files	createmultimediafreq / postglobaloriasoloworkfreq
Factor 2: Collaborating with team members	
Collaborate with team members online	onlineteamcollabfreq /postonlineteamcollabfreq
Collaborate with team members FTF	ftfteamcollabfreq/ postftfteamcollabfreq

Survey Items for *MOTIVATION*

CLA 2. Project-based learning and online project management in a wiki-based networked environment	
Activities (2 Sub-Factors)	**SPSS variable names, pre- and post-survey**
Factor 1: Creating with digital media	

Confidence in creating an interactive game from beginning to end	gamecreateconf / postconfcreatintgame
Enjoyment in creating an interactive game from beginning to end	gamecreateenj / postenjcreateintgame
Confidence in computer programming ability	compprogconf /postconfcompprog
Enjoyment of computer programming	compprogenj / postenjcompprog
Factor 2: Collaboration with project team members	
Confidence in using a wiki to manage teamwork	wikiteamconf / postconfwikiteamwork
Enjoyment of using a wiki to manage teamwork	wikiteamenj / postenjwikiteamwork

CLA 1

Survey Items for *FREQUENCY*

CLA 1. Invention, progression, and completion of an original digital project idea (for an educational game or simulation)	
Activities (1 Factor)	**SPSS variable names, pre- and post-survey**
Having creative ideas for a digital project	creativeprojideafreq, postcreativeideascompfreq
Having creative ideas for a digital game	gameideafreq, postgameideasfreq

Survey Items for *MOTIVATION*

CLA 1. Invention, progression, and completion of an original digital project idea (for an educational game or simulation)	
Activities (1 Factor)	**SPSS variable names, pre- and post-survey**
Confidence in thinking up game ideas	gameideasconf / postconfgameideas,
Enjoyment of thinking up game ideas	gameideasenj / postenjgameideas
Confidence of thinking up digital project ideas*	comprojideasconf / postenjdigiprojectideas
Enjoyment of thinking up digital project ideas*	compprojideasenj / postconfdigiprojectideas,

*CMMC and After-School programs only; not asked for TTC

APPENDIX D

Student Case Studies

APPENDIX D-1 Jessie and Sarah

TTC students Jessie and Sarah (pseudonyms) worked with a male classmate in a team they called *The Demented Trio*. Jessie and Sarah were in 10th grade, and in a team, worked on a game design project called *Sammy the Salmon* that shows significant planning and creation of several advanced game design graphics contributed by Jessie and Sarah. The *Trio's* game has an educational theme based on a local environmental issue and science topic. Up until recently many rivers in WV were stocked with Coho salmon, which is now under consideration by many states for placement on endangered species lists.

Jessie

Jessie is a 15-year-old who had little technology experience prior to her participation in Globaloria. Jessie makes high marks, but presented as quite shy and hesitant to engage with technology in our first site visit in October. In the Pre-Program Survey question about hobbies, she said she likes to fish, ride four wheelers, and mountain bike. Her previous school achievement and GPA are quite high, at the A level, according to transcripts provided by the school with her parents' permission. She indicated infrequent technology use, except for digitizing photos and creating PowerPoint presentations. She indicated confidence in surfing, information-seeking, thinking up ideas for games and creating a game, but not in publishing her work and socializing online.

During our initial site visit Jessie described her previous technology experience and motivation to take Globaloria:

> ***I want to learn how to use the software. I thought it would be fun. …I don't really know much about computers. I don't even own a computer with Internet. … I've had keyboarding. I've never done anything like this before. I'm kind of completely lost!***

Figure 9. Jessie's early graphic design sample

Early in the course Jessie experiments with graphic design, creating a file depicting text about one of her favorite bands, Nickelback. She also completes several of the early tutorials and posts examples on her Project Page.

Jessie's Wiki Activity

Jessie was above the class mean for every month except October, when she was slightly below the mean possibly due to the winter school holiday. She spent the first three months of Globaloria making an extensive number of edits, and slowed down somewhat in December, total number of wiki edits of edits. Wiki edits increased again in January, likely in the completion of her final game, and in anticipation of the final game presentations. During the semester Jessie made a total of 45 uploads to the Wiki, significantly greater than the class mean of 26. For a sophomore who reported being very new to technology — Jessie's wiki activity reflects high engagement with the program.

Table 8. Jessie's Wiki Activity

	#/Wiki Edits	Class Mean
Sep. 07	40	39.45
Oct. 07	66	78.4
Nov. 07	82	45.85
Dec. 07	24	12.2
Jan. 08	42	28.65

Jessie's Profile Page

Jessie's Profile page features her likes and dislikes and a photo of a wolf, but no video or other multimedia. S.D. had suggested that students use the Discussion tab for dialogue. Jessie takes on a more informal approach, prompting possible visitors with a social question:

> ***I don't really know what to discuss. What kind of music do you listen to? There's a good question for you to think about. Hurry! Think faster! See, it wasn't that hard was it? I listen to almost anything. I don't like rap that much though.***

Jessie's Profile Page has six comments from others, featured in the Discussion tab, features a link to her Project Page and four other external links.

Jessie's Project Page

Jessie's Project Page features 8 files related to the project assignments required by S.D., slightly below the class mean of 9.85. Her Project Page was used primarily to post assignment files and she has no comments from others on this page. Out of 20 students Jessie had a total of 41 attributes included on these two pages, equal with the class mean.

S.D. gave Jessie a grade of "96" on her design document, one of the highest scores in the class. Further results for Jessie are presented below regarding her team game development. First we will describe teammate, Sarah.

Sarah

TTC sophomore case study student Sarah is a 10th-grader whose school performance and achievement in the traditional educational setting has been quite weak; however, she showed a strong stated interest in gaming and design in the first site visit. She describes her background as follows:

> ***I lived in West Virginia when I was younger but moved back to Oklahoma. I was raised there and I miss it a lot. There was a lot more diversity and understanding there. I moved back to WV for family reasons and I have been back for about 3 years.***

Sarah's academic transcripts from the previous two school years show a low "C" Grade Point Average, including course failures. According to S.D. Sarah *just doesn't play the game of school*. However, in the Pre-Program Survey and introductory session Sarah indicated high interest in cartoons, gaming and game design as well as an independent streak:

> ***I'm hoping that the class will introduce me to designing video games because that's what I want to do. I had a course in web page design. …I hope to go to a collage and major in graphic design/art. I want to someday become the head of a graphic design company in my lifetime. …I hope to make a game to help people choose what they want to be and not follow what others have to say.***

Pre-Program Survey

Sarah indicated frequent technology use and gameplay activity as well as confidence in all of the Six CLAs except for thinking up ideas for interactive games, but little actual experience with the activities to be presented in the Globaloria program. In our September 27site visit, she mentioned she had experimented with a game design software tool other than *Flash*.[11]

Sarah's Wiki Activity

Sarah's wiki activity was lower than the class mean in the first two months, but picked up and is slightly higher than the mean in the last three months. Her wiki activity follows the class mean pattern (most substantial in October and November, drop off in December, and an increase again in January.

