

Evidence of Middle School Students'
Development of Contemporary Learning Abilities
in a Game Design Program in Rural West Virginia

Globaloria Student Case Study Series, Pilot Year 2

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Executive Summary

In Pilot Year Two of the Globaloria initiative, during July 2008 – June 2009, Globaloria was implemented in thirteen locations throughout the state of West Virginia with 291 students. As students engage together in situated learning in the Globaloria program, we suggest that they cultivate 6 contemporary learning abilities that are becoming more and more necessary for successful participation in today's technology-infused work and professional cultures. These abilities are the main learning objectives for the initiative, and are briefly summarized as follows:

- 1. Invention, progression, and completion of an original digital project idea** (*e.g., an educational game or simulation in the Globaloria context*)
- 2. Project-based learning and project management in wiki-based, networked environment**
- 3. Posting, publishing and distributing digital media** (*e.g., creating and uploading digital graphics, interactive designs, videos, notes, prototypes, and games*)
- 4. Social-based learning, participation, and exchange** (*e.g., forming and sharing ideas, process notes, programming code*)
- 5. Information-based learning, research, purposeful search, and exploration** (*e.g., researching the subject domain of a game; exploring design resources*)
- 6. Surfing websites and web applications** (*e.g., game examples, wikis, blogs, web apps*)

This study posed two research questions at the outset:

- In what ways is the Globaloria program engaging for the participating students at SRMS?
- In what ways did middle school students develop new skills and learning abilities through their participation in Globaloria in Pilot Year 2 (2008/2009)?

These questions are addressed through qualitative case study findings for three SRMS students. The case studies were developed using several data sources including wiki activity, student project artifacts, videotaped presentations, and qualitative responses to the pre-, mid-, and post-program surveys.

All three case study students (Kristine, Jack and Katie) were in eighth grade, were 13 years old, and participated in Globaloria daily for 80 minutes for the entire school year across four school quarters.

Executive Summary of Results

Kristine, Jack and Katie reflect three very different case study students who exist in a single class context, sharing the same educator and the same level of access to a common set of curriculum materials and resources. The findings for these students vary widely, and also share some common threads. The case studies provide significant insights into both research questions posed.

Kristine

Kristine presented as a student who had a prior interest in art and design, and who therefore developed graphic design abilities as a result of her participation. While she had difficulty learning Flash and using self-led tutorials, she was introduced to a range of new technologies in Globaloria. Further, she was able to complete some of the Flash assignments by relying on her peers. Her case highlights the extent to which collaboration can provide a benefit of knowledge-sharing, but at the same time, how team work can allow some team members to identify with certain roles that limit their learning across the full spectrum of CLA objectives.

Jack

Jack presented as a previously high-achieving student whose technology skills flourished in the Globaloria class. Jack experimented with and mastered all of the different technologies introduced in the course, including blogs, wikis, digital video, digital video editing tools, Photoshop, TeacherTube and Flash. His work was highly creative and as a class expert in Flash programming, he actively engaged in collaboration with his peers, to help them develop new skills. Jack was exemplary in his work and will serve as a model for our continued rollout in middle schools. His case provides evidence that students at this age and grade level are readily capable of achieving the learning objectives set out in the project.

Katie

Katie was a student who was quite tentative at first, who expresses strong hesitation to share and present her in-progress work. Over time, as she gains experience her comfort with the tools and with the workshop-based social environment and collaborative context grows, and she appears to gain a greater level of self-confidence. Her performance and learning is strongest in the second semester, when another student leaves her team and she is charged with becoming a team leader. Her attendance diminishes somewhat in the final quarter, and some shyness remains, as evidenced by her absence from the team presentation to the Advisory Board. Nonetheless, her team scores a 20 on their final game project indicating that at the end of the year, she and her one other team member were able to achieve enough Actionscript knowledge to piece together their game elements into a functioning, well-constructed final product.

Students gained CLAs to varying degrees. It appears that among the cases, Jack gained the most knowledge, followed by Katie, followed by Kristine. However, all students appeared to benefit from working collaboratively in the workshop context. By collaborating and sharing, Kristine and Katie gained many more skills than either would have working independently following the syllabus and tutorials. Jack in turn gained experience being a leader and teacher for others, due to his high level of adeptness in picking up skills independently. All students maintain that the experience gave them greater confidence with and understanding of technology.

Summary of Recommendations and Conclusion

A further thread that has been woven as a theme throughout all the cases is the extent to which students are expected to engage in self-led learning. All students mention having some level of difficulty with this. Kristine mentions trouble with video tutorials. Jack mentions a wish for more structure and deadlines. Katie expresses initial hesitation to engage collaboratively with peers in her learning, and during the third quarter falters in her self-led pursuit of Actionscript knowledge. At the same time, the students also offer ongoing evidence of enjoyment in the autonomy afforded by self-learning.

While pure and simple, game design requires hard work, based on the scholarly perspectives offered above, it appears that improvements could be made to Globaloria in the following two areas:

1. Improving scaffolding support to students: It appears students participating in Globaloria could use more direct expert guidance and scaffolding when they are beginning to shape the plans for their projects, and when they need design and programming help in the moment while developing their game.
2. Providing some greater structure in the curriculum: It appears that especially in the January, February and March timeframe, the students could use some milestone assignments, in order to best maximize the time available in this middle point of the year-long program, in order to maintain the project momentum.

Regarding scaffolding, in Pilot Year Two, the World Wide Workshop began experimenting with live virtual office hours (web-conferencing offered several days a week in which students could Skype and/or web conference with an expert Flash game designer), however this affordance was under-utilized by students. Moving forward, we will explore the extent to which this can help students.

Further, as educators become more experienced in Flash and game design across time, through trainings offered by the World Wide Workshop, and their own self-learning, they will become better prepared for providing on-location support to students in later cohorts. They will also be better at maximizing the time available, through their building of a better understanding of the overall game design process, themselves.

Overall, the case study findings provide ample evidence that the project founders and staff, and participating school administrations and teachers are making ample strides in implementing and continuing to refine the Globaloria program. Further, West Virginia students participating in Globaloria are engaging in positive creative and productive experiences that are affording them the opportunity to develop and synthesize a set of contemporary learning abilities, in preparation for successful futures in today's knowledge-driven professional work environments and cultures.

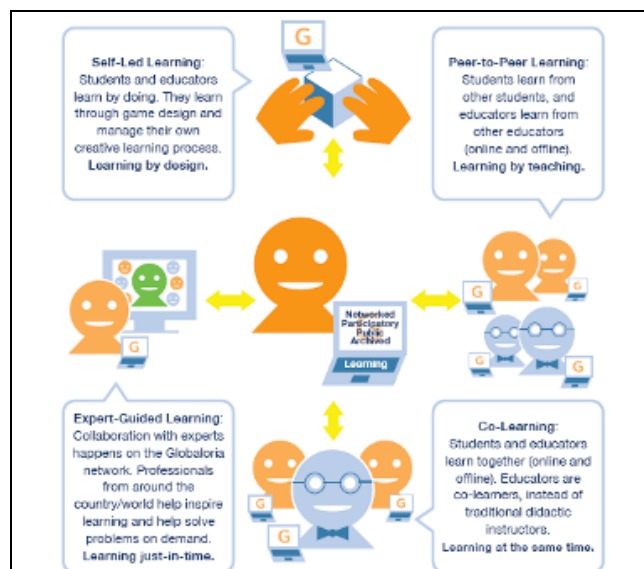
Introduction

In 2006, the World Wide Workshop Foundation in NYC established the *Globaloria* network. Globaloria empowers young people in economically disadvantaged and technologically underserved communities to experience a valuable new way of learning through the creation of intricate web content, including interactive web-games. Broadly speaking, the Globaloria program's mission is to help close the digital-literacy and participation gaps that exist in the United States (and worldwide) by empowering young people to engage in workshop-based game design projects facilitated through the use of a Web 2.0 social learning network and virtual collaboration and support.

In 2007, the World Wide Workshop Foundation partnered with the West Virginia Governor's Office of Technology to establish the *Globaloria-West Virginia* pilot, as a model for a state-wide network and curriculum to transform public education, especially in its poorest rural locations. The organization has developed a technology platform and a curricular program that provides opportunities for young learners to engage in social and collaborative game design and construction using a network of Web 2.0 tools and resources including Flash software, a programmable wiki network, a resource website, and community blogging. Figure 1 depicts the Globaloria learning formula, in which teachers and students learn together, using online tutorials and resources for game design and Flash programming, along with live, synchronous virtual and in-person technology trainings and "virtual office hours" provided by leading figures in game design and development.

Globaloria is suitable for engaging middle school, high school, and college-level students. Funding and support is provided by the current office of the WV Governor Joe Manchin, the WV Department of Education, Benedum Foundation, Verizon, the Knight Foundation, and the Caperton Fund. The goal is to increase the number of students in WV to 10,000 in the next few years, and then start replicating the program in other states.

Figure 1. The Globaloria learning formula: Project-based, Student Centered, Social Learning



Globaloria Program Components

Globaloria-West Virginia engages students and educators throughout this state in virtual and in-school design studios where they learn game design using Web 2.0 creative media and resources offered on the organization's web platform, MyGLife.org. West Virginia middle school, high school, and community college students, as well as educators, learn to program interactive web games using Flash Actionscript, following a curriculum provided to all school partners via an online collaborative wiki-learning environment. From Pilot Year 1 (PY1) to Pilot Year 2 (PY2), the number of project participants doubled, to involve 24 educators and 291 students in 11 counties throughout West Virginia. Thirteen PY2 partner locations have implemented the curriculum as an in-school game design course elective offered to students for credit and a grade during the regular school day.

Considering today's technology advances, Globaloria leverages several Web 2.0 capabilities. The term Web 2.0 refers to a variety of relatively new internet-reliant applications which permit users to actively modify, manipulate, and share content (O'Reilly, 2005). Users can easily contribute to Web 2.0 content by using tools for creating, adding, remixing, reorganizing, tagging, and evaluating (Rollett, Lux, Strohmaier, Dosinger, & Tochtermann, 2007). Web 2.0 environments allow for "collaboration, contribution and community" (Anderson, 2007, p. 4). Some examples of Web 2.0 tools include wikis, social networking sites (such as Facebook or MySpace), blogs (web logs), multimedia sharing facilitated through content-hosting services (such as YouTube and Flickr), and folksonomies (websites or networked applications which allow users to tag content).

Globaloria actively employs wikis and blogs in the classroom experience, and also facilitates students' use of free and open source online Flash programming tutorial resources. On the wiki, students engage in online collaboration and sharing of programming code and assets, document their in-progress work, and then publish their in-progress and final artifacts. Any visitor to the game galleries at MyGLife.org can play students' final games.

Additionally, in many of the schools where the program is implemented, educators encourage students' choice of a game project topic based on their own particular interests, further enhancing the possibility of meaning-making, project appropriation, and 21st Century skills development (e.g., Joseph & Edelson, 2002). Further, the program encourages students to create games with a social mission – in line with the trend in "Social Issues Gaming" being fostered by organizations such as Games for Change and the Serious Games Initiative. To-date, students in our program have chosen to create games that reflect topics in the following genres: a) traditional educational games (e.g., a game about math), b) games that provide a social message (e.g., bearing themes related to health, nutrition or global warming—often educational, too), or c) games that could be classified as purely entertainment (for example, a fantasy game about ninja pandas).

Purpose of this Study

This paper reports findings from Pilot Year Two (PY2) of this model implementation in the state of West Virginia. In this report, we present qualitative case study results for a single pilot location, Sandy River

Middle School, which is a middle school in one of the most low-income counties in West Virginia. The report addresses two main Research Questions:

- In what ways is the Globaloria program engaging for the participating students at SRMS?
- In what ways did middle school students develop new skills and learning abilities through their participation in Globaloria in Pilot Year 2 (2008/2009)?

This question is addressed through analysis of three case study students (Kristine, Jack and Katie) who were in eighth grade, 13 years old, and participated in Globaloria daily for 80 minutes for the entire school year across four quarters.

Literature Review

Principles Applied in Globaloria Program Development

The Globaloria program was conceived and produced in the past three years by a small team at the World Wide Workshop Foundation, a NYC-based educational non-profit founded by Dr. Idit Harel Caperton, who in the 1980's and 90's collaborated with MIT Professor Seymour Papert to establish the technology-driven learning "framework for action" Constructionism. Constructionist learning is inspired by the constructivist theory that individual learners construct mental models to understand the world around them. However, constructionism holds that learning can happen most effectively when people are also active in making tangible objects in the real world. In this sense, constructionism is connected with experiential learning and builds on some of the ideas of Jean Piaget. Constructionist principles were applied in projects occurring in selected schools in Boston, Costa Rica, Australia, and other cities and nations, and also in one of the first Internet companies (MaMaMedia, Inc.) with web services for children, founded by Harel Caperton – MaMaMedia.com and ConnectedFamily.com.

Globaloria is unique in that it applies constructionist principles for learning in a curriculum of game design offered via a Web 2.0 technology environment called MyGLife.org. Some of the traditional Constructionist principles applied in Globaloria include the following (e.g., Papert, 1980; Harel & Papert, 1991):

- Workshop-based learning in an informal classroom setting where students can talk openly, share their learning, collaborate, and work in teams with their peers, creating a community of practice;
- Students' use of programming languages and computational design tools to create complex representational digital artifacts such as games with a goal to help younger learners understand a concept in a given subject domain (the game's topic);
- Affording students with significant time daily, across many months, to pursue the completion of a final design artifact;
- Frequent student reflection upon and social expression about their work in progress;

- Sharing and presentation of final work in the team and group context.

Research has found that programs applying Constructionist principles provide opportunities for students to develop a sense of meaning and purpose in creative work on a digital artifact (e.g., Harel & Papert, 1991; Harel, 1988, 1989, 1991, 2002; Kafai, 1995, 2006; Lawler, 1984, 1985; Wilensky, 2003; Klopfer, 2008; Seely Brown 2005, 2006; Collins & Halverson, 2009; Dede, Ketelhut, Clarke, Nelson, and Bowman, 2009; Reynolds & Harel, 2009a & b). Globaloria gives students hands-on experience in becoming active users and creators of new technologies, in ways that we expect will be integrated in their future professional lives. This sense of personal meaning results in a greater “appropriation of the project” (Harel, 1991), and gives learners a feeling of ownership over the work they create and share.

Supporting this goal is John Seely Brown’s research (2005) in which he discusses the importance of digital literacy and collaboration in networked, evolving, technological environments. Seely Brown notes that “since nearly all of the significant problems of tomorrow are likely to be systemic problems – problems that can’t be addressed by any one specialty - our students will need to feel comfortable working in cross disciplinary teams that encompass multiple ways of knowing” (p. 2). As such, he emphasizes the importance of “learning to be” active users of technology, in contrast to “learning about” technology. He further states (p. 6),

Today’s students want to create and learn at the same time. They want to pull content into use immediately. They want it situated and actionable - all aspects of learning-to-be, which is also an identity-forming activity. This path bridges the gap between knowledge and knowing.

Situated learning is learning that occurs in the same context in which is applied. This has also been called “epistemic learning” or learning by role-taking experimentation by scholars such as Shaffer & Gee (2007).

The Globaloria program provides a model for situated, epistemic learning in which both students and educators engage in game design activity in a workshop setting in school, in which students take on the role of a real game designer. Globaloria can be considered a social learning system, in which Wenger (2003) suggests that competence is socially defined, and knowing is a matter of displaying competences defined in social communities. Wenger (2003) diagramed four areas of social constructivist learning that is achieved in communities of practice (which make up social learning systems). These areas are shown in Figure 1 (derived from Couros, 2006, p. 8; Wenger, 1998b, p. 5; Sobrero, 2008).

Figure 2. Social Learning in Communities of Practice, from Wenger (2003)



Student engagement and meaning-making are constructs integral to social learning systems (Wenger, 2003). Wenger (2003) defines engagement as “doing things together, talking, producing artifacts” (p. 78). In engaging together, members “identify gaps in their knowledge and work together to address them” (p. 82). In addition to engagement, two important facets of a social learning system are realistic imaginative activity, as well as alignment (the extent to which activity can be effective beyond the local engagement). Wenger (2003) suggests that every social learning system involves all three to some degree or another.

In Globaloria, students share language, tools, artifacts and methods. Globaloria also builds in realistic imaginative activity in that students practice professional roles. Further, students create games that are published online and playable by others – which reflects Wenger’s third attribute of alignment (effectiveness beyond the local engagement). Wenger (1998a) suggests that meaning-making activities bring about learning and change.

6 Contemporary Learning Abilities

As students engage together in situated learning in the Globaloria program, we suggest that they cultivate 6 contemporary learning abilities that are becoming more and more necessary for successful participation in today’s technology-infused work and professional cultures. These abilities are the main learning objectives for the initiative. Table 3 provides the 6-CLAs and some examples of activities in Globaloria that are designed to cultivate these abilities. The full set of Globaloria activities that cultivate the CLAs can be found in Appendix A. Their development and conceptualization is addressed in greater detail in papers by Reynolds and Harel Caperton (2009a & 2009b) resulting from Globaloria--West Virginia’s PY1 implementation.

Table 1. Contemporary Learning Abilities (CLAs)

Contemporary Learning Ability:	Examples of Globaloria activities that cultivate CLA:
1. Invention, progression, and completion of an original digital project idea (e.g., an educational game or simulation in the Globaloria context)	<ul style="list-style-type: none"> Choosing and researching a subject for a game design project Writing an original game narrative and a proposal to explain the game’s purpose and main subject Programming and completing a final game

2. Project-based learning and project management in wiki-based, networked environment

- Coordinating and managing the process of building the game (design document, user flow, budget, schedule, introduction, overview, treatment, competitive analysis, teamwork, planning, managing implementation process)
- Managing the team work (defining and assigning team roles, coordinating tasks, and executing one's role within the team)

3. Posting, publishing and distributing digital media (e.g., creating and uploading digital graphics, interactive designs, videos, notes, prototypes, and games)

- 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 game design iterations and assets to wiki

4. Social-based learning, participation, and exchange (e.g., forming and sharing ideas, process notes, programming code)

- Collaborating by using Web2.0 tools, such as posting to wikis, blogs, open source help forums, Instant messaging
- Exchanging & sharing feedback & resources with others by posting information, links, source code questions and answers
- Reading and commenting on blogs and wiki pages of others

5. Information-based learning, research, purposeful search, and exploration (e.g., researching the subject domain of a game; exploring design resources)

- 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

6. Surfing websites and web applications (e.g., game examples, wikis, blogs, web apps)

- 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

The CLAs are a working framework that we are continuing to refine through our research and development in the Globaloria-West Virginia pilot project. They serve as outcome objectives and are key drivers for the continued program design and curriculum decisions made in developing the program. Through participation in Globaloria, we expect that students' 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. Their conceptualization adds to "digital literacy" scholarship in several fields (e.g., Turkle, 1997; Barron, 2004; DiMaggio et al., 2004; Eshet-Alkalai, 2004; Eshet & Aviram 2006).

Above all, the Globaloria program offers a new and unique model of Constructionist learning towards meeting the objective of better preparing today's learners for 21st Century work. Very few, if any, of these objectives are being met in traditional education, and students are entering college and the workforce unprepared, so we believe that any student achievements in their CLAs are significant. The World Wide Workshop Foundation and their pioneering school partners are applying this model in today's public schools now, by training and working with both educators and students simultaneously. The program is a 5-year pilot, and thus is continuing to be refined and developed iteratively. As we document student advances in their CLAs longitudinally across time, we expect to find evidence which suggests that these students are better integrating these abilities into their professional skill set than their peers who have not participated.

SRMS, a Middle School in a Low-Income Sub-Region in West Virginia

A primary reason we chose an initial pilot implementation in the state of West Virginia was to test our learning innovation with a population experiencing the effects of the digital divide, in order to provide immediate benefit to students who are presently disadvantaged. The U.S. state of West Virginia has a lower median household, a lower per capita income, and higher poverty level as a percent of the population in comparison to figures for the nation as a whole. As a rural and mountainous state with a higher poverty level than most of the country, West Virginia's residential broadband diffusion has been challenging, due to geography, 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. The population is at greater risk of the effects of the digital divide, at both the first and second levels (access due to cost, and sophistication of use), limiting the potential for technology learning by young learners in the home context.

Among the thirteen participating Pilot Year 2 schools was Sandy River Middle School (SRMS) in Avondale, WV, one of three public middle schools who participated in this year. We chose this exemplary middle school from among the three as a focus for the case study, in part because SRMS students were led by a highly engaged educator in her first year of participation who delivered the program in a consistent, organized process across the school year. Further, this location is situated in a particularly high-needs, low income sub-region of the state, and thus we expected students might have a lesser extent of home internet access and means by which to gain digital skills.

Demographics of the pilot community from Year Two addressed in this study, SRMS are provided in Table 2.

Table 2. Year-One (2007) Demographics of Pilot Community, SRMS:

Broadband Available at Home:	No*
Population, Avondale, WV (2007):	594
% Sandy River Students eligible for free or reduced price lunch:	81.60%
Median household Income, McDowell County:	\$16,931
WV Median household Income:	\$37,057
National Median Household Income	\$50,740

SOURCE: Demographic data provided on the U.S. Census Community Factfinder website, <http://quickfacts.census.gov/qfd/states/54000.html>. Demographic data for % low income students was provided on the West Virginia Education Information System website, <http://wveis.k12.wv.us/nclb/pub/>

*County considered a "remote area" under the definitions released by the U.S. Department of Commerce's National Telecommunications and Information Administration and the U.S. Department of Agriculture's Rural Utilities Service.

The 2007 median income level for the SRMS pilot location is below the state and national median income. Broadband diffusion and socio-economic barriers are evident. Due to their success and the commitment of the educator, we expect that SRMS will become an exemplary middle school location that will be a focus in longitudinal observation and analysis for Pilot Years 3 -5 of the Globaloria project, to investigate what students in the most disadvantaged schools and regions are capable of when afforded opportunities such as this one.

