# Student Engagement and Development of Six Contemporary Learning Abilities in a Program of Game Design and Workshop-Based Learning: Pilot Year 3 Pre and Post-Program Survey Results, Globaloria-WV

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Abstract

Using a pre- and post-program survey we investigate student attitudes towards a range of technology activities in which students participate along 6 key dimensions that we call "contemporary learning abilities" (CLAs) which are the learning objectives for the program (Reynolds & Harel, 2009). Positive changes in student attitudes towards the continuum of Globaloria activities would indicate that socio-constructivist interventions like Globaloria using Web 2.0 technologies and game design activity can be a motivating context for student learning of an integrated set of project-oriented technology skills. Our pre and post-program self-report survey analysis using t-test statistics indicates that student frequency of engagement in, motivation towards, and understanding of, activities designed to cultivate the first three more Constructionist CLAs increased significantly as a result of participation. That is, their post-program engagement was greater than their pre-program engagement for the activities targeting CLAs 1-3, indicating a measure of success in the program at meeting the stated learning objectives. For CLAs 4-6, the results were more varied. It appears that older students were more likely to already have some initial experience prior to Globaloria engaging in the technology activities we measured representing CLAs 4-6, resulting in a possible ceiling effect. Overall, the program is unique in its focus on project-based game design learning among students, therefore increases for activities designed to cultivate CLAs 1-3 are notable.

## Introduction

This report offers readers a background on the sample of West Virginia middle school, high school and community college students participating in the Globaloria-WV program in Pilot Year 3 (2009/2010 school year). The report presents descriptive data on the composition and demographics of the overall group of students in Year 3.

Additionally, the report presents our findings on changes in students' self-reported frequency of engagement in, motivation towards, and knowledge of a range of technology and project-based work practices across six categories in a framework that we call the 6 Contemporary Learning Abilities (6-CLAs), as a result of participating in Globaloria.

Finally, the report provides descriptive data for our ongoing analysis of student behavioral outcomes, as evidenced in their measured wiki activity, and final game projects. The report offers data on student wiki activity by location, as well as longitudinally across time. We also provide the number of final games created among participating individuals and teams, and some analysis of the genres and subject matter of the games.

This report addresses the following questions:

1. What is the demographic composition of the Year 3 sample of students participating in Globaloria, and what observable differences exist across the pilot locations?
2. To what extent does students' Globaloria participation contribute to changes in student technology habits, attitudes, and understanding of a range of practices that fall within 6 contemporary learning abilities categories?
3. What is the nature of student outcomes?
4. What further research questions do these findings invite?

We are developing scholarly conference papers and journal articles based on these findings, with the addition of further analysis in progress, which includes exploration into the inter-relationships among school-level implementation context factors, educator factors, student demographics, changing technology attitudes as a result of participation, learning support resource uses, participation factors such as wiki engagement, and their project-based learning outcomes (game evaluation). The journal articles in progress will ground this work theoretically, linking to relevant scholarship in several disciplines. At the Symposium, we welcome greater discussion of strategies for situating this work in the literature, and further developing our theoretical linkages.

## Brief Overview of Pilot Year 3 Implementation

**Recruiting**

Recruitment activity for Pilot Year 3 schools occurred at the West Virginia Center for Professional Development's annual conference at the Stonewall Conference Center. There, two

staff from the World Wide Workshop Foundation presented an informational session on Globaloria, and provided materials and applications to attendees. Out of this conference we received several inquiries from interested school administrators, and new applications. Some other groups contacted us based on information heard through word-of-mouth.

**Selection Criteria for Year 3**

In Pilot Year 3, the Foundation received more applications than the current start-up budget could afford. Similar to Pilot Year-3, our selection criteria for Year 3 used to evaluate the schools' applications are listed as follows:

Students self-selected into the Globaloria elective course offered in their schools, and promoted by the participating educators. Educators heard about the opportunity to participate in Globaloria through WV news press, prior participation, and through presentations presented the year before by the WV Program Manager at state teacher conferences and events. In Pilot Year 2, the World Wide Workshop Foundation stated that the following criteria were used for school and teacher participation.

- School meets hardware technical requirements:

| |
|---|
| **1 Multimedia PC/Laptop for each student, 6-8 hours per week** with |
| • Pentium 4 processor |
| • 512K RAM |
| • HD with 20GB free space |
| • Earphones/speakers |
| • Batteries/electricity |
| Reliable **High Speed Internet** Connectivity |
| **Web Browser**: IE v6 or FireFox 1.5 (or more recent) with free Flash Reader plug-in |
| **Flash Professional 8** software (Provided by Foundation through grant) |
| **Photoshop CS3** software |
| **Text editor** for coding (i.e. Notepad) |

- School meets time requirements for educators and students (6-10 hours per week for students, for either 1 semester or full year).
- Lead Educator is an experienced teacher who has confidence and enthusiasm about learning and integrating new technologies in their class. Does NOT need to be a "techie."

- Lead Educator should not be overbooked with other obligations that prevent him/her from dedicating enough time to Globaloria
- Educators are willing and committed to doing the course and trying to make their own game, along with students. Don't just see their role as facilitating student completion. Want to learn it themselves.
- Educators can commit to participating in the in person and online training sessions and to being part of educator community -- interacting/sharing with others in the same role.
- Integrated class model preferred because it offers students more time on the computer.
- After school options considered but need to show how will meet time requirement.
- Economically/technologically disadvantaged participant populations given priority.

**The 22 Participating Locations in Pilot Year 3**

From Year 2 to Year 3, the number of schools participating in the project increased from 14 to 22. The N of students increased from 291, to 534 active students (non-drops) in Pilot Year 3. Participating schools are located throughout West Virginia, as depicted in the map below.