Table 9. Sarah's Wiki Activity

	#/Wiki Edits	Class Mean
Sep. 07	26	39.5
Oct. 07	68	78.4
Nov. 07	52	45.9
Dec. 07	13	12.2
Jan. 08	30	28.7

Sarah's Profile Page

Sarah's Profile Page features her likes and dislikes and two graphics, but no video or other multimedia. Her profile page has nine comments from others. She offers 6 comments to other students in the class. This dialogue occurs on her Discussion tab.

[11] Sarah refers to using a game design software tool, packaged with corporate games, such as those produced by Electronic Arts, that enables players to customize game elements and environments.

Sarah's Project Page

Sarah's Project Page features 13 assignment files, well above the mean for the class of 9.85. She also posts 18 game elements on this page, including 4 animations she states on the Wiki that she created *on her own*. The average number of game elements that students posted on their Project Page was 2.5, which indicates that Sarah was much more highly active in posting graphic design files on her page than other students.

Sarah had 63 attributes included on these two pages, well over the 41 mean number of attributes per classmate and the second-highest number of attributes of all students in the class. Additionally, Sarah contributed a total of 40 uploaded files to the Wiki, compared to the class mean of 26.

In her Game Design Proposal Sarah describes the *Demented Trio* game as follows:

> ***"Sammy the Salmon" is intended for children in the 3rd grade. Questions in the game are aimed at 3rd grade biology. It is an educational action/adventure RPG where you will play the role of a salmon journeying into its spawning grounds. Players will traverse rivers and streams on their way, encountering many adversities such as wild bears and fishermen… The end of this game is unique in that the player dies, just like a real salmon would die after spawning. Allowing players to experience this gives them a new level of understanding for the instincts and nature of salmon.***

Sarah envisions the game as having educational elements *beyond* the more traditional multiple choice quiz questions. Sarah's previous experience with gaming and her hobby of fishing may provide her with insight into this more complex level of representation for the game's educational objective and narrative. For her *competitive analysis*, Sarah notes:

> ***There are many games labeled "Sammy the Salmon" however these are generally racing games or other un-educational games. There were however two games with similar gameplay to ours.***

S.D. gives Sarah a grade of 96 on her design document. On the page with her game description she writes, ***Excellent,*** and on the cover next to the grade, ***Really proud of you!***

Despite this performance and her well-above-average Wiki activity Sarah received only a mediocre grade ("C"). When we inquired about this grade, S.D. explained:

> ***Sarah picked and chose what lessons she wanted to do. I gave students credit for doing tutorials and sometimes she chose not to do them so she received a 0. When all grades were averaged she received a C. She is a very talented individual but doesn't like to 'play' the school game. If it is work that she likes or feels important to her she will do it. If it doesn't appeal to her, she just doesn't do it. She is not rude or disruptive, she just quietly works on something else.***

This explanation is consistent with Sarah's general approach to school and authority as well as her desire for people to *choose what they want to be*, rather than following what others tell them.

The Demented Trio Team Project

Beginning in late October *The Demented Trio* started working together and discussing a theme:

> ***"Sammy, the Salmon" will take you on an adventure so you can experience his life cycle. Sammy will swim upstream to spawn. In order for Sammy to be successful in his journey, the player must help Sammy avoid bears, whirlpools, raging rapids, and fishermen by answering questions correctly. The player's objective allows Sammy to return to the place where he was born.***

Demented Trio's Game Design

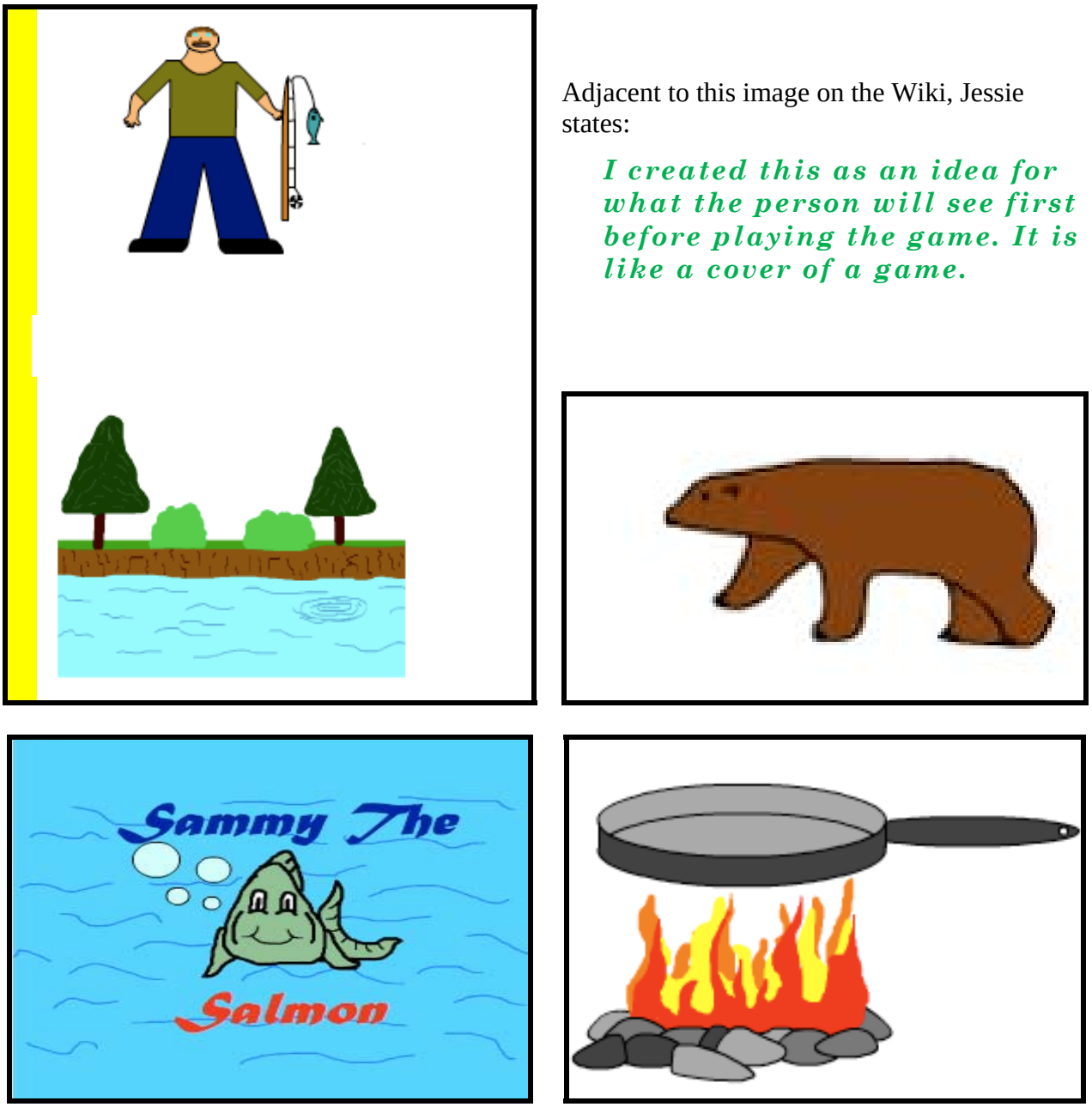
The *Demented Trio* began their game design in late October. The team's approach was to brainstorm ideas and come to a consensus on the general goal of the game, then divide up the graphic design work and create the many design elements they would need to produce their final game project. Several graphics were not included in the final *Sammy the Salmon* game. http://www.myglife.org/usa/wv/TTCwiki/index.php/Demented_Trio