Globaloria integration into SRMS Course Schedule

The Globaloria program at SRMS was offered as an elective "Game Design" course across the full 2008/2009 school year. The class was held daily in a PC computer lab, meeting five times per week, 82 minutes per meeting. Fourteen 8th-grade students worked in teams to create their game projects. This was the first year of the Globaloria implementation at SRMS. Regarding educator training, in the summer prior to the school year, and again in the winter, participating educators across WV were provided 2-day workshops trainings at a central location conducted by the World Wide Workshop called the Globaloria Academy. Students were subsequently supported throughout the year by their educators, and they also learned through use of online resources and tutorials, and participation in periodic virtual training offered by the World Wide Workshop through Webex and Skype. Participants also learn through interaction, sharing and collaboration with their peers in class as well as students at other locations, via communication on the wiki.

Active Lead Educator

Mrs. B. was the lead educator at SRMS in PY-2, age 30, and served as a middle school Reading/Language Arts teacher and Spanish I facilitator. Mrs. B. has an unusual background for an educator in WV, which she describes as follows in her pre-program survey:

"I was born and raised in Latvia, one of former Soviet republics. I have obtained my bachelor's degree in English and French linguistics over there. While in college, I have traveled to the States and Europe over the summers to work and practice the languages I was learning. During one of those travels, I met my husband and a year later got married... I am currently finishing my Master's in secondary education from WVU and planning on pursuing certification from Concord University next spring. I am happy teaching middle school for now and that's where I am intending on stay for a while."

Prior to Globaloria, she reports having never engaged in any game design initiatives, nor supported students in such activities. As for her prior technology experience, she states "I usually incorporate

technology in my lesson plans in forms of webquests, creation of power points, or communicating progress via email. I also facilitate Spanish I through WV Virtual School where most of the instruction and assessment is delivered online.” She states her goals for the program are as follows: “I hope our students will be able to become comfortable with technology tools in finding and evaluating online resources as well as using their knowledge of the content area to create interactive games to facilitate the learning of others. I would also like to become more technology savvy and more comfortable with the online environment.”

Mrs. B. was highly active in PY-2, learning hands-on game design along with her students, participating in all professional development opportunities, serving as a mentor and guide to other educators, and even engaging in talks and presentations throughout the state regarding her Globaloria participation and her students’ projects during the year.

Among the three middle schools participating in Pilot Year 2, we chose SRMS for this case study in part due to the consistency with which Mrs. B. implemented the course. She was a meticulous record-keeper and submitted highly detailed progress reports throughout the year, and her observations are woven throughout the case studies, adding significant insight into each student’s progress. In relation to other locations, her young students advanced to a greater extent, in their creation of games and in their learning. This exemplary performance was evident through our observation of student work posted to the course wiki, and our content analysis and quantitative evaluation of students’ final games.

The following table provides an overview of the Syllabus topics and tutorials covered at SRMS during this school year, by quarter. Adjacent to the timeframe and topics, we align reflections and observations at the class level that were provided by Mrs. B. in her quarterly progress reports, regarding her class progress during the given timeframe. This list of topics and educator reflections provide an initial overview of class progress during Pilot Year 2, from the educator’s perspective.

Table 3. SRMS Syllabus Topics by Quarter, and Aligning Educator Reflections

Timeframe, Syllabus Topics and Tutorials Covered	Selected Reflections from the Educator on Class Progress
<p>First Quarter: Late August – November 3, 2008</p> <p>Create Your Profile Create Your Blog Participation Guidelines Playing to Learn Social Issue Games Mini-presentations</p>	<p>The first month requires a lot of work in modeling course expectations for the students and helping them become independent learners within this framework...</p> <p>While playing the games, many students had trouble with critical evaluation of the games, and we had to nudge them to go back to the unit and put more thought into the reviews. Blogging was also an issue for some students as they were not used to writing about their experiences although as they progressed through the units, they started writing more. I believe, this aspect of Globaloria will help students hone their writing skills and become better writers. . .</p>

<p>Imagining Your Game</p>	<p>Game plan presentations have also revealed new and exciting personality traits and skills of our students such as collaboration and using each other's strengths to come up with a better project even though some of the groups still need to do work on their communication and collaboration skills.</p>
<p>Second Quarter: November -- January 11, 2008</p> <p>Paper Prototyping Planning Your Game Drawing in Flash Adding Navigation Adding Animation Adding Sound Adding Interaction Assembling The Game Presenting Your Game</p>	<p>So far, the biggest accomplishment has been seeing the student become independent learners and learn from each other. The students do not expect me or Mrs. K. to give them all the answers. Instead, they go and find out what they need themselves or ask their friends to share. We have become quite a tight community, with more advanced students always making sure that the ones who need help always get it. This atmosphere helps the less proficient students feel comfortable and willing to learn. Thus, nobody shies away from something new and complicated.</p> <p>During this time, the students had their first experience with the WebEx mini workshop. They had tons of questions and were glad they could talk to an expert. ...This learning period was quite challenging because the students were still getting used to the structure of the course and got finally started on working in Flash. I have learned a lot about my students during this period and realized that I should trust them more with their independent learning and creation of artifacts to show off their newly learned skills.</p> <p>During this time I have started seeing real student collaboration displayed in various ways in different groups. There were arguments, peer/teacher mediation, and opened lines of communication, which all showed the traits of authentic workplace collaboration evident in my classroom! I also saw a lot of social learning that I hadn't attributed much importance to before. My students shared their learning successes, concerns, and skills so naturally that I really saw the benefits of social aspect of learning. I have embraced being the "guide on the side", with my students setting their goals for the unit, advancing with their game, or helping each other learn without me telling them what to do.</p>
<p>Third Quarter: January 12 – March 21, 2009</p> <p>Moving on a Path Special Effects Scrolling Background Score Keeping Collision Detection Sound Effects Timer Character Effects</p>	<p>The end of the first semester and the beginning of the second were clearly marked by the ease of student learning as they got used to the course. During this time, the students have finished the game design units and have almost finished with the game development topics as well. When it came to game development topics, they worked as a group on dividing responsibilities and playing up individual strengths to accommodate their game design. The groups have developed schedules and assigned the units to certain group members. At this point, the students are starting to concentrate solely on game scene design using the knowledge they have obtained previously.</p> <p>It was interesting to watch the students dare into other tutorials besides the ones posted on the wiki. Again, as a chain reaction, one's use of a certain website to work</p>

<p>Drag and drop Platforms Running and Jumping Coding "enemies"</p>	<p>on a certain aspect triggered everybody's interest and resulted in many files created after learning more about Flash..</p> <p>A new thing that I have started this semester has been borrowed from Jeremy. Every two weeks my students have a peer evaluation where they grade the level of work they have accomplished in addition to evaluating their peers. This type of evaluation does help them be more productive during these two weeks because they are accountable to their team members for the work to be done.</p> <p>This year has been a huge learning curve for me. Flash was the toughest one to learn, and it still is. However, I am more comfortable with the software because I deal with it every day and I go through tutorials step by step, just like my students do. When my students ask me to help them, I learn with them, unless I have worked on a certain aspect of Flash before. The Academy in January probably helped me the most because I had enough skills already in place to see how action scripting worked with collision detection, score keeping, etc. I have not taken my Flash knowledge to my other classes, but I definitely use my increased knowledge of the wikis and blogs with my language arts students.</p> <p>I am worried about some of my students not getting as much out of this class as I would want them to. However, I don't feel that I am entitled to holding them hostage so that they finish their work and lose the fun in learning.</p>
<p>Fourth Quarter: March 22 – End of May, 2009</p> <p>Students worked on different units as indicated by their needed skills pertaining to specific games.</p>	<p>During the last quarter, students spend a lot of time working on their games, which involved covering more tutorials directly pertaining to the scenes of their game. Throughout this period, students have presented their game concepts to the McDowell County Board of Education (April 22, 2009), as well as prepared for their game presentation on May 13. These opportunities allowed students build greater self-confidence and refine their game concepts as they went along. Many times, students had to go back and "simplify" the game scenes because of the lack of time needed to accomplish their original projects.</p> <p>The process of collaboration was not easy as the students clashed again and again because of the differences in their ideas and personalities. However, this time also marked the highest independence level in student learning, with the students mostly pressuring each other to work rather than relying on Mrs. K or me for the authority. We still had to intervene to keep some of the students on track, but the incidences of it became less frequent... All of my students have learned not only game design skills but also skills of collaboration, compassion, and communication.</p> <p>The final quarter of the year was hectic, rewarding, frustrating, and... hectic, again!!! I have realized that some changes would be needed to be done next year to avoid some of the setbacks we have experienced this year. We will encourage our students to start working closely on their games earlier and keep their final game vision more realistic. We will also want our students to develop a more thorough game development</p>

	<p>schedule and record any changes they encounter on the way to be able to see that procrastinating or encountering a problem with the unit would delay the whole project. We will surely keep the student biweekly evaluation, so that they could grade their peers' work in class and keep each other accountable besides us nudging them all along.</p> <p>Looking back at the amount of work done and skills learned, I cannot believe that we did so much! Both educators and students learned a lot about the 21st century learning and teaching using a hands-on approach, experimenting, tweaking, changing, "borrowing" from each other, etc. Looking forward to the next year!</p>
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Overall, this table provides validation from the educator about which Globaloria program components described above were implemented at SRMS, as well as the class progress. Further, the comments provide insights into the evolving mindset of the educator, as she learns to guide and manage students' game design learning in a workshop-style social constructionist environment, while developing new technology skills of her own. We provide this as background information on the "intervention." As it is organized by quarters, this table parallels the chronological presentation of the case study findings below. This table serves as a reference for the quarterly research findings presented in each case study.

Method

In this paper, we use case study method to explore the performance of three students. We also draw from results of a content analysis conducted upon all Pilot Year 2 games, providing the numeric value (or "score") that was calculated for the games presented in the case studies, when the game was coded using an inter-coder-reliable content analysis coding scheme. The approaches utilized in the case studies and content analyses are described as follows.

Case Studies

In the 3 case studies, for each student we present findings as they emerged in chronological sequence in the data across Semesters One and Two. The data sources for each case study are as follows:

- 4 Educator Progress Reports submitted quarterly to the World Wide Workshop Foundation, presenting a brief synopsis of each student's performance;
- Students' pre-program survey responses to 5 open-ended questions (late August);
- Students' mid-program survey responses to 13 open-ended questions (early January);
- Students' post-program survey responses to 9 open-ended questions
- Wiki posts (including text, video, game design files, graphics files, Flash project files, code);
- Blog posts

- Post hoc interview with the educator to clarify and confirm some findings

To make sense of all the extensive data and develop the student case studies, we batched the disparate data from all of the sources by student, and by chronological order, and developed observations about student performance across time based on the content observed and reviewed. As we batched the data together and reviewed student performance, certain trends and findings emerged for each.

Chronologically, Semester One data sources used were as follows.

First Half of Semester One (September/October, 2008):

- First Educator progress report (September, 2008)
- Students' pre-program survey responses to 5 open-ended questions (late August);
- Student Wiki activity and blog posts for this timeframe

Second Half of Semester One (November 2008 - Early January 2009):

- Second Educator progress report (December, 2008)
- Students' mid-program survey responses to 13 open-ended questions (early January);
- Students' post-program survey responses to 9 open-ended questions
- Student Wiki activity and blog posts for this timeframe
- Post-hoc interviews with the Educator

Then in Semester Two, the data sources were as follows.

First Half of Semester Two (January 2009 – Early March 2009):

- Third Educator progress report (March, 2009)
- Student Wiki activity and blog posts for this timeframe

Second Half of Semester Two (Late-March 2009 – June 2009):

- Fourth Educator progress report (June, 2009)
- Student Wiki activity and blog posts for this timeframe
- Students' post-program survey responses to 9 open-ended questions
- Post-hoc interviews with the Educator

In the case studies that follow, we present observations, evidence from the data, and summarized findings for each individual student, related to the study's two research questions on student

engagement, and contemporary learning abilities gained. The resulting cases present a narrative of student engagement, and in many ways the data presented tells its own story.

The Wiki served as a valuable data source in that it offers a history of all student actions. Students must login each session in order to contribute anything to the site, so their actions are recorded and searchable in the Wiki history and archives. Further, the wiki provides automated overall metrics for each individual student's activity (number of wiki edits and uploads). It was very useful for case study generation by researchers who were working remotely and using students' produced and posted work as a main data source.¹

Content Analysis Method

For each student, we also provide the content analysis coding metrics for the final game artifact they created with their team members. Neuendorf defines content analysis "as the systematic, objective, quantitative analysis of message characteristics" (2002, p.1). A key word in this definition is "message." Neuendorf explains that in order to use content analysis, "there must be communication content as a primary subject of the investigation" (p. 14). She makes references to text as the message, but further notes that, for example, "the text of a film includes its dialog, its visuals, production techniques, music, characterizations, and anything else of meaning presented in the film" (p. 15).

Content analysis suits our research into the form and message of final student games for two reasons. First, a primary individual goal of the program is to facilitate students' construction of a final digital interactive game artifact. Thus, there are functional constructive qualities of the games that can be analyzed and measured. Secondly, as part of the overall mission of Globaloria, students are encouraged by their educators to produce games with social or educational messages to them; that is, games are purposefully constructed with the goal of conveying messages about social or educational topics. That said, some students choose to create an entertainment game in cases where educators give them the option to choose whatever theme they wish. Thus, we have found that we can categorize game subjects into three domains: educational, social issues, or entertainment.

In this way, the medium itself (the game design and functionality) is considered part of the message. Furthermore, our coding scheme touches on the deeper subtexts in the game content as well (seen for instance in the topics that students choose, such as global warming, and the way they express the game narrative).

Our content analysis procedure was conducted using a coding scheme that was developed to evaluate students' engagement and development of new skills in Globaloria during Pilot Year 2 of the program in West Virginia (the 2008-2009 academic year). Researchers who were working remotely from the actual on-the-ground project in West Virginia developed the coding scheme, through virtual interaction and

¹ In Pilot Year 2 we did not conduct site visits. In Year 2 we sought to evaluate whether the wiki data sources we used were sufficient for capturing the learning process. We wished to consider how much we can infer about a case, and about students' learning, drawing upon the actual work they produced and posted online to the Wiki environment. This is important because we expect that actual student work produced will be a key data source for the research moving forward as the project grows.

play with students' final digital project artifacts— those social-issues, educational and entertainment genre games students created and posted online during their Globaloria involvement in Pilot Year 2.

The coding scheme measures features in students' finished game projects and related wiki postings, allowing for inferences about valuable learning that resulted from student game-making. For the purposes of game content analysis, and given the wide variation in quantity and complexity of features included in student games, we define "game" as: a file that goes beyond a mere image, to include some level of interactivity, in which, at minimum, the file provides response to the player, based on a player action. We further classify a "game" as a game that reflects a .SWF (Small Web Format) file, with at least a button or character that moves and a response screen based on clicking of buttons/objects.

The coding scheme draws upon the major objective of the Globaloria program: building students' *Contemporary Learning Abilities* (CLAs) (Reynolds & Harel, 2009). The coding scheme presents a robust set of game attributes to be counted, which map to the CLAs. Students' inclusion of the given attributes in a game indicates that he or she has gained knowledge in the related CLA dimension, because in order to code the game with a given attribute requires learning the given skills.

The content analysis coding scheme measures and assesses students' contemporary learning abilities, by focusing on students' actual game design work conducted in the course of a year-long constructionist program of project-based learning. Three coders reached an average of over 80% reliability when coding 10% of all 95 games created in pilot year 2 across the 13 Globaloria pilot locations. This is an acceptable reliability level for content analysis. The final content analysis coding scheme we used is presented in Appendix A of this study. Analyzing games provides us with direct insights into students' development of CLAs in the following ways. Appendix A provides the specific codes used for each coding scheme category below.

CLA 1: Invention, progression, and completion of an original project idea for an educational game or simulation

- Indicated by the following coding scheme categories (and individual codes within):
 - Game Design
 - Game Functionality,
 - Game Audio Visual, and
 - Game Subject/Narrative

CLA 2: Project-based learning and project management in wiki-based, networked environment

- Indicated in particular by the following coding scheme categories (and individual codes within):
 - The Game Plan and Demo (it's inclusion on the wiki, and it's qualitative depth)

- Game Functionality, Game Audio Visual, and Game Subject/Narrative categories (because to achieve these categories, the student needs to have successfully project-managed the game's development).

There coding scheme we used predominantly codes for CLAs 1 and 2, and thus the higher the score, the greater extent of learning has occurred in these two CLA categories, because in order to include the elements coded, the individual must have the requisite knowledge to do so. For these more Constructionist CLAs 1 & 2, the game artifacts themselves (measured and reported upon here) may be the strongest indicators. While it is an imperfect metric of *individual* learning because in two of the three case studies presented, the students worked in teams, the value attributed to the games provides a metric for comparison between and among the games as artifacts, and with the aligning case study data we can gain a sense of what game design and programming roles students played within their given team context.

To some extent the coding scheme also addresses CLA 3 (posting, publishing and distributing digital media designs, videos, graphics, notes, and games) and CLA 4 (social-based learning and exchange), indicated by the coding scheme category of playable game *presentation on the wiki*, which requires students to publish, share and discuss their game artifacts with other students. And, to some extent the coding scheme also addresses CLA 5: Information-based learning, research, purposeful search, and exploration in that we have 1 code about student research that appears to have gone into the game narrative.

This approach to evaluation provides an alternative to administering a standardized knowledge test. Here, students' knowledge gained is evaluated through identifying the extent of their productive output in constructionist work towards a final, completed project, based on a set of learning objectives. A full methodological description of the coding scheme development is presented in the Globaloria report by Reynolds, Scialdone & Harel Caperton (2009) entitled "Developing a Content Analysis Approach to Measuring Student Engagement in Constructionist Game Making Learning Environments."

Case 1: Kristine



Globaloria-WV case study student Kristine was a 13-year-old 8th grader at SRMS during Pilot Year 2. Like all SRMS students, she participated for the entire year. Regarding her background, Kristine stated in the pre-survey that enjoys spending free time out of school reading, playing softball, and swimming. She states that she is looking forward to going to college for acting. Mrs. B describes her as a “quiet artist” in her group.

Kristine was chosen as one of the 3 cases for SRMS because at first she struggled with some of the technologies. Her first blog post of the semester shows some anxiety about using technologies as she notes “I think it’s going to be really confusin, (cause it has been so far) but we will probably learn a-lot about computers.” Kristine states that has mostly used computers for being on MySpace.com,

a popular social networking website, demonstrating that she at least has established a minimal comfort level. Her instructor, Mrs. B, observes in her September 30th progress report that, “initially she was not comfortable with the computers/Internet at all. She was very worried she would not do well in this class.”

However, through collaboration with peers, Kristine overcame these difficulties to successfully gain Flash skills and contemporary learning abilities. Her case demonstrates evidence of effectiveness of peer support for learning, and several elements of the workshop model undertaken in Globaloria.

Semester One Wiki edits and uploads, Kristine and her class

Students use the wiki as an online learning environment for sharing, collaborating, and presenting their design artifacts for peer feedback. Wiki engagement for these purposes is a key objective of the Globaloria program, reflected in CLAs 2, 3 and 4. Here we provide some data on students’ Wiki edits and uploads across Semester One, offering initial insights into students’ level of wiki activity across the timeframe. We present Kristine’s individual activity monthly, in relation to the class range.

It appears from the wiki activity overall for this location that students at SRMS made wiki edits to profile and project pages more frequently when they first began in September and October, tapering off somewhat while learning game design (November and December). Students were in class for 80 minutes each session, and with vacations and weekends, were in class about 18 days per month on average. During Semester One, on average, wiki activity of the class as a whole at SRMS appears roughly to be about three edits per student per session, and less than one file upload per student per session. Thus, it appears that networked wiki editing and uploading comprised a small proportion of their class activity, in comparison to time spent creating their games using Flash software resident on their computer’s hard drive.

Table 4 shows Kristine’s wiki edits for Game Design I by month, and compares her posts to the class range. In September, she made 60 posts, which was in the upper range compared to other students. In the later months, she engages in the upper range of activity in her wiki page editing.

Table 4: Kristine’s Wiki Edits from Game Design I, by Month

Month	Kristine’s Wiki Edits	Range of Wiki edits, low to high
August	6	1 - 12
September	60	0 - 65
October	72	22 - 72
November	17	7 - 27
December	32	8 - 32

Supporting the results for wiki *edits*, Table 5 indicates Kristine’s wiki *uploads* from Game Design I, in which she added files such as Flash files or images to the wiki. Her metrics are again upper-range during the beginning of the course, and tapers somewhat in November and December.

Table 5: Kristine’s Wiki Uploads from Game Design I, by Month

Month	Kristine’s Wiki Uploads	Range of Wiki uploads, low to high
August	2	0 - 4
September	18	0 - 18
October	30	4 - 30
November	10	6 - 28
December	9	4 - 22

Overall, Kristine’s wiki editing activity is about average in most months except October when she is the most active student.

Kristine’s Participation in the First Quarter of Game Design: Late August to November 3, 2008

In the first quarter of the academic year (from about August 27, 2008 – November 3, 2008), Kristine joined the team “Fourth Column,” which was made up of team members Chelsey, Dillon, and Cody. Kristine’s group was expected to complete the modules “Playing to Learn,” “Social Issue Games,” “Imagining Your Game,” “Paper Prototyping,” “Planning Your Game,” “Drawing in Flash,” and “Adding Navigation.” During this time, Kristine completed all of the assignments under these curriculum topics.