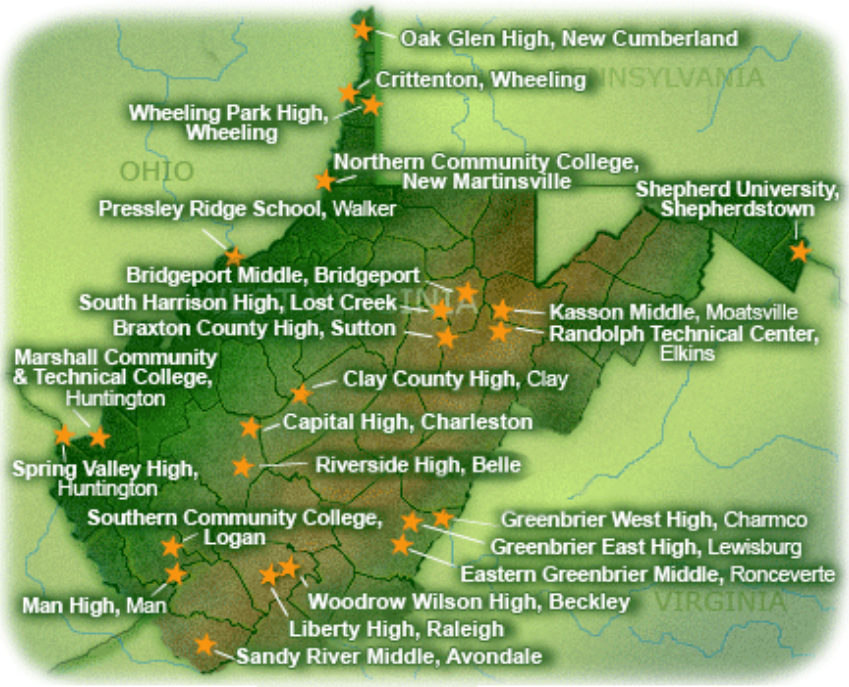



Figure 1. Globaloria-WV Year 3 Pilot Locations

In the table that follows, we list each pilot location and several implementation details including total number of educators trained, student grade levels participating at the location, type of school (MS, HS, College), total # of groups, and type of program implementation.

Table 1. Year 3 participating schools

**Schools Participating in Globaloria in 2009-2010 School Year**

| Pilot Location (School) | Location Type | Total # of Educators | Total # of Groups | Grade Levels | Total # Unique Students | Type of Program Integration (All taken for credit) |
|---|---|---|---|---|---|---|
| | | | | | | |
| **Braxton County High School, Sutton, Braxton County** | Public High School | 1NL (Donna) | 1 (1 semester) | 10-12 | 14 | Digital Imaging II (Civics Games) 5 mtgs/wk; 45 min/mtg |
| **Bridgeport Middle School Bridgeport, Harrison County** | Public Middle School | 1 NL (Melissa) 1 NS (Jan) | 1 (1 semester) | 8 | 16 | Gaming4Math8 (Math Games) 5 mtgs/wk; 45 min/mtg |
| **Capital High School Charleston, Kanawha County** | Public High School | 1RL (Bill) | 1 (2 semesters) | 9-12 | 17 | Global Advanced Biology 5 mtgs/wk; 49 min/mtg |
| | | | 1 (2 semesters) | 9-12 | 19 | Global Biology 5 mtgs/wk; 49 min/mtg |
| **Crittenton Services Wheeling, Ohio County** | Alt. Ed. (At-risk girls) | 1RL (Melonie) | 1 (2 semesters) | 8-GED | 21 | Game Design (Civics Games) 2-3 mtgs/wk; 120 min/mtg |
| | | 1NL (Dionne) 1 NS (Natasha) | 1 (2 semesters) | 8-GED | 22 | Learning to Learn (Civics Games) 2-3 mtgs/wk; 120 min/mtg |
| **Eastern Greenbrier Middle School Ronceverte, Greenbrier County** | Public Middle School | 1RL (Lisa) | 1 (2 semesters) | 8 | 18 | Globaloria 8 (Social Issue Games) 5 mtgs/wk; 45 min/mtg |
| | | 1NL, (Melanie) | 1 (2 semesters) | 7 | 9 | Globaloria 7 (Math Enrichment Games) 5 mtgs/wk; 45 min/mtg |
| **Greenbrier East High School Lewisburg, Greenbrier County** | Public High School | 1 NL (Kevin) | 2 (2 semesters) | 10-12 | 27 | Globaloria (Social Issue Game) & Architecture (Architecture Games) 2-3 mtgs/wk; 90 min/mtg |
| | | 1RL (Jim) | 1 (2 semesters) | 10-12 | 10 | Globaloria (Social Issue Games) 2-3 mtgs/wk; 90 min/mtg |
| | | 1NL (Liz) | 1 (2 semesters) | 10-12 | 10 | Globaloria (Civics Games) 2-3 mtgs/wk; 90 min/mtg |
| **Greenbrier West High School Charmco, Greenbrier County** | Public High School | 1RL, 1NS (Vicky, Angie) | 1 (2 semesters) | 10-12 | 11 | Globaloria and Computer Assisted Art (Social Issue Games) 5 mtgs/wk; 90 min/mtg |
| **Liberty High School, Glen Daniel, Raleigh County** | Public High School | 1NL (Tracy) | 2 (1 semester) | 11-12 | 15 | Digital Imaging and Multimedia 1 and 2 (Social Issue Games) 5 mtgs/wk; 90 min/mtg |
| **Man High School, Man, Logan County** | Public High School | 1RL (Natalie) | 2 (1 semester) | 9-12 | 12 | MHS Operating Systems Gaming Class (Social Issue Games) 5 mtgs/wk ; 52 mins/mtg |
| **MCTC** | Public Community College | 2 RL (Josh, Patrick) | 3 (1 semester) | College | 28 | Intro to Gaming 1 Fall, and Spring, Intro to Gaming 2 Spring 2 mtgs/wk; 75 min/mtg |
| **Oak Glen High School, New Cumberland, Hancock County** | Public High School | 1NL (Sheila) | 1 (1 semester) | 9-12 | 20 | Digital Imaging (Civics Games) 5 mtgs/wk; 90 min/mtg |
| **Pressley Ridge School Walker, Wood County** | Alt Ed (at-risk youth) | 1RL Lori, 1NS Neale | 2 (2 semesters) | 9-12 | 45 (6 x 7-8) | 21st C. Skills /Social Studies (Social Issue Games); 5 mtgs/wk in 2 45 min classes; 90 min total/wk |