The *Demented Trio* team develops an initial plan for their game and a common understanding of this plan by Jessie and Sarah, the two designers. Team members then create the design elements, which they weave together into a narrative. The *Trio* posts its proposal on the class Game Proposals page, along with 27 of their files (programmed in *Flash*) that depict screens and elements that appear in the final game. The *Sammy the Salmon* game ends with a quiz (the most popular choice). When a functional game was achieved, the *Trio* created a Team Page and posted files on there (http://www.myglife.org/usa/wv/TTCwiki/index.php/Demented_Trio) as well on the Final Games page for the class.

Evaluation of the Game

The *Trio's* game depicts a progression of difficult quiz questions on the Coho salmon, for which they conducted online inquiry and research, layered into a designed environment depicting the salmon heading upstream to spawn. The team's quiz questions support the game theme and show more connectivity between the narrative and pedagogical goals than the games of other teams. This decision by the students reflects a greater level of complexity than *The Level 50's* game for instance, whose quiz content is mostly based on historical facts about the U.S. -- unrelated to the game narrative of a haunted school in their local community that Cassie had discussed at length and set up in their design document.

Sammy the Salmon begins with a starting line and the background of the quiz portrays a progression of scenes in nature, representing the salmon's journey upstream to spawn.



Adjacent to this image on the Wiki, Jessie states:

> ***I created this as an idea for what the person will see first before playing the game. It is like a cover of a game.***

Figure 10. Jessie's static graphic elements (not implemented)

I created this as an idea for what the person will see first before playing the game. It is like a cover of a game. (not implemented)

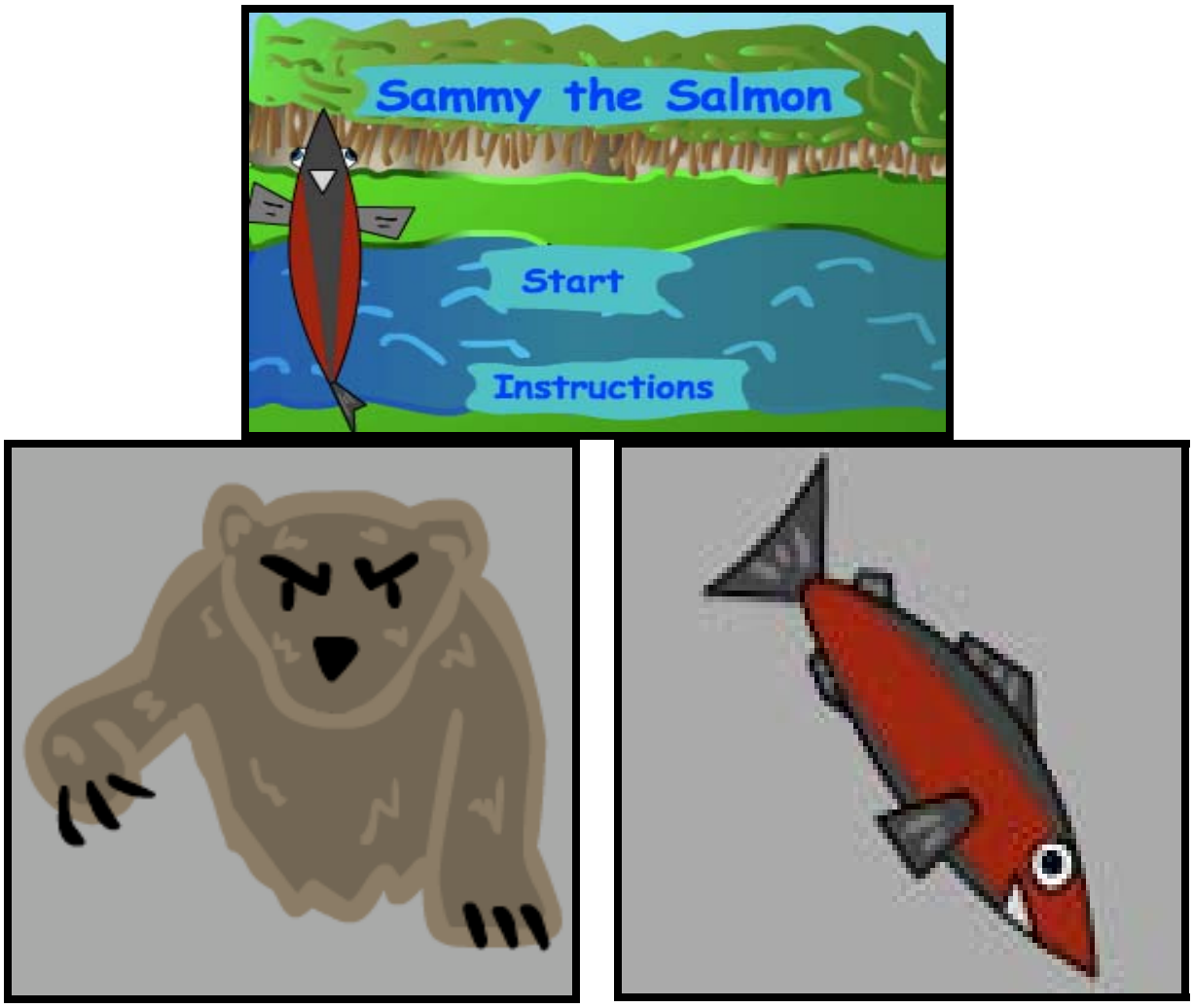


Figure 11. Sarah's animated graphic elements (not in final game)