Kristine and her team work together on a game called “Saving Planet Earth,” which is about time travel and allows the player to go back in time to reverse the effects of global warming. Kristine states in her pre-survey that “I think it would be better to have games that have a good meaning instead of the ones where you just kill people.” The team Fourth Column’s game pitch is as follows.

Audience: We are designing our game for middle school students. We are because the game is too challenging for Elementary ages and not challenging enough for high school students.

Game Play: The player sees a time portal, spaceships, and a city. The player rides a space ship through a portal and goes back in time to help save the earth. The rules are not to hit anything in the time portal, get help picking up trash, and to answer questions at the end, about global warming. You win by completing all of these tasks. The goal of the game is to stop Global Warming from happening.

Fun Factor: What makes our game fun is that the players get to go through a time portal and dodge different things.

Smart Factor: Our game teaches about global warming. By playing it someone can learn how to help prevent it and how it was started.

Style Factor: Our graphic animation style is going to be like a cartoon. We will have different kinds of background music and voices for the characters.

Originality Factor: What makes our game special and unique is that it has time travel, spaceships, and it has different obstacles that other games don't have. It will sell because it expresses a global issue(global warming) and at the same time it is fun.

Team Introduction: Dillon is the creative one who makes all the ideas. Chelsey is the smart one who makes Dillon's ideas realistic. And Kristine is the artist. Cody is the one who adds the music for all the scenes.

The group's game topic demonstrates the extent to which young people have become aware of the growing environmental concern over the global climate crisis, and the environmental legacy being left to their generation. The game topic choice may indicate a projected imaginative wish that through the interface of the computer and their game, the player can time travel back to reverse and prevent the damaging effects from occurring. This game topic provides a motivating context for the students in this team to learn new digital skills. It also provides them an opportunity to do online research to learn more about the game's subject.

Paper Prototype

The goal of the paper prototype module is to allow students to create mockups of their game on paper, before producing the digital files. Students design and present this storyboard in a digital video discussing their game plan, and then post this on TeacherTube and embed the video on their wiki.

Kristine expresses some initial anxiety about the paper prototype in her October 8th blog post in which she writes, "we had to make our own paper prototype of our game. I think the tutorials made it seem really hard, but maybe they just wanted to scare peoples." After she completed the task, she reflects a slightly different tone, writing that, "now I'm not saying it was easy, but it wasn't as complicated as they made it sound."

In Fourth Column's paper prototype, each screen of the game is presented on a different piece of paper, placing it over the previous sheet as they describe the progression of their game. Objects that will be animated are represented by different cutouts, such as the character the player can choose, and the time machine. Their prototype shows a frozen planet earth. Fourth Column explains that scientists in their game discuss a way to prevent global warming from happening, and use a time machine to travel back to the past and prevent it. Traveling in the time machine appears to represent one level. Another level consists of cleaning up garbage on the playground of an elementary school.

The students add a learning component by including a quiz challenge on global warming, which requires correct responses before the player can time travel. Figure 4 shows screenshots from Fourth Column's paper prototype. The first image is that of the time machine going through a portal, while the second shows the clean up at the elementary school. Mrs B. notes in her September 30th progress report that "Kristine is an excellent artist who will be very beneficial for her group during its work on the game."

Figure 4: Screenshots From Paper Prototype of "Saving Planet Earth"



Fourth Column's Mini-Presentation

Fourth Column's mini-game presentation video explains a little bit more about their game. During this presentation, the students describe and demo different part of their game using PowerPoint, each speaking to a different slide. They explain that the scientists live in an Earth Ship in outer space because global warming has made the Earth inhospitable. To earn points in the game, the player must spread the word about global warming through signs, posters, putting up recycle bins, and actually helping to recycle. They note that one can lose points if not enough people are warned about pollution. Figure 5 shows a screenshot from their presentation.

Figure 5: Mini-Game Presentation of “Saving Planet Earth”



Kristine's Interest in Graphic Design

Kristine's blog illustrates that she is enthusiastic about graphic design in particular. She writes in a blog post dated September 15, 2008 that "Today we painted on paint program. I can draw preetty good on there, because at home whenever my computer takes along time to load, I draw on it. It's fun so..... I drew the ocean, a rocketship, outer space, a mermaid, and the planets." Kristine's wiki project page displays some of the art that she has created during the first quarter, much of which relates to the game that her team is working on. Figure 1 shows some images that reflect visuals for "Saving Planet Earth."

Figure 3: Images from Kristine's Wiki Project Page



Kristine's Blog and Progress Notes

In this timeframe, Kristine blogs regularly and shows a strong degree of self reflection in her posts. In one dated September 29th she writes, "today in Globaloria finished writing our story in flash and decorated it. I got done today, even though we are going to spend like two days on it, but Mrs. Garret just said while everyone else is going to finish I can just like draw and practice on flash. Which is fun. I'm glad we are spending tomorrow on this, that way I can just draw and stuff. I think I will get used to flash soon, hopefully anyway..... Maybe after I use it for awhile I will, cause like I know how to use it I'm just like not comfortable with it. Like I was when we first started using wikis lol. I got used to that so I probably will soon, I just have to fiddle with it awhile."

Kristine is also diligent at keeping up with her progress notes, which provide insight into the tasks of the day. For example, on September 11th she states that "today I finished up my questions, and googled global warming. I added a link and a video to my projects. And I left a comment for people on their blogs." The following day she writes, "today we (I) searched the web to find sites, videos, and images on (global warming). I got done just in time." On September 18th she writes "today we painted more on stuff that we'll be on our game. and added them on my project, imaging your game," and on the following day she notes, "today we painted our characters.. the girl, the boy, and the robot. I got done."

Kristine's willingness to collaborate and interact with other students is observed by Mrs. B who writes in her September 30th progress report that Kristine assisted others in using the graphical software tools. Mrs. B states "she was also very helpful for other students who did not know Paint as well as she did." Mrs. B observes further that "Kristine has learned quite a lot during this period. She learned how to upload images to her wiki, how to embed Teacher Tube videos, and how to add colors to backgrounds and fonts. Kristine is quite consistent with her progress notes and keeps a detailed blog about her experiences in Globaloria."

Kristine's Participation in the Second Quarter of Game Design: November to January 11, 2008

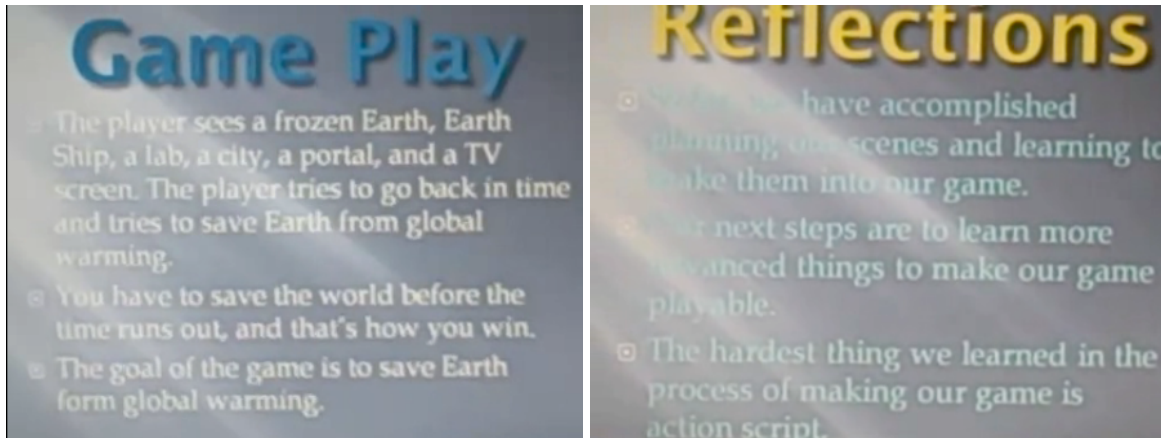
The second quarter of Globaloria ran from the first week in November, 2008 through January 11, 2009. During this time Kristine and her team members completed the modules "Adding Animation", "Adding Sound", "Adding Interaction", "Assembling The Game", and "Presenting Your Game".

For the "Presenting Your Game" assignment, Kristine and her team members posted a Powerpoint file that is essentially an updated version of the team's game pitch (see above). While the team's previous presentation of their game indicated that it would be a point-based game, during this presentation, they state twice that players have a time limit in which they need to prevent global warming.

There is a "reflections" section of the presentation in which they talk briefly about their experience and what is left to do. They first note that they need "to learn more advanced things to make our game

playable”, and also that “the hardest things we learned in the process of making our game is action script”. Figure 6 highlights screenshots from this presentation.

Figure 6: Updated Game Presentation for Fourth Column



Kristine's Learning of Actionscript

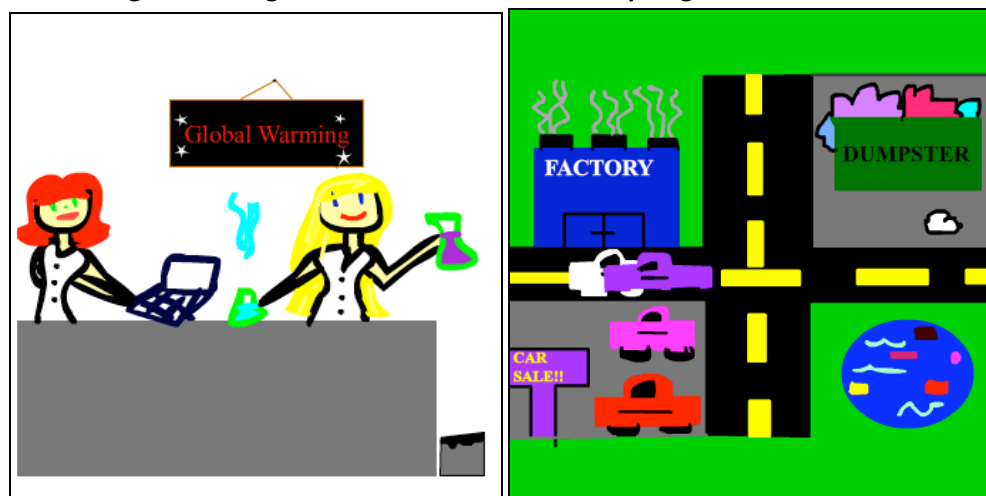
Kristine's blog posts during the second quarter indicate a comfort level with the initial Actionscript assignments. She writes about her "Intro to Action Script" on January 9th that "Today we finished intro to actionscript. It really wasn't hard because I finished it in one day."

Mrs. B observes in her progress report that Kristine "has learned how to add sound and interaction to the game. She loved adding animation and creating buttons." Indeed, this is also reflected in her blog. About adding animation, Kristine says on November 20th, "it was really fun to learn to make everything move around and stuff. There is so much you can do to something really simple like a flower... Flash is good for a-lot of things, I'm surprised that teachers don't use it more."

About adding sound on December 1st she states, "adding sound was a fun lesson to learn. Adding sound wasn't hard for me to learn, usually it takes me awhile, but this didn't. I guess that means it was pretty easy." Overall, she gives the impression that she was expecting to be frustrated, and is pleasantly surprised that she is not. Her post dated December 3rd conveys this sentiment as she writes, "adding interaction is fun. It's not as hard as I thought it was going to be...it's very fun because it's easy, and if you add sound and everything we've learned, it's really cool."

Continued evidence of her artistic abilities is illustrated in Figure 7 as her team's wiki contains some additional artwork during this time period.

Figure 7: Images from Fourth Column Group Page in Quarter Two



Both of these screen-captures show progress toward the team's game. The first of these images appears to be the lab of the future where they develop a plan to go back into time to ensure Earth is not destroyed by global warming. The second appears to show a world distraught with pollution and litter. The files on the wiki both contain animation not reflected in the screenshot. In the lab scene, smoke is seen rising from the beakers the blonde character is holding; while the cars in the pollution scene move along the road.

Summary, Semester One

In Kristine's first semester, she appears to be gaining impressive graphic design skills, as indicated in her paper prototype and her digital graphic files. She also appears to self-report having successfully completed several of the initial assignments requiring Actionsript, and engages extensively in blogging and wiki posting. She uses the blog and wiki to express in text thoughts about the game topic, and the learning process in which she is engaged. Overall, it appears she is beginning to gain expertise in CLAs 1 (Invention, progression, and completion of an original digital project idea), 2 (Project-based learning and project management in wiki-based, networked environment), 3 (Posting, publishing and distributing digital media), and 4 (Social-based learning, participation, and exchange). She completes several assignments by seeking out and using online tutorials, evidencing CLAs 5 (Information-based learning, research, purposeful search, and exploration). It is unclear to what extent she has searched out game examples, which would reflect engagement in activity supportive of CLA 6 (Surfing websites and web applications).

Mrs. B notes in her December 8, 2008 progress report that "Kristine had trouble with adding navigation between the scenes and usually needs help with the topics that require a more technical approach (such as action script)." This observation is interesting and parallels some of Kristine's self-reporting about the challenge of Flash. Overall, however, Kristine's affect remains positive about the experience despite the challenge and she appears to have completed several of the initial steps in the curriculum.

Semester Two: Wiki Edits / Uploads / Posts

In the second semester, students transition into some of the more technical “game development” modules of the Globaloria curriculum. During this timeframe, Kristine’s wiki activity appears to be about average in relation to her fellow students, for both edits and uploads. The two tables below indicate her Semester Two wiki activity.

Table 6: Kristine’s Wiki Edits from Game Design II

Month	Kristine’s Wiki Edits	Range of Wiki edits, low to high
January	26	1 - 26
February	18	5 - 22
March	26	7 - 74
April	18	0 – 34
May	26	0 - 41

Table 7: Kristine’s Wiki Uploads from Game Design II

Month	Kristine’s Wiki Uploads	Range of Wiki uploads, low to high
January	8	0 - 12
February	8	2 - 23
March	2	2 - 46
April	14	1 - 25
May	14	0 - 29

Kristine’s average activity meshes with her hesitation to learn programming, and her identification as designer. Semester Two was centered on learning programming so it appears Kristine may not have been as active in this second half of the year.

Kristine’s Participation in the Third Quarter of Game Design: January 12 – March 21, 2009

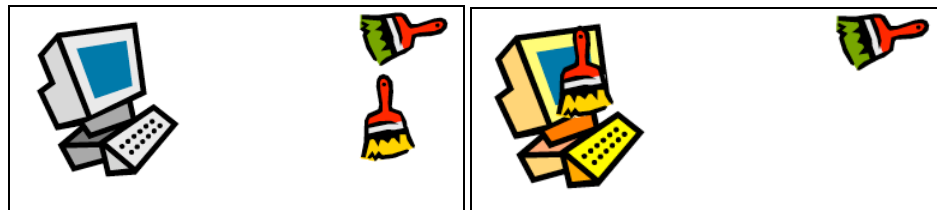
During the third quarter timeframe, Kristine’s class was assigned to complete the modules “Programming Practices”, “Learning From Others”, and “Finding Solutions”, as well as to begin “Game Development Topics Chosen by Each Group”. Kristine’s project and team pages do not contain any assignments completed for these topics, however her blog provides some insight into her activities. She mentions efforts made to complete the modules of adding special effects, learning character effects, how to create a scrolling background, and learning codes to allow objects to be dragged and dropped.

Kristine’s Continued Actionscript Learning

Kristine’s blogs continue to reflect some uncertainty about Actionscript. When writing about following a character effects tutorial on February 16th, she states, “it was really confusing, but after a few times I think I got it. It was good to know that stuff. The fade effects especially, because we could use it alot.”

She writes on March 12, 2009, “the other day I finished drag and drop...it was really easy. You just dragged the paint brushes and turned the computer yellow and green. I didn’t know why I needed to learn it, but Chelsey said to so I did. Afterwards, she said it was because we have the school scene where the kids have to drag and drop the trash. It’s a good thing we learned how to use the drag and drop.” Kristine’s drag and drop assignment file that follows is the same as most of her classmates, depicting the player’s use of a paintbrush to color a computer. The user clicks on the paintbrush, drags it to the computer, and once he or she lets go, the computer is painted. Her blog post appears to indicate a level of disconnect between Kristine and her team member who appears to be managing the project to a greater extent.

Figure 8: Paintbrush/Computer Interaction



On February 26, 2009, Kristine blogs about discovering how to create a scrolling background. She writes, “the scrolling background tutorial on myglife was really confusing and I couldn’t get it to work. It was probably just me, but I still didn’t get it. after awhile I asked Chelsey how she got it to work and she said she went to some site called www.pixeldesign.com It helped alot better than the other one did. I had to do it on the clouds moving. It really pretty.”

Mrs. B writes in her March progress report, “she fully cooperates with her team members but is not an independent contributor to the creativity.” Yet, Mrs. B does observe that, “her group relies heavily on Kristine to draw many of the scenes, with others adding action script or any other special effects.” It appears that in the team game design context, by taking on different roles, students experience a variation in the types of skills students learn. For Kristine, it appears that while her graphic design skills are in use, she is not challenged to also go as deep into programming.

The Challenge of Self-Learning

While Kristine seems to enjoy collaboration, autonomy, and not relying on the teachers for guidance, it appears that she may connect more fully with graphic design because she has trouble with self-led aspects of learning Flash. In her mid-survey comments, she writes that she likes learning “without completely releying on the teacher. I think the teachers are all ready helping us meet our goals for the course, I don’t think they could do their job any better.” She states that “the three most important things I have learned are that just because it looks simple doesn’t mean it really is, you have to pay attention, and you have to be patient.” She writes further that the program “is preparing you to be a hardworker and not giving up because something is difficult.”

However, Kristine is not hesitant to admit her frustrations in her survey comments, stating that, “two things that I dislike about this class is that it takes so long to learn things in flash and actioscript. And alot

of times you have to watch videos to learn, and it is so hard to watch them.” About the video tutorials, she elaborates that, “If they were all words that would be good, because I have to watch the videos so many times to understand, and sometimes I never do.”

It appears that Kristine could use more hands-on support in her Flash learning. Because of the team context, she relies on other team members to do the programming and contributes graphic elements that are still important, but less challenging.

Kristine’s Participation in the Fourth Quarter of Game Design: March 22 – End of May, 2009

The final quarter of the academic year took place between approximately March 22, 2009 and the end of May. During this time period, the students focused mostly on completing their team games. While Kristine blogged regularly during the other three quarters, she has only a total of five for this time period, and in fact notes this in one post, saying on May 7th that lately, “I haven’t been writing a blog. We’ve been very busy making scenes for our game.” Less than a week later, she mentions in one post that to prepare for their final game presentation, “we’ve been staying after school and coming up for gym and lunch.” This suggests Kristine and her team’s dedication in completing their game.

Kristine’s blog posts indicate that she learned to create a smoke effect, and worked on score keeping. Neither of these is manifest on her or her team’s wiki. It is unclear what the smoke effect was intended to contribute to their game, but she does express much frustration in trying to learn this. She states, “it was really hard. Usually, when I can’t get a tutorial to work the result is the same every time. With this, the result was always wrong, but always different than before. I found like, a 100 ways to do that tutorial wrong. Not once did the smoke actually look like smoke. I hope Dillon can figure it out.” Again, she is expressing her difficulties in with Flash programming, but also again expressing her reliance on her team members to persevere where she has been unable to.

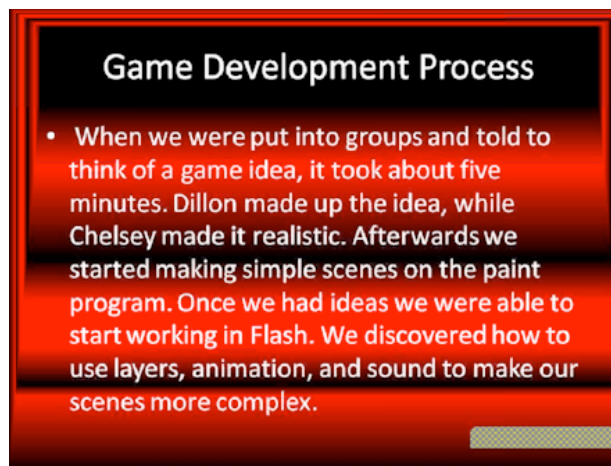
In regard to scorekeeping, she writes on April 20th, “I didn’t know we had to do it, but Chelsey said would need it for something in the game.” This is notable because in their second game presentation, the team indicated that the game would be time-based. It appears the team reverted back to their initial plan to award points, possibly because the timer element was too difficult to program. While their final game contains a quiz element, it does not tally a score.

On May 13th, she posts a blog about how the team is going to present their game on this day. She writes, “I still don’t think we’ll be ready. Chelsey couldn’t get her scene to work to there really isn’t a game, just a bunch of scenes. Cody said he’d make a scene for it yesterday, but he lost what he had put together. He said he was almost done putting it together, but I bet something will go wrong. Again.” Her frustration is quite evident. Indeed, the final game presentation demonstrates a game that has not been assembled.

Final Game Presentation

At the end of the school year, the students put together a final game presentation that was filmed and posted on the wiki. Fourth Column's final game presentation begins with a PowerPoint that discusses the elements of their game, the game development process, and the roles each member played in the team. In discussing their roles, the students note that Kristine drew pretty much every scene that is shown in their presentation. Mrs. B notes in her June progress report that Kristine "was responsible for creation of the power point for the game presentation." Figure 9 below shows off one of the slides from that part of their presentation. Their PowerPoint does not have significant design characteristics, but that Kristine took on this responsibility is evidence of her comfort using a range of software programs.

Figure 9: Scene From Final Game Presentation PowerPoint



Because their game is unfinished, they show the ".fla" format which is the Flash project file.² They state that they have completed more scenes, but were unable to put them all together thus far.

The first file they load up shows an introduction scene that has a green Earth colliding with a frozen Earth. This is reminiscent of the "loading" screen from their paper prototype in which the frozen Earth covers the green Earth as the game loads. Figures 10 and 11 show a comparison of these scenes between the prototype, and the version presented in the final game presentation.

