

# 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 3

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## Executive Summary

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In Pilot Year Three of the Globaloria initiative, from August, 2009 – June 2010, Globaloria was implemented in twenty-two locations throughout the state of West Virginia with 534 students. As students engage together in situated learning in the Globaloria program, we propose 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 media 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 and tinkering with web services and web applications** (*e.g., game examples, wikis, blogs, web apps*)

This study posed two research questions at the outset:

- How are student participants in the Globaloria program learning game design, in the context of the co-learning model?
- To what extent did middle school students develop new skills and learning abilities through their participation in Globaloria in Pilot Year 3 (2009/2010)?

These questions are addressed in the qualitative case study findings of two 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.

One case study student, Tegan, was 13 years old and in 8<sup>th</sup> grade. The other student, Billy was in 7<sup>th</sup> grade and was age 12. The students participated in Globaloria daily for 80 minutes for the entire school year across four school quarters. Mrs. B, the teacher for the 7<sup>th</sup> grade class was in her second year as a Globaloria educator whereas Mr. L, the teacher for the 8<sup>th</sup> grade class was in his first year.

## Executive Summary of Results

As Globaloria students, Billy and Tegan were both highly motivated and perseverant in their learning of Actionsript programming, wiki development, and blogging. However, in comparison we observed several individual, group, and process-level factors that led to some important differences that are worthy of note.

Specifically, with regard to role-taking, Tegan initially adopted the role of team manager, appearing somewhat apprehensive about programming. Tegan's aptitude for organization and teamwork was evident in her team leadership role, paying off for her as well as her team in terms of the learning outcomes of the individuals.

Then, mid-way through the school year, Tegan played a pivotal role in noticing an inequity in the skills being developed by her teammates, and adjusted her team's work practices to encourage all students to learn a fuller range of the activities in Globaloria, including those outside of their particular role instead of specializing. It appears that it was through Kegan's reflective practices that she arrived at the decision to support the Flash Actionsript learning of all team members regardless of their roles. This was a critical stance she developed towards the way the program was being conducted locally.

As the semester progressed into the final months and weeks, similar to some other past female case study students we have written about, Tegan ends up becoming integral in finalizing and completing the team's final game project, piecing together the disparate elements each of the team members created, requiring Actionsript knowledge. It appears she steps in at the end when she sees her fellow students leaving several elements of the work undone.

In contrast, our male case study student Billy immediately identified with the role of team programmer, but instead arrived at the role of team manager out of a compromise, allowing his teammate Garrett to take on the programmer role. However, in contrast to his manager role, throughout the course, Billy worked individually for the most part, engaging in extensive experimentation with the social media tools introduced in the project, pursuing his own curiosities about the tools, modding and adapting them, and embedding an eclectic array of 'bells and whistles' into his blog and wiki pages.

As Semester Two progressed, Billy transitions into the role of programmer, taking over the role from his teammate, with whom he maintained a somewhat competitive dynamic. When the game was being finalized he acted unilaterally in large part, whizzing ahead of his teammate who had a different style of learning, unlike Tegan who played a more facilitative role in ensuring all team members' learning.

One important consideration here when comparing the leadership styles of these two students is their gender. Both Tegan and Billy gained a range of Actionsript programming and social media technology skills through their participation. However, Tegan also demonstrates a considerable capacity for leadership of collaborative team practices, and personal reflection in her blogs, whereas Billy does not.

This capacity appears related to the varying communication styles of the students, which may be a result of individual differences. Further, facilitative vs. competitive styles are gendered constructs. This result may indicate that educators unintentionally hold implicit gender role stereotypes, to the extent that they do not actively challenge gendered assumptions of student roles.

In the well-rounded educational context that Globaloria strives to be, the program holds a full array of 6 contemporary learning abilities as objectives. Social learning, collaboration and teamwork is CLA 4. Just as girls are actively encouraged to take on new programming, game design and project management skills and confidence (reflected by CLAs 1 and 2), boys should be challenged to develop their social, facilitative and reflective practices (CLA 4). Educators should be made aware of what appear to be trends in gendered early role-taking in the class, and perhaps make efforts to challenge students along all of the CLA categories, based on gaps (and not implicit gender roles).

Overall, the findings in this case study highlight systems-level activity occurring, relating to the following factors:

- Globaloria pilot year (in this case, Year 3)
- School participation year (for SRMS, Year 2)
- Educator participation year (for Mrs. B, Year 2; for Mr. L, Year 1)
- Educator prior technology / game design experience
- Educator perspective / understanding of the holistic, big picture course objectives (namely, integration of range of activities and their inter-related contributions to each other)
- Team game design (N of students, gender of students)
- Student team roles (designer, programmer, project manager, sound designer, etc.)
- Student adherence to / shifting of / sharing of team roles across time
- Broad versus focused learning of activities designed to cultivate each of the 6 CLAs

It appears that for SRMS, a second-year school with one second-year and one first-year educator in the third pilot year of Globaloria, Mrs. S was able to arrive at enough of a holistic understanding of the course to be able to begin directing students towards greater integration of the range of activities, so that her students' final games reflect both programming knowledge, and, substantive content reflecting an emphasis on CLA 5, research and information seeking in support of student games' narrative development. It was a big step forward to see online research, copyright, and citation reflected in Mrs. B's students' games, coupled with designs that were fairly cohesive. These results may be generalizable; that is, it may be that a greater integration of activities can and should be expected of second year educators involved in the project.

Other results presented indicate that Mrs. B's second year of course implementation presents several incremental improvements over the prior year, and her own reflective practice translated into more organized course implementation. Mrs. B's students created games that were quantifiably more advanced than first year educator Mr. L, as measured by our coding scheme. This finding is sensible given the educators' experience, and lends credence to the validity of our content analysis approach

(however we must be cautious in attributing causality to educator experience alone, as other factors such as those listed in the bullets above served as differentials).

Overall, this year's SRMS case study reveals quite important new evidence in Year 3 that Globaloria is achieving systems-oriented thinking in both educators and their students across time in the pilot, as the disparate activities designed to cultivate the range of CLAs become more cohesively linked in the context of the course delivery, and thus become more integrated in the resulting game design. From observation, it does appear that the engagement in the range of activities designed to cultivate each of the CLAs contributes to the holistic learning and game design outcomes of students. This finding needs to be further explored in our ongoing design-based research agenda.

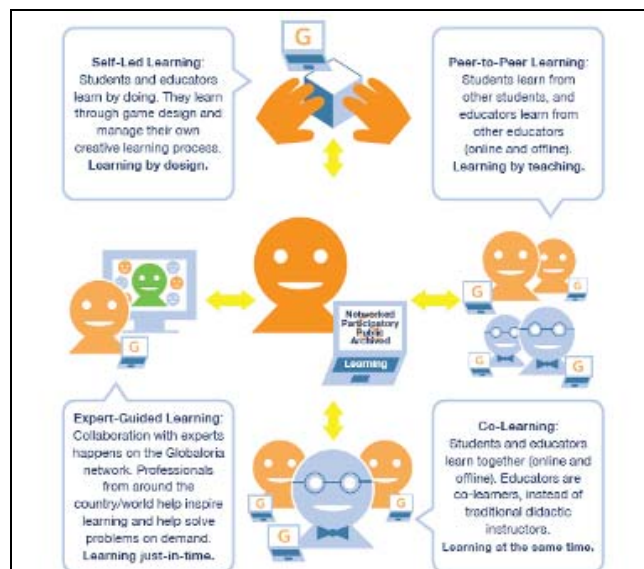
## Introduction

In 2006, the World Wide Workshop Foundation in NYC established the *Globaloria* network. The Globaloria program's broad mission is to help close the digital-literacy and online participation gaps that exist in the United States (and worldwide) by empowering young people in disadvantaged communities 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 is being offered daily in public schools throughout the state as a year-long elective game design course, for credit and a grade.

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. 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 involves students and educators throughout this state in participation 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 3 (PY3), the number of project participants doubled, to involve 68 educators and 534 students throughout West Virginia. Twenty-two PY3 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 social media capabilities. Specifically, 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 21<sup>st</sup> Century skills development (e.g., Joseph & Edelson, 2002; Hidi & Renninger, 2006). Further, at some locations 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. And at other locations, students create games about core curricular topics such as math or science. To-date, students in our program have chosen to create games that reflect topics in the following genres: a) educational games about core curricular topics (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 entertainment (for example, a fantasy game about ninja pandas).

## **Purpose of this Study**

This paper reports findings from Pilot Year Three (PY3) 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:

- How are student participants in the Globaloria program learning game design, in the context of the co-learning model?
- To what extent did middle school students develop new skills and learning abilities through their participation in Globaloria in Pilot Year 3 (2009/2010)?

This question is addressed through analysis of two case study students, Tegan<sup>1</sup>, a 13-year old 8<sup>th</sup> grader, and Billy<sup>1</sup>, a 12-year-old 7<sup>th</sup> grader, who each 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 over the past four 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 informed development of one of the first Internet companies with web services for children (MaMaMedia, Inc.), founded by Harel Caperton.

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, while developing

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<sup>1</sup> Student names have been changed.



deeper knowledge and understanding about the subject domain of the artifact than that elicited by more instructionist, top-down types of lessons (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, 1998, p. 5).

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 (1998) 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 1 outlines the 6-CLAs and some examples of activities in Globaloria that are designed to cultivate these abilities. Their development and conceptualization is presented 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:
<b>1. Invention, progression, and completion of an original digital project idea</b> (e.g., an educational game or simulation in the Globaloria context)	<ul style="list-style-type: none"> <li>Choosing and researching a subject for a game design project</li> <li>Writing an original game narrative and a proposal to explain the game’s purpose and main subject</li> <li>Programming and completing a final game</li> </ul>

**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 can be achieved in an integrated way through constructive, project-based activities that engage learners in a wide spectrum of technology uses. We will address results in the context of this framework.

## ***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, and provide immediate benefit to disadvantaged students. The U.S. state of West Virginia has a lower median household and per capita income, and higher poverty level as a percent of the population in comparison to figures for the nation as a whole. 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 twenty-two participating Pilot Year 3 schools was Sandy River Middle School (SRMS) in Avondale, WV, one of three public middle schools participating in this year. We chose this exemplary middle school from among the three as a focus for the case study, in part because 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. Additionally, the school is in its second year of implementation, and it is being conducted in a highly organized manner by the lead educator, Mrs. B. Last year, the students were all 8<sup>th</sup> graders. This year, the school added a second group (the 7<sup>th</sup> graders). Repeat educator Mrs. B taught the new 7<sup>th</sup> grade class this year, and a new teacher in his first year, Mr. A, took on the 8<sup>th</sup> grade class (also comprised of a new set of students).

Demographics of the pilot community as of 2007 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 2009/2010 school year. The class was held daily in a PC computer lab, meeting five times per week, 82 minutes per meeting. Fourteen 7<sup>th</sup>-grade students and thirteen 8<sup>th</sup>-grade students worked in teams to create their game projects. This was the second 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 learned through interaction, sharing and collaboration with their peers in class as well as students at other locations, via communication on the wiki.

## **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 3 games, providing a numeric evaluation value 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 (June)

- Wiki posts (including text, video, game design files, graphics files, Flash project files, code);
- Blog posts

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 across time, certain longitudinal trends and findings emerged for each.

Chronologically, Semester One data sources used were as follows.

**First Half of Semester One (September/October, 2009):**

- First Educator progress report (September, 2009)
- 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 2009 - Early January 2010):**

- Second Educator progress report (December, 2009)
- 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 2010 – Early March 2010):**

- Third Educator progress report (March, 2010)
- Student Wiki activity and blog posts for this timeframe

**Second Half of Semester Two (Late-March 2010 – June 2010):**

- Fourth Educator progress report (June, 2010)
- Student Wiki activity and blog posts for this timeframe
- Students' post-program survey responses to 9 open-ended questions

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.<sup>2</sup>

### ***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. A primary individual goal of the program is to facilitate students' construction of a final digital interactive game artifact, and there are qualities of the games that can be analyzed and measured. The medium itself (the game design and functionality) is considered part of the message.

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.

The coding scheme measures two main domains of expertise, as reflected in students' final products in the form of both the SWF and FLA file. The first focuses on certain Actionscript codes that have been chosen to align with the game design course curriculum/syllabus assignments, to represent a reasonable set of attributes that we can expect students to have incorporated into their game after a full year of participation. The scale is 0=not present, 1=present. This can be used as a proxy variable for "knowledge" in our datasets (noting with qualifiers all the limitations of evaluating digital, collaborative project-based work as an assessment of student knowledge assessment). The second focuses on design attributes we expect to see in student games. There are four sub-categories: Visual and sound design,

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<sup>2</sup> In Pilot Year 3 we did not conduct site visits and thus rely upon the actual work they produced and posted online to the Wiki environment as data sources.

game play experience, concept development, genre, and multiple codes within each category. The scale is: 1=Not present / insufficient representation; 2=basic / introductory representation; 3=well-developed representation.

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 CLAs 1 and 2. Two coders reached inter-rater reliability statistics of Kappa >.75 ( $p < .001$ ) across four coding categories. 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. We use the quantitative content analysis results for the games created by our case study students to report overall programming achievements, and, to compare the results in relation to the mean achieved for games created by all students in each of the two classes.

## Results



### **Case 1: Tegan**

Globaloria-WV case study student Tegan was a 13-year-old 8<sup>th</sup> grader at SRMS during Pilot Year 3. Like all SRMS students, she participated for the full 2009/2010 school year. Tegan's class was one of two classes at SRMS in which Globaloria was offered. The 7<sup>th</sup> grade class focused on civics games; Tegan's 8<sup>th</sup> grade class focused on creating games specifically about math.

Regarding her career interests, Tegan stated in the pre-survey she hopes to go to college to become a forensic scientist. In her pre-survey response, Tegan explained her initial interest in Globaloria:

*I decided to do this because the teacher made it seem like a challenge and i would love to have a class that pushes me to do my best. I hope that I make a game that teaches and one that people want to play!*

While expressing enthusiasm at getting started, Tegan's earliest blog posts also show a degree of anxiety about sharing of games and in-progress work, echoed in past case studies, especially other girls whose progress we have charted. The post indicates that she is thinking about the game's audience from the beginning of its development.