| Pilot Location (School) | Location Type | Total # of Educators | Total # of Groups | Grade Levels | Total # Unique Students | Type of Program Integration (All taken for credit) |
|---|---|---|---|---|---|---|
| **Randolph Technical Center Elkins, Randolph County** | Technical/ Vocational H.S. | 1RL (Denise) | 3 (1 semester) | 9-12 | 28 (20 Fall and Spring, 8 Spring only) | Game Design 1 (Fall); Game Design 1 and 2 (Spring); 5 mtgs/wk; 90 mins/mtg |
| **Riverside High School Belle, Kanawha County** | Public High School | 1NL (Norma) | 1 (1 semester) | 9-12 | 13 | Digital Imaging (Social Issue games); 5 mtgs/wk; 90 min/mtg |
| | | 1 NL (Heather) | 1 (1 semester) | 12 | 25 | English 12 (Social Issue Games); 5 mtgs/wk; 90 min/mtg |
| **Sandy River Middle School Avondale, McDowell County** | Public Middle School | 1RL (Ingrida) | 1 (2 semesters) | 7 | 14 | Globaloria 7th Grade (Civics Games) 5 mtgs/wk; 82 min/mtg; Xhelp: 40min activity period |
| | | 1NL (Aaron) | 1 (2 semesters) | 8 | 13 | Globaloria 8th Grade (Math Games); 5 mtgs/wk; 82 min/mtg, Xhelp: 40min activity period |
| **Shepherd University, Shepherdstown, Jefferson County** | Private University | 1 NL (Monica) | 2 (1 semester) | College | 24 | Game Design (Fall), Flash Games (Spring) 2 mtgs/wk; 75 min/mtg |
| **South Harrison High School Lost Creek, Harrison County** | Public High School | 1NL (Cheri) | 3 (1 semester) | 10-12 | 15 | Digital Imaging Multimedia I (Fall, Spring) and II (Spring only) (Civics Games); 5 mtgs/wk; 90 min/mtg |
| **Southern Community College, Logan County** | Public Community College | 1 NL (Matt) | 2 (2 semesters) | College | 10 | Globaloria Gaming 1 Fall, Globaloria Gaming 2 Spring 2 mtgs/wk; 75 min/mtg |
| **Spring Valley High School Huntington, Wayne County** | Public High School | 1RL (Jeremy) | 4 (2 semesters) | 10-12 | 78 (62 in Gaming, 23 in Architecture; 7 took both) | Game Design (Soc Issue games) 5 mtgs/wk; 45 min/mtg |
| | | | 4 (1 semester) | 10-12 | | Drafting (Drafting games) 5 mtgs/wk; 45 min/mtg |
| **Wheeling Park High School Wheeling, Ohio County** | Public High School | 1NL (Bob) | 1 (2 semesters) | 9-12 | 20 | Globaloria Game Design (Social Issue Games); 5 mtgs/wk; 47 min/mtg |
| **Woodrow Wilson High School, Beckley, Raleigh County** | Public High School | 1NL (Melinda) | 1 (1 semester) | 9-12 | 13 | Digital Imaging II (Social Issue Games) 5 mtgs/wk; 90 min/mtg |
| **WVNCC-Northern New Martinsville Campus, Ohio County** | Public Community College | 1 NL (Larry) | 1 (1 semester) | College | 10 | Globaloria Game Design (Spring) 1 mtg/wk; 160 min/mtg |
| **22 Schools** | **3 Middle Sch 13 High Sch 2 Alt. Ed 4 Colleges** | **33 Educators** | **48 Groups** | **7th Grade to College** | **577 Student Participants** | **For Credit Integrations include: Biology, 7th and 8th Grade Math, Art, English, Drafting, Digital Imaging, Game Design, Social Studies** |

## *Demographic composition of the Year 3 sample*

**Total Number of Participants**

The total number of participants in Pilot Year 3 was 534, with 334 males and 190 females participating. We arrived at this metric by cross-checking the Globaloria database (which draws from educator quarterly progress reports as the primary source), and student pre-surveys. The N of students by grade level for the 534 non-dropped students is presented in the following table. The alternative education category refers to two pilot locations, Pressley Ridge School and the Florence Crittenton Center for Girls.

Table 2. N of students by grade level

| | N | Percent |
|---|---|---|
| **Middle School** | 64 | 12.0% |
| **High School** | 322 | 60.2% |
| **Community College** | 71 | 13.3% |
| **Alternative Education** | 77 | 14.6% |
| **Total** | **534** | **100.0%** |

Out of 534 student participants, a total of 472 completed the pre-survey, and 343 completed the post-survey. The summary data table that follows provides by-location data for gender, semester start, pre and post-survey N, and, the average number of participation months for students at each location. The sources for this data are the Globaloria database as well as surveys.

Table 3. N of students by location, for the following variables: Gender, semester start, survey N, average participation months