² Games are typically made in this format and then converted to a Shockwave file ".swf", which is a compressed, final version that cannot be edited or changed once converted.

Figure 10: Earths Colliding Scenes from Prototype to Final Version

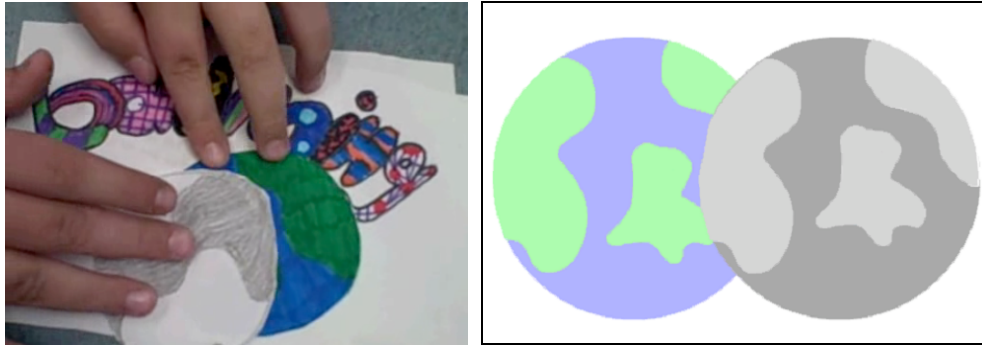
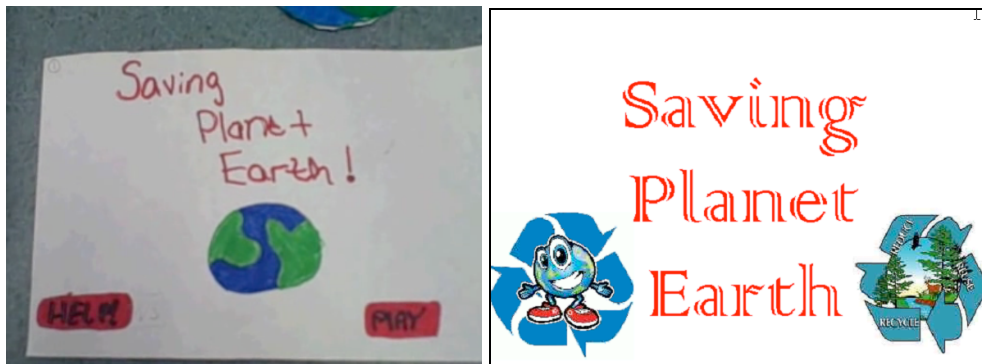


Figure 11: Menu Screen Comparison Between Prototype and Final Version



In the paper prototype, a player can choose between a boy and a girl avatar for the game. Scientists are then shown in a lab discussing that they can use a time machine to go back to the past and stop this disaster. It appears that the first level of the game will consist of dodging objects as the player travels through a time portal. In the final game presentation, right after a brief loading scene, the game cuts to the screen of the time machine in the lab. They note that it took a very long time to produce the screens that they are demoing. Figures 12 and 13 show the comparison between the time machine scene in the paper prototype and the final version. They state that they had not animated the entrance of the time machine into the portal as they planned.

Figure 12: Comparison Between Time Machine Screens on the Paper Prototype and Final Version



Figure 13: Traveling Through Time Screen Comparison Between Prototype and Team Wiki File

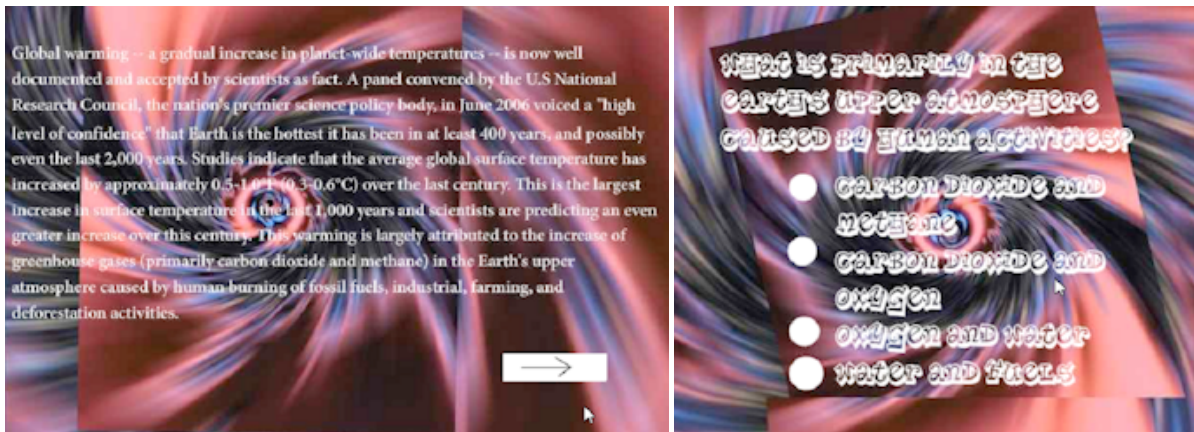


In the prototype, the player then emerges into a town, seeing it filled with pollution from factories and cars, as well as trash lining the streets. Following this, the player is then at an elementary school where he or she asks the students to help in picking up trash. Next, the player gets back into the spaceship/ time machine and goes back through the portal. Fourth Column states that this is where the learning element of the game comes in. To proceed, the player must answer questions about global warming. The team explains that if one gets an answer wrong, a “game over” screen appears and sends the player back to the main menu. If all answers are made correctly, a “you win” congratulatory screen appears.

Following the demoing of their first “.fla” file during the final game presentation, Fourth Column then opens another “.fla” file that shows the quiz element of the game first described in their paper prototype. In the final version, the player is confronted with 2 long factual paragraphs about global warming, and then has to answer questions about it. It appears that they copied the text from a website, but the website is not cited or credited. If one answers the question correctly, he or she then proceeds to the next question. The background behind the factual paragraphs and the questions spins constantly. It is unclear if Kristine created this animation or if it was repurposed from somewhere else.

Their final presentation has a total of four quiz questions included. The programming of the quiz is faulty, in that when you answer incorrectly, the game cuts to a “you win” screen. This is the same screen the player sees if he or she answers all the questions correctly. Figure 14 shows a factual paragraph from the final game presentation, and one of the quiz questions.

Figure 14: Factual Paragraph and Questions from Final Version of “Saving Planet Earth”



The team visits the wiki and demos a few files, and then concludes their presentation by fielding questions, and indicating their plan to keep working on their project with the little time remains in the academic year.

Mrs. B expresses some disappointment about this in her June progress report, stating that, “the students have not done as well as I thought they would. When the final game presentation date arrived, the group has ended up with a fair amount of scenes that were not connected in any meaningful way.”

Content Analysis of Final Saving Planet Earth Game

In the last few weeks of the class, the Fourth Column team used the remaining time they had to piece together their game scenes and files into final, functioning game file using Actionsript. Each of the team members report in their individual progress reports on 5/28 (the last day of the class) that they finally integrated all the screens. The students note that in the last week, they had a training session in Webex with a professional game designer from the World Wide Workshop.

The students post a final game to the wiki on 5/28. Thus, we were able to evaluate their work using the content analysis coding scheme.

Students across all pilot location schools in West Virginia in Pilot Year 2 created a total of 95 games. SRMS students created a total of four team games during the fall semester, of which Saving Planet Earth was one.

In order to evaluate all games on a common scale, we content analyzed all student games created in Semester One and Semester Two, using the process and coding scheme described in the Method section. Out of a total of 26 possible game attributes that we included in our coding, Saving Planet Earth achieved an overall value of 20. The table that follows indicates the final tally. The codes detect the presence of the student designers’ skills in CLA categories 1 and 2.

Table 8. Saving Planet Earth Content Analysis Results

<p>Game Title: Saving Planet Earth</p> <p>Student/Team Name: Fourth Column</p> <p>Team or Individual Game: Team</p> <p>URL: http://www.myclife.org/usa/wv/srmswiki/index.php/User:Team_Fourth_Column/Projects</p> <p>BRIEF GAME OBJECTIVE: The player sees a time portal, spaceships, and a city. The player rides a space ship through a portal and goes back in time to help save the earth. The rules are not to hit anything in the time portal, get help picking up trash, and to answer questions at the end, about global warming. You win by completing all of these tasks. The goal of the game is to stop Global Warming from happening.</p>		
CATEGORY	CRITERIA	1= Yes
Game Plan and Demo [Design Template; Prototype]	Did the students create a Paper Prototype?	1
	Does the game appear complete/finalized?	0
	Please EVALUATE the Game Design Plan for its written content describing student intentions for their game design (Overview, pitch, scenes, elements/assets, etc.) [0=None; 1=Incomplete; 2=Satisfactory; 3=Thorough/Excellent]	2
Playable Game Design	Are there gameplay instructions?	1
	Does the game play exactly as the instructions specify?	1
	Is there a visual / graphic STYLE that carries throughout the game, consistently? (e.g., color-scheme, character-design, are game-play objects in consistent locations throughout the game)?	1
	In all relevant instances, does the game offer feedback to the user based on actions (e.g., quiz game provides feedback on a response; when a character dies a life is lost or a message appears; rollovers change color or display a pop-up; do collisions elements work properly)?	1
	Do the feedback / response elements add to the challenge of the game, (e.g., the game is over if the timer, lives, or health run out; scoring is variable; the game can be "lost" or "won")?	1
Playable Game Functionality	Are there objects (not characters) that are interactive for the player (e.g., buttons with rollover; objects that can be drag and dropped)?	1
	Are there characters that the player can interact with (e.g., player avatar that moves with arrows, and/or enemies or allies that are animated or moving)?	0

	Do the objects and/or characters interact to cause some effect? That is, do objects detect collisions? (e.g., objects bump and change direction, character gains/loses life when it touches something else, gains/loses points, etc.)	0
	Are there multiple levels, progression of different scenes, and/or increasing difficulty?	0
Audio/Visual	Are visual elements well executed (e.g., are images clear without blurriness or 'fringing')?	1
	Is there background music to the game?	1
	Does the game feature sound effects that happen based on player action or by on-screen objects?	1
	Is the artwork creative and engaging?	1
Playable Game Subject / Narrative	Briefly, in a few words, what is the MAIN TOPIC AREA of the game (e.g., sports)	Global Warming
	What is the game genre (educational, social issues, or entertainment)	social issue
	Does the game feature a subject that reflects an educational or social issues theme?	1
	Are the educational/social theme elements <i>active</i> or <i>central</i> to the game play (e.g., a game about global warming takes place in a landfill)	1
	Does the game have a cohesive storyline and/or a beginning, middle, and end?	0
	Does it appear that the students did research into the educational/social aspects of the game (e.g., not simply a basic math game, or a "name the capitals" game, but rather teaches players something that is potentially new, and the designer learned something new).	1
Playable Game Presentation on the Wiki	Did the student provide the FLA file for the Final Game on the Wiki?	1
	Did the student provide the SWF file for the Final Game on the Wiki?	1
	Is the final game marked clearly on the Student or Team Project wiki page, specifying it as the final game?	1
	Is the final game provided in the Game Gallery on the Wiki?	1
	Total Tally	20

Summary of Results, Kristine

The Saving Planet Earth game evaluation value can be compared to the other student games created at SRMS, as well as to the games created across all locations, by considering their averages. Among the

four games created, the average game evaluation value at SRMS was 20, which means that Saving Planet Earth's value of 20 out of 26 equals that of the overall SRMS class mean. When compared to the 95 games created by all WV middle school, high school and community college students in Pilot Year Two (which achieved an average game evaluation value of 11.7), this game's value of 20 is well above the average.³ While the students were not able to complete the game by the presentation, their efforts in the last two weeks pay off and they end up with quite a high scoring game, considering that they are in middle school.

As discussed in the Methods section, the game evaluation categories can be linked to student achievement of Contemporary Learning Abilities 1 and 2, in that a) the coding scheme categories of Game Design, Functionality, Audio Visual, and Subject/Narrative indicate that students have had success with invention, progression, and completion of an original project idea for an educational game or simulation (CLA 1), and b) the coding scheme category of Game Plan and Demo (as well as the other categories) indicates that students have had success with Project-based learning and project management in wiki-based, networked environment (CLA 2). Students' inclusion of the attributes we counted provides evidence that they learned the skills necessary to do so.

It is important to note that the game evaluation value reflects the combined work of the entire team, not the individual. Kristine contributed mostly to the game's graphic design. Therefore, it appears that she may have gained a different variation of knowledge in CLA categories 1 and 2 than her teammates who were the programmers. As for the other Contemporary Learning Abilities categories (3 – 6), the game coding scheme is not as strong a measure, thus we must rely on other data sources.

We know that Kristine learned how to blog during Semester One, as well as use the wiki to upload and present files, evidence of some level of mastery in CLA categories 3 (Posting, publishing and distributing digital media) and 4 (Social-based learning, participation, and exchange). Further, Kristine and her teammates engaged in online research to find out more about the climate crisis (the subject of their game) and also to find Flash tutorial resources to help them learn certain game design functions, indicating some level of mastery of CLA 5 (Information-based learning, research, purposeful search, and exploration) and CLA 6 (Surfing websites and web applications).

It is clear from the above files that Kristine made considerable effort in appropriating the project (that is, becoming heavily invested in the work) and gaining a strong motivation and interest in the design activities. One contributor to Kristine's success in Semester One might have been her diligence at the start of the semester in completing early assignments with an intention towards her final game artifact. Several of Kristine's early graphics files were used in the final product, and it appears that she was able to build upon the earlier planning and design work she put into the project in order to advance the game in the time allowed.

³ It is important to note that many factors vary across WV locations and impact students' learning experiences (including student grade level, number of participation months, prior experience, and game design context as team versus individual) so the comparison is not exactly apples to apples.

Kristine expresses in her post-survey that her learning experience in Globaloria was beneficial. She notes that “it has increased my knowledge in technology and I can relate many things to Globaloria, even in other classes.” She also explains that being in the course has helped her develop teamwork skills, noting “it has purely taught us how to work with each other better.” Kristine’s reliance on her teammates to help her get through some of the tougher assignments was evident.

Overall, this team’s origination of a game idea about time travel to prevent the effects of the climate crisis (in their game, depicted as a frozen planet) demonstrates how game design can serve as an imaginative space where young people can play out their creative ideas. This experience of playful creation in a constructive context around a social issue theme of global importance may help to empower students with a greater sense of self-efficacy and perception that their actions can make a difference. Through their engagement, the students’ work may allow them to imagine new possibilities and even experience an enhanced feeling of empowerment and activation that might carry forward outside the simulated game design context.

Kristine’s case also illustrates both the benefits, and limitations, of team work and peer collaboration. It appears overall that while Kristine benefited from relying on peers to learn certain Flash skills, she may have used the teamwork context to evade needing to learn some of the more challenging Actionscript skills. She may have developed a greater identification with graphic design and illustration, but as for meeting the course objectives to gain in all CLA categories, it appears her development of CLAs 1 and 2 may have been more limited than those of others in the class. It appears that Kristine could have used greater individualized support in the learning Flash, especially given her expressed frustration at the self-led learning aspects of the course, and her difficulty with the tutorials. It also appeared that she may not have synthesized her knowledge and understood the connections among different activities as much as some of the other students. Overall, though, she was certainly introduced to many new digital creative opportunities through her participation, and her engagement in project- and workshop-based learning may have positive outcomes for her future work.



Case 2: Jack

Jack, whose Wiki name is Muffinman36, is an 8th grade student at SRMS who has self-reported prior experience using a range of computing technologies. He notes on his profile that he enjoys using computers, and has since he was 3 or 4. He states that he finds them easy to use, and that in his free time he likes to put humorous videos up on TeacherTube. His favorite website is Google. In regard to what he hopes to achieve in Globaloria, he notes in the pre-survey, “I hope to learn more about digital design and think it will be a good experience.”

We chose Jack as one of the SRMS case studies because he is a highly creative, communicative student who finds in Globaloria a range of new media and outlets for this creativity to emerge into expression. It seems that in all realms (within his spoken expression and engagement in the open in-class workshop setting, his communications on his blog, his game, and in several videos he created) Jack actively explores and investigates the new spaces he has been afforded, and finds ways to use them creatively as channels for his unique thoughts and ideas. He also demonstrates significant abilities to synthesize his experiences in each of the spaces, so that his ongoing expressions and artifacts created build in complexity, and in the associations and connections he makes among them.

Semester One Wiki edits and uploads, Jack and his class

To provide some background on Jack’s wiki activity, we first highlight his wiki editing and uploading metrics, in relation to the rest of the class. Table 9 shows Jack’s wiki edits for Game Design I by month, and compares his posts to the class range. In September, he made 65 posts, which was the highest compared to other students. In the later months, he performs from the lower to the mid range in wiki page editing activity. His wiki editing activity appears to taper somewhat in later months. These findings are discussed in context of his game design activity to follow.

Table 9: Jack’s Wiki Edits from the Fall Semester of Game Design, by Month

Month	Jack’s Wiki Edits	Range of Wiki edits, low to high
August	8	1 - 12
September	65	0 - 65
October	36	22 - 72
November	17	7 - 27
December	8	8 - 32

Table 10 indicates Jack's wiki *uploads* from Game Design I, in which he added files such as Flash files or images to the wiki. His metrics are mid-range during this time, with a few instances of posting just slightly more than his classmates. His activity in uploading is highest in October.

Table 10: Jack's Wiki Uploads from the Fall Semester of Game Design I, by Month

Month	Jack's Wiki Uploads	Range of Wiki uploads, low to high
August	0	0 - 4
September	12	0 - 18
October	14	4 - 30
November	12	6 - 28
December	4	4 - 22

Overall, across the first two quarters, Jack's wiki activity is about average in most months. These metrics belie his extensive level of activity in the class; much of his work manifests within the game design artifacts themselves, and, within the work of others in his class who he helps in troubleshooting and guiding in their Flash programming.

Jack's Participation in the First Quarter of Game Design: Late August to November 3, 2008

In the first quarter of the academic year (from about August 27, 2008 – November 3, 2008), students worked on a number of course topics that included creating their profiles and their blogs. Jack's group was expected to complete the modules "Playing to Learn", "Social Issue Games", "Imagining Your Game", "Paper Prototyping", "Planning Your Game", "Drawing in Flash", and "Adding Navigation". During this time, Jack completed all of these expected tasks except for "Adding Navigation".

Jack's first blog post reflects his excitement of tackling game design as he writes, "I am pretty excited about creating our game! I am planning on making a game with a superhero toaster! However difficult it may be I am determined to see a toaster solve world hunger!" His humor is apparent from the start, and this is an idea he sticks to. For his game project, Jack teamed up with Tyler, Phyllis, and Kirt to form Team Alliance of Super Tr33 Stumps to create the "Super Toaster" game.

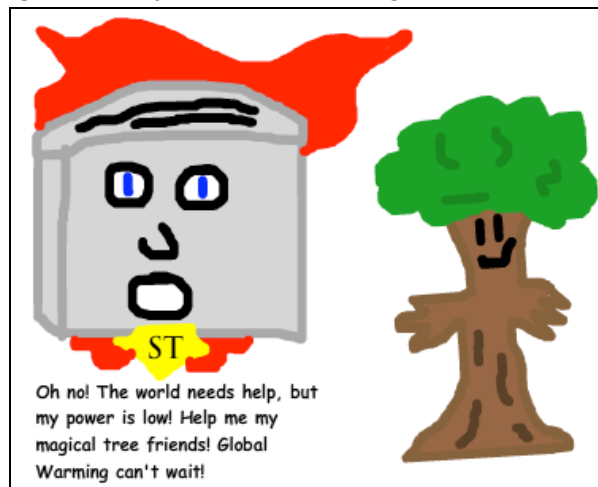
In the "Imagining Your Game" section of his wiki project page, Jack discusses of his group's game idea as follows:

Our game idea bases around global warming. It tells about fact and includes fun for all fiction. Our cast of characters are Super Toaster, magic trees, sheep, and penguins! We hope that with these random and fun concepts we can help teach global warming in a fun and interesting way. With all the many ways to help stop global warming and get clean energy this game is far from being small. We hope to have a cute, cartoon like feel to the game even though the issue is complex. We also hope that many teachers will find our information on hybrid cars, renewable energy, habitat loss, and global warming overall helpful!

Have a Toasty Day!

Jack's playfulness is evident in this proposal as he looks to include a number of eclectic characters in his team's game. On his blog, dated September 16, 2008, Jack writes about his game "This game will have magical trees, super toasters, penguins, and many ways to learn and have fun. (Ha ha! I sounded like a commercial) It is going to teach about the different types of clean energy, hybrid cars, recycling, why the world is going through Global Warming, and how to help stop the process of global warming." The work on his wiki project page during the first quarter largely corresponds to what he proposes in "Imagining Your Game." Figure 15 shows a screen capture from the "Drawing in Flash" module, illustrating his Super Toaster character, as well as one of the magic trees.

Figure 15: Super Toaster Drawings From Jack's Wiki



In a section detailing aspects of their game "Super Toaster", Jack's team, Team Alliance of Super Tr33, Stumps writes:

Audience: We are designing our game for teachers, students, and game players in general! (And for us too!)

Game Play: The players see how global warming affects the environment and how they can help stop the contributing factors in a fun cartoon like way. The rules are simple, you mostly read in game instructions because the game play changes often. To win you must complete all the levels and use what you know and what you learned to complete the final level. The goal is to help as many people and animals as possible from the affects of global warming and to teach them how to help stop the adding of the crisis.

Fun Factor: You get to play as fun, friendly, and fictional characters, and you have to complete challenging levels that help get your mind off of the learning process while you actually are learning.