*9/2 "I am a little bit scared about how peoples reaction will be to my game. I am worried that people will be judgmental of my game like they are to people on the first day of school. I want people to be like I love Tegan's game. And people from last year didn't really talk that much about the games that were made. But so far Globaloria has been a blast!!*



Tegan reflects some apprehension and a wish for approval and acceptance from her peers. She links this approval to her game design achievement. While presentation and sharing is a part of the learning process, it is not for the purposes of being judged and approval gained, but rather for knowledge sharing and modeling to occur in the context of the creative activity. It appears from Tegan's case that prior to Globaloria, some students may automatically associate the sharing and presentation with judgment and approval of others rather than process-oriented learning and self-fulfillment and personal creativity and vitality; the extent to which this perception changes over time is one area for exploration. Overall, from the beginning of her participation in Globaloria, Tegan emerges as a motivated and ambitious student, who actively seeks out opportunities and resources in order to gain concrete technological skills.

## **Instructor's overview of his own progress and class progress, Semester One**

Below we provide an overview of the game design units covered by students during Semester One of Pilot Year Three among Mr. L's 8<sup>th</sup> grade class. The table below also includes Mr. L's comments and reflections on the class progress for each quarter. These notes provide useful context for the emergence of Tegan's case, reported below. Overall, his initial comments reveal his own beginner status, learning alongside of his students in the co-learning model. These comments indicate a likelihood that students engaged in a significant amount of their own inquiry and use of online tutorials and resources available through the wiki syllabus, as they engaged in the class during Semester One with their novice educator.

Table 3. SRMS Syllabus Topics by Quarter, and Mr. L's Aligning Reflections

<b>Timeframe, Syllabus Topics and Tutorials Covered</b>	<b>Selected Reflections from the Educator on Class Progress</b>
<b>First Quarter:</b> Late August – September 21, 2009 Playing to Learn Choosing a Topic	When reflecting on our summer academies a few things come to mind, learning flash, adding gadgets to blogs, and creating wikis. These were all great personal learning experiences for me. When I first saw the bunny game I was thinking well this is not much. After putting action script to it, my opinion about the game changed. Learning flash was/is a great personal learning experience. Learning to add gadgets to blogs really make blogging more fun and interesting. It makes it fun for the educator and makes it a lot easier to sell to the students. Many of my students add a music player to their blog. At first they were not interested in blogging, but after showing them they could add music they were immediately hooked. I am excited to still learn more about programming in flash.
<b>Second Quarter:</b> October 1 – December 14	As I stated in the first quarter progress report, Globaloria continues to be a great learning experience for me. Even though I worked on the mini game

Imagining Your Game Paper Prototyping Planning Your Game Drawing in Flash Adding Navigation Adding Animation Adding Sound Adding Interaction	project in the summer, I still learned new things this time around. Creating the button did not come easy for me. I had to work through creating it a couple of time before I got it working correctly. It was fun, but also flash can become very tedious at some points. While working through the adding navigation I really became a little confused. Trying to go from one scene to the next I thought was very difficult for me. I have found lots of new learning experiences for me in the second quarter. The first quarter was really just a refresher course from the summer, but there in the last few weeks we have dug deep into flash.
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## **Tegan's Participation in the First Semester of Game Design: Late August to December 15, 2009**

In the first quarter of the academic year (from about August 27, 2009 – October 1, 2009), Tegan joined the team “~Frosted Loops~,” which also included team members Bobby and Nathan. Tegan’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, Tegan completed all of the assignments under these curriculum topics, as evidenced on the wiki.

Tegan and her team worked together on a game called “Frac Man,” with a goal of teaching fractions to elementary school children. Tegan repeatedly emphasizes wanting to use her game to help others learn math. For instance, on 9/2 she states,

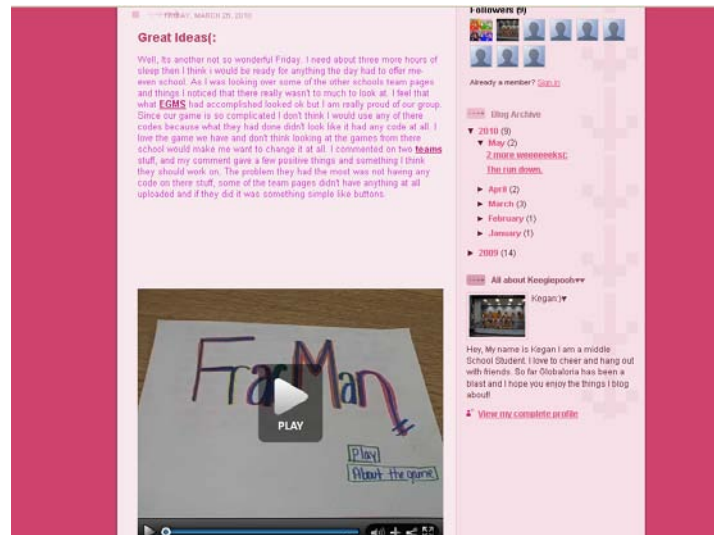
*“ Hopefully my game will succeed in helping kids ... by educating them about what you will need for math class... When I was first in middle school i needed alot of help with fractions so I am wanting the game to be about fractions and everything there is to learn about them! “*

While some students used blogs only as much as was required, Tegan created a blogroll, linking to each and every blog for the students in the class. She is quite reflective in her blog content; more so than other students. On 9/22 she reflects further on her game ideas.

*I want to learn how to make my game better then last years by learning all I can from my wiki page. I would like to make my game about problems I had when I was younger in class. I would really like to make the game focused towards up coming sixth graders to help them when they first get to middle school. But I want the game to be focused in there math journey because thats what i had the biggest problem with.*

A learning log entry on the wiki from September 22 (in which students itemize their tasks completed) asserts, *"I think this is my best blog so far. Each time I do a blog i think it gets better and that makes me look forward to the next blog!!"* This post indicates that Tegan appears proud of her blogging efforts.

Figure 3. Screenshot of Tegan's blog



## Frosted Loops' Game Pitch

The Frosted Loops' game pitch posted on the wiki is as follows.

*Audience: We are designing the game for elementary kids because they sometimes struggle with fractions.*

*Game Play: You get to choose between fracgirl and fracman. The game is a little bit like pacman and You have a question and u go through your maze and find your answer. If you get your question wrong then you go to a different page and you have to answer three questions to get back into the game.*

*Fun Factor: Getting to play in the maze and collect points is the fun factor of our game.*

*Smart Factor: Our game is about fractions. They can learn almost anything playing out game that they will need to know about basic fractions.*

*Style Factor: We will use alot of mazes and we will use alot of animated sounds.*

*Originality Factor: Our game is special because we are the only group that uses fractions while making a game.*

*Team Introduction: Tegan Nealen- Team manager, Bobby Dotson-Flash Coder and sound person, Nathan Baker-Artist*

In this early phase of planning, Tegan (the only girl in her group) identifies with the role of team manager. The two boys take on the role of Flash coder and graphic designer. It is interesting to note that Tegan gravitates towards a less technical team role at the beginning. This finding parallels observations from past years of early team dynamics, in which girls are initially somewhat tentative about programming, expecting they will engage in less-technical team roles when partnered up in groups where their other team members are boys.

### Paper Prototype

Posted on November 3, Frosted Loops' paper prototype digital video explains the key components of their game. The team explains while leafing through paper images of their game plan that the purpose of the game is to teach fractions. Players select a character "FracMan" or "FracGirl" and then navigate a maze, attempting to avoid ghosts and earning points by moving over colored dots. At the top of the screen, users will see a fraction, and by navigating to the reduced fraction, a user proceeds to the next level. If the wrong answer is chosen, the player is directed to a quiz of math fractions. Having answered the quiz correctly, the user can return to the game. With each level, different math games involving fractions are required, including multiplication and mixed numbers.

**Figure 4. Screenshots From Paper Prototype of "FracMan"**



FracMan shows playfulness in its use of iconic videogame imagery – PacMan – applied in an educational capacity. This integration of a pop culture reference reflects today's remix culture among young people.

Mashing up pop themes in a collage-like approach is a natural choice for young people when given the opportunity to create their own media objects. In turn, the emphasis on math and fractions demonstrates Tegan's wish to help younger middle school students with a subject that she has identified as challenging.

Mr. L's comments on Tegan's first quarter performance remark on Tegan's development of a number of skills in the first months of Globaloria, including technological familiarity with Flash, a comfortable knowledge of blogging and a sense of dedication to her project:

*Tegan has learned to upload images, change font and background colors, and add videos. Tegan has really enjoyed her blog. She has added a music player. She also adds links, images, and videos to each blog. Tegan has added her whole class to her blog roll. Tegan works hard and spends extra time in the evenings and over the weekend working on the computer. I am confident she can be a programmer.*

### **Tegan's Role as Team Manager**

As team manager, Tegan's responsibilities involve tracking individual project assignments and monitoring the group's progression. Tegan's dedication to her team is evident from as early as September 7, where in a learning log entry, she writes:

*Today I am going to have to after school to finish..My group really seems to be struggling with this...But we are pulling together and helping each other out!!*

Showing a willingness to stay after school to complete assignments so early in the semester suggests that Tegan is determined to keep her team on task and on schedule. It also portrays ~Frosted Loops~ as a group that demonstrates collaboration. Tegan further discusses her perspective on teamwork in a September 11 blog post, writing:

*Sometimes when you can't use the calculator your teacher will allow you to be with a partner. I really enjoy working with a partner or group because you get to see what your classmates know."*

Tegan's comments on teamwork are in the context of math courses, but it illustrates her positive view of teamwork in a class setting (in contrast to more introverted students), which may contribute to her abilities as team leader. She also expresses a real interest in becoming familiar not only with game design but with other technological practices embedded in the Globaloria curriculum, stating on 9/25 in another blog post,

*9/25 This class has so far provided alot that nobody else knows how to do. We get to us flash and we get to blog and alot of other stuff people thinks is boring. But this class is so much fun. Its opened my eyes to see that this is actually the most interesting class I have ever taken.*

As the semester progresses, the game develops and the team roles solidify. As team manager, Tegan appears very aware of the responsibility of bringing disparate opinions, ideas and skills together into a coherent group. On 10/22 she writes in her blog,

*My role in the group is a project manager. So far i think i am pretty good at the job. i help people when they need help and I think i usually keep the group on track. The only thing i am worried about is negative comments. I know how hard we work and I would hate for somebody not to like the game that we are working so hard and putting a lot of time into. Our inspiration for the game was actually another game, pacman. I really like the game and the other ones in my group did to so we wanted something kinda close to it.*

Tegan references the extent to which peer feedback is a part of Globaloria game design class, which is quite new to students. She expresses some anxiety again about sharing of in-progress work. Her repeated references to her group (signified by the use of “our” and “we” pronouns) indicate team cohesiveness. Later on she also states, “I also don't like when my group is working against me instead of with me.” This comment indicates the tensions that can emerge within group work, to which Tegan was particularly sensitive as group manager. Tegan seems to find this role both rewarding and challenging, and seems to take her responsibilities very seriously.

Whereas Tegan’s blogs tend to be fairly upbeat and positive, her learning logs occasionally reflect some of the more frustrating aspects of game design (it should perhaps be noted that even when expressing frustration, however, Tegan ends every single learning log entry with a smiley face). In the specific context of learning how to make buttons in Flash, Tegan reported in her learning log on November 12:

*I am so confused..The work i do in here never seems to pay off....*

Like a number of students, Tegan finds the coding aspects of game design to be a challenge, and although she excels at blogging and tracking her assignments, she finds specific tasks like learning buttons to be a frustrating experience.

### **Self-Reflection About Learning**

Throughout the semester, Tegan’s team focuses on developing Fracman, and on 11/13, she begins to reflect upon her team’s learning in a blog post. Interestingly, she takes a critical stance towards the practice of team members’ adopting of specific roles, because to her it appears some team members miss out on programming learning opportunities as a result. She states,

*There is always work to be done in this class. When we first started off my group has so many ideas and all wanted our individual ideas in the game. We have all come along way and made our outline for the game. We have a lot to our game that makes it different from other peoples. We use flash for everything in this class, but none of us were really good at it. Recently my whole group learned how to make our images and stuff more realistic and we also learned how to*

*make out buttons. I think the thing my group struggles with the most is learning things together. I have noticed that usually only one person from the group knows how to do it..To be honest I don't think its fair so I talked to my group and we are all going to try to put more effort in to our learning.*

It appears from Tegan's comments that not all students in the class engage in the full range of practices in Globaloria that are meant to cultivate the 6-CLAs. By adopting team roles, students may close themselves off from learning a full range of practices in the class. Tegan demonstrates an ability to oversee and reflect on her group's progress in her position and role as team manager. However, she reacts somewhat negatively to such role-taking practices, and takes it upon herself to encourage all of her group members to learn how to constructively use technology and learn to program the game. This finding is important. It appears that all students do not gain the same set of skills in this diverse learning environment, largely due to an emphasis on role-taking. It also appears that the autonomy and openness of the setting allowed Tegan to observe and articulate a critical stance towards her group's learning process, and make the adjustment in dynamic necessary to mitigate the problem she observed.

It is unclear whether discussion among the class or with Tegan's instructor influenced her team's decision to encourage all group members' learning of Actionscript. Globaloria holds the full range of CLAs as learning objectives. It may be that in program implementation, we need to develop training addressing teachers' encouragement of student teamwork and role-taking, while at the same time, also guiding and scaffolding students towards individual mastery of a full range of practices reflecting all of the CLAs.

### **Continued teamwork processes**

Tegan's thoughts about working as a group evolve as the class progresses, and in her blog, she writes honestly about her thoughts on the members of ~Frosted Loops~.

*12/1 When we first started off in this class I was not happy about who my group was but, as the year has gone on I have really started to appreciate them(: Both of my team mates have strong and weak points. But I have noticed that when one has a problem the other can fix it! Some of the other teams still complain about there group but I don't think i would trade mine if I could(:*

A series of December learning logs provides further insights into team interactions. On December 2, 3 and 8, Tegan mentions getting help from or working with her teammate Bobby on specific Flash tasks.

- *I also watched the adding navigation movie with Bobby!*
- *I need to get Bobby to show me how to make my shape move*
- *Bobby helped me add the sound because what ever i was doing was not right at all.*

Bobby's role on the team is the flash coder and sound person. These learning log entries show a determination to learn how to code from her teammates who have already learned a specific skill, in keeping with her learning reflections recounted above.

Mr. L's comments about Tegan's performance in class suggest that she is particularly driven in Globaloria, even compared to her work in other classes. He states,

*Tegan is a member of the Frosted Loops and they are creating a game on fractions. She is definitely the team manager. She keeps both of her team members on task and busy all of the time. Tegan has been another joyful surprise as I think she works above and beyond what she does in other classes. She completes her units and enjoys blogging. She helps everyone in the class as she spends extra time working at home. She has done a good job on all of the units. Her projects page is one of the best for all of my students. She is a great student to have in this class.*  
Grade A

Mr. L's comments on Tegan's dedication and willingness to help others suggest that the qualities she has developed in the course of her responsibilities as team manager in fact extend beyond her individual team to the class as a whole.