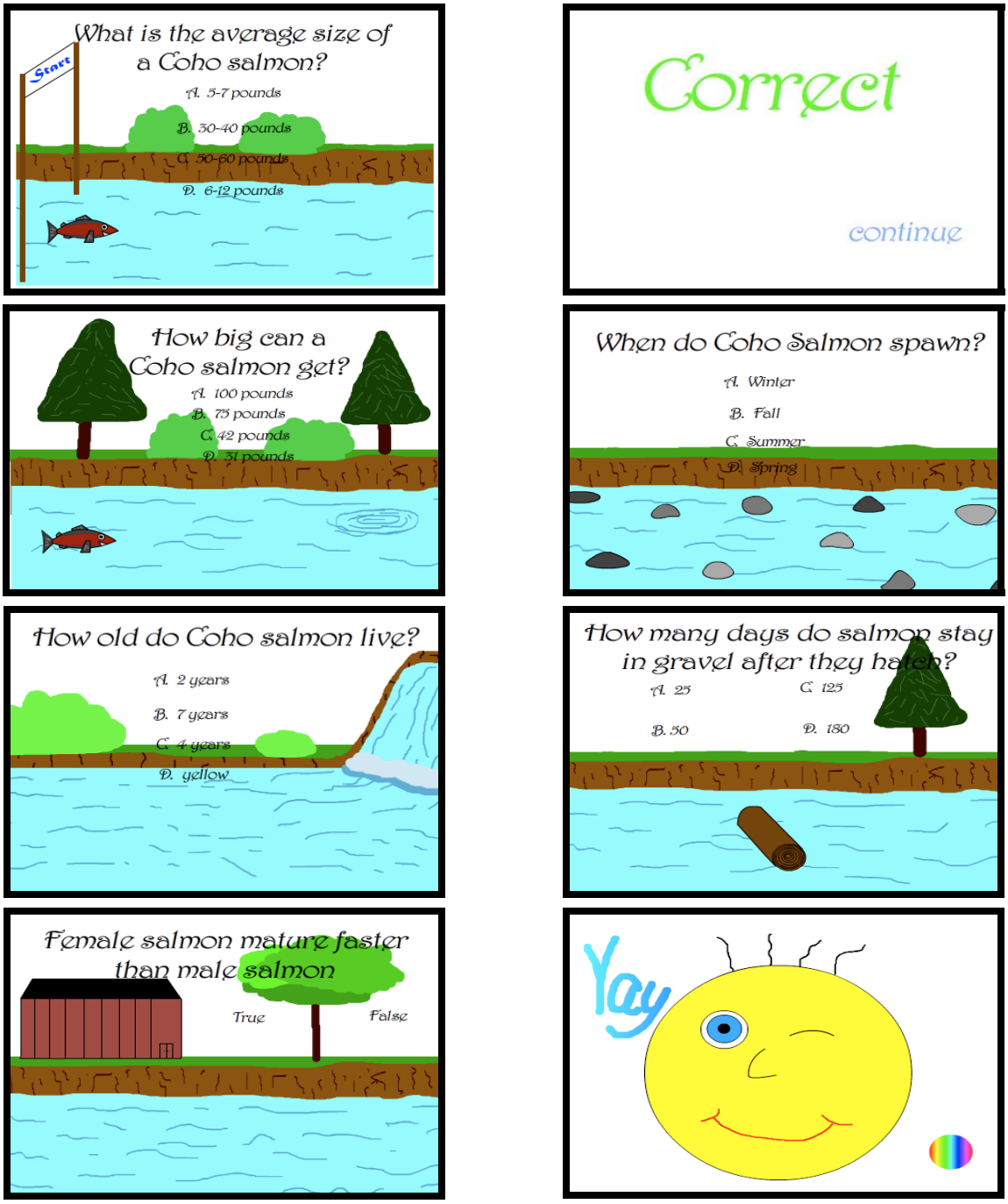


Figure 12. Screen Shoots from Sammy the Salmon

Sammy the Salmon does not feature animation although several of the earlier graphic images were animated. As in other teams several planned graphics were not utilized in the final game project. When the time came to integrate the ideas of all team members, the students experienced some hurdles in programming the game in *ActionScript* and bringing their files together into a coherent experience for a player. *The Demented Trio* expresses this frustration on the Wiki, next to their Final Game Project file:

> ***This is no way near what we wanted to do but with a main person of our group was not here the last two days and things got complicated.***

In our video of final project presentations, Jessie says snow days interfered with the team's game development schedule. Nonetheless, the *Demented Trio* posted many more game elements than most other teams and their graphic design effort indicates a strong interest and motivation.

ActionScript Programming, Jessie and Sarah

For Sarah and Jessie Globaloria led to a greater level of confidence in several areas of technology use. Sarah was known as the programmer for her team, however, her absence at the end of the course and failure to complete some of the more complicated proposed features made it difficult to determine Sarah's knowledge of *ActionScript*[12]. It appeared that at the last minute, in Sarah's absence, Jessie took on a greater role in coding the game features the team achieved for the final game posted on the Wiki. It is possible that the impending close of the semester and assignment of final grades was a motivating factor for Jessie in stepping up to help finalize the project in Sarah's absence. They both would have liked more time to advance their learning.

Final Team Presentation, Jessie and Sarah

Jessie, Sarah and their partner stood up as a team and presented their game on a *SmartBoard.*[13] Sarah provides an overview of their project.

> ***Many children and people in general don't understand the hardships that animals go through just to survive. In Sammy the Salmon we were hoping to teach children about some of the hardships they go through just to reproduce, to survive and to live their lives. Right now we're trying to implement things like jumping animations, the bear's claw swiping at the water, the fisherman casting his pole in, and we haven't quite been able to implement those into the game yet, and the sound needs to be put in, but this is what we have so far.***

Sarah provides some insight into her own approach to game design:

> ***With most of my artwork in the video games – I play video games 24/7 if I can, and I watch cartoons all the time, maybe a bit too much, so that's more toward my art style – cartooning, humorous, I was trying to make it so that it would be entertaining art styles for kids.***

Jessie, one of the youngest members of the sophomore class, presents the game quite professionally and answers questions with strong articulation about the game design and her participation in the program, in stark contrast to her shy presentation at our first site visit.

When a World Wide Workshop panel member asks the students how they were able to put the game together, Jessie responded:

---

[12] ***ActionScript*** is the programming language utilized in Flash software design

[13] ***SmartBoard*** is an interactive white board similar to a very large touch-screen of a tablet computer.

> ***ActionScript. It was on a blog site and we just googled it and it was on this Blogger site. I had tried, I knew at least 10 ActionScript codes that I couldn't get to work and finally I found it on a Blogger site. Stephanie helped me find it, and I just tried it out and after S.D. helped me and Toby helped me we finally got it to work and I was like so happy. If you hit the space bar, he will jump – hit spacebar- yup! That was also kind of hard to do I couldn't quite get it to work right. The dancing salmon was created by Sarah, and we are going to put this as the beginning, have the salmon singing and dancing and stuff.***

Jessie then comments about the social meaning of her team's game and what she learned:

> ***Basically a lot of people don't care, and I was researching the other day and apparently, I found out, Coho salmon are actually going extinct because of people's carelessness in polluting streams and stuff like that.***

Jessie confirms that the team ran out of time to complete their game:

> ***All the snow days this year took a toll on this class. I was kind of glad we got an extra 5 days built onto the end of the semester. I would have rather been working here than taking a snow day! I don't know about these two, but yeah. I like Flash, I think it's kinda fun. I think if I could get it to how I would want it to be, it would take a couple of years.***

Jessie, a sophomore, has been introduced to technology and Constructionist learning at an early phase of her high school career. Jessie expresses a career interest in game design. We expect Jessie's interest in project-based work to blossom as she continues with the Game Design practicum in the 2008-09 school year.