Smart Factor: The game explains what global warming is and why it is bad for our environment. They will also learn what is helping to add to global warming and how they can stop it. Our game is focused on anyone who is willing or wanting to learn about global warming and/or have fun at the same time.

Style Factor: Full motion animated picture (where character moves in completed motion). You will hear sounds like theme music, voices of our team members, sounds of cars, wind, oceans, and etc.

Originality Factor: No one has ever seen a characters like this game features. We have imaginative characters that can put a smile on almost anyone's face. It also has challenging levels that will provide unlimited fun and extensive learning for all types of players of all ages.

The Alliance of The Super Tr33 Stumps: Jackua Clevenger---Idealist/Art ~~ Kirk Riffe---Grounded One/Art ~~ Tyler Evans---Animator/Art ~~ Phyllis Waldron---Team Manager/ BOSS LADY!!!!!!

Mrs. B states in her September progress report how Jack has great communication skills within his group, noting that “Jack came up with the idea of Super Toaster for the game and managed to justify using this character for the game within the group.” Mrs. B highlights Jack’s persuasive abilities with his teammates, and his success in applying his creative and humorous Super Toaster concept into the proposed game plan.

Paper Prototype

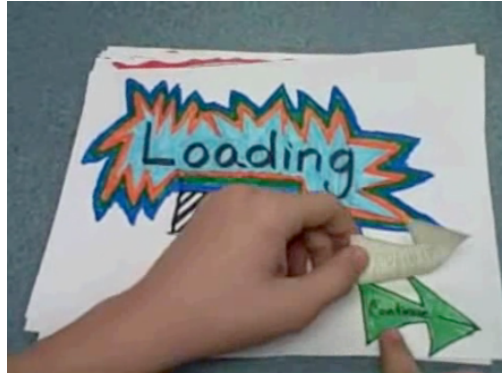
Team Alliance of Super Tr33 Stumps’ wiki contains a paper prototype presentation for the envisioned design and functionality of their game. This presentation was recorded and placed on TeacherTube, an educational video-sharing website. Each piece of paper in the presentation represents a different scene of their game. One member of the group narrates the video, while another can be heard in the background making sound effects, and at one point, Jack is heard speaking the dialog of the Super Toaster character.

As the students describe it here, at the beginning of the game, Super Toaster is talking to a tree, saying that global warming must be stopped. The presentation then moves onto a screen representing level one. Before playing, the player has to read a “fun fact” about global warming, and move a tree from the bottom to the top of the screen, across a street dodging traffic and trash.

The students then show another level, a penguin on an iceberg, with multiple smaller chunks of ice floating in front of him. Questions appear, and if they are answered correctly, the player advances onto an ice chunk. The idea is to get the penguin from the top of the screen to safety on the bottom by answering such questions. After completing the game, the player is presented with a button to click in order to collect a prize. The narrator of the video is very mysterious about this, stating that one will have to play their game once it’s complete to find out what the prize is.

The students also managed to have a realistic computer “click” sound made whenever a finger presses an area of the paper to simulate where one would click with the mouse. Figure 16 shows the loading screen from the prototype.

Figure 16: Loading Screen from “Super Toaster” Paper Prototype

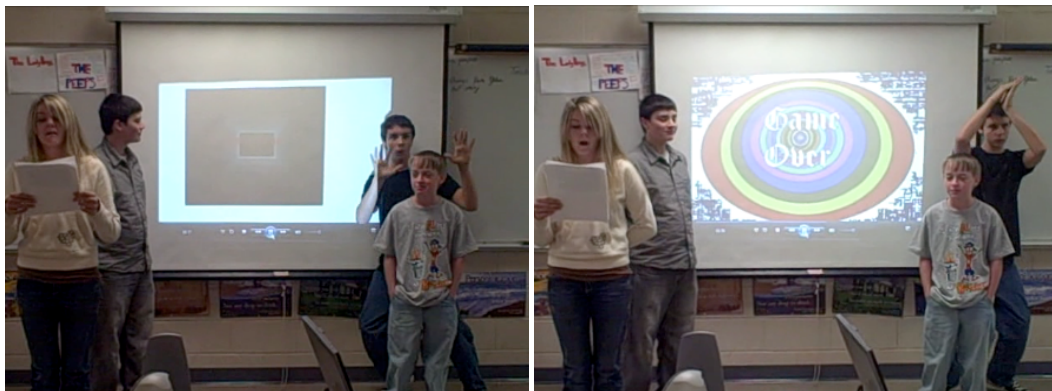


Mini-Presentation

The team also posts a mini-presentation of their game on the wiki, which was filmed in front of a projector screen. Phyllis talks about the game, while they show PowerPoint slides that include the graphics that they plan to use. The presentation notes that they hope the players of their game will learn what causes global warming, how they can help, and what serves as more environmentally-friendly transportation. Jack’s enthusiasm and humor are apparent in this presentation as he spends the whole time dancing, gesturing and acting out the game’s ideas, as seen in the screenshots below.

Figure 17 is made up of two screenshots from the presentation, which ends with the words “Have a Toasty Day”.

Figure 17: “Super Toaster” Mini-Presentation with Jack Dancing



Self-Reflections on Learning, and Collaboration with Others

Although Jack has displayed much enthusiasm and playfulness in the course, it appears he also remains circumspect when describing his process. For instance, his blog post dated August 29, 2008 states, “I have created my wiki and found it easier than it seems. However, it is still a challenge and I am looking to overcome that. We have also started our blogs. I am having a good time and experience. A lot of the others in the program are also having the same problems as me, so it is good to know that we can share ideas and help. We haven't even began the flash yet, but I know it will be 10 times as difficult than what is happening now.”

In this post he notes enjoying the collaborative elements of the course, and sharing ideas and interacting with his peers. Evidence of this is shown in his posting of comments on the discussion page of nearly every student early in the semester, offering humorous and complimentary comments. This was not a trend that we noticed with any of the other students. It appears that in this early timeframe, he enjoyed his newfound capacity to review the work of others, and communicate his feedback on the wiki. Some examples of his posts are collected here:

(Comment on CdRowe09's page)

--Muffinman36 16:12, 9 September 2008 (UTC) Two things 1. Cool 9/11 video 2. I like tacos too!

(Comment on Tye2013's page)

--Muffinman36 15:58, 9 September 2008 (UTC) Cool page Tyler. Wiki wiki wak

(Comment on Ladyvol8's page)

--Muffinman36 16:14, 9 September 2008 (UTC) Muffins should be spelled muffuns muf**FUNS** Basketball can't do that.

Jack appears to be enjoying the informal aspects of the learning environment that allow him greater informal expression. In her September progress report, Mrs. B. writes that during the first month of the course, “Jack has progressed significantly during this time.” She elaborates that “within the group, Jack has become a creative director and a contributing artist. He has created the group's presentation using the Movie Maker software, adding the music and the drawing in Paint the members of the group have created.” She further states that “Jack has great collaboration and communication skills, which will help him greatly to successfully work on the projects within a group.” Mrs. B accepts his informal humor and creativity, and indeed views it as an asset; an interpretation that might not be as common among other teachers in more traditional classes.

Jack's Participation in the Second Quarter of Game Design: November to January 11, 2008

The second quarter of Globaloria ran from approximately November 4, 2008 through January 11, 2009. While Mrs. B notes that in this timeframe students worked on “Adding Animation,” “Adding Sound,”

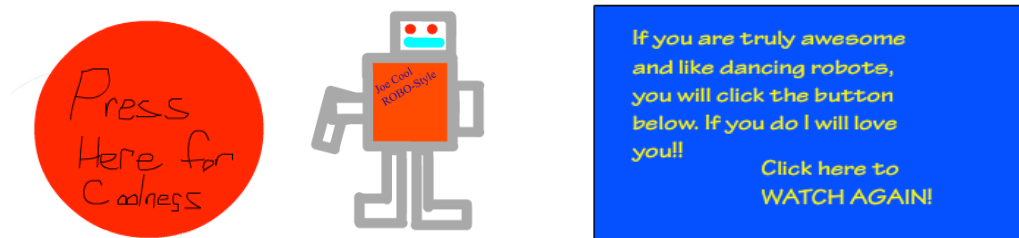
"Adding Interaction," "Assembling The Game," and "Presenting Your Game," it appears that Jack only has a few additional pieces of work available on his wiki during this time, and has only added (slightly) to the section "Drawing in Flash" which he had created during the first quarter. Jack's team page does make references to these different modules, indicating that perhaps they were completed by the group as a team effort.

On the whole, Mrs. B is pleased with his progress. She writes in her December progress report that, "Jack has an independent mind, and it takes me a lot to get him to go through tutorials because he likes to experiment a lot and come up with his own solutions to new stuff. I still have him go through tutorials because they are full of information that he would not deem necessary to concentrate on his own (for example, I had spent a lot of time trying to convince him that creating layers was a useful thing to learn). Jack likes to morph his existing and new knowledge into the same scenes thus creating a more complex product as he goes through tutorials."

Assignments and Team Work in the Second Quarter

There are only a few examples on Jack's wiki project page that provide evidence of his completion of tutorials. One contribution, which he also posts on his profile page, is a small Flash movie that presents itself as a button for the user. This is shown in Figure 18 below. Once clicked, there is an animated dancing robot, followed by a message to the visitor. Of this file, Jack blogs excitedly on November 17th, "I would just like to announce that I have made a new flash animation and I have it under my wiki and my projects wiki! It is a totally awesome, totally cool, totally mind boggling dancing robot! I used everything I have learned so far to make it! I used my knowledge from adding animation, navigation, and sound! I used actionscript, buttons, and motion tween to do it too! It was so easy and so fun to watch when it was finished!"

Figure 18: Dancing Robot Button



Mrs. B states in her progress report that when Jack learns particular skills he then shares them with his classmates. Regarding the assignment of motion tweening, she states, "everybody knew how to do the motion tween because Jack immediately shared his knowledge with everybody." She further notes, "Jack is a good teacher and always helps others with their problems." In this regard, in one of his blogs dated November 17th, Jack notes, "sometimes, Phyllis and Tyler would ask me questions and I would help them out with what I could. Even the other team, The Fourth Column, members asked me how to do some things while I was at it."

Figure 19 shows some of Team Alliance of Super Tr33, Stumps' work in the second quarter, posted on their team wiki page. Jack was not responsible for uploading the files, but it appears he was instrumental in their creation in Flash.

Figure 19: Team Wiki Work by Jack



In her December progress report, Mrs. B states that “Jack sometimes has trouble with keeping up with progress notes,” however she explains that his blog posts “are mind blowing. He certainly likes to share his experiences in Globaloria with everybody. His vocabulary and writing skills have always been great, but it seems that recently he has gained so much more insight into blogging!”

While Jack’s blogs are quite expressive and reflect synthesis, he only blogs on two days during the second quarter, and only once more for the rest of the academic year. The following is an excerpt from one of his blogs dated November 17th:

I haven't been blogging at all recently and I thought I would catch up on it. I will start with adding navigation. ADDING NAVIGATION HAS BROUGHT US SO DEEP SO FAST WE ALMOST DROWNED!!! But really, we were doing these little things with the animation and thought, "Hey, look what I did! I made the little thing go back and forth, and up and down!" But now we know what actionsript is and we are now think, "Why God? Why couldn't you have been merciful?" Not really! However, we did learn a lot really fast, and I thought it was really interesting and really fun. It was super hard at first until we all joined together and figured it out!

Jack states right away that he has not been blogging lately. He refers to the challenge of the class, and the fun and interest he has in it. He also refers to collaboration.

Challenge and fun may seemingly be contradictory states, and we hear about this phenomenon over and over in our Globaloria cases. “Hard Fun” learning has been cited as a common outcome of Constructionist programs and environments. Papert (2002) states that hard fun activities are those that are fun *because of*, not in spite of their challenge. He suggests hard fun “...is expressed in many different ways, all of which boil down to the conclusion that everyone likes hard challenging things to do. But they have to be the right things matched to the individual and to the culture of the times. These rapidly

changing times challenge educators to find areas of work that are hard in the right way: they must connect with the kids and also with the areas of knowledge, skills and (don't let us forget) ethic adults will need for the future world.” It appears from Jack’s seemingly contradictory statements that he is enjoying the challenge of Globaloria, because it presents a learning environment that he find relevant and motivating, sparking him to continue pursuing solutions.

Semester Two: Wiki Edits / Uploads / Posts

Paralleling Mrs. B’s observations about Jack’s less-frequent but high quality blog posting, overall, in Game Design II Jack appeared to post infrequently on the wiki, as noted in Tables 11 and 12.

Table 11: Jack’s Wiki Edits from Game Design II

Month	Jack’s Wiki Edits	Range of Wiki edits, low to high
January	7	1 - 26
February	5	5 - 22
March	7	7 - 74
April	0	0 – 34
May	8	0 - 41

Table 12: Jack’s Wiki Uploads from Game Design II

Month	Jack’s Wiki Uploads	Range of Wiki uploads, low to high
January	3	0 - 12
February	5	2 - 23
March	5	2 - 46
April	1	1 - 25
May	13	0 - 29

Mrs. B notes in her March progress report that his interest in working in Flash often causes him to fall behind when it comes to the more procedural elements of the course such as documentation. She states, “Jack’s creative genius lets him forget about keeping up with the progress reports and blogging. Usually, he has to catch up with the progress reports after multiple reminders from me but manages to blog extensively covering several units at a time.” It appears that for Jack, logging his activity is somewhat tedious. Interestingly, Jack himself writes in his mid-survey comments that “the teachers could better help students meet there goals by setting up due dates, because most students do not have a good sense of time.” The progress notes are meant as a structuring guide. Here though, it seems he is calling for more structure in the form of deadlines in the game design process across the timeframe.

Jack's Participation in the Third Quarter of Game Design: January 12 – March 21, 2009

The third quarter of Globaloria ran from approximately January 12, 2009 through March 21, 2009. Jack posted the following files on his profile page during this timeframe that are unrelated to his game. On the wiki, Jack showed how he used Photoshop to enhance his team's group photo, which had previously been posted early on in the year. Jack use of photo-editing software is apparent as he has altered the background, and made it look as if he is holding a ray gun.

Figure 20: Images from Jack's profile page



Jack's Second Game Presentation Video

At the beginning of the third quarter, Team Alliance of Super Tr33 Stumps posts another game presentation video that essentially updates their game pitch. The video begins with Jack and his teammate Kirk bouncing up and down, announcing that it is time for the Jack and Kirk Power Hour. Jack does the majority of talking in the video, but Kirk (who is wearing an elf hat, and is referred to as “the elf friend”) also adds a few comments such as describing the characters. Phyllis, who is recoding the video, also interjects a few times, reminding them to mention something.

When the roles of the team members are listed, Jack explains that he came up with the ideas and has contributed some of the art. Kirk notes when discussing their next steps that they've made a few prototype levels. He also explains that everyone in the group was previously having trouble with figuring out and programming Actionscript. At this point Jack pops back onto the screen and whispers loudly, “Actionscript was bad for us...but we're making it through”.

More humorous elements in the presentation show through when Jack makes comments such as that their game “can appeal to the old people who like toast, and to the young people who like toasters.” He also notes that Super Toaster will fly around in full motion animation, and that their game will be “cooler than Frogger” (and Jack makes some brief Frogger sound effects for emphasis). He ends the presentation by using what appears to be the team's catch phrase, “Have a Toasty Day”. Figure 21 shows images of Jack and Kirk from the video.

Figure 21: Jack and Kirk from their Quarter Three Game Presentation



Jack's Game Design Activity in the Third Quarter

In this quarter, students engage in “Programming Practices,” “Learning From Others,” and “Finding Solutions,” as well beginning “Game Development Topics Chosen by Each Group.” These modules do not result in specific assignments posted online, so it is unclear from Jack’s wiki pages to what extent he has completed these modules or used the relevant resources.

Overall, in the third quarter, it appears that Jack continues his practice of independent self-learning of how to program specific game elements as the design need arises in the moment. That is, when he is working on the game, he allows his creative ideas to drive the design and development effort. When he encounters a problem or hurdle in this context, he seeks out the appropriate solution to help him meet his game design objectives. He applies his solution in the moment. This approach contrasts with other students whose game design prioritization and decisions are driven by the syllabus assignments they complete, and then choose to apply to their game.

Mrs. B in her March progress report refers to Jack as “our little genius” due to his effort and the superior Flash skills he has developed during his time in Globaloria. Further observations about Jack’s learning style are offered by Mrs. B who states in her progress report for the third quarter that, “even though Jack definitely brings more to the table complexity wise, he does not produce as many files as others do. His work does not include one aspect of Flash at a time but incorporates a lot of things he has or is currently learning.” This observation indicates Jack’s ability to synthesize his learning, and the multiple strands of activities introduced to students in Globaloria. The work that Jack posts to his wiki during the third quarter highlights this synthesis.

While there are not many additional elements added to his wiki, the few that are there do stand out generally as more complex than those that were posted by his peers. For example, he posts an animation with a scrolling background that is also found on a number of other students’ wikis. Yet, he goes one step beyond and places Super Toaster into the animation. He also posts an animation that is of a still picture with reflective, moving water. These are shown below in Figure 22, but the screen captures do not do the moving animations justice.

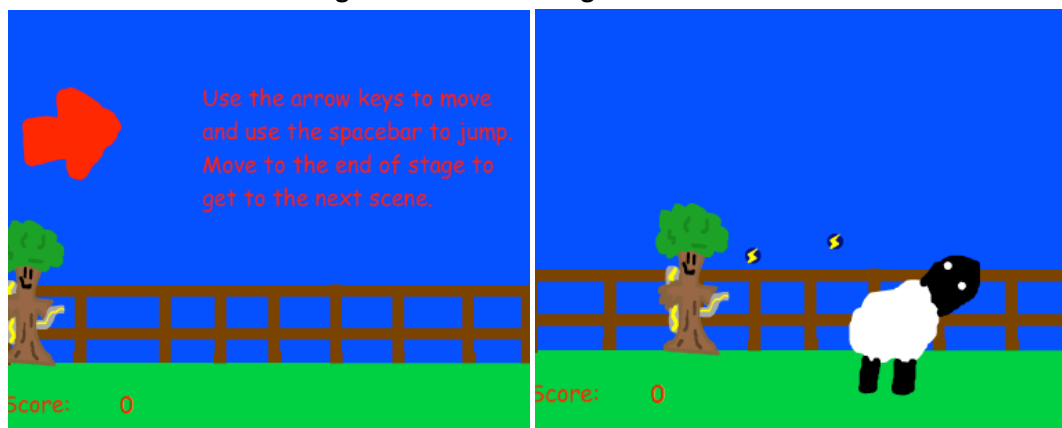
Figure 22: Jack's Animations



Regarding his design process, Mrs. B notes that Jack “does not hesitate to search other online sources for easier tutorials, which he also does not hesitate to share with other students.” Jack’s self-reflections support Mrs. B’s observations. In a blog post on January 23, 2009, Jack discusses how he made the scrolling background seen in the left screenshot of Figure 20. He writes “Ah! The Scrolling Background, one of my favorites. I didn't even use the tutorial on the wiki! I used one on www.pixelhivedesign.com. This tutorial didn't do the exact same thing as the other one on the wiki, but it did make a scrolling background!” The same cloud animation is found on the pages of several other students in the class (minus Super Toaster). Jack found this initially, and then shared it along with others. This example provide solid evidence of Jack’s typical knowledge-sharing practice.

Jack’s other main Flash file posting to his wiki during the third quarter shows his team’s game Super Toaster coming to fruition. In the first file posted, as shown in Figure 23, the user can navigate the tree character left and right across the screen and use the space-bar to jump. Once the player reaches the right side of the screen, another screen appears with a sheep and some floating spheres. None of these objects are interactive, and the tree character simply moves behind them as it is navigated from left to right. When the end of this scene is reached, the player is brought back to the first screen.

Figure 23: Tree Moving Across a Field



Continued evidence of Jack’s enjoyment in the collaborative aspect of the course are provided in his mid-survey comments. Here he notes that as a group they “are like construction workers building a tower.”

Jack's Participation in the Fourth Quarter of Game Design: March 22 – End of May, 2009

The final quarter of the academic year took place between approximately March 22, 2009 and the end of May. During this time, the students mainly focused on completing their team games, therefore there was little additional material posted on Jack's individual or team wiki, other than the final game files.

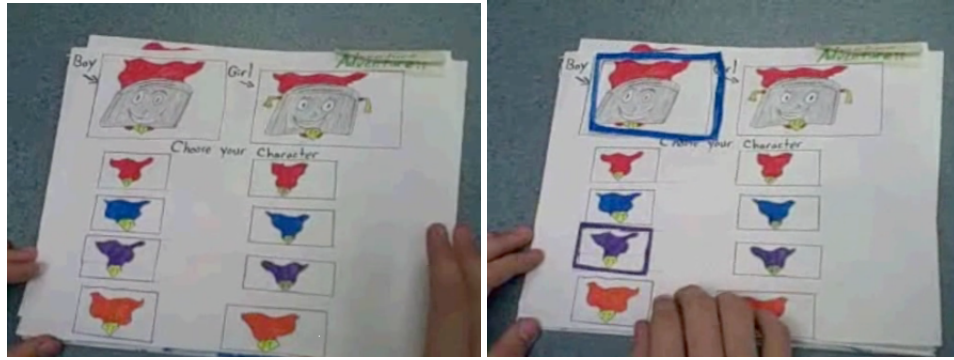
Team Alliance of Super Tr33 Stumps' final game presentation took place on May 13, 2009. It begins much in the same way that their other presentations have; students review their game pitch and highlights different facets of their game and work. The team members take turns talking throughout the presentation. In the presentation the students note that Jack came up with the ideas in the game and contributed to the art. Tyler and Kirk are also mentioned as having contributed to the artwork in the game in addition to their other responsibilities.