### **Summary of fall semester activity**

From the start of the class, Tegan offered her team a sense of leadership and motivation, working to keep them organized and on task. Tegan also develops technological proficiency through her own project-based work. This can be seen in the organization of her blog, where she makes a point of adding classmates to her page and commenting on other students' blogs, including students in other classes throughout WV. Tegan's programming and coding skills begin to develop as well during this initial timeframe.

### **Instructor's overview of his own progress and class progress, Semester Two**

In his Q3 and Q4 progress reports, Mr. L indicates that in this later timeframe, Actionscript programming became the emphasis of the class. He discusses his own progress and challenges learning Flash, and notes in particular the way in which students and educator continue learning together. He references his own and his students' anxieties while learning, but in his summary of the 4<sup>th</sup> quarter his post evidences a pride in his students' perseverance. He also references his students' growth in their comfort speaking in public, discussing and presenting their works in progress.

Most interesting is his observation that this is "a unique class," referring to this mix of students it seems. This comment mirrors the reflection of another first-year educator in one of our previous case study reports, who also attributes the success to the makeup and composition of the group. *Here we pose the question – is it really the students who are unique, or is it the vastly different approaches to pedagogy*



*that are being conducted in Globaloria, that elicit unique student outcomes, and that bring about a greater appreciation in the teacher for the transformation and change that are possible among his students (and love of teaching) as a result?*

Table 4. SRMS Syllabus Topics by Quarter, and Aaron X's Aligning Reflections

Timeframe, Syllabus Topics and Tutorials Covered	Selected Reflections from the Educator on Class Progress
<p><b>Third Quarter:</b>  December 15 – April 10  Assembling the Game  Presenting Your Game  Development Plan  Intro to ActionScript  Programming Practices  Learning From Others  Finding Solutions  Moving on a Path  Special Effects  Scrolling Background  Score Keeping  Collision Detection  Sound Effects  Timer  Character Effects  Drag and Drop  Platforms  Running, Jumping, Etc.  Coding "Enemies"  Testing and Debugging  Publishing Your Game</p>	<p>During the third quarter a lot of flash work took place. I feel that I have learned a lot about flash, but still seemed overwhelmed at times. I have worked through some of the assembling your game topic and learned a lot about that. Combining our files on the Assembling your game unit was the biggest struggle we have had so far. That took a lot of work from the class as well as me to help each other make it through. I was very pleased with my student's game presentations. When they presented to the Globaloria Team, Mr. Campbell and Mrs. Lusk attended as well. Considering all of the last time, my students have progressed. Most of them have their scenes created in flash. We need to get the interaction and movement working and they will be on their way to a completed game.</p>
<p><b>Fourth Quarter:</b>  April 11 – June, 2010</p>	<p>During the fourth quarter my students worked extremely hard to complete their games. I saw students work more collaboratively than any other time this year. They were all excited to complete their games; therefore student motivation was at its highest point. I also saw more anxiety during this quarter. I am proud of all of my students. They worked really hard. Our final presentations went really well. One thing that has come from this class is that my students do not get nervous speaking in front of people now. I also had 2 teams that competed in the STEM competition, I wish them well. This was a unique class. One thing I can say about this group is</p>

	<p>that they taught me a lot when working with flash. Working with blogs and wikis has taught me a lot of other ways to capture the attention of students. I worked a lot with flash, and learned an enormous amount scripting throughout the year. I was working myself to death in the early stages of the year. I found out that while we were working on tutorials together, the students would often understand before me and they would then teach me. I started with creating a buttons, and now help with making FracMan move around the scene. I was looking at the end result and thinking my students didn't progress as they should, but what I have found is that not only myself, but my students learned so much this year.</p>
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## **Tegan's Participation in the Second Semester of Game Design: Dec. 15 – June, 2010**

Throughout the winter, Tegan and her fellow teammates continue progression of their game. She posts several times on her blog in this timeframe. She reflects further on the math content of the game on 12/18, stating,

*Can math Games be fun? When this question is asked I would usually say NO! But the reason I would say no is because I really don't like math at all. When I play some math games on FunBrain they can be alot of fun. I think the games that are fun usually have a math question then a fun thing to follow. As my blog readers already know I am not a fan of math and I really don't think there is anything that can be done to make it anymore fun.*

While at the start of the school year Tegan states that math is a challenge, it is only here that she remarks that she doesn't actually like math (but she likes FunBrain math games). In their final game, the Frosted Loops team adopts the specific game mechanic she mentions here that she does enjoy (that is, fun math games' offering a math question then "a fun thing to follow"). It may be that while she expressed some negativity about math here, her reflection in the blog post contributed to this chosen technique in their own game.

Mr. L. continues to provide positive feedback about Tegan's performance in his third quarter evaluation of her progress:

*Tegan is still one of the very first students to finish a lesson. She is willing to help others on her team as well as other teams. She is still one of the top Globaloria students in my class. She attends school regularly and keeps up with all assignments. Tegan is leading her team well. In my opinion, the frosted loops are making more progress in the game development more than*

*any other team. Tegan and her teammates are doing a great job in designing their game. The Frosted Loops are making a lot of progress on their game. They have every scene created in flash. They will also need to add a scorer and timer for each level. Grade A*

### **Interaction with other classes and schools**

With multiple classes participating in Globaloria, Tegan and her classmates are able to learn from students in other classes as well as her own. Tegan discusses this inter-class learning in a March 2 blog post in which she discusses watching the 7<sup>th</sup>-graders' civics game presentations.

*I have learned a pretty good bit from the 7th graders so far. We watched them about two weeks ago and it looked pretty difficult. I learned that you have to share turns with others before the end of your power point. And if you don't then you will get points taken of your grade. I really like working on power point So this was a fun topic to do.*

Tegan's response to watching the other (younger) students' presentations includes an assessment of their public speaking and teamwork, both of which will come into play as Frosted Loops begins to prepare for their upcoming final presentations. In addition to watching presentations of other classes at SRMS, Tegan's class also looked at games from other Globaloria schools such as EGMS. Tegan addressed this process in her blog on March 26.

*I feel that what EGMS had accomplished looked ok but I am really proud of our group. Since our game is so complicated I don't think I would use any of there codes because what they had done didn't look like it had any code at all. I love the game we have and don't think looking at the games from there school would make me want to change it at all. I commented on two teams stuff, and my comment gave a few positive things and something I think they should work on. The problem they had the most was not having any code on there stuff, some of the team pages didn't have anything at all uploaded and if they did it was something simple like buttons.*

This post indicates the network effect potential of Globaloria, as the program scales and the opportunity for cross-location interaction among groups is expanded. For Tegan, looking at other teams' games allows her to compare FracMan in context of her peers' achievements, noting areas where their work exceeds that of other locations. While not a main focus of the program currently, it appears that this kind of occasional review of other schools' work and comparison could lend to a level of constructive criticism, and, competition, among schools.

### **Final work**

With deadlines approaching, FrostedLoops continued to develop FracMan, and Tegan's role as team manager brings her organizational and social competencies to the forefront. It grows increasingly clear as the year winds down that addition to her responsibilities as team manager, Tegan also has become an active contributor with game coding. Tegan reports integrating a number of distinct programming skills into her team's game, indicating that she did not simply oversee the work of her two male team

members (who both identified initially with more technical roles) -- she became directly involved in the coding. On 4/16 she posts in her blog,

*Doing my game has many ups and downs. The main thing I run into that stresses me out is forgetting to add key-frames or forgetting to rename things in my code. My game includes the mini game code and I also used the code that we used for buttons to go different places. I think the best part of our game will probably be collecting the fracdots. I really can't wait to see the finished product of our game, im soooo excited.*

Tegan's final blogs read like to-do lists of coding tasks. For example, on 4/23 she writes,

*So, I guess i should start of by saying that we have got so much done with our game. So far we have got level one done, and our fracman can move and it keeps score. But right now i still need to go back and add code to make our fracghost move around. I also need to make the out lines for my game walls so my fracman will not travel all around he will have to work for what he want.*

Overall, Tegan's sense of accomplishment in the closing weeks of the school year appears directly related to her sense of expertise with Flash.

In terms of teamwork, in her role as team manager, Tegan demonstrated a sense of anxiety about meeting deadlines, particularly as far as keeping the group on track for completing assignments. On 4/23 she also notes,

*I love my group more then anything but I really need there help with all the dead lines coming up here soon. I would love for my team to step up and show me that they want to have the best game and that they want to work hard and have something to show for it.*

On 5/11 she hints at the end of her post that she seeks a modicum of recognition for her appropriation of the programming role.

*I have everything ready like on the demo skeleton but I completely re-did it so it would look better. The only thing i wish was different about it is the coding. It took me like 3 days to get all the buttons to work and my instance names to work as well so i could do the hit test. Now my fracman is working and keeping score. I am so excited to see how all my stuff will come together for tomorrow. I hope my team makes Mr. Lester proud we(i) have really worked extremely hard.*

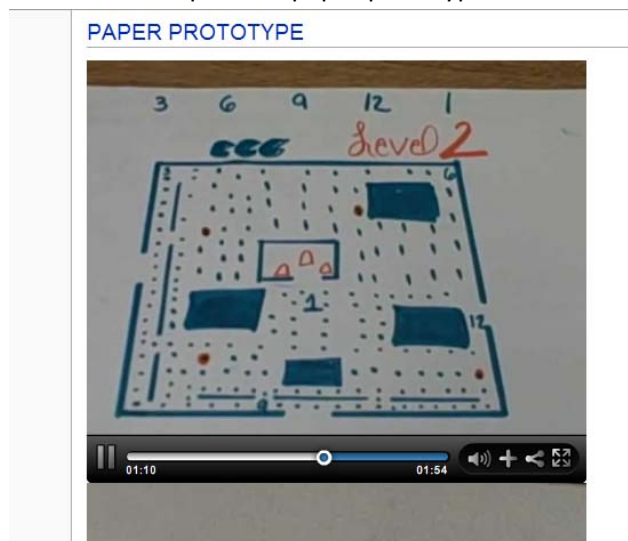
Similar to previous findings in our case studies of motivated female Globaloria participants, Tegan appears to step into a primary role as programmer at the end, in order to complete the work when her fellow students are less responsive.

## Final Game Presentation

At SRMS, students were responsible for creating a final presentation for the class, which was also delivered via web-conferencing to members of the World Wide Workshop Foundation team. In the recorded web conferencing session posted on the wiki, the viewer sees screenshots and visuals of the team game on a computer screen, and hears audio of the team members describing the game and their process. Tegan and Bobby present their game to the team; the Frosted Loops' third member, Nathan, was unable to attend class. Although Tegan and Bobby take turns presenting, Tegan is the more confident speaker in the video, and presents for longer periods of time than Bobby. The Frosted Loops' presentation consists largely of working through the team's wiki page, as they explain the game pitch and key concepts. Tegan and Bobby take turns explaining the main features of FracMan, the progression of levels and educational components.

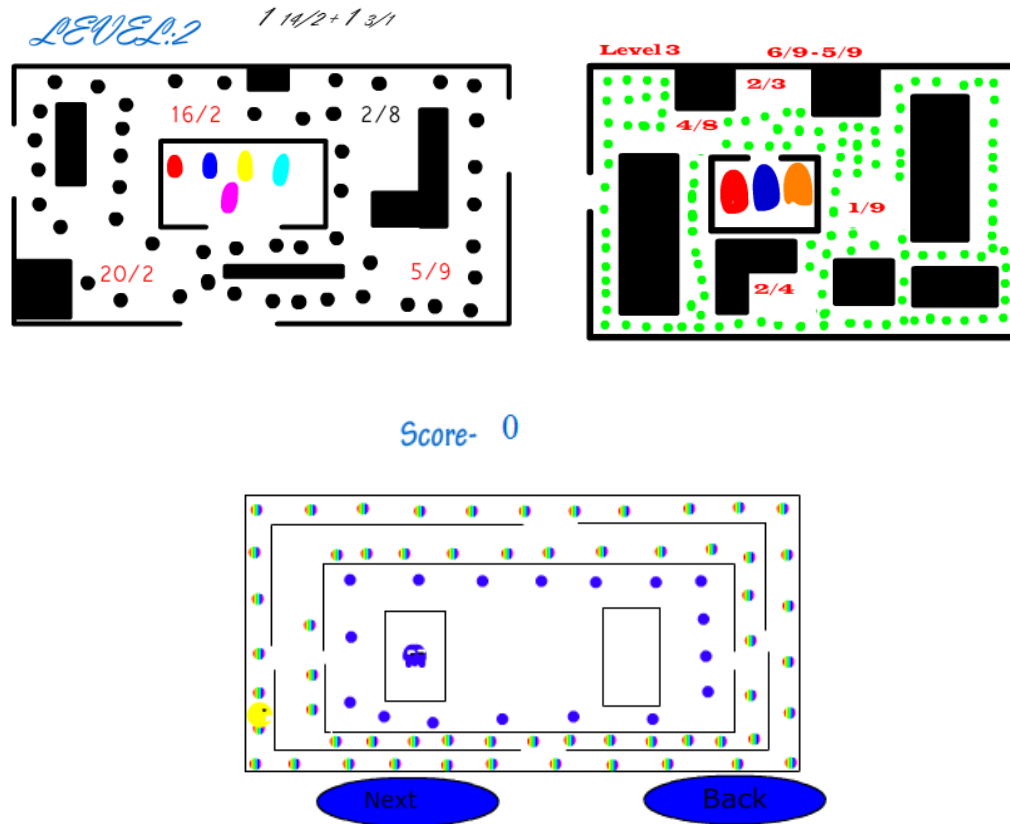
Screenshots of the game in relation to the paper prototype are presented below. A player selects between FracMan or FracGirl. The first level shows a familiar maze screen, with a fraction at the top. The player must properly perform the fraction-based math problem by navigating to the correct answer among several fractions throughout the maze. While the figure moves throughout the screen, points can be earned by moving over colored dots. With each level, the maze offers more and more dots for players to gain points. Although some features of the game do not function perfectly, the team's game does present a working game. Overall, the game incorporates basic math skills into a functioning game that has interactivity for the player.

Figure 5. Frosted Loops team paper prototype video screenshots



## Game Scene 2: level 2

## Game Scene 3: level 3



In her final blog post for the class, Tegan describes the final presentation and her sense of accomplishment with her team's achievements.