Sarah Upon entering the program Sarah identified herself as a gamer. She is individualistic in her attitude towards schoolwork and can be said to march to the beat of her own drum. Sarah's efforts, particularly wiki activity (highest in the class) and initial design document (which received a high mark) well exceeded most of her classmates but she received a "C" grade in the course because she did not complete several assignments and was absent on the last two days of class when her group was finalizing their game. Sarah intends to continue activities that use the skills she learned and demonstrated a continued confidence and interest in a future career in game design.

Sarah's highly independent style is one we suspect may become more frequent as teens engage in time spent with interactive media and become more autonomous in learning outside of school. Students like Sarah *get it* (even if their traditional school environment previously has not) – and they latch onto Globaloria and exert effort because they see the connection between our program and significant career opportunities. It is interesting that Sarah rejected the more traditional aspects of Globaloria as implemented at RTC. Tech-savvy teens cynicism about school might be mitigated by independent learning opportunities with technology, which will provide them the chance to experience success, and build their self-confidence.

APPENDIX D-3

Semester Two Team Game Proposal and Planning

Team Adventure West Virginia was comprised of eight students. The students brainstormed together in the first few classes of Semester 2, discussing their goals for the team game project. While students in Semester 1 did not create written design documents for their individual games, in Semester 2, the students created a collaborative design document and storyboard in Flash to set out the initial plans for their 2nd project.

Team "Adventure West Virginia's" initial game proposal presents text in response to a game proposal template provided by the World Wide Workshop. The students identify four outdoor activities they will simulate in a Flash game. They discuss project team members' roles. Each team member's assigned role refers back to strengths each student reflected in the initial Semester 1 game projects.

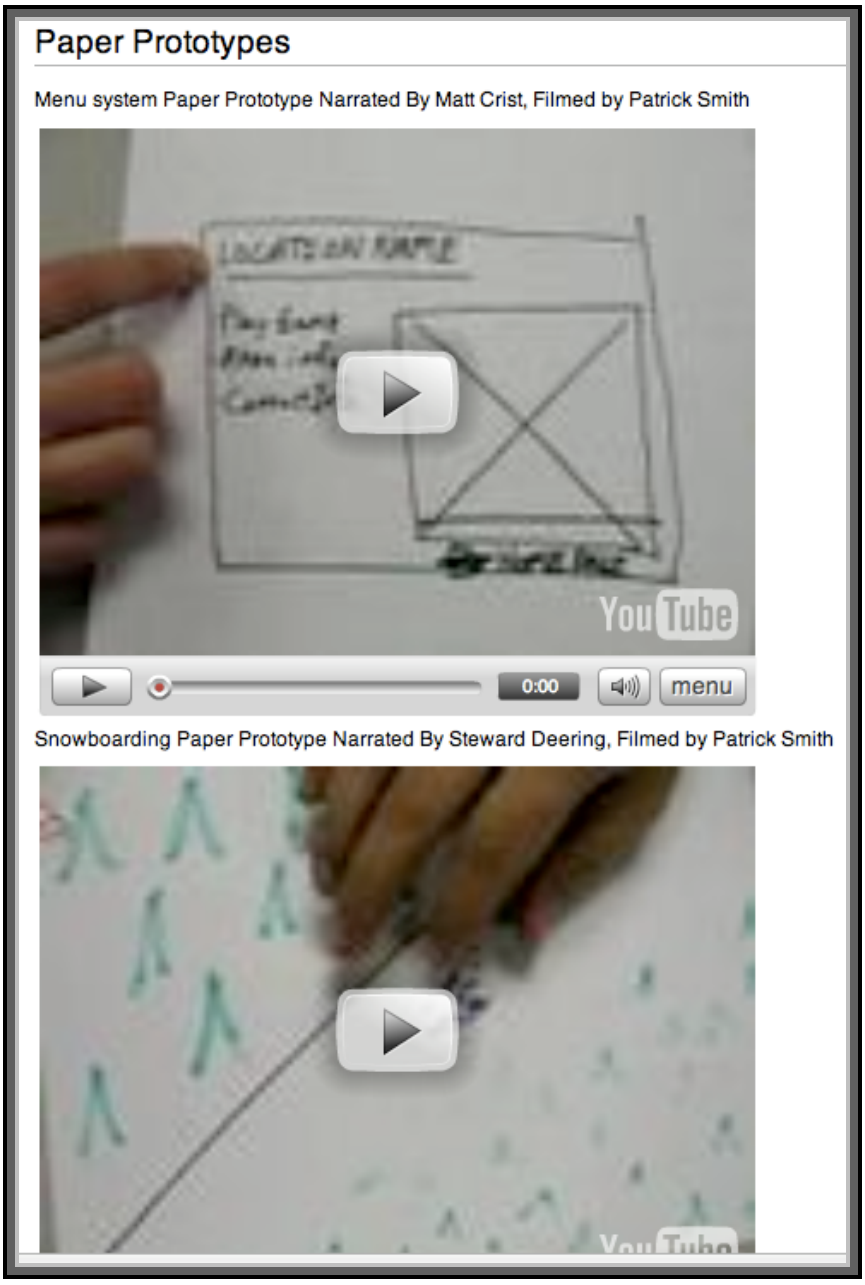
S.P.'s mid-semester Progress Report from March 15, 2008 confirms that on the whole, the team members appropriated and maintained the assigned roles outlined in the game proposal. S.P. reports the following below.

Table 10. Semester 2, mid-semester student progress reports

	CMMC PROGRESS REPORT
1	M.C. has been working on the menus, submenus, and animation of the menus as well as sound development for the project. He has started doing extensive self-learning to find ways to facilitate his responsibilities to the project. He has also started the internship program which I believe has helped spur his desire for self-learning
2	DS has taken on the responsibilities of Actionscript coding as well as sound development on the project. He has also taken on the leadership role of the group. He asks for status updates from each student, and is the reason the group stay s efficient. DS doesn't particularly like the spotlight, but saw a need for a leader and took the role. I believe his work in the internship program has also facilitated this value of self-initiative.
3	ML has taken on the responsibilities of background design in the project. She has also started the internship program which has instilled a sense of pride in her work.
4	LR has been doing information research for the project as well. Through team interactions, LR's shy demeanor has changed to a person who shows confidence and can convey her ideas clearly to the group.
5	**PJ** has been working on character development for the project. Through team interactions, PJ voices his opinions and ideas more often than he did in a non-team environment.
6	**YJ** has taken on the responsibility of Actionscript coding for the project. He is DS's right hand man, and as such has shown tremendous leadership skills as well. Y.J. has developed great communication skills allowing him to convey to the background and character artists what he needs without confusing them with technical jargon that may confuse them.

The students' design and planning process continued to advance throughout the semester as they shaped their ideas into a fully functioning final game project. One of these planning steps involved an assignment the World Wide Workshop added to the syllabus, requiring them to create Paper Prototypes of their proposed game navigation. At CMMC, the students decided to film their prototypes and feature them online on the Wiki, uploading their narrated video clips to Youtube and posting them online on their Wiki team design page. The paper prototypes created by the students in Semester 2 reflect a similar approach as their educator S.P., who created and posted his own self-made game design tutorials. Screenshots of the students paper prototypes featured on the MyGLife.org Wiki are included as follows.