| School | N of Students | Female | Male | Semester 1 Start | Semester 2 Start | Pre-Survey N | Post-Survey N | Avg. Partic. Months |
|---|---|---|---|---|---|---|---|---|
| Braxton County High School | 14 | 8 | 6 | 0 | 14 | 13 | 10 | 4 |
| Bridgeport Middle School | 16 | 7 | 9 | | 16 | 16 | 15 | 4 |
| Capital High School | 33 | 13 | 20 | 33 | 0 | 31 | 22 | 9 |
| Eastern Greenbrier Middle School | 20 | 4 | 16 | 20 | 0 | 19 | 18 | 9 |
| Florence Crittenton Center for Girls | 33 | 33 | | 24 | 10 | 22 | 5 | 6.9 |
| Greenbrier East High School | 43 | 8 | 35 | 43 | 0 | 42 | 28 | 9 |
| Greenbrier West High School | 9 | 5 | 4 | 9 | 0 | 9 | 5 | 9 |
| Liberty High School | 15 | 2 | 13 | 15 | 0 | 15 | 12 | 9 |
| Man High School | 12 | 6 | 6 | 1 | 11 | 10 | 8 | 4.5 |
| Marshall Community & Technical College | 27 | | 27 | 14 | 13 | 23 | 23 | 3.8 |
| Oak Glen High School | 20 | 10 | 10 | | 20 | 20 | 13 | 4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pressley Ridge School | 44 | 25 | 19 | 24 | 20 | 26 | 14 | 6.7 |
| Randolph Technical Center | 28 | 8 | 20 | 18 | 9 | 25 | 18 | 4.2 |
| Riverside High School | 36 | 16 | 20 | | 36 | 34 | 28 | 4 |
| Sandy River Middle School | 26 | 14 | 12 | 26 | 0 | 25 | 25 | 9 |
| Shepherd University | 24 | 11 | 13 | 12 | 9 | 24 | 11 | 3.5 |
| South Harrison High School | 15 | 2 | 13 | 14 | 1 | 14 | 12 | 9 |
| Southern West Virginia Community & Technical College | 10 | 3 | 7 | 10 | 0 | 1 | 5 | 4 |
| Spring Valley High School | 76 | 8 | 68 | 76 | 0 | 73 | 48 | 8.5 |
| Wheeling Park High School | 10 | 2 | 8 | 10 | 0 | 10 | 9 | 9 |
| Woodrow Wilson High School | 13 | 4 | 9 | | 13 | 12 | 6 | 4 |
| WV Northern Community College | 10 | | 10 | | 10 | 8 | 8 | 3.5 |
| | **534** | **190** | **334** | **349** | **184** | **472** | **343** | |

**Proxies for Socio-Economic Status: Parent Education, Prior Computer Use (Home/School)**

Data sources for the rest of the descriptive results are as follows:

- Pre-program student survey data
- Post-program student survey data
- Course wiki
- Student game files

Our surveys were conducted online, with links distributed to students via each pilot location wiki on MyGLife.org. Educators were strongly encouraged to introduce surveys prior and subsequent to student engagement with the program, with follow-through from Foundation staff to monitor completion.

In the table below, we present by-location results for parent education, and prior frequency of computer use at home and at school. These variables may be seen as proxies for student socio-economic status. Yellow cells denote the highest two values and blue cells denote the lowest two values among the locations listed.

For parent education, we asked students to identify the level of education for each parent separately. The scale for parent education that was used is:

0= Don't Know/ missing
1= Did not complete HS
2= Completed HS
3= Completed HS, attended some college
4= Completed college (at least 4 years)
5= Completed college, attended some GS
6= Completed GS

The parent education metric reflects the level of education for the parent with the highest education level (since many students only responded for one parent).[1]

The table below reflects that parent education is highest at Bridgeport Middle School and WV Northern Community College, and lowest at Sandy River Middle School and Pressley Ridge School. PRS is one of our alternative education programs, and SRMS is located in a particularly poor county in the state.

Frequency of *home* computer use prior to Globaloria is highest among students at Southern West Virginia Community & Technical College and Shepherd University (not surprisingly both colleges), and lowest at Florence Crittenton Center for Girls and Sandy River Middle School. FCCG is one of our alternative education programs, and again we refer to SRMS's location in a poor region.

Frequency of *school* computer use prior to Globaloria is highest at Southern West Virginia Community & Technical College (not surprising for a college) and Braxton County High School. It is lowest at Bridgeport Middle School and Florence Crittenton Center for Girls (alternative education location where student computer use is restricted). Interestingly, Bridgeport is highest for parent education which would seem to conflict with its lowest value in school use.

These proxies for socio-economic status (SES) provide important context on school characteristics. Sandy River is lowest in two of the three SES proxy variables; interestingly they are one of our top-performing schools when it comes to extent of game design learning.[2] This indicates that SES is not necessarily to be thought of as a negative predictor of performance; in fact, we are seeing that it may be a positive predictor, in that the neediest students most value and take advantage of the opportunities afforded by Globaloria (with the help of dedicated

[1] The relationship between adolescents' self reports and parents' actual reports of parental education has been found in a previous study to be in fair agreement; kappa statistics were 0.30 and 0.38 for fathers' and mothers' education, respectively (Lien, Friestad, Klepp 2001). This finding supports the validity of using student self-reports of parent education.

[2] It is important to note that statistical tests of difference *have not been* conducted among locations to identify differences that may be due to chance or random error.

educators). Students at Riverside High School and Liberty High School also both present low parent education means, and both are high-performing, and thus may provide more support for this observation.

Table 4. Means and standard deviation for parent education, frequency of computer use at home and at school

| School | Parent Education | Std. Deviation | Frequency of Computer Use at Home | Std. Deviation | Frequency of Computer Use at School | Std. Deviation |
|---|---|---|---|---|---|---|
| Bridgeport Middle School | 4.00 | 0.95 | 5.06 | 1.29 | 3.75 | 1.07 |
| WV Northern Community College | 4.00 | 1.26 | 5.38 | 1.41 | 5.25 | 0.89 |
| Southern West Virginia Community & Technical College | 3.80 | 1.23 | 5.90 | 0.32 | 5.60 | 0.84 |
| Shepherd University | 3.67 | 1.40 | 6.00 | 0.00 | 5.50 | 0.93 |
| Woodrow Wilson High School | 3.55 | 1.29 | 5.00 | 1.71 | 4.25 | 1.42 |
| Spring Valley High School | 3.50 | 1.27 | 5.34 | 0.82 | 4.44 | 1.26 |
| Eastern Greenbrier Middle School | 3.38 | 1.41 | 4.84 | 1.07 | 4.37 | 1.12 |
| Marshall Community & Technical College | 3.36 | 1.50 | 5.70 | 0.56 | 5.59 | 0.73 |
| Greenbrier East High School | 3.31 | 1.03 | 4.76 | 1.59 | 4.17 | 1.08 |
| Randolph Technical Center | 3.29 | 1.27 | 5.64 | 0.57 | 4.40 | 1.23 |
| Capital High School | 3.29 | 1.56 | 4.71 | 1.42 | 3.90 | 1.17 |
| South Harrison High School | 3.21 | 0.80 | 4.93 | 1.44 | 5.57 | 0.51 |
| Oak Glen High School | 3.15 | 1.39 | 4.95 | 1.54 | 4.45 | 1.57 |
| Braxton County High School | 3.09 | 1.22 | 5.00 | 1.60 | 5.67 | 0.49 |
| Man High School | 3.00 | 1.12 | 5.60 | 0.70 | 4.67 | 1.00 |
| Wheeling Park High School | 3.00 | 1.53 | 5.80 | 0.42 | 5.50 | 0.53 |
| Liberty High School | 2.86 | 0.86 | 5.27 | 1.44 | 4.33 | 1.35 |
| Riverside High School | 2.59 | 0.87 | 5.18 | 1.29 | 4.00 | 1.32 |
| Florence Crittenton Center for Girls | 2.50 | 0.86 | 4.18 | 2.02 | 3.52 | 1.50 |
| Greenbrier West High School | 2.44 | 1.13 | 4.89 | 0.93 | 5.00 | 1.23 |
| Sandy River Middle School | 2.43 | 1.04 | 4.54 | 1.86 | 4.00 | 1.02 |
| Pressley Ridge School | 2.27 | 0.88 | 4.88 | 1.99 | 4.65 | 1.09 |