*5/14. We had our "final" presentations Wednesday, it was crazy. We had so much to do before the actual presentations. We actually worked all of Wednesday morning until our presentation took place. When it was finally time for my team to go up I was actually a little bit scared that they wouldn't like the game as much as we wanted them too. We have worked so hard and really wanted them to see that. When they finally told us there comments it felt as if 100 pounds had be lifted form my shoulders.*

Mr. L's final evaluation for Tegan states,

*If I had to give an award out for this course it would go to Tegan. She worked so hard on her game and completed a lot of flash. She had her FracMan moving throughout the stage using the arrow keys. The most tedious coding that was completed this year was by Tegan. She had to write a code for every frac dot on her stage. She worked extremely hard on completing her*

*team's game. I am just in shock of how hard she worked and how well she worked as a team leader. Grade A*

### Content analysis evaluation of FracMan

The table below presents the content analysis evaluation of the Fracman game created by the team Frosted Loops. The development of the coding scheme and our content analysis approach is discussed in the Methods section above.

Table 5. Content analysis results for Fracman, created by The Frosted Loops

Game Functionality and actionScript Proficiency: For the following codes, please indicate the presence or absence of the following Actionsript (0=not present, 1=present) NOTE: students include AS on or in objects, as well as timeline. Need to review all code. Using FIND feature can help.				Fracman
<b>Events – items that trigger code to execute</b>		*Must look in FLA code to detect		SWF: <a href="http://www.myglife.org/usa/wv/srmswiki/images/c/c6/Thenewgame.swf">http://www.myglife.org/usa/wv/srmswiki/images/c/c6/Thenewgame.swf</a>
CATEGORY*	How it looks in the game file	FLA Code	related syl. topic	FLA: <a href="http://www.myglife.org/usa/wv/srmswiki/images/a/af/Thenewgame fla">http://www.myglife.org/usa/wv/srmswiki/images/a/af/Thenewgame fla</a>
roll over/roll out	when you place the mouse over or move the mouse off of an object without pressing, does something happen?	Symbol.onRollOver **or** Symbol.onRollOut	<a href="http://myglife.org/usa/wv/rtcwiki/index.php/Code_Library">http://myglife.org/usa/wv/rtcwiki/index.php/Code_Library</a>	0
Button presses	when you click a button on the screen, does something happen?	myButton.onPress **or** myButton.onRelease	<a href="http://myglife.org/usa/wv/rtcwiki/index.php/Code_Library">http://myglife.org/usa/wv/rtcwiki/index.php/Code_Library</a>	1



hit test/collision detection	When two objects on the screen overlap or collide, does something happen (such as points gained/lost, color change, etc)	Symbol.hitTest(other Symbol)	<a href="http://myglife.org/usa/wv/rtcwiki/index.php/Collision_Detection">http://myglife.org/usa/wv/rtcwiki/index.php/Collision_Detection</a>	1
key press	does something happen when you press the keys on the keyboard (like the arrow keys)	if Key.isDown(Key.NAMEOFKEY) {effect of key press}	<a href="http://myglife.org/usa/wv/rtcwiki/index.php/Adding_Input_I:_Keyboard">http://myglife.org/usa/wv/rtcwiki/index.php/Adding_Input_I:_Keyboard</a>	1
on enter frame *	(will have to check the fla and code)	onEnterFrame = function() { continuous looping code }	<a href="http://myglife.org/usa/wv/rtcwiki/index.php/Score_Keeping">http://myglife.org/usa/wv/rtcwiki/index.php/Score_Keeping</a>	1
timer *	does this game have a time limit or do certain things happen at timed intervals (you will have to check in fla for the latter)	setInterval ***or*** getTimer();	<a href="http://myglife.org/usa/wv/rtcwiki/index.php/Timer">http://myglife.org/usa/wv/rtcwiki/index.php/Timer</a>	0
<b>Additional code commonly found in games</b> (0=not present, 1=present)				
drag and drop	can you click and drag a symbol to move it and the release the mouse button to drop it?	Symbol.startDrag(this ); ***and*** Symbol.stopDrag();	<a href="http://myglife.org/usa/wv/rtcwiki/index.php/Drag_and_Drop">http://myglife.org/usa/wv/rtcwiki/index.php/Drag_and_Drop</a>	0
dynamic text or input text	Dynamic Text (e.g., score counter): the text changes depending on your actions--might have to find in actionScript to ensure it's dynamic text. Input Text: you can type text into a text field.	Dynamic Text: textBox.text = "Your Text Here";    Input Text: output = input; or, .htmlText	<a href="http://myglife.org/usa/wv/rtcwiki/index.php/Text">http://myglife.org/usa/wv/rtcwiki/index.php/Text</a> , <a href="http://myglife.org/usa/wv/rtcwiki/index.php/Score_Keeping">http://myglife.org/usa/wv/rtcwiki/index.php/Score_Keeping</a>	1

preloader	is there a preloader before the game appears?	<pre> var total = this.getBytesTotal(); this.onEnterFrame = function(){ loaded = this.getBytesLoaded() ; percent = Math.round((loaded/ total)*100); preload_txt.text = percent+"%"; mask_mc._yscale = percent; if (loaded &gt;= total) { this.play(); delete this.onEnterFrame; //gotoAndPlay("stLyn n") } } </pre>	<a href="http://myglife.org/usa/wv/rtcwiki/index.php/Preloader">http://myglife.org/usa/wv/rtcwiki/index.php/Preloader</a>	0
load sound	Does the game have sound?	<pre> var my_sound:Sound = new Sound(); my_sound.loadSound ("song1.mp3", false); </pre>	<a href="http://myglife.org/usa/wv/rtcwiki/index.php/Adding_Sound">http://myglife.org/usa/wv/rtcwiki/index.php/Adding_Sound</a>	0
if statements* (conditional executions)	you will have to look in the code to know whether this is present because it is not immediately apparent during game play to the average user.	<pre> if (condition is true) { result } switch (variable) { case a: if variable is a, doX(); case b: if variable is b, doY();          break; } </pre>	<a href="http://myglife.org/usa/wv/rtcwiki/index.php/Intro_to_ActionScript">http://myglife.org/usa/wv/rtcwiki/index.php/Intro_to_ActionScript</a>	1
Physics engine	Do characters accelerate (as opposed to moving at a fixed rate)? Can they jump?	anything mentioning "isJumping", "velocity", "landspeed", or "gravity" will denote presence of a physics engine, generally	<a href="http://myglife.org/usa/wv/rtcwiki/index.php/Jumping">http://myglife.org/usa/wv/rtcwiki/index.php/Jumping</a>	0
variables*	you will have to look in the code	var name = value;	<a href="http://www.myglife.org/usa/wv/resources/en/learn/tutorials/flash/scuba-variables">http://www.myglife.org/usa/wv/resources/en/learn/tutorials/flash/scuba-variables</a>	1

content evaluation: For the following codes, please evaluate the quality of the representation on a scale of 1 to 3.		1=Not present / insufficient representation; 2=basic / introductory representation; 3=well-developed representation
<b>Visual and sound design elements....1=Not present / insufficient representation; 2=basic / introductory representation; 3=well-developed representation</b>		
The visual design of the game creatively reflects the concept of the game (e.g., the designer uses color, shapes, and patterns so that the visuals and design reinforce the ideas in the game design plan)		3
The visual / graphic style carries throughout the game consistently (e.g., elements of color-scheme, character design, game-play objects are held consistent throughout the game)		3
Sound is used to enhance game-play (e.g., no sound = 1. if certain objects have sound embedded = 2. If sound is used to enhance experience overall =3)		1
Non-player moving characters and animated objects in the game provide dynamism to the game play (e.g., graphic animation elements are created and included as files)		3
Sprites, animations and/or sounds add to the coherence of the design plan and game story; they encourage players to immerse themselves in play		2
<b>game play experience</b>		
Game instructions are clear and helpful to the viewer		3
Game provides helpful feedback when the player advances or fails to advance through the game (e.g., quiz game provides feedback on a response; when a character dies a life is lost or a message appears, etc.)		1
Game is navigable and intuitive to use		1
Game mechanics are simple to understand and learn, but challenging to master		2
Based on their game design plan on the wiki, it appears that students have a clear idea of their "audience", and their game design has been executed to address this audience based on the plan.		2
<b>concept development</b>		
The game provides enough context up front (either in the storyline or mechanics) so that the game's objective, strategy are apparent to the player.		2
Game concept, storyline are coherently integrated with the mechanics and gameplay (e.g., an educational game uses effective instructional strategies; social issue games use mechanics that fit well with expressing the topic, etc.)		2
Any facts included are presented accurately and reflect research.		2
Any facts are integrated with the game concept and game mechanics, not as isolated quizzes		1
Game has an ending/conclusion that provides closure to the player.		1
The game design document on the wiki is thorough, clear, understandable.		2

Genre	
Is the game a Social Issue game, an Educational game, or an Entertainment game? (write out which)	Educational
If the game is educational, what is its topic? Please state if it could be considered science, technology, engineering, math, or civics. If not, what is the topic?	Math

Regarding genre and topic, the game is educational and its subject matter is math.

In the Programming category, the Frosted Loops' Fracman game achieved an additive value of 7 out of 13 possible codes (1=present, 0=not present). The programming evaluation mean for the 11 games created in the class was 7.09 (low=2, high=11), therefore the Fracman game was about average in its inclusion of the programming features that we counted.

In the Visual and Sound Design category, the Fracman game achieved an additive value of 12. For this category and the next two, each code could be scored 1, 2, or 3 (the table above presents the scale). Thus, among the five codes, the highest additive total a game can receive is 15. The mean for the class was 11.82 (low=7, high=15). Thus, here again Fracman was about average.

In the Gameplay Experience category, the Fracman game achieved an additive value of 9 out of 15 (for 5 codes). The mean for the class was 12.64 (low=7, high=15). Here we see that the Fracman game scored lower than average. In particular, the game scored more poorly in its interactivity / feedback response to the player, and in its navigation. We found that upon gameplay, the game's navigation was incomplete and the player character easily disappeared out the side of the screen. Also, in the maze the walls served no purpose and the character could traverse the entire screen without barriers.

In the Concept Development category, the Fracman game achieved an additive value of 10 out of 18 (for 6 codes), whereas the class mean was 14.18 (low 7, high 18). Here again, Fracman was lower than the class mean, largely because the mathematics content of fractions was not well integrated with the game mechanics and its Pacman-like video gameplay concept as it was executed in the final files (despite the game's clever title, and the plans discussed in the game design document). Further, the game had no apparent ending.

On the whole, while it is clear that the students in Frosted Loops learned several Actionscript skills, the design and execution of the game did not meet all of its original intended goals. We cannot say for sure that Tegan gained all of the skills as identified by this coding scheme, since it was a team effort. Moving forward, we need to find a better method for measuring the individual-level learning of students. While the wiki learning logs can provide insight into the assignments and tasks completed, at several locations including SRMS, the students were not thorough in completing this self-report with consistency.

### Summary of Results, Tegan

Over the school year, Tegan emerges as a team leader who both manages her team, and in the end, becomes a primary Actionscript coder. At the same time, Tegan also presents occasional expressions of frustration with self-learning in the Globaloria context along the way. In the specific context of learning how to make buttons in Flash during Semester One, Tegan reported in a November learning log, *"I am so confused.. The work i do in here never seems to pay off...."* After Semester Two, in her post-survey response, she writes, *"The most difficult thing about this class is keeping your head up when it seems like your game is falling apart."* Despite the difficulty of learning game design, she perseveres and ends up achieving quite a lot, reflecting an introductory mastery of all of the CLAs – the main goal for the course.

Most interesting was Tegan's own critical stance towards the learning process, and her recognition of the need to encourage all group members to learn the full range of Globaloria practices, not just those specific to her initially chosen role. This finding signals important programmatic feedback for the World Wide Workshop about teams' division of work, and the extent of individual learning. This finding can be applied toward administration of teacher trainings, because it appears that Tegan's educator was not scaffolding *all* students towards learning of all CLAs. If some students appropriated a role, it appears that the educator allowed those students to focus only on mastery of the practices required for that given role. It appears that Tegan's own observation as team manager and self-correction toward her team's collective learning is one her educator himself could learn from and apply towards his engagement with the entire class, encouraging all students to experience Actionscript programming.

Guzdial and colleagues report that introducing students to programming through creation of "computational media" products is an especially motivating way to teach computational thinking that can provide new pathways for under-represented students and groups to enter into computer science disciplines and appropriate technical expertise (Guzdial & Soloway 2003; Rich, Perry, & Guzdial 2004; Guzdial & Forte 2005). Tegan's case study provides support for this claim. Tegan becomes an active Actionscript programmer as the year progresses. In her role as team manager, she is acutely aware of looming deadlines, and she jumps in when needed to learn relevant programming practices needed to achieve the team's initial game design goals. In fact, she becomes a programming leader in her team. Further, at the end of the course, Tegan demonstrates extension in her learning, stating in her post-survey, *"I have taken some of the simple codes from this class and used it on my myspace page."* This indicates that she has applied her learning to her engagement in participatory media cultures outside of school.

Longitudinal research will contribute to our understanding of further extension and transfer of Tegan's newfound participatory media cultural practices in her ongoing work, both within school and outside of it.



## Case 2: Billy

Billy was a 12 year-old participant in Globaloria for the 2009 to 2010 school year in Mrs. B's seventh grade class. A creative thinker with an avid curiosity about computers and technology, Billy tended to prefer working on his own, following his individual interests (which sometimes led him off-task). His case demonstrates the challenge presented to students in Globaloria of balancing individual preferences, skills, and role-taking, with the needs of team members in the teamwork

context, who share the goal of completing a functioning game in the timeframe of the course.

In his pre-survey, Billy states that, *"My goal for the future is to be a game designer."* He also mentions wanting to make a game similar to Guitar Hero, which becomes a major influence in the game he designs with Garrett, his teammate in The Spikers. In his pre-survey, Billy states, *"I decided to enroll in Globaloria because it seemed fun and challenging to make a game, and I hope to achieve a game that talks about problems such as Global Warming, Litter, etc."* It appears that Billy has an interest in the environment from his initial reflections. As it turns out, Billy's individual interest in music manifests in his team's final product, "Rock for the Constitution," which uses music to teach middle school students about the civil liberties guaranteed by the first ten Constitutional amendments.