In the "How to Play" section, the students note that the player must follow onscreen instructions for the different levels that are in the game. Prior to loading the game, the students note that it is still unfinished and contains a few "glitches" that they are planning to iron out before the end of the year. For example, the first screen the player sees after starting the game from the main menu allows the player to pick the color of Super Toaster's cape. While this screen is functional, the player can only have the color red in the game. The game omits their original plan to allow the player choose their gender.

Figure 24 shows the differences between their original design, and that shown in their final presentation.

Figure 24: Cape Selection Screen in Paper Prototype and Final Presentation





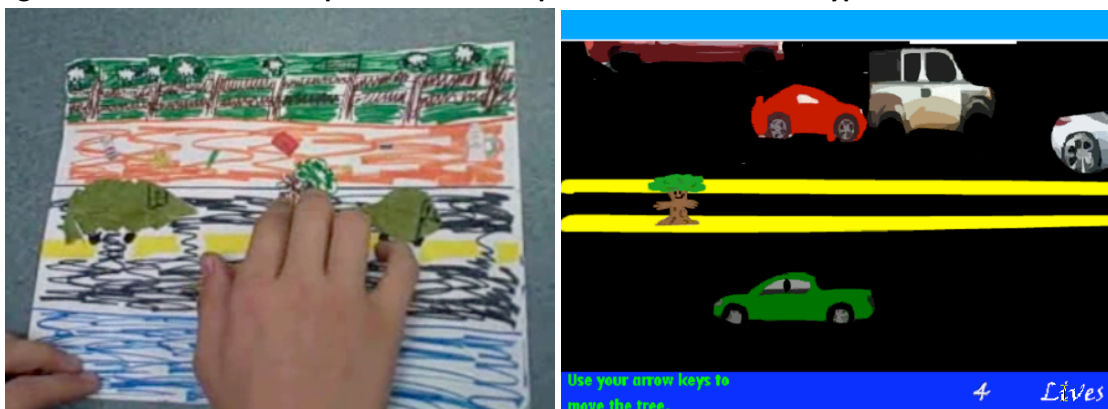
After choosing the cape color, a “next level” screen comes up, and when the player clicks on it, a full screen of text appears talking about vehicle emissions. It is unclear where the students retrieved this information as it is not cited.

The player clicks “next” to move on to the first level. This is slightly different from the paper prototype as the next screen after choosing a cape serves as an intro, showing Super Toaster talking to a tree, saying that global warming must be stopped. They do note though that screens such as this are intended to be in their game eventually should they be able to keep working on it, as such screens will tie together a cohesive storyline for the game.

In both the original and final presentation version of the game, the player has to read about global warming before playing level one. In the original version they call these “fun facts,” and note that they will appear before each level. They also state that these facts will appear in random order. In the final version, only a single fun fact appears before the first level.

Figure 25 shows screenshots from both versions. Note that in the final presentation version, the instructions are located in the bottom left of the screen, advising the player to use the arrow keys to move.

Figure 25: Level One of “Super Toaster” Comparison Between Prototype and Current Version

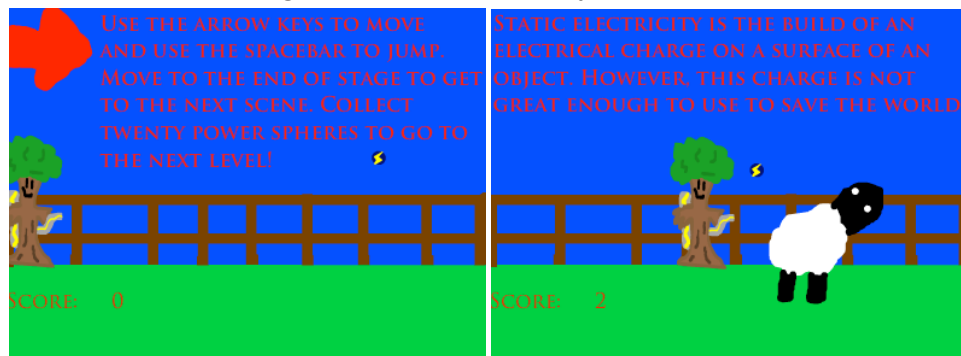


The next level reflects more fully articulated versions of two of Jack's earlier files. In this level, the player moves the tree character across a few screens of fields to collect what they call "power spheres" in order to power up Super Toaster so he can save his penguin friends in Antarctica. The "power spheres" are represented by lightning bolts, and add to the player's score as they are collected.

In this version, the "power spheres" cannot yet be collected, nor does the score work. However, the final version of the game they posted a few weeks later does reflect a later iteration in which these features function as intended, where the spheres are collected, and the score raises a point for each one. This final version reflects the programming of "object collision detection" and "scoring" elements. Also, in the later version the tree is made to move using the arrow keys, but it can also now jump when the spacebar is pressed.

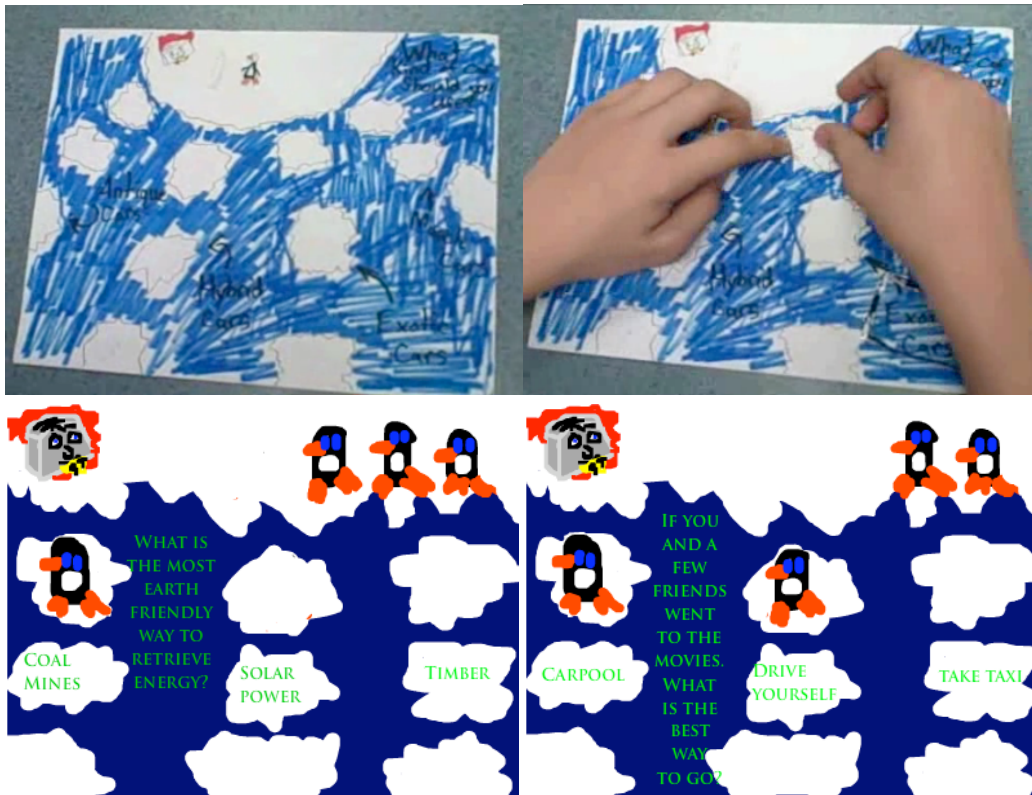
Figure 26 illustrates screenshots of this from the final version posted to the wiki, not the incomplete version in their presentation. Note that the first screen shows the instructions for the level, while the second shows that they have managed to post a fact about energy within the level.

Figure 26: Level Two of Super Toaster



Level two contains a total of 4 screens the tree moves across, and is completed once 20 "power spheres" are collected. The third level is similar in both the final version, and the paper prototype. It consists of Super Toaster helping penguins navigate across ice chunks to safety by answering questions about global warming correctly. In both versions, if an answer is wrong a message will then pop up explaining why this answer was wrong. If the answer is correct, the penguin will progress and a message will explain why this was the right answer. Once again, the version shown in the presentation is slightly incomplete, but has been fixed and posted to the wiki by the time the academic year ended a few weeks later. Figure 27 shows a comparison of the original and final version of the game.

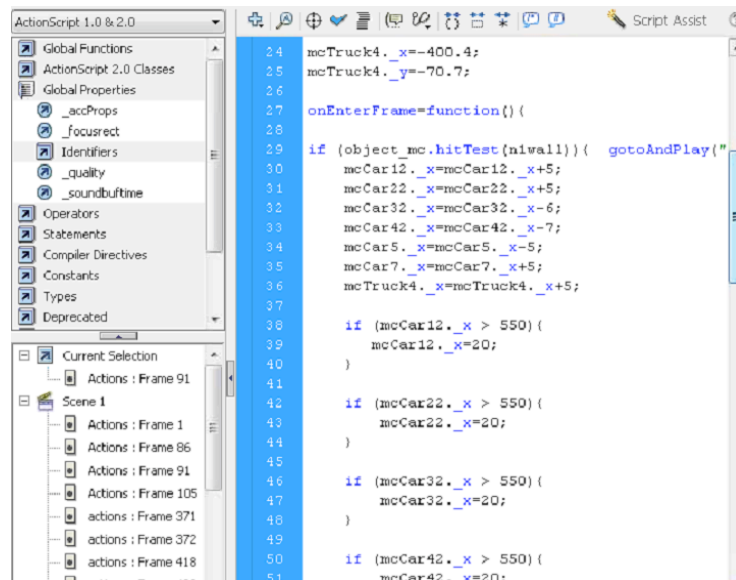
Figure 27: Penguin Level of “Super Toaster” Compared Between Prototype and Final Version



This third level is the final one of the game. Once completed, the player is greeted with a screen announcing that the game has been won. When they presented their prototype, the team states that there would a button for the player to click in order to collect a prize and that one will have to play their game for real once its complete to find out what the prize is. This idea does not appear to have made it through to the final version.

Following the presentation of their game, the team navigates briefly through the “.fla” file so that the audience could see how much coding was involved. The screen they show is from Phyllis’ level that she coded (level one), and they state that it is just a taste of the amount of work that went into their game. Figure 28 shows a screen capture of their file.

Figure 28: Screenshot of action script coding for level one of “Super Toaster”



In discussing what he learned in his final game presentation, Jack only briefly mentions Flash and Actionscript. Instead he emphasizes how he learned to collaborate online using wikis and blogs. He indicates that he had not used such technologies prior to being in Globaloria, and that he understands how these can help in online group work. He also notes overcoming the challenge of learning Actionscript has proven to him what he is capable of, and as such, he has found the course personally rewarding. When wrapping up the final game presentation, Jack signs off by reminding the audience to “have a toasty day.”

Jack’s reiterates these self-reflections in his post-survey comments. When answering how the course may have helped prepare him for other aspects of his life, he writes, “I believe that this class gave me a better understanding of computers. I think that having a better understanding in all of aspects of the computer will help in the future somehow.” When asked “in what ways do you feel your Globaloria experience might have influenced you?” he responds, “this showed me many different things I can do with a computer, and now I strongly suggest replacing books with computers.” His interest in helping others in Globaloria is also expressed in his post-survey when asked if he will continue using the online resources. Jack writes, “I will continue to see what other students are doing, and I want to try to help them however I can.”

Content Analysis of Super Toaster Game

Super Toaster was one of 95 West Virginia games in Pilot Year 2 and one of four games at SRMS. In order to evaluate all games on a common scale, we content analyzed the games created in Semester One and Semester Two, using the process and coding scheme described in the Method section. Out of a total of 26 possible game attributes that we included in our coding, the Super Toaster game achieved an overall value of 25, reflecting the highest score that a game achieved this year, across middle school,

high school and community college students of all age levels. The table that follows indicates the final tally. The codes detect the presence of the student designers' skills in CLA categories 1 and 2.

Table 13. Super Toaster Content Analysis Results

<p>Game Title: Super Toaster</p> <p>Student/Team Name: Alliance of Super Tr33 Stumps</p> <p>Team or Individual Game: Team</p> <p>URL: http://www.myclife.org/usa/wv/srmswiki/index.php/User:Team_Alliance_of_Super_Tr33_Stumps/Projects</p> <p>BRIEF GAME OBJECTIVE: The players see how global warming affects the environment and how they can help stop the contributing factors in a fun cartoon like way. The rules are simple, you mostly read in game instructions because the game play changes often. To win you must complete all the levels and use what you know and what you learned to complete the final level. The goal is to help as many people and animals as possible from the affects of global warming and to teach them how to help stop the adding of the crisis.</p>		
CATEGORY	CRITERIA	1= Yes
Game Plan and Demo [Design Template; Prototype]	Did the students create a Paper Prototype?	1
	Does the game appear complete/finalized?	1
	Please EVALUATE the Game Design Plan for its written content describing student intentions for their game design (Overview, pitch, scenes, elements/assets, etc.) [0=None; 1=Incomplete; 2=Satisfactory; 3=Thorough/Excellent]	2
Playable Game Design	Are there gameplay instructions?	1
	Does the game play exactly as the instructions specify?	1
	Is there a visual / graphic STYLE that carries throughout the game, consistently? (e.g., color-scheme, character-design, are game-play objects in consistent locations throughout the game)?	1
Playable Game Functionality	In all relevant instances, does the game offer feedback to the user based on actions (e.g., quiz game provides feedback on a response; when a character dies a life is lost or a message appears; rollovers change color or display a pop-up; do collisions elements work properly)?	1
	Do the feedback / response elements add to the challenge of the game, (e.g., the game is over if the timer, lives, or health run out; scoring is variable; the game can be "lost" or "won")?	1
	Are there objects (not characters) that are interactive for the player (e.g., buttons with rollover; objects that can be drag and dropped)?	1

	Are there characters that the player can interact with (e.g., player avatar that moves with arrows, and/or enemies or allies that are animated or moving)?	1
	Do the objects and/or characters interact to cause some effect? That is, do objects detect collisions? (e.g., objects bump and change direction, character gains/loses life when it touches something else, gains/loses points, etc.)	1
	Are there multiple levels, progression of different scenes, and/or increasing difficulty?	1
Audio/Visual	Are visual elements well executed (e.g., are images clear without blurriness or 'fringing')?	1
	Is there background music to the game?	1
	Does the game feature sound effects that happen based on player action or by on-screen objects?	1
	Is the artwork creative and engaging?	1
Playable Game Subject / Narrative	Briefly, in a few words, what is the MAIN TOPIC AREA of the game (e.g., sports)	The environment
	What is the game genre (educational, social issues, or entertainment)	social issue
	Does the game feature a subject that reflects an educational or social issues theme?	1
	Are the educational/social theme elements <i>active</i> or <i>central</i> to the game play (e.g., a game about global warming takes place in a landfill)	1
	Does the game have a cohesive storyline and/or a beginning, middle, and end?	1
	Does it appear that the students did research into the educational/social aspects of the game (e.g., not simply a basic math game, or a "name the capitals" game, but rather teaches players something that is potentially new, and the designer learned something new).	1
Playable Game Presentation on the Wiki	Did the student provide the FLA file for the Final Game on the Wiki?	1
	Did the student provide the SWF file for the Final Game on the Wiki?	1
	Is the final game marked clearly on the Student or Team Project wiki page, specifying it as the final game?	1
	Is the final game provided in the Game Gallery on the Wiki?	1
	Total Tally	25

The class mean at SRMS was 20. Jack's team game evaluation value of 25 was well above the average. Further, when compared to the 95 games created by WV middle school, high school and community college students in Pilot Year Two (which achieved an average game evaluation value of 11.7), this game's value of 25 is the highest scored, and well above the average.⁴

Summary, Jack's Performance in Game Design at SRMS

Overall, the Super Toaster game includes 25 out of the 26 possible attributes we coded for in each game evaluation category. As discussed in the Methods section, these categories can be linked to student achievement of Contemporary Learning Abilities 1 and 2, in that a) the coding scheme categories of Game Design, Functionality, Audio Visual, and Subject/Narrative indicate that students have had success with invention, progression, and completion of an original project idea for an educational game or simulation (CLA 1), and b) the coding scheme category of Game Plan and Demo (as well as the other categories) indicates that students have had success with Project-based learning and project management in wiki-based, networked environment (CLA 2). Students' inclusion of the attributes we counted provides evidence that they learned the skills necessary to do so. Jack contributed to many aspects of the game's design and development and was the main programmer of the game. Therefore, it appears that he gained a significant level of knowledge in the two most Constructionist CLA categories. As for the other Contemporary Learning Abilities categories (3 – 6), the game coding scheme is not as strong a measure, thus we must rely on other data sources.

Jack was more active in posting to the wiki and in blogging when he first started out, and when these activities were more novel. Overall, the level of interaction and dialogue among students on the wiki was somewhat limited, thus, there might not have been as much motivation to do so, since his other classmates were not responding to his comments. We know that Jack learned how to blog during Semester One, as well as use the Wiki to upload and present files, evidence of functional mastery in CLA categories 3 (Posting, publishing and distributing digital media) and 4 (Social-based learning, participation, and exchange). Clearly Jack engaged in significant collaboration in the context of the class itself, so his CLA 4 was further enhanced through these in-person team interactions. And, Jack and his teammates engaged in online research to find out more about global warming, pollution and vehicle emissions (the subject of their game) and also to find Flash tutorial resources to help them learn certain game design functions, indicating some level of mastery of CLA 5 (Information-based learning, research, purposeful search, and exploration) and CLA 6 (Surfing websites and web applications). However, he and his fellow students did not cite or credit this material, so a greater emphasis on copyright issues in information-seeking may be needed in subsequent Globaloria implementations.

In her final progress report, Mrs. B notes that Jack put in large amounts of time and effort into refining his team's game. She writes that, "Jack spent countless hours after class, whether it was after school or after lunch." She also notes that he "was often sidetracked by other students from other groups who needed help with action script. Jack always selflessly helped others as well as his team members with

⁴ It is important to note that many factors vary across WV locations and impact students' learning experiences (including student grade level, number of participation months, prior experience, and game design context as team versus individual) so the comparison is not exactly apples to apples.

their game scenes.” These actions take place in the classroom context and are not observable on the wikis or blogs, so there are not any examples to provide that exemplify Jack’s mentorship of his peers. However, Mrs. B’s words about his collaborative nature indicate that Jack is sufficiently engaged and enthusiastic about the content of the course that he happily assists others in grasping concepts that they may not understand.

Mrs. B’s progress report also observes that, “being the mastermind behind the Super Toaster, of course, Jack’s creative busy genius fell behind on keeping track of the progress reports and blogging, but he surely made up for that in his project activity.” She also explains that, “having a huge interest in creating videos, Jack shot several videos about student learning in Globaloria, one of which was submitted to an AMD contest in the ‘My AHA Moment’ category.” This was an interactive media contest sponsored by the corporation American Micro Devices.

Overall, Jack appears to be a model student who epitomizes the potential that Globaloria has to be an engaging learning environment for students. Jack arrived in the program with no prior background in Flash, but with a strong record of academic achievement. His ideas, such as using a toaster as a character, are very original and creative. While he noted the challenge of learning Actionscript, through his perseverance and hard work, it appears this middle school student at SRMS may have gained the most programming knowledge of anyone who participated in Pilot Year 2, across age levels. Jack’s inquisitive, creative and exploratory nature found a medium and outlet in Globaloria. He was a student who quite fully leveraged the digital affordances and resources he was provided. His team’s high game score was very impressive, and indicates that Globaloria can be suitable to a range of age levels as a motivating introduction to programming through media creation. Follow up interviews with Jack now that he has entered high school are being planned, to explore any potential ongoing impacts from his experience.



Case 3: Katie

Katie, whose wiki name is Elmo12, is an 8th grade student at SRMS who we chose for our third case study. Katie states in her pre-survey that she participates in cheerleading outside of school, and has aspirations of being a member of the FBI when she finishes her education. Her favorite technological gadget is her cell phone. Regarding her prior technology experience, Katie notes that she began using computers about three years prior, and that most of her experience was in using the web service MySpace, and instant messaging.

We chose Katie as a case study student because she initially expressed hesitation and some anxiety about the more social elements of the course, in which students are expected to share work and ideas that are still in-progress. Katie writes in her first blog post in early September that, “my fear is that my games will be boring and no one will like them. Im scared that I won't accomplish alot in this class and that i won't understand what im doing.” Through her engagement in her game design project over time, Katie grows to become more comfortable sharing her work with her classmates. Within the second quarter timeframe in particular, she assumes a leadership role in the team’s work.

Katie’s case provides evidence that Globaloria participation introduces students to new modes of social engagement and learning in the school setting. While Katie’s level of participation and game design activity fluctuates across the timeframe, she gains a valuable experience in a context of creative design and collaborative knowledge-sharing that is quite unusual in relation to the typical school experience. It appears that through her involvement in the Globaloria workshop experience, Katie gained some new confidence in herself that may carry over in her approach to future novel experiences.

Semester One Wiki edits and uploads, Katie and her class

Table 14 and 15 show Katie’s wiki edits and uploads for the first semester of the Game Design class by month, in relation to the class range. Katie’s wiki activity in the first two quarters indicates that her wiki edit and upload frequency is in the middle range, in relation to the rest of her class.

Table 14: Katie’s Wiki Edits from Game Design I, by Month

Month	Katie’s Wiki Edits	Range of Wiki edits, low to high
August	7	1 - 12
September	34	0 - 65
October	29	22 - 72
November	19	7 - 27
December	20	8 - 32

Table 15: Katie's Wiki Uploads from Game Design I, by Month

Month	Katie's Wiki Uploads	Range of Wiki uploads, low to high
August	4	0 - 4
September	0	0 - 18
October	8	4 - 30
November	12	6 - 28
December	16	4 - 22

Katie's wiki use appears to increase in the second quarter timeframe in November and December, at the same time that she takes on some extra responsibilities in her group, when a third group member leaves the course.