**Student Participant Diversity**

State-wide ethnicity demographics for West Virginia are as follows, provided for comparison with the Globaloria sample of students.

Table 5. 2007/2008 Student race/ethnicity composition, West Virginia elementary and secondary school students

| | | |
|---|---|---|
| **Total Number of WV Schools** | 781 | |
| **Total WV Students** | 282,535 | |
| **Total WV Students- Amer Ind/AK Native** | 324 | 0.1% |
| **Total WV Students- Asian/Pacific Islander (*)** | 2,020 | 0.7% |
| **Total WV Students- Black** | 14,781 | 5.2% |
| **Total WV Students- Hispanic** | 2,525 | 0.9% |
| **Total WV Students- White** | 262,885 | 93.0% |

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Public Elementary/Secondary School Universe Survey", 2007-08, Version 1a; and "Local Education Agency Universe Survey", 2007-08, Version 1a; and "State Nonfiscal Survey of Public Elementary/Secondary Education", 2007-08, Version 1a.

The table that follows presents the race/ethnicity composition of students in Globaloria. The data reflect the number of students out of 534 who self-identified in each of the categories. Note, students could select more than one category. On the whole, the sample of students participating in Globaloria resembles the demographic composition of students throughout the state as a whole, the majority of whom are white.

Table 6. Globaloria student race/ethnicity composition

| | | |
|---|---|---|
| **Total Number of Schools** | 22 | |
| **Total Students** | 534 | |
| **Total Students- Amer Ind/AK Native** | 13 | 2.4% |
| **Total Students- Asian/Pacific Islander (*)** | 11 | 2.1% |
| **Total Students- Black** | 16 | 3% |
| **Total Students- Hispanic** | 8 | 1.5% |
| **Total Students- White** | 443 | 82.8% |

Source: Globaloria Year 3 Pre-Survey, list-wise N=472; students could select more than one category

**Demographic Results Summary**

Overall, we expect that all of the variables presented in these first five tables may play a significant role as factors contributing to student engagement, learning and development in Globaloria. They will be analyzed as independent contributor variables in regression analysis underway, using wiki activity and game evaluation data as dependent, outcome variables. Further, we expect that educator and location factors will also impact outcomes.

## *Qualitative Data on Student Backgrounds*

At the end of the pre-program survey, we asked students five open-ended questions. These results are being analyzed in context of our case study reports. Additionally, as further student background context, we have conducted a content analysis of the full range of Globaloria students' pre-survey responses to the open-ended questions, specifically for question 3 (future goals) and question 5 (prior game ideas), as follows.

3. Tell us about your future goals. Are you already thinking of college and/or a particular job or career?

5. What initial ideas do you have for an interactive game?

We focused on these questions because they reflect meaningful information about the students prior to their participation. Additionally, changes in the overall composition of student responses to question 3 (future goals) from pre- to post-survey may indicate an effect of Globaloria participation.

**Students' future goals**
To conduct the content analysis of student responses, we first read and reviewed each student response. For question 3, we were particularly interested to note that some students' future goals already included technology and/or game design. Thus, we coded each response that reflected such an interest. Our content analysis found that 18.8% of participants describe prior career interests that would involve technology.

A selection of the student responses reflecting prior technology interest are presented as follows.

Tell us about your future goals…

> "I would like to go to college and persue a job in nursing or a technical medical carreer."
>
> "a job in the field of computer programing or design."
>
> "mechanical or electrical engineer."
>
> "I want to be an Architect or Software Designer."
>
> "My future goals are to go to college and be a Technical Engineer."

> "becoming a software engineer."

This finding may indicate a certain extent of self-selection by students as to their involvement in Globaloria, based on prior career interests (however, we do not presently have data on the % of students who indicate a career interest in technology prior to participation, among the general student population).

After counting those with technology-oriented goals, we identified those within this group who indicated a specific future goal or interest in game design. A total of 11.8% of participants in total mention that a career in game design is of interest to them. A selection of the responses pertaining to an interest in game design include the following.

Tell us about your future goals…

> "I am working on getting into college, and either becoming a business representative or a video game designer, and if I can't get one of those two jobs I will do my best to find something that will make me happy."
>
> "I plan to attend W.V.U, and become either a video game desinger or a actor."
>
> "want to work for EA (electronic arts)."
>
> "Im going to go to DeVri to become a game designer."
>
> "I'm going to college and I want to be a doctor, lawyer, teacher, or game designer."
>
> "i plan to finish college with a degree in computer game design and recieve my certifications and eventually work with either blizzard or microsoft as a game developer."

It is unclear the extent to which students may have responded as such out of a social desirability bias, or, based on a situational interest connected to their self-selection into the project (after having awareness raised that this is an option). We intend to explore in what ways students' responses to this question (repeated in the post-survey) may be reinforced, refined and/or changed entirely, subsequent to their Globaloria participation and role-taking experiences in the program.