## Instructor's overview of her own progress and class progress, Semester One

Billy's 7<sup>th</sup> grade civics game design class was taught by Mrs. B, a highly active, savvy educator who is emerging as a leader among the WV educator community. While she taught the one class of 8<sup>th</sup> graders last year, she chose to work with this new age group, the 7<sup>th</sup> graders in Pilot Year 3, leading them in their development of games addressing civics themes. Civics became a particular focus in Globaloria-West Virginia at select locations, due to the award of a grant from the Knight Foundation.

In her Q1 and Q2 progress reports presented in the table below, Mrs. B reflects on her game design learning during the Pilot Year 3 school year in relation to the previous year, when she and her school participated in Globaloria for the first time. She highlights the training and teamwork she engaged in with other teachers as they worked on their own team game, and discusses how her experience in her team has informed her understanding of the process her students go through.

In her comments on the second quarter reflection, Mrs. B discusses the difficulty of "stepping back" and "not giving her students the answers" – and teaching them a greater measure of self-sufficiency in their game design. It will be interesting to further probe what specifically she means by this, and *how* she determines when to guide students more directly, to get them past certain programming hurdles and

barriers, versus, when to let them struggle. Research has found that beginner students need greater levels of support and may become frustrated with discovery-based learning that requires them to autonomously seek non-teacher information-based learning supports. Mrs. B herself notes that the students find the autonomy challenging in the beginning. We wish to better understand this dynamic as we explore student engagement in Globaloria, especially in this context in which students' educators are learning along side them.

Table 6. SRMS Syllabus Topics by Quarter, and Mrs. B's Aligning Reflections

<b>Timeframe, Syllabus Topics and Tutorials Covered</b>	<b>Selected Reflections from the Educator on Class Progress</b>
<p><b>First Quarter:</b> Late August -- October 29, 2009</p> <p>Playing to Learn Choosing a Topic Mini Game Project Imagining Your Game Paper Prototyping Planning Your Game</p>	<p>This quarter has been a rewarding, challenging but not frustrating in comparison to the last year's huge learning curve because I was comfortable with the Globaloria platform and its challenges, requirements, and structure. I have still tons to learn in Flash, but at least I have the basics now ... Having to work with the existing game and enhance it helped me put more practice in with bitmap images as well as the button functions. Having to work in groups also helped me gain a better insight into the group dynamics my students might experience this year thus making me spend a considerable amount of time contemplating the group set up. The new wiki setup is great as it lets educators and students build community in such a productive way!</p>
<p><b>Second Quarter:</b> 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>This quarter has let me truly see how much I have learned last year, as I was able to be a better guide for my students in helping them navigate through Globaloria curriculum. Throughout this time, I refreshed my skills in creating buttons, navigating from one page to another, as well as creating motion and shape tween. I finally got to sit down and go through tutorials on adding a sound and using AI for enemies ... I have created a file on learning to use the latter but impatiently waiting on the addition of the loading screen tutorials to the wiki, so that I could teach this to the students, as many of them are drawing loading screens for their games.</p> <p>One of the biggest challenges was to be able to let the students work through the units independently; allow them to struggle through trying to figure out what is not working and how to achieve success without me giving them an answer. I learned to step back and watch them become self-sufficient learners, which is one of the biggest challenges in the beginning months of Globaloria ...</p>

	<p>This year has added a different spin on Globaloria as I embarked on using Civics as the topic for student games. This endeavor has become a big learning curve for my students as well as me ...The process of growth and reflection was not easy for our class, but the fact that my students acknowledged that they were learning more about civics in my class than in their social studies class says a lot about the work accomplished, even though this acknowledgement is a little saddening.</p>
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## **Billy's Participation in the First Semester of Game Design: Late August to December, 2009**

Billy and his partner Garrett form the two-person team "The Spikers." Billy and Garrett develop a game called "Rock for the Constitution," in which players unlock songs in the game by answering correctly questions about constitutional amendments. The team explains the concept of "Rock for the Constitution" in the SRMS game gallery page as follows.

*Our game is about a guy who plays the guitar and learns his amendments though playing popular songs throughout the decades. It teaches civics through a fun game by having cases about the amendments and having a page with the first ten amendments of the Constitution.*

The game merges civics content with music, using snippets of songs as rewards for answering questions about the Constitution correctly. Similar to Tegan's group basing FracMan on PacMan, Billy's group was inspired by the popular game Guitar Hero. This influence is evident from one of Billy's early blog posts on 9/22.

*I hope to make a good game about either the government or citizen's rights. The game I hope to make a game that is Guitar Hero based, but it won't be as hard as Guitar Hero. I'm really excited about getting to make a game to teach about civics in the United States.*

In a September 16 wiki edit, Billy elaborates on choosing a topic.

*I want to learn more about the 27 amendments. Learning about America's History is hard to learn. A game can help by teaching people about Civics in a fun way ... It would be fun to make a music game to teach kids about Civics and after every song they collect a part of the Constitutional Bill of Rights.*

Where some teams will see a fair amount of fluctuation in the content and functionality of their game over the course of the semester, the main components of "Rock for the Constitution" remain fairly close to Billy's description in this September blog post.



## **Frosted Loops' Game Pitch**

The team explains the focus of “Rock for the Constitution” in their pitch.

*Team Introduction: Garrett Hunt- Actionscripiter, Game Constructor.*

*Charles Rowe- Artist, Team Manager and Sound Editor.*

*Learning Topic: Our game on civics focuses on the subject of Rights and Responsibilities.*

*Audience: We're designing the game on the Middle School Level for elementary kids because they need to know about their rights as a citizen of the United States of America.*

*Game Play: The Player will see their character, dressing room (if we get into making that) and the playing field. The Player will click on buttons, tap the keys of the notes on the screen, press the spacebar to get the fire flame of the screen and learn about the amendments. The only two rules are have fun and follow the on-screen directions. You win the game by winning the songs and amendment parts. The goal of the game is to teach about the amendments by playing a game.*

*Fun Factor: The Player has fun by playing a game just like Guitar Hero, DDR and Rock Band.*

*Smart Factor: Our game teaches about the Rights of the amendments. Someone can learn all their rights.*

*Style Factor: All of the notes will be moving, the characters will be talking and the buttons will work. We will use music as sounds.*

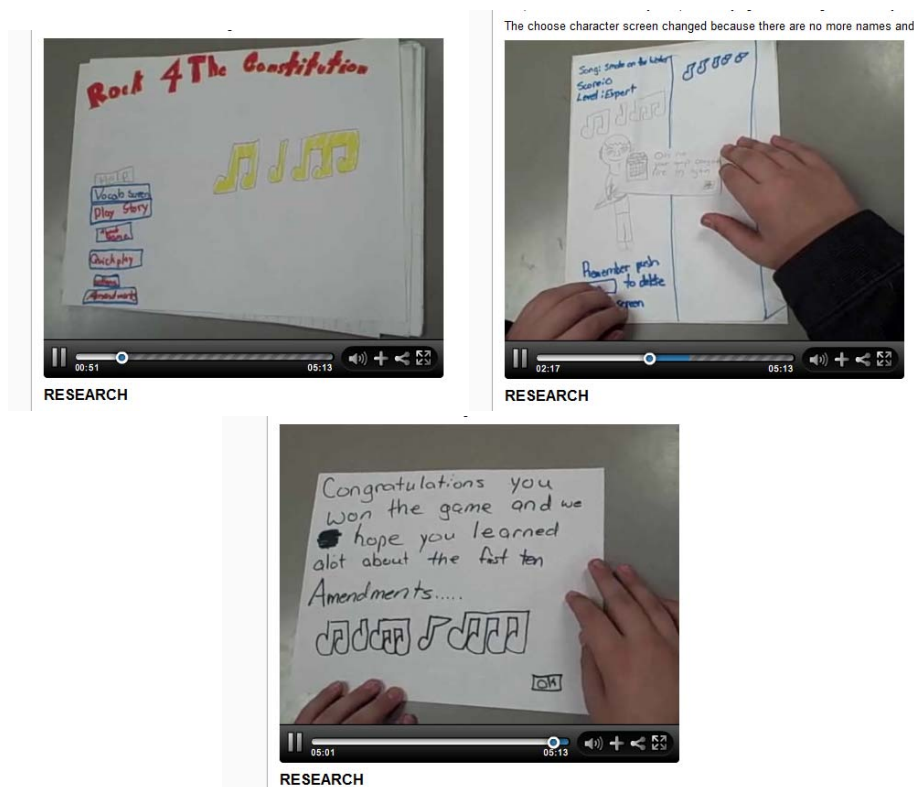
*Originality Factor: The reason our game is different because it teaches about the amendments. It will sell because it is fun just like DDR, Guitar Hero and Rock Band.*

Billy and Garrett state that “Rock for the Constitution” is targeted towards middle schoolers, the boys’ own peer group. As such, their approach to creating an educational game reflects the kind of approach that they expect would be successful for adolescents. Using elements of games that have been successful among that demographic (Guitar Hero, Dance Dance Revolution and Rock Band) represents a logical attempt to tap into frameworks and premises of popular games. With a relatively consistent premise for the game, the main source of evolution and development for the Spikers will be in terms of coding ability, class assignments and team work.

## **Paper Prototype (Oct. 2009)**

The following figure presents screenshots from The Spiker’s paper prototype of Rock for the Constitution which was uploaded on 10/27/09. Both boys participate in the Paper Prototype video by flipping through their scene-by scene descriptions, however, Billy does all of the talking in the presentation.

Figure 6. Screenshots From Paper Prototype of “Rock for the Constitution”



In their presentation, Billy and Garrett explain the central components of their original game idea. From the opening screen, a player can choose from “Help,” “Vocabulary,” “Play Story,” “About Game,” “Quick Play,” “Options” and “Amendments.” The “Options” song allows players to manipulate the volume of sound effects or music. The “Amendments” screen lists each of the first ten Constitutional Amendments. The “Play Story” screen allows users to choose from a number of characters, including Garrett and Billy.

Once the game starts, a player chooses a song to play and a level. At that point, a pop-up screen shows the player a fun fact about one of the Constitutional amendments. After the pop-up screen, a player has to hit a series of notes corresponding to the selected song. Notes are played using keyboard commands. A timing element is introduced by the appearance of a stage-related obstacle – a flame icon moves up the music side of the screen, and if a player doesn’t hit the correct notes before the flame moves from the bottom to the top of the screen, the player’s amp will catch fire. By playing songs correctly, a player earns Amendment points. After finishing a song, the screen is shown in which players’ knowledge of the Constitution is tested by a scenario requiring the user to answer correctly about civil rights.

#### Presentation to World Wide Workshop Foundation staff

Students at SRMS presented their game plan to members of the World Wide Workshop Foundation staff, in order to gain feedback on their plans prior to starting in on the game design in Flash. They communicated virtually, using an online conferencing tool, and sharing the design doc on the Wiki via screen sharing. The students talked through the paper prototype again using a conference phone line.

Although Billy's blog is fairly limited on the subject of the paper prototype, Garrett's blog from March 5 discusses the presentation, and the feedback the students at SRMS received from Globaloria staff.

*I think that we did pretty good on our game presentations and they gave us some really good ideas on how we could make our game better. I feel that Billy and I done a really good job on our presentation. I learned that we need to take our expectations down in our game. After we told them what we wanted to do in our game and what our general idea was, they thought that it was going to be a great game. Then, they said that it would really be a lot of work, and that we would most likely not get it done in time for our FULL game presentation. So, we improvised, we said that we would just take some things off. They said that would be a good idea. So far, we have took off some songs and things like that and not tried to put so much detail into our drawings and things like guitars and our characters.*

This feedback provides evidence of the influence that expert support from the World Wide Workshop staff provides to students as students engage in and present their ongoing work. Such interactions likely also provide a model for educators who participate and listen in, providing ways the educator can scaffold the student project development themselves. As a result of feedback, the Spikers made a number of changes, including the removal of some unnecessary components (such as a dressing room scene) and simplifying others (changing the select character function to a choice between two characters).

### **Billy's Role as Team Manager and Sound Editor**

Working on a two-person team, Billy and Garrett each take on two roles in the Spikers. Garrett handled Actionscript and game construction while Billy takes on the roles of team manager as well as being in charge of audio components. Initially, Billy wanted to take on responsibilities for audio components and "game construction," as he explained in his September 28 blog post.

*I hope to be both the sound expert and the game constructor, because I have music I was wanting to put on the game and I'm pretty good at putting stuff together.*

However, Billy's teammate Garrett adopted the role of "designer" and "game constructor" and Billy compromised, adopting the role of team manager and sound editor.

In Mrs. B's comments on Billy's work, it becomes clear that she feels he has strong technical capabilities, while at the same time some social limitations that may affect his performance in the classroom

throughout the school year, especially in his given role as team manager. She states in her progress report,

*Billy is an out-there genius who is not very social and usually ends up willingly sitting by himself while working on assignments. The student barely ever asks any questions because he likes to tinker with stuff and figure it out by himself. He loved adding pictures to his wiki and blog and is very thorough with his work. I know without a doubt that Billy will be successful in Globaloria, but I am yet to see what side of him will benefit from the class the most.*

The role of team manager requires social communication and organizational skills in order to bring a game into fruition. Given the emphasis in Globaloria on collaboration and the extent to which being a team player is necessary for creating a successful game, Billy makes for an interesting case study. A creative thinker who prefers to figure things out for himself rather than consulting tutorials or asking for help, Billy's appropriation of team manager as his role poses some interesting challenges for him. His case study presents an interesting contrast with Tegan whose social capabilities strongly supported her own team manager role.

### **Team Work of the Spikers**

As a two-person team, The Spikers' dynamic requires close collaboration between Billy and Garrett. As team manager, Billy's role is to provide a sense of organization and leadership. Billy reflects on his early performance in Globaloria in a September 28 blog post discussing his role.

*In Globaloria I'm doing very well, I find that Flash, Wiki, and Blogger are very interesting because I never would have made a blog, or a game, or even a wiki if I hadn't of got in Globaloria. I've learned how to work with Flash and work on making a game ... My experience in Flash is pretty good, and I hope to make a very good game to share with all the Globaloria world.*

In these comments Billy focuses on his individual ambitions for Globaloria, and seems enthusiastic about the technological affordances of Globaloria. In contrast to Tegan who reflects at length upon team process and dynamics, Billy's comments in most blog communications remain focused on technical issues (Actionscript, Flash) and don't tend to refer to team or social dynamics.