Figure 13. Student paper prototype examples



Additionally, to help organize team project tasks and roles, the students utilized a project management chart on the wiki, which they developed in construct with S.P. As each student proceeded through their given assignments, they added comments on the wiki chart and highlighted the percent completion of their task towards the creation of the final game product.

Project Resources

Resources / Assests for Adventure WV Game Studios

Activity:	Assigned to:	ETC: (Hours)	% Complete	Finished?	Comments:
Intro Menu / Animation			100%	YES	Still need to add actionscript code for preloader to function correctly. Sound to menu buttons have been added and music will be added by weeks end.
Submenus /Animation			100%	YES	All menus for the games are correct and go to the respected areas.
Data Researcher/Fact Finder			100%	YES	Found facts about rafting companies and winter resorts. Also found interesting facts about West Virginia.
Background Design -WWR		4 hours	100%	YES	The rapids are a movie clip.
Background Design - SB		4 hours	100%	YES	The moving effect was created by making the larger trees in the back move slower than the smaller trees in the front.
Character Design - WWR			100%	YES	There are four characters in the beginning. As the player collides with objects in the game, a paddle is lost. Loosing a paddle will reduce the player's life.
Character Design - SB			100%	YES	The character has four basic movements: normal, duck, jump, and crash.
WWR Coding			100%	YES	The game lasts for about 2 to 2 1/2 min. Background cycles thru 3 times.
SB Coding			100%	YES	
Sound Developer(s)			100%	YES	Last bit of sound for the game needs to be retrieved. Use of music has been ok'd by the band 1937 Flood

SB - Snow Boarding, WWR - White Water Rafting

Figure 14. Wiki project management grid for Adventure West Virginia team

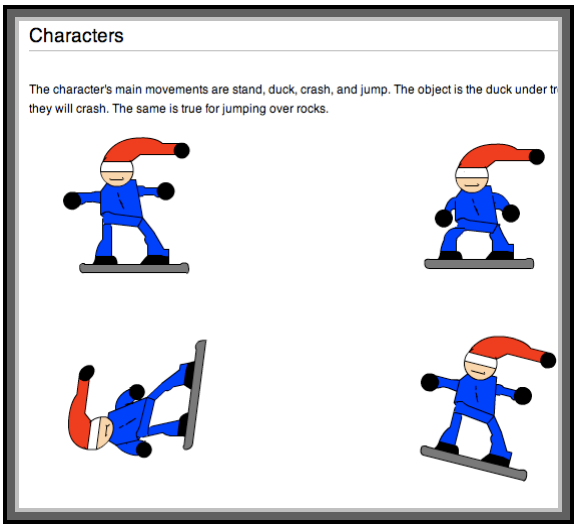
Team Adventure West Virginia's use of this table for organizing their project tasks shows improvements over their previous semester's game planning, which was not as cohesive as Semester 2, partially due to sequencing issues in the World Wide Workshop syllabus (resulting in changes to our core curriculum). Use of this chart also demonstrates collaboration among team members, and communication that helped the entire group advance their ideas and implementation.

Final Game Project

As students advanced across the semester, they created and posted several assets for their final Flash game on the Wiki. Two of these Flash objects are included in the screenshots that follow, posted on April 7, 2008.

Figure 15.

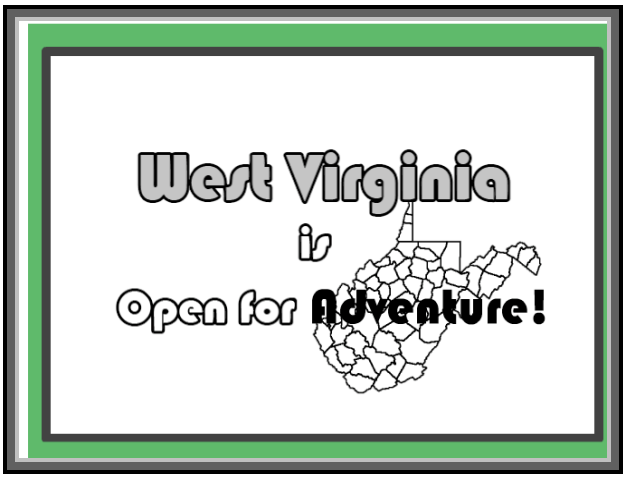
Game Design elements



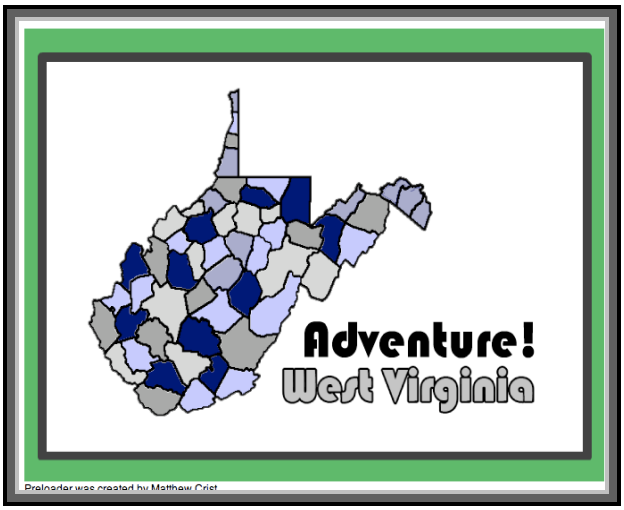
The first screenshot presents a background design ML has created for the snowboarding game. The second presents snowboarder characters created by P.J.. The students vetted these graphics with their team members on the Wiki before deciding on final game attributes. Students continued working on their game design through May of 2008, after the class was officially over, in anticipation of presenting their games to World Wide Workshop team and advisory board members and project funders at the end of May.

Screenshots from Team Adventure's final design environment are featured as follows.

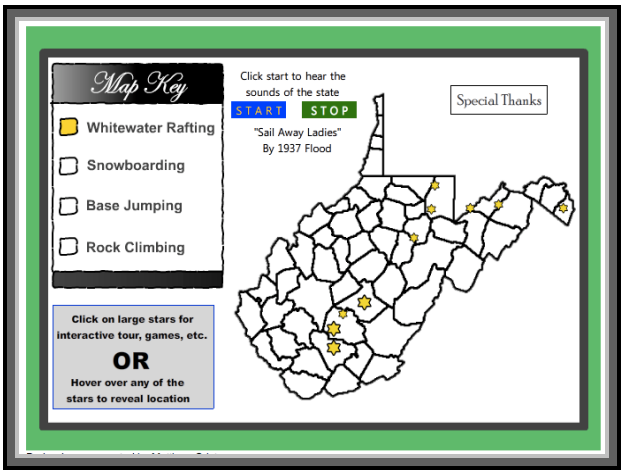
Figure 16. Adventure West Virginia final game