**Students' game design ideas**

To content analyze question 5, we reviewed and read all responses. Many students either left the question blank, or stated "I don't know yet," or something vague such as "To make the game as fun as possible," or "i dont have any yet, but im going to make it girlie."

Out of 472 students, 29.5% provided a preliminary idea for a video game.

Some of the student game ideas prior to Globaloria are included as follows. We have segmented the idea examples based on gender due to some differences we observed in this regard.

*Female respondent game ideas:*

> "I would like to create a game where special need kids can have just as much fun." –Female, age 16

> "I have an idea for a game including the series of books for Twilight, but a very small one." –Female, age 13

> "aliens attack small towns in there U.F.O's and you get to pick out a character, and make your own team,then you blow up the U.F.O with your jet."
> –Female, age 11

> "Global warming and converting natural reasoures into gasolin and major uses."
> –Female, age 13

> "I want to make a game like the McDonalds game =)" – Female, age 17

> "I have a lot. I get a lot of inspiration from my surroundings and this wonderful online MUD called DragonStone (dragonstone.org). I have this thing for vampires, dragons, faeries, etc. Mythical creatures are my forte." –Female, age 17

> "An idea I have is for a game to do with books or mysteries. A fantasy game where someone has to go on a quest is another idea I think would make a fun game." —Female, age 16

> "Olympics, Money management game" – Female, age 17

> "a scavenger hunt" – Female, age 17

*Male respondent game ideas:*

> "I think, as in games I have played, that the player should be able to make choices that will affect the story and the player will be able to control that. I figure that would be good story and gaming flexibility." –Male, age 13

"hunting/fishing/fighting/shooting/mud boggs/girls" –Male, age 13

"We are going to make our game about Saving the Beach!" –Male, age 14

"well i really like first person shooters, war strategy, and business strategy games. i have had some great ideas for a game or two in the past while playing games like Call of duty, Metal of Honor, Americas Army for PC. Also games like roller coaster Tycoon. i hope to come up with something like a first person shooter in a modern war setting that includes advanced weaponry, vehicles, and a large variety of tasks to accomplish to gain enough credits to build and command an army while still being in the action with the first person view of Call of Duty and the freedom of Grand Theft Auto. i believe this will be a combination of the future." –Male, age 16

"We decided to do it on sasquatch because we want to know more about him and make a cool and fun game." –Male, age 13

"China Overpopulation Crisis strategy game."—Male, age 18

"Maybe a classic old fantasy war game such as World of Warcraft, but just not as large and more detailed...but that type of story line would be awesome...and/or new war time game such as games like Halo for X-box."–Male, age 17

"you are in an adobe house and for some reason people are attacking you. use the beginner gun along with upgrades, gunmen, and missile turrets to defend your house."—Male, age 16

"A war game, Where the hero can either be swayed to good or bad depending on hoow they start the game. But once their path is chosen it cannot be changed. They could choose their race and gender. Maybe an elf or a human or anything that exists in modern fairy tales that is a human like or subhuman. They could choose between being an archer mage warrior berserker or a mix of the atributes they like. There would be different types of weapons and armor in the game like plate, chain, and leather items. It would be a mmorpg for either the computer or the xbox 360. If they had it for the 360 they would not have to payt for online game access since they are already paying for xbox live. As for character customization they could change the hair, hair color, facial hair, height, and weight of their characters." –Male, age 17

While a majority of students did not yet have game ideas, the selection of student responses to question 5 demonstrates the broad range of themes students think about when brainstorming game ideas. Those who did respond with game ideas pose responses that range from somewhat vague to highly elaborate.

Male student game ideas above reflect themes of weaponry and other references to fighting, the subject of overpopulation, environmental themes, and Sasquatch. Two male respondents above who wrote at some length about their game ideas reference existing games in their description, and their survey results indicate a strong prior frequency of gaming. It appears these students were already cognitively primed with prior knowledge of game design from their experience in gameplay, and that the prior experience may have influenced their thinking about a game idea.

The selection of females' game ideas above reflect very different themes -- fantasy, books (the Twilight series), commercial online games (McDonalds), environment, aliens and UFOs, Olympics, money management, scavenger hunts, and help for special needs kids.

Further more rigorous content analysis of these ideas is needed to establish and confirm these gender-driven differences. It is also likely worthwhile to explore the ways in which prior experience with game play may shape students game ideas and activity in the class. It may be that when given a choice of game design topic in the Globaloria course, male students will choose themes, design elements or mechanics that are more commonly found in existing popular games they are used to playing in their game designs. In contrast, perhaps females, who according to our survey results are less likely to engage in gaming than males prior to Globaloria, may seek to implement game design themes that are not as commonly associated with gaming. The negotiation of game topics among male and female team members is also worth exploring.

Our post-program survey asks students, "Do you have plans for a new design project?" These post-survey responses will be compared with student game design ideas reflected prior to Globaloria – in both quantity, and content.

## *Student Change in Attitudes Towards Technology Practices Representing 6 Categories of Contemporary Learning Abilities*

During their participation in Globaloria, students engage in Constructionist role-taking and meaning-making experiences that build understanding of how to be a participant in today's digitally-oriented online cultures and knowledge-based economy (Reynolds & Harel, 2009). The Globaloria founders have applied Constructionism, situated learning, social learning systems, and computational thinking principles to the program's design and development (Harel &

Papert, 1991; Seely Brown, 2005, 2006; Lave & Wenger, 1991; Guzdial & Soloway 2003; Rich, Perry, & Guzdial 2004; Reynolds & Harel, 2009).

The learning objectives of the project (Table 7) specify that students will develop a range of six "Contemporary Learning Abilities" (CLAs), which are the six main dimensions of student practice and expertise that we use as learning objectives.

**Table 7. Globaloria PROMOTES DEVELOPMENT OF SIX CONTEMPORARY LEARNING ABILITIES (6 CLAs)**

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

We initially scoped this framework while developing our research design for Globaloria-West Virginia, prior to the launch of pilot year one (Summer, 2007). We revised it in the 2007/2008 timeframe. See Reynolds and Harel Caperton (2009) for further details on the framework's development. The framework has served as conceptual model to guide research.