As the semester progresses, Billy and Garrett's work on "Rock for the Constitution" involves occasions for cooperation. As a team, they improvise a strategy for making this process more engaging, by instituting a competition using the leveling system that is part of the course wiki, in which students are appointed with a profile label stating "dood," "elite," or "wiki master" based on their number of file uploads. In Mrs. B's second quarter evaluation, she observes this, stating,

*Billy and Garrett even had a competition on how many files each one of them would upload trying to get to the levels of dood, elite, or wiki master. We'll see who wins.*

This finding may indicate a greater tendency in Billy's leadership style towards applying competition as a motivator -- in contrast with Tegan's more facilitative approach.

### **Semester One progress on game design**

As the semester progresses, The Spikers narrow the focus of Rock for the Constitution. Instead of covering all 27 Constitutional Amendments, Billy and Garrett decide to focus solely on the first amendment. In Mrs. B's second quarter evaluations of Billy's work on "Rock for the Constitution," she addresses his performance in terms of his creativity, coding abilities and contributions to The Spikers. She states,

*Billy has proven again and again how much he loves tinkering with stuff. The student likes to add new files to his user page and loves playing with Flash. He is the creative mind in his group, even though Garrett contributes quite a lot to the game scenes. It was Billy's idea to create a game following the principles of Guitar Hero but dealing with constitutional amendments. Billy has created many files showing his progress through the units on adding sound, adding navigation, adding animation and interaction. However, managing his learning log is not on the list of Billy's priorities. This is something we have to work on this semester. He has managed to add the new features he has learned to his game that resulted in many files uploaded to the wiki. Grade: A*

While he may be somewhat indifferent to requirements such as the learning log, Mrs. B's comments indicate that Billy is a student who clearly enjoys learning about technology. For example, he writes on his user page,

*I'm using word dictation to type, all of this, which means I am using the microphone to control the computer.*

Billy finds and uses a speech-to-text editor to write text on the screen, an activity in which he becomes fascinated. Further, both his blog and his user page on the wiki are sprinkled with videos, links, photos and music players. It appears that the audio capacities of the computer in particular capture his interest and give him a self-gratifying feeling of control over the digital environment.

### **Summary, Semester One**

Although Billy is an eager student with a genuine interest in gaining technological proficiency, he struggles to complete some of the basic curriculum assignments, such as learning logs. Billy's main focus is instead rooted in experimenting with the range of different social media and production tools that students are introduced to in Globaloria. Although his teacher evaluations thus far express optimism about Billy's performance, they also address some of the challenges Billy faces as he moves through the program. Left to work independently, one could see Billy getting lost in the midst of his own enthusiasm for "tinkering," as Mrs. B puts it, without ongoing re-direction. Working with Garrett, Billy is obligated to

shape his own interests to fit within the requirements of the class and needs of his team, which creates somewhat of a tension that we see unfold in Semester Two.

## Semester Two: Instructor's overview of her own progress and class progress

In her Q3 and Q4 progress reports, Mrs. B discusses the process and challenge of students' integration of their games' civics subject matter, with the game mechanics and overall design and implementation of the final game. She discusses the ways in which she specifically chooses to support students' narrowing the subject scope required to develop a game with a clear and feasible, achievable design. She reflects upon the differences she observes between students in 8<sup>th</sup> versus 7<sup>th</sup> grade, and mentions 7<sup>th</sup>-graders' need for greater support and scaffolding around conducting online research and blogging.

This is an important observation. Given the effort she puts forth supporting and reinforcing these skills with the 7<sup>th</sup> graders, it appears from her reflections that in Mrs. B's view, CLAs 4 and 5 (learning with social media, and online information-seeking and research) are integral to the game design process, just as we postulate in our 6-CLAs framework. She states that the activities of blogging and online research into a game topic add a lot to the students' game projects, and thus are quite worthy of her own and students' deliberative efforts to master. In her fourth quarter progress report, Mrs. B reflects further upon the supplementary activities that support the central game design goals. It appears that in this second year of participation she is focused on better integrating the set of parallel activities afforded through Globaloria— just what we hope to see in educators as they gain experience and understanding of how the program components can contribute to each other.

Overall, Mrs. B's comments below demonstrate just how integral her own reflection, learning process and growing mastery as an educator are in developing the best support strategies for students towards advancing student success. She specifically references how her experience in the prior year helped her with time management, course organization and sequencing in Year 3, which translates to student outcomes.

Table 7. SRMS Syllabus Topics by Quarter, and Mrs. B's Aligning Reflections

Timeframe, Syllabus Topics and Tutorials Covered	Selected Reflections from the Educator on Class Progress
<b>Third Quarter:</b> January 12 – March 21, 2009 Moving on a Path Special Effects	Probably, the most challenging part of the class has lied in students becoming knowledgeable about the topic they have chosen to teach through their games. After the game demo presentations, it has become evident that students needed to narrow down their topics to a specific amendment or freedom in order to create games with clear focus. With more stressed timeframe for finishing up the games, it

<p>Scrolling Background Score Keeping Collision Detection Sound Effects Timer Character Effects Drag and drop Platforms Running and Jumping Coding “enemies”</p>	<p>has become even harder to find time to let the teams meet and discuss their topic without feeling rushed to move on with the units. However, I deem this part of the game completion vital for student success and therefore will take time to meet with each team, discuss their plans for game completion, and provide a worksheet to fill out in order for the team to sustain clear focus and create a clear goal for game completion. Working with 7th grade students requires twice more time in order to get the tasks of research and blogging accomplished on a satisfactory level, but it is vital for their success in creating games that teach about civics in a knowledgeable and compelling manner.</p> <p>The use of blogging as a tool for reflection and learning has become even more profound during this quarter. I attribute many of student successes to giving them time to write and examine their topic. However, blogging has presented another opportunity for learning about plagiarism as the students wanted to find an easy way out and copy and paste information about their topic into blogs. I seized this opportunity to help them see firsthand why plagiarism is not appropriate under ANY circumstance and again will be meeting with the students individually to help them identify strategies for using information without running the danger of plagiarism.</p> <p>The addition of My Civic Engagement site to help students form a community with others who are working on the topics within the same framework has been very beneficial even though initially intimidating to my students (as we are the youngest in the Civics strand). The site has been a great resource for the students, and Rachel has been very instrumental in helping me guide students through their blogging in inspiring, challenging, probing, as well as giving them food for thought in her blog comments.</p> <p>Learning about Flash has been the least of our troubles this year. Being more confident with the software, I can help my students troubleshoot Flash issues more successfully, and they are learning quite a lot on their own as well. We still have a lot of units to accomplish in order to make the games interactive, and asking Meredith for help is still to come! On a personal note, I have not quit mastering new things in Flash for myself and really worked on creating platforms scenes as many of my students are working on the same topic, Thus, I want to be able to troubleshoot or guide them in the right direction if needed.</p>
<p><b>Fourth Quarter:</b> March 22 – End of May, 2009 Students worked on</p>	<p>Looking back at the year, I can see how much my students have accomplished, and how my growing knowledge of Flash and the curriculum helped me guide them through the school year. During the last quarter, I felt very stressed and frustrated because I felt that I was not meeting the needs of my students and helping them</p>

<p>different units as indicated by their needed skills pertaining to specific games.</p>	<p>through the hurdles of mastering the content. I guess, we had to go through a period of stagnation before the kids just took off, and all the groundwork, extra pushing, tedious narrowing the topic finally paid off. During the last two months of school, I kept on comparing our accomplishments to the work done last year and could see how much smarter my time and topic management has become. To my mind, spending extra time on helping my students narrow their topics helped them not to be too frazzled during the “crunch” time and come up with more complete games in comparison to the last year’s work. This realization got reinforced during the final game presentations when the last year’s students I invited to the presentations kept on saying how really impressed they were with the games and were so envious that so much got accomplished.</p> <p>During the last quarter of Globaloria, I always get amazed how fast the students take off and assume responsibility of their own learning by planning what scenes to add, what tutorials to work on for these scenes, and how to keep each other accountable for the work accomplished. This reinforces the belief of mine that if right foundation is laid in the beginning of the year, and right habits are reinforced throughout, the students become their own guides of learning, and the teacher facilitates, nudges sometimes, and learns alongside. I by no means have become an expert, as there is always something new to learn. But, isn’t it what being a teacher is all about anyways? We need to stay abreast the newest developments in curriculum, school policies, federal and state mandates, and most importantly, child development characteristic to the era we live in and the future job market we prepare our students for.</p> <p>Our blogging took on a more reflective note as the year came to an end, as the students started dwelling more into what has been learned during the year and how they were getting ready for the final presentations. Overall, I feel a sense of accomplishment, as most of my students are continuing Globaloria with Aaron creating math games next year. They are excited, and I am brainstorming the ways of helping them take the existing curriculum to a higher level, as they have already learned so many things! Our numbers have grown slightly, and this year showed tremendous interest in the part of the incoming students (even the ones still in the elementary schools feeding into our middle school), as we communicated the program curriculum to the parents frequently.</p> <p>Participating in First Annual Civics Competition has truly helped all my students push for the best delivery of the content and made them check the validity of their sources many times, as they knew their games would be judged by the experts in the field. We went into the competition in hopes of showing off our school in a positive light and getting that extra motivation to get things accomplished, as my students were probably the most inexperienced within the civics content.</p>
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## Billy's Participation in the Second Semester of Game Design: January – June 2010

As Globaloria students progress into the second semester, Billy seems optimistic and ambitious about the work remaining on “Rock for the Constitution.” On Jan. 22 he posts the following in his blog.

*My N.Y.R [New Year's Resolution] is to finish the game in time for the deadline. I'm hoping that Garrett's and my game gets at least top 3 in the 1st Annual Globaloria Competition. I, personally, can't wait till the school year is over, but not until we get our game finished. Globaloria is a fun class but when the Actionsript doesn't work I could throw it out the window. 2010 is going to be a good year. Flash is cooperating good so far now because it is close to the deadline.*

Clearly the opportunity to compete in the Globaloria game design competition is a motivation for Billy, which aligns with our earlier observations on his inclusion of competitive dynamics in his teamwork. Interestingly, in the last sentence of the post, Billy attributes the challenges of learning Actionsript programming to the tool's functioning (i.e., “Flash is cooperating”), rather than his own actions, coding, and learning process. Overall in his blogs, he does little inward reflection.

Again in Semester Two, there is a difference between Billy's learning logs, which only have one entry (from May 28) and his wiki user page and blog, which contains a number of attachments, links, images and videos. The figures below depict some of these files.

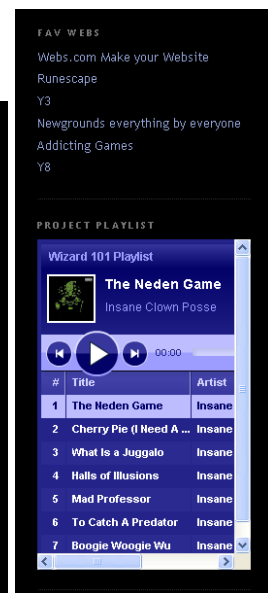
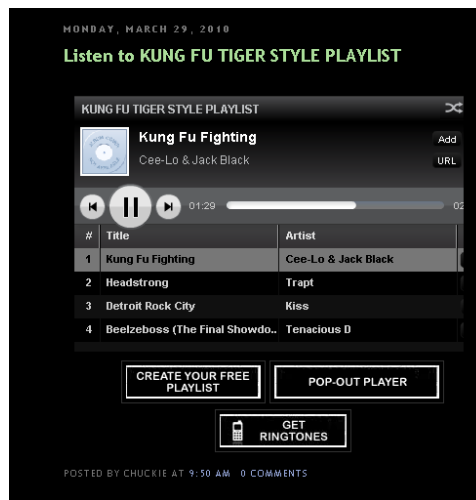
Figure 7. Billy's Semester Two learning log

<a href="#">user page</a>	<a href="#">talk</a>	<a href="#">view source</a>	<a href="#">history</a>
User:Chuck455/Learning Log			
< User:Chuck455			
<b>Learning Log</b>			
Yo, bienvenido a mi página de registro de aprendizaje.			
Yo, welcome to my learning log page.			
After each class, add a short entry about what you did on this log. This will help you see your learning progress.			
Topic	Date(s)	Time Spent	Notes
Work Work Work	5-28-10 to 4-1-10	2 hours 40 minutes	We worked on a blog and I published The Spikers Final Game to the Game Gallery
Topic Name	MM-DD-YY	X hours	Comments and notes about your work here
Topic Name	MM-DD-YY	X hours	Comments and notes about your work here
Topic Name	MM-DD-YY	X hours	Comments and notes about your work here
Topic Name	MM-DD-YY	X hours	Comments and notes about your work here
Topic Name	MM-DD-YY	X hours	Comments and notes about your work here
Topic Name	MM-DD-YY	X hours	Comments and notes about your work here
Topic Name	MM-DD-YY	X hours	Comments and notes about your work here

Figure 8. Screenshots from Billy's Semester Two *wiki Projects page*



Figure 9. Screenshots from Billy's Semester Two *blog*



Billy is willing to spend significant amounts of time adding components to his page, above and beyond the majority of his classmates. However, while learning logs are a required assignment and a tool for teachers to track the progress of students in Globaloria, for students like Billy, it is simply not as interesting as creating Wordles, adding music players and tinkering with wiki structure.

### Billy's continued teamwork and Actionscript learning

As Semester Two progresses, and deadlines arise, Billy continues to learn Actionscript and work on components of the game. Mrs. B describes this activity in her Q3 progress report below. She also references the need for the students to narrow down their topic to fit in the scope of their technical

expertise, which Mrs. B notes above in her overall reflections was a theme for the class. She also mentions that while Billy was responsible for the presentation, he also ended up completing the programming for the game demo, displacing his teammate Garrett whose role it was to do so. It appears this occurred somewhat last minute. It seems that as programmer, Garrett struggled more with programming. Mrs. B states,

*Thus far, Billy has finished working through Intro to Action Script tutorials as well as organized the layers in his game following the Programming Practices. Blogging is going well for the student even though he often has to go back to the posts to add more detail or research. Learning log entries are still a big struggle. The student was in charge of the power point for the game demo presentations and ended up assembling the game files for game demo as well and barely had it ready before the deadline. Billy and Garrett need to sit down and narrow the topic for their game in order to have a tangible plan in place to come up with the functional game by May. Grade: B*

Mrs. B elaborates further on some of the issues raised by Billy's enthusiastic style and his individualism.

*Billy is one of my most creative minds but also one of the most carried away with everything else but the curriculum. Billy is the big idea person and has a hard time taking his time to communicate his view of the game to Garrett who needs a more tangible understanding of the game idea. It takes a lot of reminders from me to keep Billy on task and going through the assigned units instead of teaching the computer to operate on the voice commands ☺. So, we need to compromise on how much time Billy needs to spend on the curriculum to be able to devote his energy on other things later.*

Mrs. B's summary positions Billy's curiosity for technology and tinkering in opposition to his classroom responsibilities and the goals of the course to have a finished game by the end. As for the teamwork dynamic, from Mrs. B's comments, it appears that Billy and Garrett may be undergoing a communication breakdown as of this timeframe, midway through the second semester.