1 Preloader Screen



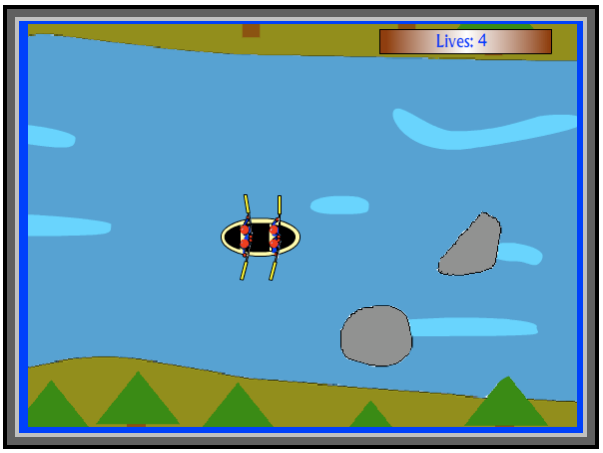
2 Preloader Screen



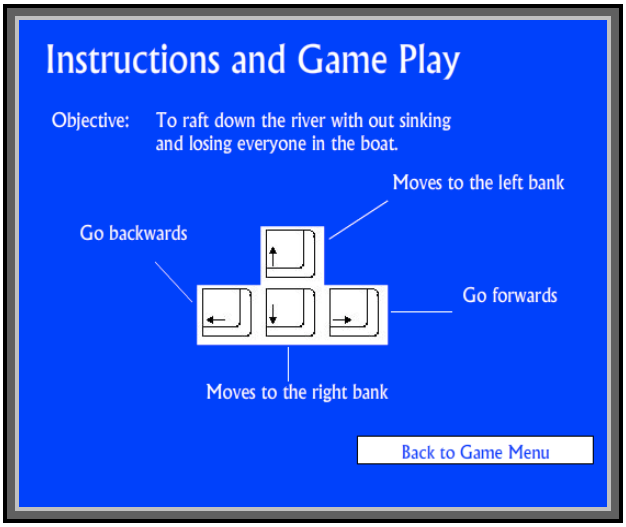
3 Central Navigational Screen

4 Central Navigational Sub-screen

5 Central Navigational Sub-screen

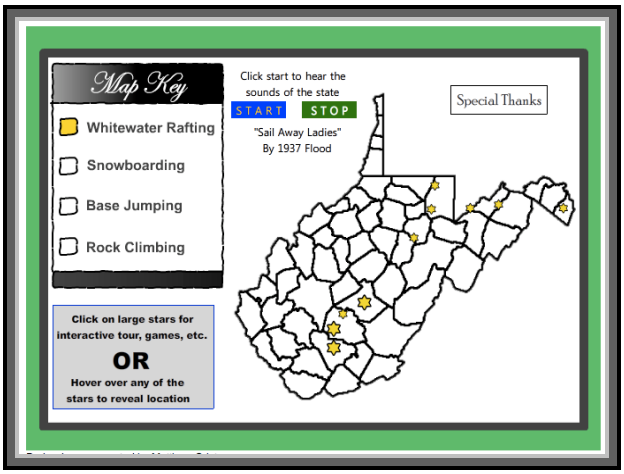


6 White Water Rafting Game .SWF



7 White Water Rafting Game .SWF

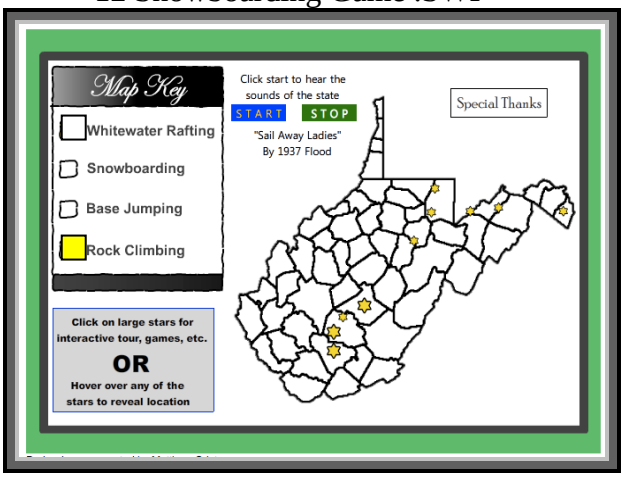
8 White Water Rafting Game .SWF



9 Central Navigational Screen

12 Snowboarding Game .SWF

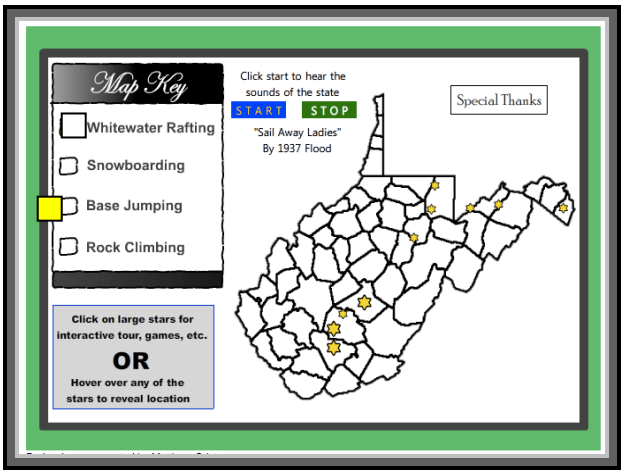
10 Central Navigational Sub-screen



13 Central Navigational Screen

11 Snowboarding Game .SWF

14 Central Navigational Sub-screen



15 Central Navigational Screen

17 Thank You and Credits

16 Central Navigational Sub-screen

Adventure West Virginia Game Structure and Functionality
In the Semester 2 game project, students adopted a unique approach to the navigational structure of their game. They created a total of 4 Flash files to accomplish their goals. Flash file 1 was the "pre-loader" which presented an animation depicting the introduction to the game, and according to their notes on the Wiki, this was created by M.C.. Flash file 2 was the central navigational file that directed users to one of four adventure activities: whitewater rafting, snowboarding, base jumping, and rock-climbing. When the user selects one of the four activities, a map is depicted, highlighting several locations in West Virginia where the given activity was prominent. By clicking on the stars for those locations, the player arrives at a page with 5 options: 1) playing a simulational game; 2) watching a video of the activity at that location; 3) viewing a slideshow; 4) finding out more information on the area; and 5) contact information for getting to the destination and for reaching official contacts there.

The pre-loader and the central navigational file were posted on MyGLIfe.org Wiki as the starting point for the game. The pre-loader features traditional West Virginia blue grass music from the 1937 Band – a song called "Sail Away Ladies." The "Play Game" option leads the player to one of two games created by the students (a whitewater rafting game -- Flash file 3, and a snowboarding game -- Flash file 4). The base jumping and rock-climbing games are still in development. The students hosted their actual game files on the C. University servers and included links to these hosted games within their navigational file 2. They mirrored their final game files on the MyGLife.org Wiki environment provided by Globaloria. In addition, the game presents an acknowledgements screen that thanks several local West Virginia sources for PR information provided in the environment, which gives it an official feel.

Team Adventure West Virginia's Formal Presentation of their Game
Understanding that they would need to present their work in order to promote and market it, the students presented their project formally on two occasions, during a site visit on April 17 by a panel of judges from the World Wide Workshop and Benedum Foundation funders, and then again during a formal presentation to the West Virginia Governor's office and the state's First Lady, Gayle Manchin. The team created the following Powerpoint presentation highlighting their overall design process.