We hypothesize that through participation in Globaloria, the 6-CLAs develop in parallel, contribute to each other, and can be achieved in an integrated way through the Globaloria intervention's ongoing project-based activities, towards students' development of an interactive game about a subject of their interest. This framework is a new learning innovation, and represents a departure from many traditional information and digital literacy initiatives in place today, in that it emphasizes computational project-based learning.

# Method: Measuring the 6-CLAs

## Year 3 Pre/Post Survey

Individual students bring varying prior experiences, motivations, interests, and technology knowledge to the program. To address the question of students' engagement in the range of practices specified by the CLA framework through their Globaloria participation, our pre/post survey analysis addresses student shifts in attitudes towards these practices. This is one of several methods we use to explore the nature of student engagement in practices within the 6-CLA categories.

### Non-experimental pre/post design

Within the overall design-based research project we have undertaken, this study employed a non-experimental pre/post survey design to measure change in student attitudes towards a set of activities inherent to Globaloria. The surveys included three types of self-report measure for each contemporary learning ability – *frequency*, *enjoyment*, and *knowledge***.** We present the rationale for using these measures, and present our operationalizations for each below.

We hypothesize that a positive shift in student attitudes towards the range of practices across all CLAs will result from their Globaloria participation.

*Factor Analysis*
To begin to validate our theoretical categorization of the 6-CLAs, prior to developing combinations of CLA constructs using multiple survey items, we applied factor analysis to the pre-program survey items representing each CLA category, within the full West Virginia pre-survey dataset (N=472).

We hypothesized that the groupings of survey items presented to students reflecting the activities designed to cultivate the CLAs would hang together in factor analysis, reflecting a single factor. We performed factor analysis for each CLA below using the multiple items

indicated in each table (anywhere from 2 to 7 items). It is standard practice in factor analysis to only retain factors with eigenvalues greater than 1. Values greater than 1 indicate that the factor explains a significant amount of the variability in the construct.

Factor analysis confirmed the relatedness of the individual items used to identify each of the CLA factors, with items below hanging together for CLAs 1, 3, 4, 5 and 6 (with eigenvalues >1). More details on this analysis and specific eigenvalues for each construct are available upon request. For CLA 2, across the dimensions of self-reported frequency, motivation and knowledge, the factor analysis results indicated 2 sub-factors (*creating with digital media* and *collaborating with team members online* separately). Therefore we defined this as 2 separate categories.

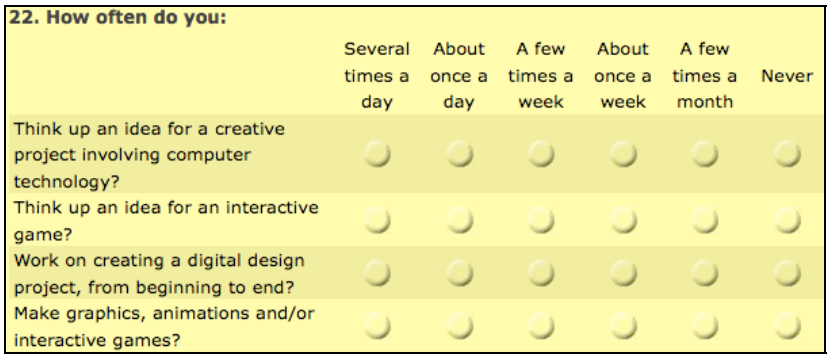
After confirming the constructs' cohesion, we performed additive combinations for the set of items in each CLA category identified (five single factors, and two sub-factors) for the measures for frequency, enjoyment and understanding. We combined appropriate variables in this way in the pre-survey dataset, and in the aligning post-survey dataset. Survey items that did not factor into categories were excluded from the final combinations. Pre/post program survey t-tests were then run for Self-Reported Frequency, Enjoyment and Knowledge, using the single combined construct in the pre- and post- surveys, in each of the 6 CLA categories.

**Frequency of student engagement in practices within the 6 CLA categories**

Above, we reported by-location results for student frequency of technology activity at home and school using an aggregate single item measure. This general measure yielded fairly high means across locations. However, we also measured student frequency of engagement in a number of very specific technology activities. Here we found a greater extent of variation in students' prior experience.

Increases in self-reported frequency of engaging in Globaloria practices representing the CLA categories from pre- to post-program provide initial evidence that student behaviors have shifted as a result of participation (to the extent that frequency self-reports hold construct validity with their actual behavior). To measure frequency we used criteria employed by the Pew Internet and American Life Project[3] in their national surveys of media and technology use. An example of the frequency survey items is provided as follows. See Appendix C for details on survey itemization, and combinations of frequency items that represent the CLA constructs.

[3] See www.pewinternet.org



| 22. How often do you: | Several times a day | About once a day | A few times a week | About once a week | A few times a month | Never |
|---|---|---|---|---|---|---|
| Think up an idea for a creative project involving computer technology? | | | | | | |
| Think up an idea for an interactive game? | | | | | | |
| Work on creating a digital design project, from beginning to end? | | | | | | |
| Make graphics, animations and/or interactive games? | | | | | | |

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

**Frequency results**

At the request of the program founder, in conducting our survey data analysis we excluded the students from alternative education 2 schools: Pressley Ridge and Florence Crittenton Center for Girls. This decision was due to the extent of variation in the way these two programs were implemented, when compared to the public schools, as well as the ongoing turnover, adding and dropping of students at these two locations. We also segmented the dataset into middle school students, high school students, and community college students, due to the varying grade levels, student populations, and program implementation factors present among these three groups. Note, the N reported below each table reflects the number of student pre/post survey respondents in each grade level for whom we have available matched-case data.