Katie's Participation in the First Quarter of Game Design: Late August to November 3, 2008

Katie's initial profile page features some background information she has written in response to questions posed online from the World Wide Workshop to all students. Her profile page is fairly basic, though she learns how to change the background color and font color, and she uploads a graphic. Mrs. B observes that during this time, "Katie has learned how to make her page look cool by adding images and different font and background colors. She has also learned how to upload files and how to embed TeacherTube videos." While she has learned these skills, Katie expresses some reservations initially about becoming fully activated in her wiki use.

Figure 29: Screenshot of Katie's Profile Page in The First Quarter



Katie is a member of the team Gamevision, and creates a game called “Save the World,” which is also about recycling and environmental issues, a common theme in the SRMS class. In the first quarter, in the “Imagining Your Game” section she posts a paragraph on her Project page that discusses an idea for her team’s game.

However, in the “Drawing in Flash” module that has been started, she has only put up her name on her Projects page. Mrs. B notes in her September progress report that “even though Katie drew the trash compactor character in Paint, she did not upload it to the wiki.” It becomes evident that her reservation to publish files publicly at first is due to the shyness and reservation expressed in her pre-survey, in sharing her work with other students. This is a reaction we have seen in other student cases, and it appears Mrs. B accommodates this tentativeness by not requiring Katie’s public sharing of work, until she feels comfortable and ready for this.

Katie’s team, Gamevision, originally consisted of two additional members, Destany and Shane, the latter of whom would later leave the course. Mrs. B states in her progress report that, “in the group, Katie and Destany assumed leadership roles, with Shane staying in the background.” The game pitch for “Save The World” is as follows:

Audience: i am designing my game for elementary cause it is simple and they could learn why people should recycle. They need to learn these things at a young age, so when they get older they will know what it causes.

Game Play: the goal of the game is to pick up all the trash around the dirtiest parts of the world and then recycle it. if you dont put the trash in the right place when you go to recycle it you have to redo the level.

Fun Factor: its fun because you get to be a robot and save the world.

Smart Factor: how to recycle and how recycling helps the environment.

Style Factor: I would use cartoon style because most robots are cartoons.

Originality Factor: it has a robot that spins around like a tornado.

The game is similar to others created in the class, with both social issue awareness-raising and educational goals.

Paper Prototype

During the first quarter, Gamevision also produces a paper prototype for their game, presenting the paper prototype as a video uploaded to TeacherTube and embedded on their team wiki. The two main characters featured are the Magic Trash Compactor and Recyclanator. In the first part of the game, the Magic Trash Compactor swoops down and cleans all of the trash out of the Dead Sea. For the purposes

of their game, they state that the Dead Sea is the dirtiest body of water on the planet. The next scene is similar in that a playground is shown covered with trash, and the trash compactor character flies in and cleans all of it up. Following this, the playground is shown again, in its clean form, but now with kids who have come to play.

It is then that the interactive, playable portion of the game appears to begin. Full of trash, the Magic Trash Compactor dumps it all off at the recycling center, where there are three bins: one for glass, one for plastic, and one for aluminum. The player then assumes control of the Recyclinator, a robot who must sort the trash into these bins. The students state that if a particular piece of garbage is put into the wrong bin, the player is told so and has to do it again. They state that if all of the trash is put away correctly, the player wins and the Recyclinator and the Magic Trash Compactor get to go back to their home worlds.

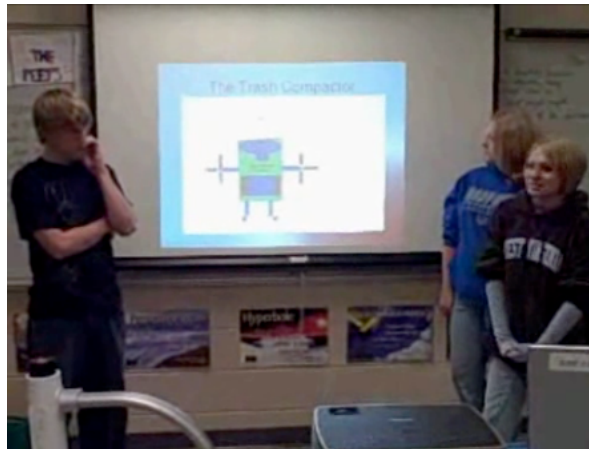
Figure 30: Screenshot from Paper Prototype of “Save the World”



Mini Game Presentation

Gamevision also records a mini-game presentation video during this time, in which they describe their game using PowerPoint slides. All the members of the team take turns in presenting the slides. While the presentation doesn't appear to add anything new beyond what is shown in their paper prototype and game pitch, it does show that the team members appear to be rather shy, compared to the other teams and student cases analyzed. They rarely look at the camera, read the slides verbatim, and speak softly so it is difficult to hear. This finding supports Katie's self-reflections regarding her initial fear of presenting and sharing work. While she completed the requirement, presenting in class on camera was a new experience for her. Figure 31 is a screenshot from their mini-presentation.

Figure 31: Screenshot from Gamevision's Mini-Presentation



Mrs. B observes that during the first quarter, Katie “is keeping up with her progress notes quite well and is improving on her writing in the blog.” Katie’s blog posts tend to be, on average, longer than most of her other classmates. Her blogs reflect both excitement and enjoyment of classroom activities, but also a sense of anxiety over her assignments. On September 16th, she writes about her mini-game presentation, stating “I’m excited about our game. I’m nervous about the presentation tomorrow.” But by September 26th, she observes that “what I have learned during my experience is that im not as shy in front of people. I get really nervous especially when I have to watch my self,” later adding “hopefully everyone will like how were putting everything together.”

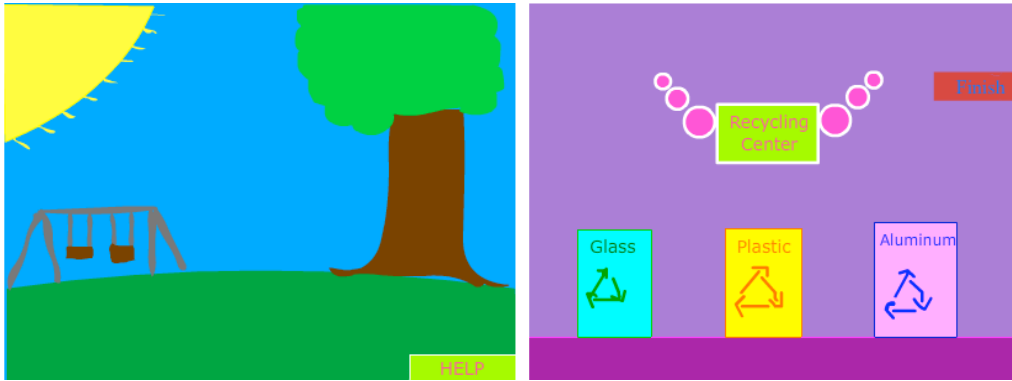
It seems that Katie is discovering parts about her personality that she hadn’t expected, and reflecting more about her social interactions with others. The experience is helping Katie to understand herself more, leading to a lesser extent of hesitance in presenting her work.

Katie’s Participation in the Second Quarter of Game Design: November to January 11, 2008

The second quarter of Globaloria ran from approximately November 4, 2008 through January 11, 2009. Katie’s group during this time was expected to complete the modules “Drawing in Flash” (which she started during the previous quarter), “Adding Navigation”, “Adding Animation”, “Adding Sound”, and “Adding Interaction”. Katie completed all of these assignments during this time with the exception of the last one. In her December progress report, Mrs. B writes that, “Katie has learned how to draw in Flash and experimented with layers. She has learned how to create buttons and probably got into further units before everybody else in her group did because the boys from the first group shared everything they have learned with her.”

Figure 32 shows some of the images she has produced during the second quarter which she posted under the module “Drawing in Flash”.

Figure 32: Game Design Images



Of the “Drawing in Flash” module, Katie observes in her blog that she “had alot of fun drawing my scenes. It was a really great way of expressing how each team member visualized a certain scene, and how to tell how much skill they had in using flash.” While her graphic design artwork is simplistic, the functionality in the animations and objects is well constructed and functional.

Figure 33: Roll-Over Objects for Sound Interaction



It is during this quarter that their team member Shane leaves the program. Of her team member’s departure, Katie blogs on December 5, 2008 that, “It is harder without shane in this section, and I mis him alot. We're doing pretty good so far without him though, even though destany and I both wish he was still here.” To support their learning with one team member gone, Katie and Destany turn to their peers, and begin collaborating more with other teams.

On November 19th Katie blogs about how other classmates have been helping her, writing that “it was very interesting seeing how far other teams have come in flash. Sometimes it was a little harder for our group to catch up since we lost one of our members during this section. But, we finally got back on track thanks to other people in the class like Jack, and Tyler.” Mrs. B points out that even still “Katie has not had any major difficulties with action script because Tyler [from another team] spent considerable amount of time teaching her about it.”

Katie’s Game Design Learning in Quarter Two

Overall, Katie stays on track in her Flash learning in Quarter Two. On November 19th she writes, “Things are getting a little harder but the better I pay attention to the tutorials, the more i'll understand. I know that I can get help from the other class members, and that are alot of help when you dont really

understand what the tutorials are trying to explain. I can't wait to start on navigation and figure out how to make buttons. I'm starting to like the class a lot more now that I understand everything a little better." On December 16th, she writes that "I wish we had more time in here to work on our game. I can't wait until classes change and were in here for two class periods. I think once we're in here more that we'll get more done and progress a lot more."

Mrs. B's progress report in quarter two notes that "Katie has come long ways since starting the course. She is a very shy girl who has not had too much confidence in her own skills. The circumstances within her group forced her to assume the position of a leader, which she is becoming more comfortable with this position." Mrs. B also observes that "Katie shares her experiences in Globaloria through the blog very well and keeps up well with her progress notes."

These posts support Mrs. B's observations that Katie really has come a long way from where she started. It appears that as she participates, she grows in confidence, and this sparks her forward. It may be that this experience will allow her to approach future novel context with less timidity.

Semester Two: Katie's Wiki Edits / Uploads

On average, in the second half of the course, it appears that Katie's wiki edits and uploads are again in the middle range of student wiki activity in Semester Two.

Table 16: Katie's Wiki Edits from Game Design II

Month	Katie's Wiki Edits	Range of Wiki edits, low to high
January	16	1 - 26
February	7	5 - 22
March	17	7 - 74
April	7	0 - 34
May	12	0 - 41

Table 17: Katie's Wiki Uploads from Game Design II

Month	Katie's Wiki Uploads	Range of Wiki uploads, low to high
January	10	0 - 12
February	2	2 - 23
March	22	2 - 46
April	8	1 - 25
May	14	0 - 29

In the third quarter, Katie uploads files on her own projects pages, but does not add the files to the team page. In March she uploads a number of game files and updates her team page with these files. In May her uploading activity increases, in preparation for her final group presentation.

Regarding blogging, Katie is the only student in our case studies who expressed in her mid-survey that she liked this activity, which may reflect why her blogs tend to be a bit longer than those of most of the other students. Mrs. B noted that Katie “keeps up with her blog and her progress reports consistently and does not need to be nudged to do so.” Katie identified blogging as one of the most important things she has learned thus far, and in discussing what she enjoyed about the class most she wrote, “I like the fact that we get to type blogs even though we have to type a lot about what we learned it’s fun to learn how to use these websites.”

Katie’s Participation in the Third Quarter of Game Design: January 12 – March 21, 2009

The third quarter of Globaloria ran from approximately January 12, 2009 through March 21, 2009. At the beginning of the third quarter, students completed their mid-survey comments. Katie noted that “my best work is Under Adding Interaction, and is my arrow key movement scene with the background of the Joker. I chose this because I worked the hardest on this and it was the one thing I really got interested on.” Figure 34 shows this work, and how the face of The Joker can be moved over the background image of him.

Figure 34: Katie’s work on “Adding Interaction”



While this work does not relate directly to Gamevisions’ project, it shows that Katie is applying what she is learning in Flash to her interests outside of the program. Mrs. B noted in her March progress report that during the third quarter, “Katie experimented with special effects a lot, with the purpose of applying them to her game.” In one instance, she used a tutorial that helps her create a “matrix” effect with her name. In another, she animated an image of a gun adding moving smoke. These are shown in Figure 35 (though the images lose their dynamic animation in the screenshots). It appears that in lieu of drawing, Katie has learned how to repurpose found graphics to create dynamic animations of her own.

Figure 35: The Matrix and Gun Smoke Effects



Katie's Game Design Work in the Third Quarter

Katie blogged on January 13, 2009 about the “Adding Interaction” module, stating that, “Adding interaction was kind of easy. There wasn't a lot to do with this section but I understand everything better now. I'm starting to understand things better than what I did before.” Mrs. B's progress report also observed that during the third quarter, “Katie is a leader within her own little group. Destany's absences kind of triggered Katie taking in charge, and now Katie directs her group's work.”

However, while she expressed growing confidence in her Flash learning, she also expressed hesitation to share this work with others. In her mid-survey she stated, “I don't like presenting what I've accomplished with my game because I'm not good at talking in front of people even if it is only my class mates.”

Confirming her anxieties about presenting, her January 13th blog post further explains that, “I'm scared that our game isn't going to be finished in time to show to everyone. We've got a lot to work on. And a lot of stuff to get finished. We haven't really accomplished much so far. I can't wait until we have everything ready so I won't be so stressed about not having everything we need.” She continues that, “we really need to start working and start trying to accomplish more.”

Globaloria is different from most classes in which students learn a given module of content and then move on to something else. It takes a significant amount of time to learn the building blocks necessary to complete a final game, and some of this learning is rather unstructured, in that it is driven by students' own creative ideas and design choices. Thus, students may at times feel a lack of orientation.

It appears that Katie is expressing uncertainty about finishing because she does not yet see how the project will all come together. When asked in her mid-survey what she plans on doing during the second half of the academic year, she notes that she plans “on working faster and trying harder to get things together.” Also, she responds to the question of how teachers could help her better meet her goals by writing that, in part, they could “give us more time to get through the different courses.” These comments indicate that she has a strong motivation to meet the goal of completing a game, and having

past the mid-point of the year, she is anticipating (and expressing some anxiety over) what it will take to close out the work.

Katie's Participation in the Fourth Quarter of Game Design: March 22 – End of May, 2009

The final quarter of the academic year took place between approximately March 22, 2009 and the end of May. During this time, the students mainly focused on completing their team games. There were a few updates to Katie's wiki during this time, mostly new effects that she learned. Her wiki postings continue to show that she is learning new Actionsript functions. For example, Figure 36 shows a photo effect that she learned, where the animation reveals a picture behind a white screen. She also completes a drag and drop tutorial and posts this online.

Figure 36: Photo Effect Animation on Katie's Wiki

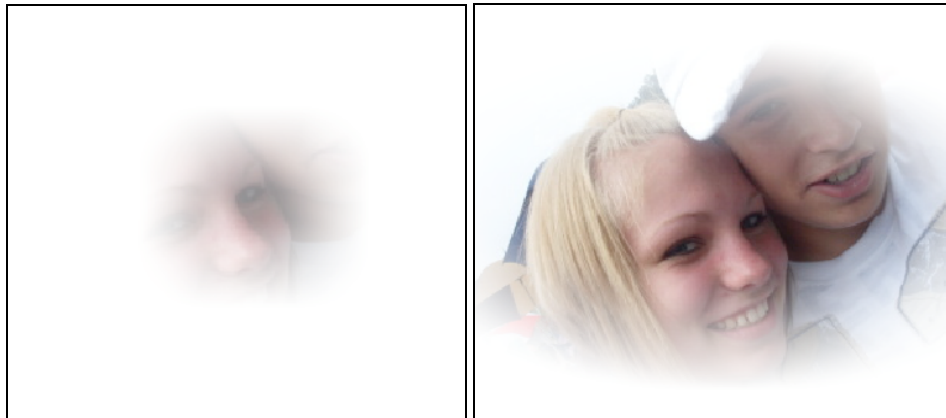
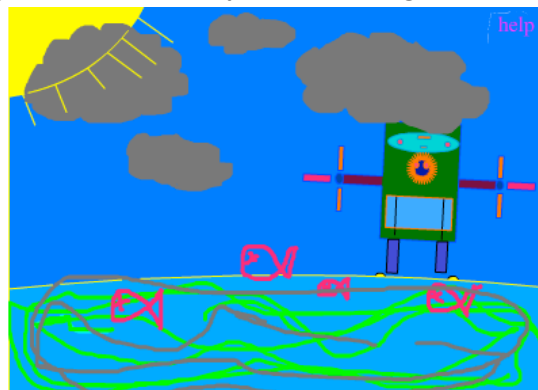


Figure 37 illustrates an animation on Gamevision's wiki featuring the Magic Trash Compactor moving in rapid circles, presumably cleaning up the dirty water. This was a screen the students planned from the beginning.

Figure 37: Trash Compactor Cleaning the Dead Sea



Gamevision's Final Class Presentation

The students in the class film a final presentation that they make to their class in the last 2 weeks. Both Katie and Destany present their game in the final game presentation taking turns talking about their game. The final presentation is delivered via web-conferencing screenshots that shows a computer screen and features audio of the team members describing the game. The girls have a very similar voice, so it is hard to distinguish who makes particular comments when they talk.

Their presentation presents a mix of a) screens from their initial paper prototype, b) screens from their initial Powerpoint, and c) presentation of the game files they created to build out their initial game plan. At the time of the presentation, similar to the other teams, they did not yet have a completed, cohesive version of their game to show. The following figures present screens from their final presentation.

Figure 39: "Save the World" Paper Prototype Title Screen

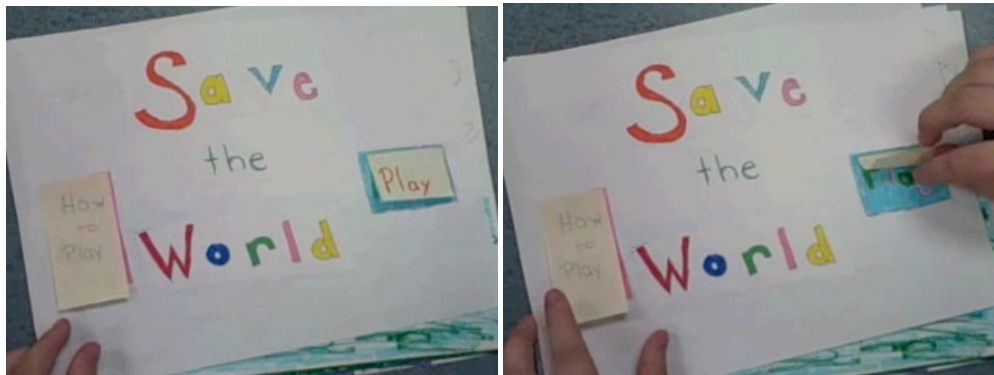


Figure 40: The Trash Compactor Cleaning the Dead Sea

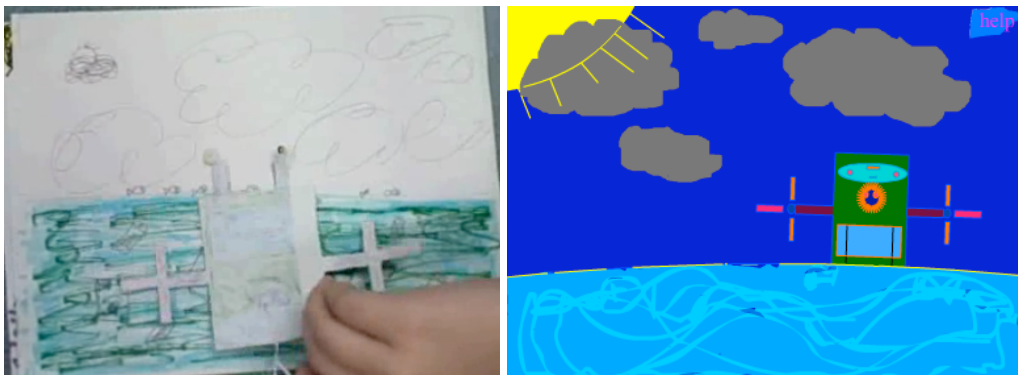
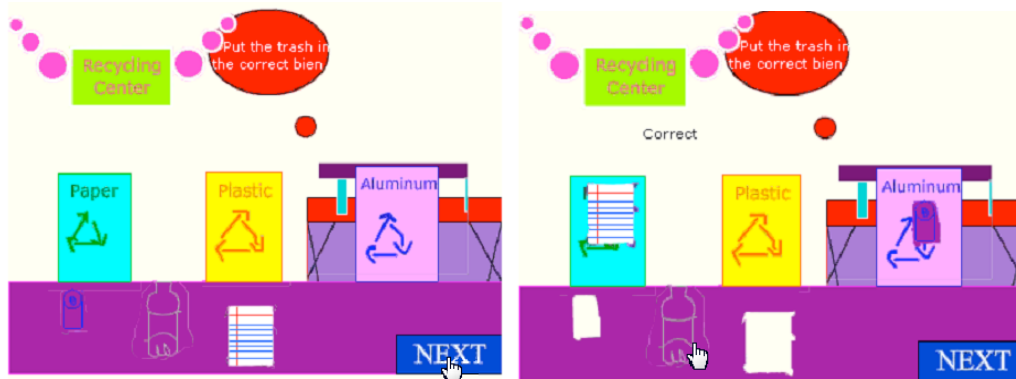


Figure 41: Recycling Center from Paper Prototype



Figure 42: Recycling Center from Final Presentation



The final version also contains a small quiz element that was not part of the paper prototype. Players have to drag and drop words from the left side of the screen, matching them up with the proper definition on the right side. Once a word is properly matched, a message appears saying this is correct. Next, the Magical Trash Compactor and the Recyclonator are shown back at their home planet, a scene that was envisioned but not shown in their paper prototype.