Another important perspective The Spikers' team dynamic is provided on Garrett's 3/20 blog. Here he states,

*The thing that is easiest to me is when you import a picture to the stage and trace over it. The hardest thing for me to do is when you have to remember all of the codes to put something on the screen. The way that I over came the challenges was that I asked my partner Billy, but if he couldn't help me I would ask Mrs. I. B for help.*

Garrett here expresses that he views Billy as a resource for information on coding, and that his teammate is in fact a more natural source to consult than his teacher. While in Mrs. B's estimation, Billy much prefers working individually and tinkering, and may struggle in some social skills and in his

teamwork with Garrett, it seems that from Garrett’s blog posts, Billy is in fact sharing knowledge with Garrett and offering peer learning support. It seems that the team naturally adapts towards the role shift, with Billy taking on the programming role out of perceived necessity, in order to meet the team goals and deadlines.

### Final Game Presentation

Billy and Garrett present “Rock for the Constitution” to their classmates in May, as well as World Wide Workshop Foundation experts, again via a voice line and web conferencing interface that is recorded and posted on the wiki. The Spikers have a fully-functioning game in time for their presentation, and Mrs. B plays the game in the course of Billy and Garrett’s presentation. Both teammates spend time explaining the game, but Billy is a slightly more confident speaker. The boys take turns explaining the key functions of their game.

Screenshots from the final game, and the group’s online video presentation are depicted below.

Figure 10. Spikers’ final game screenshots; class presentation video





The final game dynamics are as follows. Players can opt for one of two characters – Garrett or Billy – rather than the larger number of characters that had initially been proposed. At each level, players use arrow keys to collect money from circles moving from the bottom to the top of the screen. At the moment, this feature is only working somewhat well; on some of the screens, the arrow keys do not result in movement in the circle that represents the player.

Each level has a 15 second clip of music playing during the gameplay screen. The game's Credits screen included citations for the music clips, reflecting Billy's learning of copyright restrictions of remixing and using digital music. On the game screen with the rising circles and 15-second music clips, when the player reaches a set amount of money, the next screen automatically shows up. This next screen explains a legal scenario related to constitutional rights; all of these case scenarios are local to West Virginia, indicating that Billy conducted research to find local case examples. The screenshot that follows presents the content of one of these cases.

Figure 11. Example of local WV constitutional case presented in the Spiker's game, representing student research and game subject elaboration

## CASE #1

## QUESTION

*Petitioner Roger L. Bolen, 13 years old, and petitioner Clyde T. Stacy, 13 years old, attended middle schools in McDowell County, West Virginia. Petitioner Brooke D. Bolen, Roger's sister, was a 13-year-old student in middle school.*

*In December 2009, a group of adults and students in McDowell County held a meeting at the Bolen home. The group determined to publicize their affection to the Coal Miners' by wearing black ribbons during the holiday season and by fasting on December 16 and New Year's Eve. Petitioners and their parents had previously engaged in similar activities, and they decided to participate in the program.*

*The principals of the McDowell County schools became aware of the plan to wear ribbons. On December 14, 2009, they met and adopted a policy that any student wearing a ribbon to school would be asked to remove it, and if he refused he would be suspended until he returned without the ribbon. Petitioners were aware of the regulation that the school authorities adopted.*

After reading the case file above, the player is then asked a question about the specific amendment guaranteeing rights referenced in the previous scenario. Upon answering correctly, the player progresses to the next level and is able to hear a new song.

The game has a works cited page, where Billy and Garrett list the court cases referenced in their game, as well as explaining that due to file size and copyright rules, the songs unlocked by successfully answering questions are limited to 15 seconds.

At the end of their video presentation, the clip features feedback from World Wide Workshop Foundation team members including several positive comments about "Rock for the Constitution." During the feedback exchange, the team asks Billy and Garrett to explain the role played by money and the connection between specific songs and civics. Billy handles all of the responses to the team, explaining that the money was originally intended to allow the player to fund a trip to Washington DC, but the team ran out of time. Additionally, he explained that the songs selected for each level share a connection to the theme of civil liberties (although the choices of the songs, "Bodies," "Kryptonite," "We Will Rock You" and "One" may not have the clearest connection to civics).



As a whole, the game has been simplified from its original premise. Rather than a Rock Band inspired premise of gaining points by playing notes that correspond to songs, players collect dollars by mousing over circles that move across the screen, and after a certain number of dollars, progress to the next level. The game scenarios contextualize the Bill of Rights in an everyday language vocabulary, and overall shift the focus of the game from music to civics.

Billy's reflections in his last blog post on 6/1 offer a concise synopsis of the game design classroom experience.

*Globaloria is the most fun I've had this year. Making games, blogging and getting on laptops.*

As he has done throughout the school year, in this post Billy's emphasis is on concrete interactions with technology rather than group work or personal reflection of changes he might have noticed in himself.

### Content analysis evaluation of Rock for the Constitution

The table below presents the results of our content analysis evaluation of the Rock for the Constitution game created by the team The Spikers. The development of the coding scheme and our content analysis approach is discussed in the Methods section above.

Table 8. Content analysis results for Rock for the Constitution, created by The Spikers

Game Functionality and actionScript Proficiency: For the following codes, please indicate the presence or absence of the following Actionscript (0=not present, 1=present) NOTE: students include AS on or in objects, as well as timeline. Need to review all code. Using FIND feature can help.				Rock for the Constitution
<b>Events – items that trigger code to execute</b>		*Must look in FLA code to detect		<a href="http://www.myglife.org/usa/wv/srmswiki/images/5/50/Final_Game_Spikers.swf">http://www.myglife.org/usa/wv/srmswiki/images/5/50/Final_Game_Spikers.swf</a>
CATEGORY*	How it looks in the game file	FLA Code		<a href="http://www.myglife.org/usa/wv/srmswiki/images/6/61/Rock_For_The_Constitution_Final_Game fla">http://www.myglife.org/usa/wv/srmswiki/images/6/61/Rock_For_The_Constitution_Final_Game fla</a>
roll over/roll out	when you place the mouse over or move the mouse off of an object without pressing, does something happen?	Symbol.onRollOver **or** Symbol.onRollOut	<a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Code_Library">http://myglife.org/usa/wv/rtc/wiki/index.php/Code_Library</a>	<b>1</b>

Button presses	when you click a button on the screen, does something happen?	myButton.onPress **or** myButton.onRelease	<a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Code_Library">http://myglife.org/usa/wv/rtc/wiki/index.php/Code_Library</a>	1
hit test/collision detection	When two objects on the screen overlap or collide, does something happen (such as points gained/lost, color change, etc)	Symbol.hitTest(other Symbol)	<a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Collision_Detection">http://myglife.org/usa/wv/rtc/wiki/index.php/Collision_Detection</a>	1
key press	does something happen when you press the keys on the keyboard (like the arrow keys)	if Key.isDown(Key.NAME_OF_KEY) {effect of key press}	<a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Adding_Input:_Keyboard">http://myglife.org/usa/wv/rtc/wiki/index.php/Adding_Input:_Keyboard</a>	1
on enter frame *	(will have to check the fla and code)	onEnterFrame = function() { continuous looping code }	<a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Score_Keeping">http://myglife.org/usa/wv/rtc/wiki/index.php/Score_Keeping</a>	1
timer *	does this game have a time limit or do certain things happen at timed intervals (you will have to check in fla for the latter)	setInterval ***or*** getTimer();	<a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Timer">http://myglife.org/usa/wv/rtc/wiki/index.php/Timer</a>	0
<b>Additional code commonly found in games</b> (0=not present, 1=present)				
drag and drop	can you click and drag a symbol to move it and then release the mouse button to drop it?	Symbol.startDrag(this); ***and*** Symbol.stopDrag();	<a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Drag_and_Drop">http://myglife.org/usa/wv/rtc/wiki/index.php/Drag_and_Drop</a>	0
dynamic text or input text	Dynamic Text (e.g., score counter): the text changes depending on your actions--might have to find in actionScript to ensure it's dynamic text. Input Text: you can type text into a text field.	Dynamic Text: textBox.text = "Your Text Here";    Input Text: output = input; or, .htmlText	<a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Text">http://myglife.org/usa/wv/rtc/wiki/index.php/Text</a> , <a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Score_Keeping">http://myglife.org/usa/wv/rtc/wiki/index.php/Score_Keeping</a>	1



preloader	is there a preloader before the game appears?	<pre> var total = this.getBytesTotal(); this.onEnterFrame = function(){ loaded = this.getBytesLoaded() ; percent = Math.round((loaded/ total)*100); preload_txt.text = percent+"%"; mask_mc._yscale = percent; if (loaded &gt;= total) { this.play(); delete this.onEnterFrame; //gotoAndPlay("stLyn n") } } </pre>	<a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Preloader">http://myglife.org/usa/wv/rtc/wiki/index.php/Preloader</a>	1
load sound	Does the game have sound?	<pre> var my_sound:Sound = new Sound(); my_sound.loadSound ("song1.mp3", false); </pre>	<a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Adding_Sound">http://myglife.org/usa/wv/rtc/wiki/index.php/Adding_Sound</a>	1
if statements* (conditional executions)	you will have to look in the code to know whether this is present because it is not immediately apparent during game play to the average user.	<pre> if (condition is true) { result } switch (variable) { case a: if variable is a, doX(); case b: if variable is b, doY();          break; } </pre>	<a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Intro_to_ActionScript">http://myglife.org/usa/wv/rtc/wiki/index.php/Intro_to_ActionScript</a>	1
Physics engine	Do characters accelerate (as opposed to moving at a fixed rate)? Can they jump?	anything mentioning "isJumping", "velocity", "landspeed", or "gravity" will denote presence of a physics engine, generally	<a href="http://myglife.org/usa/wv/rtc/wiki/index.php/Jumping">http://myglife.org/usa/wv/rtc/wiki/index.php/Jumping</a>	0
variables*	you will have to look in the code	var name = value;	<a href="http://www.myglife.org/usa/wv/resources/en/learn/tutorials/flash/scuba-variables">http://www.myglife.org/usa/wv/resources/en/learn/tutorials/flash/scuba-variables</a>	0
<b>content evaluation: For the following codes, please evaluate the quality of the representation on a scale of 1 to 3.</b>			<b>1=Not present / insufficient representation;</b> <b>2=basic / introductory representation;</b> <b>3=well-developed representation</b>	

<b>Visual and sound design elements....1=Not present / insufficient representation;  2=basic / introductory representation;  3=well-developed representation</b>	
The visual design of the game creatively reflects the concept of the game (e.g., the designer uses color, shapes, and patterns so that the visuals and design reinforce the ideas in the game design plan)	3
The visual / graphic style carries throughout the game consistently (e.g., elements of color-scheme, character design, game-play objects are held consistent throughout the game)	3
Sound is used to enhance game-play (e.g., no sound = 1. if certain objects have sound embedded = 2. If sound is used to enhance experience overall =3)	3
Non-player moving characters and animated objects in the game provide dynamism to the game play (e.g., graphic animation elements are created and included as files)	3
Sprites, animations and/or sounds add to the coherence of the design plan and game story; they encourage players to immerse themselves in play	3
<b>game play experience</b>	
Game instructions are clear and helpful to the viewer	3
Game provides helpful feedback when the player advances or fails to advance through the game (e.g., quiz game provides feedback on a response; when a character dies a life is lost or a message appears, etc.)	3
Game is navigable and intuitive to use	2
Game mechanics are simple to understand and learn, but challenging to master	3
Based on their game design plan on the wiki, it appears that students have a clear idea of their "audience", and their game design has been executed to address this audience based on the plan.	3
<b>concept development</b>	
The game provides enough context up front (either in the storyline or mechanics) so that the game's objective, strategy are apparent to the player.	2
Game concept, storyline are coherently integrated with the mechanics and gameplay (e.g., an educational game uses effective instructional strategies; social issue games use mechanics that fit well with expressing the topic, etc.)	3
Any facts included are presented accurately and reflect research.	3
Any facts are integrated with the game concept and game mechanics, not as isolated quizzes	3
Game has an ending/conclusion that provides closure to the player.	1
The game design document on the wiki is thorough, clear, understandable.	3
<b>Genre</b>	
Is the game a Social Issue game, an Educational game, or an Entertainment game? (write out which)	Educational
If the game is educational, what is its topic? Please state if it could be considered science, technology, engineering, math, or civics. If not, what is the topic?	Civics

As for the genre, the game is educational and its subject matter is civics.

In the Programming category, Rock for the Constitution was coded as “present” for 9 out of 13 possible codes (1=present, 0=not present). The mean for the 11 games created in the class was 7.09 (low=2, high=11), therefore this game was above average in its inclusion of the programming features that we counted.

In the Visual and Sound Design category, the game achieved an additive value of 15. For this category and the next two, each code could be scored 1, 2, or 3 (the table above presents the scale). Thus, among the five codes in this category, the highest additive total a game can receive is 15. The mean for the class was 11.82 (low=7, high=15). Thus, here again the game was above average.

In the Gameplay Experience category, the game achieved an additive value of 14 out of 15 (for 5 codes). The mean for the class was 12.64 (low=7, high=15). Here again the game exceeded the average in the evaluation in this category.

In the Concept Development category, the game achieved an additive value of 15 out of 18 (for 6 codes), whereas the class mean was 14.18 (low 7, high 18). Here again, the game was higher than the class mean.

On the whole, Rock for the Constitution had the 4<sup>th</sup> highest evaluation value among the 11 games created by the 7<sup>th</sup> and 8<sup>th</sup> grade students at SRMS. Interestingly, the other 3 games were also created by 7<sup>th</sup> grade students in Mrs. B’s class, indicating the extent to which the educator’s level of experience plays a role in student outcomes (given that it was Mr. L’s first year, but he was teaching 8<sup>th</sup> graders who would presumably be capable of more based on their age).

#### **Mrs. B’s Q4 evaluation of Billy**

Mrs. B’s Q4 progress report on Billy’s performance addresses his classroom work, the progress of “Rock for the Constitution,” and Billy’s future plans for game design.