HL introduces the game as follows.

> "Our game concept was promoting tourism because tourism is very popular in our state, and with this, we wanted to educate everybody about the different ways they can participate in our wonderful outdoor activities. We aimed for the ages of 14-35 but we don't want to limit it to that because with the snowboarding game there are different levels of slopes at the different mountains, and the rivers have different levels and classes of rapids that anybody would enjoy. With our user design interface we wanted to stay true to the outdoor feeling, and wanted you to feel like you were actually there on the river or snowboarding down the mountain."

D.S. states further,

> "Pretty much what we tried to do with developing the game was – we know people out there don't have a lot of computer experience, so we tried to keep it as simple as possible. A lot of point and click interface. As you notice here, we have 4 simple buttons. Very easy, nothing complicated. Up, down, left, right arrows. It's not like WOW or Halo 3 – if you're 2 or 92, you can navigate through this."

Regarding process, ML states,

> "We kind of fed off each other. Stew was our coder, and I did background, and we worked together. We worked to our strengths."

D.S. echoes ML's point, stating,

> "Just like any other business, it was like we had departments. We had Y.J. here, my fellow co-developer. We had M.C., another one of our interns, who was the person who developed the loading screen to our game. B.S. and L.R. were our factfinders and information gatherers, if we needed to know anything about a given area to develop the game, they gave us game elements. P.J. was basically the guy who created the characters in our games, and was the mastermind behind the characters. ML and Justin were our background developers. ML had a hand in the snow boarding game and Justin had a hand with the white water rafting. I was doing sound development, general development, and project management. This was all doable because of the Wiki, email, phone calls, chats, Webex, and late night coding. This gentleman [points to Y.J.] has come over to my house at 10pm to do coding, driving an hour to get here. It gets to 2 in the morning and we'll be like, 'dude, we can make it work!' The greatest thing we have learned is learning from each other."

These team roles mirror those discussed and assigned by the students earlier on, having carried through across the Semester 2 timeframe. D.S. states further that the Wiki played a strong role in holding the team together. He states,

> "When it came time to get everyone together to work on this game, we really used the Wiki. Yes, we worship the Wiki as well. We created a resources chart that we thought was handy. It helped us keep track of who was doing what, how much time was spent, what work was done, if they have any questions – any comments, they could put them right there beside it. I'm normally used to being by myself, working on a computer, not having to bounce anything of anyone. When it came to this class, I was really able to open up and work with people."

D.S. offers another interesting point regarding the strategy behind his approach to choosing the informational videos featured as links within the game. He states,

> "Any of the videos that you see on our game have a personal feel because every video was made by someone who is not a professional, for instance by high school students. I just linked to their videos. I thought this would be better, instead of some PR firm coming in and making a video of our area and this activity, glorifying it as opposed to normal people coming in and saying 'I loved this, I'm going to take a video of it, and put it online.' If people see people just like me and you coming in and enjoying themselves, they'll be much more likely to say, you know, 'here's my credit card, let's go!'"

Summary of Findings, Adventure West Virginia Game

CMMC students' development of Adventure West Virginia was inventive on many levels in that it was created to serve as a multimedia infotainment PR platform, promoting the state of WV for the purposes of economic development. The game's themes demonstrate entrepreneurship, a value for economic development in the region, and a level of business knowledge that adventure tourism is a burgeoning industry in West Virginia, which presents a real marketing opportunity.

Students used the opportunity presented through Globaloria to leverage the timing of this economic growth cycle for adventure tourism in the region by choosing this topic for their interactive game. They drew many Web 2.0-type connections and recognized that placing such a resource online could lead to a greater level of visitation by tourists who encounter the information, and that the platform could serve as a viable marketing environment to sell space to businesses local in the region. The also reflects a highly local connection in the overall theme to the cultural region of origin, as students anticipate the appeal of local culture to outsider communities who may travel in West Virginia. Further, the CMMC students appear to be highly motivated during the presentation to state leaders on May 29, 2008, recognizing potential opportunities for their own career advancement through networking with this audience.

Students report the following estimates on their time spent per week in Globaloria during Semester Two. The variation in these results is reflective of the educators' adoption of an open workshop setting, requiring students' presence in at least 2 of the 4 scheduled classes per week. On the whole, it appears that L.R. spent the most time in class working on her projects, and M.C. spent the most time outside of class on his projects, and both of these students report the most overall time spent on Globaloria. Both of these students received high scores in their Semester 1 game evaluations, suggesting that their motivation for the project carried across time. It appears that time spent is a key contributor to performance in the program, and this finding should be explored further in continued research.

Table 11. Time spent per week on Globaloria during Semester 2, CMMC case study students

	S2 Time Spent Per Week (Hours:Mins)		
	In class	Outside class	Total
M.C.	4:00	15:00	19:00
L.R.	8:00	4:00	12:00
Y.J.	6:00	2:30	8:30
D.S.	2:30	5:00	7:30
ML	3:30	1:30	5:00
P.J.	:30	:50	1:20

While students report significant time on the project in Semester Two, Wiki data indicates that from October through January (4 months), the full class of CMMC students made 844 Wiki edits, whereas from February through May (4 months), the class made only 191 edits. This result partially reflects the fact that the start of the school year requires setup and launch of profile and projects pages, so students clock more activity at this time. However, even accounting for this setup, it appears that educators and the World Wide Workshop need to identify further supports for students' continued use of the Wiki as an effective tool for project management, collaboration and communication.

Out of a total possible 80 points, in Semester Two, the CMMC students' Adventure West Virginia game achieves a score of 49 by a team of five game evaluators who achieved inter-coder agreement on the game through a process of initial individual coding, score comparison, discourse on discrepancies, and attainment of consensus. This game achieves the highest coded score of all the games created in Globaloria-West Virginia in Pilot Year-1.

The following selection of quotes highlights Globaloria students' testimonials regarding their participation.

> P.J., age 21: "Hopefully I will have a job in the technology field when I graduate."
>
> L.R., age 38: "I'm going to college for programming, and Globaloria gave me the experience of working with a team."
>
> M.C., age 28: "I am working as a Web Developer with editing and design capabilities. I hope to continue expanding my knowledge of development tactics and eventually manage a Web site as a Web master, managing editor, or chief developer. I have been fortunate to find work which has allowed me to incorporate some of my Flash skills. I am working with my employer now on some Flash animation and will continue to do so. Globaloria has given me experience in a team setting and the program has helped me develop my Flash skills tremendously. I look forward to watching this wonderful resource

grow from its infancy (when I was able to be a part of its success) to adulthood. Thanks for allowing me the opportunity to be a part of the Globaloria project, and I hope to continue a working relationship with all of those involved!"

D.S., age 27: "My participation in Globaloria has brought about the realization that my dream is possible. It has opened a whole new door of possibilities for me. After my internship, I hope that I will be employed by the World Wide Workshop."

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