Figure 43: Matching Words and Home Planet of Characters from “Save The World”



Following their final presentation, Gamevision notes that there are some additional elements that they would like to add to their game, such as a way to keep track of points when a player recycles the correct items at the recycling center. They also state that they would like to add scenes that provide more of a story element to the game and explain about the types of trash being collected. When asked what they learned about things they were unable to do in their game, they state that they may have been thinking too big, and that they were not able to do everything that they wanted. This may be attributed to the fact that their team was half the size of any of the other teams at SRMS.

When discussing what they learned in the class, the girls observe that they learned about computers, and how to communicate and collaborate. Katie is asked directly by Mrs. B about how the program has helped her improve her skills with technology. She responded that every time she used to use her computer at home, she would mess something up. She says that now that she knows how to use computers more, she is not just better, but also enjoys them more. Katie also explains that her communication skills improved as she had to collaborate with not just Destany, but other members of the class.

Mrs. B notes in her final progress report that Katie had more absences in the final quarter than usual, but still seems mostly pleased with her outcomes. She writes that, "Katie's absences increased during this period even though she was very productive during the days she was present. Katie has managed to build many scenes and never hesitated to ask for help from other students, me, or Jeff. Katie used drag and drop technique, created buttons, and worked on assembling some parts of the game."

Gamevision's Final Game Presentation to Advisory Board Panel

At the end of the school year, some students presented their game to a panel of experts on the Globaloria-WV Advisory Board. Katie was absent for the final game presentation, and it appears Mrs. B thinks that this was intentional. Mrs. B notes in her progress report for this timeframe that, "Katie switched roles with Destany during this quarter. It seems to me that she couldn't muster enough courage to present at the first event- the presentation at the Board, which left Destany alone." The final game presentation consisted mostly of Destany looking at a laptop with Mrs. B, talking a little bit about her team's game. Mrs. B begins the presentation to the Globaloria-West Virginia Board of Advisors by noting Katie's absence, joking that she "ate too many cookies or something." Figure 38 reflects two screenshots from this video presentation, posted to the student's team wiki page.

Figure 38: Gamevisions' Game Presentation to the Board



Destany presents for the team, explaining that in their game, the Magical Trash Compactor travels to all the continents in the world and cleans up the garbage that is causing pollution. She says that following this, the player gets to control the Recyclonator, and has to separate the trash such as metal, paper, glass, and plastic. Following this, she notes that the characters get to travel back to their home planet. The video then shifts to a projection screen where Destany scrolls through some of the animations on Gamevisions' wiki. She concludes by disclaiming that their game is not as advanced as some of the other ones that were shown at the presentation, because their team only consists of two people.

Content Analysis of Recycling Game

Out of a total of 26 possible game attributes that we included in our coding, Katie's team Gamevision's Recycling Game achieved an overall value of 20, similar to Kristine's team game. The table that follows indicates the final tally. The codes detect the presence of the student designers' skills in CLA categories 1 and 2.

Table 18. Recycling Game Content Analysis Results

<p>Game Title: Recycling Game</p> <p>Student/Team Name: Gamevision</p> <p>Team or Individual Game: Team</p> <p>URL: http://www.mylife.org/usa/wv/srmswiki/index.php/User:Team_Gamevision/Projects</p> <p>BRIEF GAME OBJECTIVE: the goal of the game is to picked up all the trash around the dirtiest parts of the world and then recycle it. if you dont put the trash in the right place when you go to recycle it you have to redo the level.</p>		
CATEGORY	CRITERIA	1= Yes
<p>Game Plan and Demo</p> <p>[Design Template; Prototype]</p>	<p>Did the students create a Paper Prototype?</p>	<p>1</p>

	Does the game appear complete/finalized?	1
	Please EVALUATE the Game Design Plan for its written content describing student intentions for their game design (Overview, pitch, scenes, elements/assets, etc.) [0=None; 1=Incomplete; 2=Satisfactory; 3=Thorough/Excellent]	2
Playable Game Design	Are there gameplay instructions?	1
	Does the game play exactly as the instructions specify?	1
	Is there a visual / graphic STYLE that carries throughout the game, consistently? (e.g., color-scheme, character-design, are game-play objects in consistent locations throughout the game)?	1
Playable Game Functionality	In all relevant instances, does the game offer feedback to the user based on actions (e.g., quiz game provides feedback on a response; when a character dies a life is lost or a message appears; rollovers change color or display a pop-up; do collisions elements work properly)?	1
	Do the feedback / response elements add to the challenge of the game, (e.g., the game is over if the timer, lives, or health run out; scoring is variable; the game can be "lost" or "won")?	0
	Are there objects (not characters) that are interactive for the player (e.g., buttons with rollover; objects that can be drag and dropped)?	1
	Are there characters that the player can interact with (e.g., player avatar that moves with arrows, and/or enemies or allies that are animated or moving)?	0
	Do the objects and/or characters interact to cause some effect? That is, do objects detect collisions? (e.g., objects bump and change direction, character gains/loses life when it touches something else, gains/loses points, etc.)	1
	Are there multiple levels, progression of different scenes, and/or increasing difficulty?	0
Audio/Visual	Are visual elements well executed (e.g., are images clear without blurriness or 'fringing')?	1
	Is there background music to the game?	0
	Does the game feature sound effects that happen based on player action or by on-screen objects?	0
	Is the artwork creative and engaging?	1
Playable Game Subject / Narrative	Briefly, in a few words, what is the MAIN TOPIC AREA of the game (e.g., sports)	The environment
	What is the game genre (educational, social issues, or entertainment)	social issue

	Does the game feature a subject that reflects an educational or social issues theme?	1
	Are the educational/social theme elements <i>active</i> or <i>central</i> to the game play (e.g., a game about global warming takes place in a landfill)	1
	Does the game have a cohesive storyline and/or a beginning, middle, and end?	1
	Does it appear that the students did research into the educational/social aspects of the game (e.g., not simply a basic math game, or a “name the capitals” game, but rather teaches players something that is potentially new, and the designer learned something new).	1
Playable Game Presentation on the Wiki	Did the student provide the FLA file for the Final Game on the Wiki?	1
	Did the student provide the SWF file for the Final Game on the Wiki?	1
	Is the final game marked clearly on the Student or Team Project wiki page, specifying it as the final game?	1
	Is the final game provided in the Game Gallery on the Wiki?	1
	Total Tally	20

The Recycling Game evaluation value can be compared to the other student games created at SRMS, as well as to the games created across all locations, by considering their averages. Among the four games created, the average game evaluation value was 20. Recycling Game’s value of 20 out of 26 equals that of the SRMS class mean. When compared to the work of all WV middle school, high school and community college students in Pilot Year Two (which achieved an average game evaluation value of 11.7), this game’s value of 20 is well above the average.⁵ While the students were not able to complete the game by the presentation, their efforts in the last two weeks pay off and they end up with quite a high scoring game, considering that they are in middle school.

Mrs. B discusses her impressions of Gamevision in her final progress report. She writes that “the girls surprised me with their game. It was simple, with a clear vision of a directed audience and engaging. Many judges on our panel at the game presentations were impressed with the sheer amount of work these two girls have done.” She adds, “if both group members attended school more frequently, their game would have been more advanced, I think. However, here I see how keeping the project grounded helped these girls stay on track and get their game more accomplished.”

⁵ It is important to note that many factors vary across WV locations and impact students’ learning experiences (including student grade level, number of participation months, prior experience, and game design context as team versus individual) so the comparison is not exactly apples to apples.

Summary, Katie's Performance in Game Design at SRMS

As discussed previously, each of the game evaluation categories can be linked to student achievement of Contemporary Learning Abilities 1 and 2, in that a) the coding scheme categories of Game Design, Functionality, Audio Visual, and Subject/Narrative indicate that students have had success with invention, progression, and completion of an original project idea for an educational game or simulation (CLA 1), and b) the coding scheme category of Game Plan and Demo (as well as the other categories) indicates that students have had success with Project-based learning and project management in wiki-based, networked environment (CLA 2). Students' inclusion of the attributes in their game that we counted and noted above in the coding scheme provides evidence that the students learned the skills necessary to include these features.

It is important to note that the game evaluation value reflects the combined work of the entire team, not the individual. Katie contributed to the game's graphics and underlying Actionscript programming. It appears she gained knowledge in CLA categories 1 and 2. It is not entirely clear to what extent her knowledge of programming is greater than her team member Destany. In future research we are determining ways to better measure knowledge gained at the individual level.

As for the other Contemporary Learning Abilities categories (3 – 6), the game coding scheme is not as strong a measure, thus we must rely on other data sources. We know that Katie engaged readily in blogging, and also used the wiki at about a mid-range activity level, providing evidence of some mastery in CLA categories 3 (Posting, publishing and distributing digital media) and 4 (Social-based learning, participation, and exchange). Further, Mrs. B notes that Katie engaged in online research to find out more about recycling and also tutorials about different game design and animation effects, indicating some level of mastery of CLA 5 (Information-based learning, research, purposeful search, and exploration) and CLA 6 (Surfing websites and web applications).

When writing in the post survey about how the course has influenced her, Katie states "Globaloria has changed my thoughts about technology alot. In the past I thought websites like Flash was very complicated but now since I've experienced the learning and achievements in this class I understand and like technology so much more." She also observes that this will help prepare her for the future because, "our future is going to be almost completely based on new technology." She notes that she genuinely enjoyed being in Globaloria "because I learnt so many different skills, and my view on technology improved." This comment is a significant change for the same student who expressed in her first blog post at the beginning of the semester that, "Im scared that I won't accomplish alot in this class and that i won't understand what im doing." Even if some of her anxiety and shyness has remained, her final post-survey comments indicate she has clearly come a long way.

Discussion of Cases

This study posed two research questions at the outset:

- In what ways is the Globaloria program engaging for the participating students at SRMS?
- In what ways did middle school students develop new skills and learning abilities through their participation in Globaloria in Pilot Year 2 (2008/2009)?

Kristine, Jack and Katie reflect three very different case study students who exist in a single class context, sharing the same educator and the same level of access to a common set of curriculum materials and resources. The findings for these students vary widely, and also share some common threads. The case studies provide significant insights into both research questions posed.

Kristine presented as a student who had a prior interest in art and design, and who therefore developed graphic design abilities as a result of her participation. While she had difficulty learning Flash and using self-led tutorials, she was introduced to a range of new technologies in Globaloria. Further, she was able to complete some of the Flash assignments by relying on her peers. Her case highlights the extent to which collaboration can provide a benefit of knowledge-sharing, but at the same time, how team work can allow some team members to identify with certain roles that limit their learning across the full spectrum of CLA objectives.

Jack presented as a previously high-achieving student whose technology skills flourished in the Globaloria class. Jack experimented with and mastered all of the different technologies introduced in the course, including blogs, wikis, digital video, digital video editing tools, Photoshop, TeacherTube and Flash. His work was highly creative and as a class expert in Flash programming, he actively engaged in collaboration with his peers, to help them develop new skills. Jack was exemplary in his work and will serve as a model for our continued rollout in middle schools. His case provides evidence that students at this age and grade level are readily capable of achieving the learning objectives set out in the project.

Katie was a student who was quite tentative at first, who expresses strong hesitation to share and present her in-progress work. Over time, as she gains experience her comfort with the tools and with the workshop-based social environment and collaborative context grows, and she appears to gain a greater level of self-confidence. Her performance and learning is strongest in the second semester, when another student leaves her team and she is charged with becoming a team leader. Her attendance diminishes somewhat in the final quarter, and some shyness remains, as evidenced by her absence from the team presentation to the Advisory Board. Nonetheless, her team scores a 20 on their final game project indicating that at the end of the year, she and her one other team member were able to achieve enough Actionscript knowledge to piece together their game elements into a functioning, well-constructed final product.

Students gained CLAs to varying degrees. It appears that among the cases, Jack gained the most knowledge, followed by Katie, followed by Kristine. However, all students appeared to benefit from working collaboratively in the workshop context. By collaborating and sharing, Kristine and Katie gained

many more skills than either would have working independently following the syllabus and tutorials. Jack in turn gained experience being a leader and teacher for others, due to his high level of adeptness in picking up skills independently. All students maintain that the experience gave them greater confidence with and understanding of technology.

Recommendations and Conclusion

A further thread that has been woven as a theme throughout all the cases is the extent to which students are expected to engage in self-led learning. All students mention having some level of difficulty with this. Kristine mentions trouble with video tutorials. Jack mentions a wish for more structure and deadlines. Katie expresses initial hesitation to engage collaboratively with peers in her learning, and during the third quarter falters in her self-led pursuit of Actionscript knowledge. At the same time, the students also offer ongoing evidence of enjoyment in the autonomy afforded by self-learning.

Globaloria's Use of Self-Directed Learning Features

In the field of education research, instructional strategies involving “discovery based learning” have come under fire recently. Kirschner, Sweller, & Clark (2006) claim that programs requiring learners to find their own resources can result in student frustration due to the heavy working memory load (aka cognitive load). The authors claim it is far from optimal to place students in a learning context in which they are tasked with assimilating and accommodating new knowledge, while at the same time being tasked with finding the materials and resources necessary to learn this new knowledge. These authors contend that the cognitive load required in “discovery-based learning” undermines its benefits, stating, “Although unguided or minimally guided instructional approaches are very popular and intuitively appealing, these approaches ignore both the structures that constitute human cognitive architecture and evidence from empirical studies over the past half-century that consistently indicate that minimally guided instruction is less effective and less efficient than instructional approaches that place a strong emphasis on guidance of the student learning process” (p. 75).

Guzdial (2009) discusses this research in a recent blog post (Oct. 2, 2009) clarifying that discovery based learning can take many forms, and that educators often use a combination of approaches and a continuum of guidance. In referring to Kirschner, Sweller & Clark (2006), he notes that based on his own research and observations as a longtime undergraduate computer science educator, he finds that students learn well when they see and interact with direct examples of fully worked-out programming assignments, and then have a chance to apply the solutions to a new set of problems similar to the worked out examples. He cites research suggesting that in such a scenario, students who view the fully worked-out examples learn more, quicker, than those who are asked to solve the problem without seeing it worked out, using related textbook references only. Kirschner, Sweller and Clark (2006) support the modeling and “worked example” strategy that Guzdial also uses in his own pedagogy.

Guzdial suggests that while he may think of himself as a “discovery-based learning” advocate, his practice reflects *guided instruction* that is presented in context of hands-on student-driven experiential learning activities.

Overall, Globaloria adopts a similarly eclectic approach. The students in Globaloria can create any kind of game they want, in any genre that is capable of being coded using Flash. Globaloria students are provided with game design and programming “worked examples” in every online syllabus topic to review while they are completing their assignments. The assignments students perform are then modeled from these original examples. Further, some educators have gone so far as to complete the assignments themselves and post the completed assignments online for their students. A group of community college students in Pilot Year One particularly appreciated and gave positive feedback on this approach.

However, often students are so new to gaming and game design when they start Globaloria, that it takes time for students to even understand what a game is, before they can think about the type of game they might wish to create themselves, and then learn the fundamental computer and programming capabilities to do so. Guzdial (2009) points out that he has observed that when instruction is less guided and student tasks are less structured, then *effective learning occurs for only some of the most advanced students*. Guzdial (2009) states that “This literature is not saying never program. Rather, it’s a bad way to start. Students need the opportunity to gain knowledge first before programming, just as with reading. ... There is a place for minimally guided student activity, including programming. It’s just not at the beginning.”

Support from the educator appears to be key. At SRMS, the educator was highly active in learning Flash herself, and thus was able to provide a greater level of guidance than educators at other locations. Additionally, the class was supported by several instances of Webex tutorial sessions from a Flash design expert.

While pure and simple, game design requires hard work, based on the scholarly perspectives offered above, it appears that improvements could be made to Globaloria in the following two areas:

1. Improving scaffolding support to students: It appears students participating in Globaloria could use more direct expert guidance and scaffolding when they are beginning to shape the plans for their projects, and when they need design and programming help in the moment while developing their game.
2. Providing some greater structure in the curriculum: It appears that especially in the January, February and March timeframe, the students could use some milestone assignments, in order to best maximize the time available in this middle point of the year-long program, in order to maintain the project momentum.

Regarding scaffolding, in Pilot Year Two, the World Wide Workshop began experimenting with live virtual office hours (web-conferencing offered several days a week in which students could Skype and/or web conference with an expert Flash game designer), however this affordance was under-utilized by students. Moving forward, we will explore the extent to which this can help students.

Further, as educators become more experienced in Flash and game design across time, through trainings offered by the World Wide Workshop, and their own self-learning, they will become better prepared for

providing on-location support to students in later cohorts. They will also be better at maximizing the time available, through their building of a better understanding of the overall game design process, themselves.

Continued Research

More research is needed in Globaloria to better understand student team dynamics and roles, and how this influences individual learning. Further, we need a better understanding of how educators and students are using available resources. We recommend in-person participant observation in classes, to explore how the class management is occurring by the educators, and what strategies for improvement might be offered back to them. Such research may also lead to improvements in the syllabus and program design. Having an experienced computer science educator evaluate the curriculum and offer recommendations might also yield valuable recommendations.

Our rationale for employing a discovery-based learning approach (what we call Constructionism) is the larger societal context of technological advancement in which we are educating today's youth and training educators -- and the urgent, immediate need to implement programs that bring about a computationally-literate public, now. Instructional design (just like technology development) is an iterative process. The need for implementing digital literacy programs in schools to prepare students with 21st century skills is urgent.

Scholars such as Kirschner, Sweller & Clark (2006) are advocates for the optimization of technology solutions for learning that provide advances in cultivating traditional core curricular domain knowledge in the learner. Globaloria leaders and designers seek to the best practices in computer science education research, ensuring that best practices filter into the iterative design of the learning tools and program curriculum, and thereby into educators' professional development, and ultimately to student pedagogy. Continued research is necessary to improve our pedagogy.

Finally a few notes about the methodology. While the Wiki, student videos, surveys, and educator progress reports proved as very fruitful data sources for case study generation by the authors, who were working remotely, we certainly missed observing a world of phenomena occurring at the local level in the classroom. For the richest findings and highest validity, we recommend that future research draw upon a combination of the data sources included here, *along with* student interviews and on-location participant observation site visits. We expect that this further-triangulation of sources will allow us to better answer questions this study generated, especially in regard to the role the team dynamics of the students plays in their learning outcomes, and, the ways students and their educators are using the Wiki resources, how they might do so more effectively, and what further iterative development is needed to best support students.

Overall, the case study findings provide ample evidence that the project founders and staff, and participating school administrations and teachers are making ample strides in implementing and continuing to refine the Globaloria program, and that the present participating West Virginia students are engaging in positive experiences that are affording them the opportunity to develop contemporary

learning abilities, in preparation for successful futures in today's knowledge-driven professional work environments and cultures.

APPENDIX A
Globaloria Pilot Year 2 Coding Scheme

Game Title: Student/Team Name: Team or Individual Game: URL: BRIEF GAME OBJECTIVE:		
CATEGORY	CRITERIA	1= Yes
Game Plan and Demo [Design Template; Prototype]	Did the students create a Paper Prototype?	
	Does the game appear complete/finalized?	
	Please EVALUATE the Game Design Plan for its written content describing student intentions for their game design (Overview, pitch, scenes, elements/assets, etc.) [0=None; 1=Incomplete; 2=Satisfactory; 3=Thorough/Excellent]	
Playable Game Design	Are there gameplay instructions?	
	Does the game play exactly as the instructions specify?	
	Is there a visual / graphic STYLE that carries throughout the game, consistently? (e.g., color-scheme, character-design, are game-play objects in consistent locations throughout the game)?	
Playable Game Functionality	In all relevant instances, does the game offer feedback to the user based on actions (e.g., quiz game provides feedback on a response; when a character dies a life is lost or a message appears; rollovers change color or display a pop-up; do collisions elements work properly)?	
	Do the feedback / response elements add to the challenge of the game, (e.g., the game is over if the timer, lives, or health run out; scoring is variable; the game can be "lost" or "won")?	
	Are there objects (not characters) that are interactive for the player (e.g., buttons with rollover; objects that can be drag and dropped)?	
	Are there characters that the player can interact with (e.g., player avatar that moves with arrows, and/or enemies or allies that are animated or moving)?	
	Do the objects and/or characters interact to cause some effect? That is, do objects detect collisions? (e.g., objects bump and change direction, character gains/loses life when it touches something else,	

	gains/loses points, etc.)	
	Are there multiple levels, progression of different scenes, and/or increasing difficulty?	
Audio/Visual	Are visual elements well executed (e.g., are images clear without blurriness or 'fringing')?	
	Is there background music to the game?	
	Does the game feature sound effects that happen based on player action or by on-screen objects?	
	Is the artwork creative and engaging?	
Playable Game Subject / Narrative	Briefly, in a few words, what is the MAIN TOPIC AREA of the game (e.g., sports)	
	What is the game genre (educational, social issues, or entertainment)	
	Does the game feature a subject that reflects an educational or social issues theme?	
	Are the educational/social theme elements <i>active</i> or <i>central</i> to the game play (e.g., a game about global warming takes place in a landfill)	
	Does the game have a cohesive storyline and/or a beginning, middle, and end?	
	Does it appear that the students did research into the educational/social aspects of the game (e.g., not simply a basic math game, or a "name the capitals" game, but rather teaches players something that is potentially new, and the designer learned something new).	
Playable Game Presentation on the Wiki	Did the student provide the FLA file for the Final Game on the Wiki?	
	Did the student provide the SWF file for the Final Game on the Wiki?	
	Is the final game marked clearly on the Student or Team Project wiki page, specifying it as the final game?	
	Is the final game provided in the Game Gallery on the Wiki?	
Total Tally		

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