*Billy remained the creative mastermind behind his game and really worked on adding interactivity and managing the development of the game throughout the last quarter. The student was able to fulfill his vision of creating a game combining music and civics into a great teacher tool. However, the addition of the music to the file got me really engaged and taught me a lot, as Billy’s addition of the wav. files made the game file HUGE, so Meredith and I worked on helping Billy reduce the size of the file. During the process, we discovered that MP3 files are significantly smaller than the other type, which solved the problem and was a great learning moment for me! Billy experimented with music, hitTest, as well as the character effects in his game, with Garrett working on some content questions even though Billy also contributed significantly to the research component of the game. The student has also created the game presentation file and effectively presented the game to the audience. Billy was really inspired by Dr. Games’s visit and extensively used the websites Dr. Games recommended. The student is*

*participating in next year's Globaloria, and I hope to see great things coming out of his work with Aaron.*

Mrs. B's evaluation demonstrates some of the ways that teachers and students learn together in Globaloria. In this case, Billy's experimentation with .wav files yielded a challenge (the large file size) that Mrs. B then built upon, researched herself, and solved for him, allowing her to support and scaffold his work while learning something new in the process that she can apply and share with other students moving forward.

Mrs. B also references Billy's information-seeking and research efforts for the civics component of the game, incorporating local West Virginia examples of constitutional and first amendment rights cases into "Rock for the Constitution." Here again we see Mrs. B's concern with, and her students' successful outcomes in integrating activities supporting development of a range of CLAs. This integrative approach reflects an advance this year at SRMS; in the previous two years, while schools would at least initially try out the full range of activities afforded in Globaloria, their ongoing practice of all activities varied to a large extent; very few of the schools sustained their reflective blogging efforts over time, nor did students (or teachers) get far enough in their programming skills to be able to implement more complex messages into the games and find the time to integrate content research.

### **Summary of Results, Billy**

Billy was a student who initially held a strong interest in game design as noted in his pre-survey. By the end of the school year, Billy reports in his post-survey that he still intends to pursue a career in programming.

*I'm thinking about going to college and earning a degree in Technology and then when I earn enough money I will be able to get the Adobe CS3 Professional Program.*

This 7th grader wants to be able to a) go to college, b) to learn computer science to get a tech job, so he can c) earn enough money to finally buy and own the constructive, productive design software he used for game design this year -- because he can't afford it at home, and he loves game design that much. This comment presents a strong statement about Billy's intrinsic motivation towards this work. It also speaks volumes about socio-economic status, technology access, and the digital divide.

Socio-economically disadvantaged students such as Billy who have such strong interests and creative talents should be readily afforded with opportunities to learn with and use technology, and not feel it is so far out of their personal reach to own such tools. There are many more Billys out there in the U.S.; this case presents an example of the untapped potential existing in under-performing schools in disadvantaged communities across the nation where students have no technology access, much less programs such as Globaloria that demonstrate how a range of technology activities can be engaged and integrated for creative, constructive, purposive and meaningful learning.

Billy also discusses his career interests in music, another theme he was able to interweave into his game. He states in the post-survey,

*If my career as a rock and roll musician dosen't take off I'm going to make games with the Flash Program.*

It appears he is playing with different ideas about his future as he answers his post-survey. His participation in Globaloria allowed him to experiment creatively with two of his strong personal interests, and his game is a vibrant outcome of the work. He maintains his wish to continue pursuing both of these interests moving forward.

Additionally, Billy had a positive attitude about incorporating civics into his game, which he references in his post survey.

*I learned a lot about al the amendmets. (Although we are only using the first 10 for our game.)  
I learned that as citizens of the U.S.A. we have rights of the government that nobody can take away.*

Billy and Garrett researched, chose, and interwove legal court case content relating to local WV cases of rights violations and coal mining into their final game. It appears the inter-mixing of this game subject into a creative activity that involved two of Billy's strong interests (music and gaming) presented a particularly meaningful context for Billy to incorporate his research findings. I wish we had more data relating to the meaning-making Billy had for this particular aspect of the game. It appears this process has possibly raised Billy's social consciousness and awareness of his own personal civil rights, and his experience researching and learning about these personally relevant WV court cases involving youth could also have an impact on his future interests (even leading to a possible interest in law or something related, long down the line). Additional contributing factors to the meaning-making could have been the openness of the workshop setting, and the self-driven style of learning that is encouraged (the relative freedom to tinker, of which Billy took advantage).

Billy also illustrates an interesting example of receptiveness to feedback and criticism. When feedback is based solely on the game, Billy seems willing to make changes. Encouraged to simplify "Rock for the Constitution" from their original concept, he and Garrett are receptive, and they ultimately produce a successful, original game.

While Billy is a motivated, eager student he occasionally has trouble staying on task, completing assignments he may see as boring (learning logs), and communicating his ideas with his team member. Nonetheless, Garrett made references to ways in which Billy provided guidance and assistance, and the team ultimately creates a successful game, which they were able to enter into the first annual civics game competition (although the team did not place). Billy shows a lot of promise as a game designer, with a zeal for technology and an aptness for finding ways to blend hobbies into a single project.

### ***Discussion of SRMS Cases: Tegan and Billy***

As Globaloria students, Billy and Tegan were both highly motivated and perseverant in their learning of Actionscript programming, wiki development, and blogging. However, in comparison we observed

several individual, group, and process-level factors that led to some important differences that are worthy of note.

At the start, Tegan appeared to be somewhat apprehensive about programming, choosing the role of team manager and letting the boys take on programming roles. Tegan's aptitude for organization and teamwork was evident in her team leadership role. Of note, Tegan played a pivotal role in noticing an inequity in the skills being developed by her team mates, and thus adjusted her team's dynamic to encourage all students to learn a fuller range of the activities in Globaloria, including those outside of their particular role instead of specializing. In Tegan's case, it appears that it was through her reflective practices that she arrived at the decision to support the Flash Actionscript learning of all team members regardless of their roles. This was a critical stance she developed towards the way the program was being conducted locally. To her, it was an ethical issue; she felt it wasn't fair to limit students from the full array of skills due to early-assigned team roles, and therefore she adjusted her tactics. It would be interesting to understand Mr. L's perception and response to her decision (and whether he prompted its emergence in some way).

Then, as the semester progressed into the final months and weeks, similar to some other past female case study students we have written about, Tegan ends up becoming integral in finalizing and completing the team's final game project, piecing together the disparate elements each of the team members created, requiring Actionscript knowledge. It appears she steps in at the end when she sees her fellow students leaving several elements of the work undone.

As for our evaluation of Tegan's team's final game Fracman, a Pacman-like game meant to teach fractions, while the game files reflected many of the introductory programming elements we included in our coding scheme, Fracman had several unfinished design elements, and also lacked cohesiveness and closure for the player. Thus it didn't achieve particularly high values in the design categories of the coding scheme. Nonetheless, all students in her team including Tegan learned an introductory level of programming, and Tegan played a strong role in leading and guiding her 3 team members, managing personalities and interests of multiple participants, demonstrating keen social and collaboration skills.

In contrast, Billy immediately identified with the role of team programmer, but instead arrived at the role of team manager out of a compromise, allowing his teammate Garrett to take on the programmer role. However, in contrast to his role, throughout the course, Billy worked individually for the most part, engaging in extensive experimentation with the social media tools introduced in the project, pursuing his own curiosities about the tools, modding and adapting them, and embedding an eclectic array of 'bells and whistles' into his blog and wiki pages. As Semester Two progressed, his Actionscript skills were needed by Garrett the team programmer in the final completion of the game. At this time, rather than share collaboratively and manage ideas and communications with his team mate, to arrive at consensus on what to include (more reflective of Tegan's facilitative approach), when the game was being finalized Billy acted unilaterally in large part, whizzing ahead of his team mate who had a different style of learning. Billy also exhibited some preferences for a dynamic of competition within his team,

such as the mini-game he implemented in which he and Garrett would *compete against teach other as team members* to upload the most files and become a “wiki master,” which appeared less than cooperative.

One important consideration here when comparing the leadership styles of these two students is their gender. Both Tegan and Billy gained a range of Actionscript programming and social media technology skills through their participation. However, Tegan also demonstrates a considerable capacity for leadership of collaborative team practices, and personal reflection in her blogs, whereas Billy does not. This social capacity may be related to the varying communication styles of the students, and individual differences. Further, facilitative vs. competitive approaches are gendered constructs, thus gender needs to be considered. However, while Mrs. B frequently comments in her evaluations on Billy’s individualistic style, he does provide some guidance to Garrett as Garrett struggles to learn Actionscript. And he certainly takes to developing his wiki pages and blog -- though, unlike Tegan, his activity does not present reflective written narrative about his process; instead he embeds applets for the play of evocative music. Direct communication and collaboration with teammates however does not appear to be a strength for him unlike Tegan.

The cases of Billy and Tegan indicate the array of work styles, processes, and outcomes that can emerge in a year-long game design workshop such as Globaloria. While it certainly appears that Mrs. B tried, it may have been that she could have further challenged and scaffolded Billy to develop his personal reflective capacities, written expression, and facilitative his teamwork and collaboration practices to a greater extent. The absent learning logs and minimalistic technically-oriented blog posts left us with little insight into his feelings, and process.

This result may indicate that educators unintentionally hold implicit gender role stereotypes. In the well-rounded educational context that Globaloria strives to be, the program holds a full array of 6 contemporary learning abilities as objectives. Social learning, collaboration and teamwork is CLA 4. Just as girls are actively encouraged to take on new programming, game design and project management skills and confidence (reflected by CLAs 1 and 2), boys should be challenged to develop their social, facilitative and reflective practices (CLA 4). Educators should be made aware of what appear to be trends in gendered early role-taking in the class, and perhaps make efforts to challenge students along all of the CLA categories, based on gaps (and not implicit gender roles).

Further, in comparing final game artifacts, we see that the Spiker’s game Rock for the Constitution (as well as the games of the other 7<sup>th</sup>-grade teams) evidenced a greater elaboration and articulation of the game’s theme of civics (specifically, the amendments), and a greater working through of dynamic game mechanics into the narrative themes presented, when compared to the Frosted Loops’ Fracman game. In Fracman, the gameplay was unrelated to the fraction content, and the game mechanics were not fully fleshed out. Additionally, the 7<sup>th</sup>-graders’ civics game narrative overall was more cohesive, providing a sense of closure for the player.

This case study demonstrates how the continued involvement of educators across years, and their own reflective practice as they proceed can lead to implementation and course management improvements that directly impact student outcomes. The educators' four annual written progress reports are integral to their reflective practice. Mrs. B stated in her elaborate reflections that this year she emphasized integration of the varying activities of blogging, online research, and game design and development. We observe that she was able to better manage the course sequencing and timing due to a more holistic picture she held for the course implementation, based on her prior year's experience. Mrs. B as an educator is particularly insightful. Her progress reports are fascinating to read due to the keen observations and evaluations she provides on her students, as well as the big picture course management observations she makes. One key outcome for her class as a whole is the extent of research her students undertake in year 3, to support their game design. Mrs. B specifically chose to enhance support for her students in the area of CLA 5 – online inquiry and information-seeking to support the game design narrative development. For instance, in the case of Rock for the Constitution, Billy actively engaged in research to find legal cases involving 1<sup>st</sup> amendment violations that were local to his home state of West Virginia.

In contrast, Mr. L who was in his first year was still gaining his initial introduction to each of the activities for the first time, and thus had not yet achieved a bigger picture understanding of how it all fits together. Mr. L's progress reports reflect his first-year status, in which he discusses his own personal grappling with the course material, and his own Flash learning. He begins to develop his personal evaluation style relating to students as the year progresses. Tegan's team applied little research in her team.

In the end, Mr. L's students received lower evaluation values in the content analysis than Mrs. B's, whose students' games reflected greater cohesion. It is also possible that the civics subject matter addressed by the 7<sup>th</sup> grade class lent itself to more creative narrative representations in the game design. It may have been that the students in the 8<sup>th</sup> grade math-oriented class did not feel the need for online research to create games about math and instead relied on basic, already-understood math constructs as their game content. It may also have been because her educator had not yet understood the ways in which game topic research and reflection can contribute to the games' conceptualization and narrative development. The relative impact of educator experience, course focus, grade level, etc. remain open for further research.

Overall, the findings in this case study highlight systems-level activity occurring, relating to the following factors:

- Globaloria pilot year (in this case, Year 3)
- School participation year (for SRMS, Year 2)
- Educator participation year (for Mrs. B, Year 2; for Mr. L, Year 1)
- Educator prior technology / game design experience



- Educator perspective / understanding of the holistic, big picture course objectives (namely, integration of range of activities and their inter-related contributions to each other)
- Team game design (N of students, gender of students)
- Student team roles (designer, programmer, project manager, sound designer, etc.)
- Student adherence to / shifting of / sharing of team roles across time
- Broad versus focused learning of activities designed to cultivate each of the 6 CLAs

It appears that for SRMS, a second-year school with one second-year and one first-year educator in the third pilot year of Globaloria, Mrs. S was able to arrive at enough of a holistic understanding of the course to be able to begin directing students towards greater integration of the range of activities, so that her students' final games reflect both programming knowledge, and, substantive content reflecting an emphasis on CLA 5, research and information seeking in support of student games' narrative development. Further, it appears that the work of educators and students can continue to be advanced even further within the timeframe of a year, through scaffolding even greater creativity and dynamism in the game mechanics. For instance, in the case of Rock for the Constitution, perhaps the students could have chosen a first amendment case relating to music. Or, perhaps they could have animated the court cases visually, and assigned the player a role as the judge instead of writing in text-based case content. Nonetheless, it was a big step forward to see online research, copyright, and citation reflected in Mrs. B's students' games, coupled with designs that were fairly cohesive. These results may be generalizable; that is, it may be that a greater integration of activities can and should be expected of second year educators involved in the project.

Other results presented indicate that Mrs. B's second year of course implementation presents several incremental improvements over the prior year, and her own reflective practice translated into more organized course implementation. Mrs. B's students created games that were quantifiably more advanced than first year educator Mr. L, as measured by our coding scheme. This finding is sensible given the educators' experience, and lends credence to the validity of our content analysis approach (however we must be cautious in attributing causality to educator experience alone, as other factors such as those listed in the bullets above served as differentials).

Overall, this year's SRMS case study reveals quite important new evidence in Year 3 that Globaloria is achieving systems-oriented thinking in both educators and their students across time in the pilot, as the disparate activities designed to cultivate the range of CLAs become more cohesively linked in the context of the course delivery, and thus become more integrated in the resulting game design. From observation, it does appear that the engagement in the range of activities designed to cultivate each of the CLAs contributes to the holistic learning and game design outcomes of students. This finding needs to be further explored in our ongoing design-based research agenda.

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