*Prior to Globaloria*

As reflected in the pre-survey means reported in the tables below, prior to Globaloria, middle school, high school and community college group means for their frequency of engagement in the less-constructionist CLAs 4 – 6 (learning with social media, information-based learning and purposeful research, and surfing the internet) appear to be higher than the group means for the more constructionist CLAs 1 – 3 (invention progression & completion, project-based learning (creating and collaborating), and publishing/distribution digital media). This result was somewhat expected, since CLAs 1 – 3 reflect practices that are more complex, constructionist and project-based, representing activities, which most students have not experienced prior to participating in Globaloria.

*From Pre to Post*

As reported in the tables below, the pre and post-program self-report survey analysis using t-test statistics indicates that *middle school students* report statistically significant increases in their frequency of engagement in Globaloria activities representing CLA dimensions 2 (both project-based learning and project management), 3 (publishing/distributing digital media) and 5 (information-based learning, research, purposeful search). We tend to characterize CLAs 1-3 as involving more Constructionist practices than CLAs 4-6. Thus, these patterns of increase include both the less-Construcionist categories (information-seeking on game design topics) as well the more constructionist ones involved in project-based creation and publishing of game artifacts.

*High school students* report statistically significant increases in their frequency of engagement in Globaloria activities within all CLA dimensions, except CLA 4 (social-based learning). It appears that the results for CLA 4 may have been due to a ceiling effect (that is, students already had a high frequency of engagement in using social media for communications with peers prior to Globaloria).

*Community college students* report statistically significant increases in their frequency of engagement in Globaloria activities within both the individual and teamwork sub-dimensions of CLA dimension 2 (project-based learning and project management), and CLA dimension 3 (publishing and distributing digital media content). Again, it appears that a ceiling effect was in place for CLAs 4-6. It appears that the program did not play a role in students' frequency of creative brainstorming and ideation about original project ideas (survey items representing CLA 1).

Table 8. Middle school students' pre- and post-program change in frequency of engagement in practices in the 6 CLA categories

| CLA # | CLA Name | Pre-Survey Mean | Std Dev. | Post-Survey Mean | Std Dev. | *t* | Statistically significant t-value? |
|---|---|---|---|---|---|---|---|
| CLA 1: | Inventing creative project ideas | 2.20 | 1.29 | 2.50 | 1.60 | -1.28 | |
| CLA 2: | Project-based learning and project management | | | | | | |
| 2a: | *Creating digital media with software* | 1.73 | 0.83 | 2.62 | 1.49 | -4.24 | * |
| 2b: | *Collaborating with team members* | 1.46 | 0.80 | 2.62 | 1.69 | -4.82 | * |
| CLA 3: | Publishing/distributing digital media | 1.94 | 1.12 | 3.04 | 1.34 | -5.64 | * |
| CLA 4: | Learning with social media | 2.20 | 1.38 | 2.55 | 1.56 | -1.68 | |
| CLA 5: | Information-based learning, research, purposeful search | 2.65 | 1.00 | 3.07 | 1.40 | -2.38 | * |
| CLA 6: | Surfing websites and web applications | 2.77 | 1.70 | 3.24 | 1.85 | -1.80 | |

Source: Globaloria West Virginia Pre-and Post-Program Survey, STUDENTS, Pilot Year-3. Alternative education schools Pressley Ridge and Crittenton are omitted.

**N = 56**

Two-tailed statistical significance at the $p \leq .05$ level is indicated by an asterisk (*).

Survey item scale (*How Often Do You ...*): 1 = Never , 2 = A few times a month, 3 = About once a week, 4 = A few times a week, 5 = About once a day, and 6 = Several times a day.

Table 9. High school students' pre- and post-program change in frequency of engagement in practices in the 6 CLA categories

| CLA # | CLA Name | Pre-Survey Mean | Std Dev. | Post-Survey Mean | Std Dev. | *t* | Statistically significant t-value? |
|---|---|---|---|---|---|---|---|
| CLA 1: | Inventing creative project ideas | 2.77 | 1.71 | 3.11 | 1.72 | -2.73 | * |
| CLA 2: | Project-based learning and project management | | | | | | |
| 2a: | *Creating digital media with software* | 1.88 | 1.10 | 2.65 | 1.28 | -8.21 | * |
| 2b: | *Collaborating with team members* | 1.46 | 1.01 | 2.54 | 1.28 | -9.85 | * |
| CLA 3: | Publishing/distributing digital media | 2.06 | 1.36 | 3.08 | 1.25 | -9.33 | * |
| CLA 4: | Learning with social media | 2.75 | 1.61 | 2.94 | 1.59 | -1.40 | |
| CLA 5: | Information-based learning, research, purposeful search | 3.51 | 1.32 | 3.94 | 1.40 | -4.42 | * |
| CLA 6: | Surfing websites and web applications | 3.71 | 1.70 | 4.13 | 1.71 | -3.11 | * |

Source: Globaloria West Virginia Pre-and Post-Program Survey, STUDENTS, Pilot Year-3. Alternative education schools Pressley Ridge and Crittenton are omitted.

**N = 208**

Two-tailed statistical significance at the $p \leq .05$ level is indicated by an asterisk (*).

Survey item scale (*How Often Do You ...*): 1 = Never , 2 = A few times a month, 3 = About once a week, 4 = A few times a week, 5 = About once a day, and 6 = Several times a day.

Table 10. Community college students' pre- and post-program change in frequency of engagement in practices in the 6 CLA categories

| CLA # | CLA Name | Pre-Survey Mean | Std Dev. | Post-Survey Mean | Std Dev. | *t* | Statistically significant t-value? |
|---|---|---|---|---|---|---|---|
| CLA 1: | Inventing creative project ideas | 3.17 | 1.78 | 3.22 | 1.75 | -0.20 | |
| CLA 2: | Project-based learning and project management | | | | | | |
| 2a: | *Creating digital media with software* | 2.46 | 1.44 | 3.13 | 1.43 | -3.46 | * |
| 2b: | *Collaborating with team members* | 1.76 | 1.34 | 2.51 | 1.79 | -3.26 | * |
| CLA 3: | Publishing/distributing digital media | 2.63 | 1.35 | 3.27 | 1.48 | -2.74 | * |
| CLA 4: | Learning with social media | 3.87 | 1.50 | 3.79 | 1.56 | 0.36 | |
| CLA 5: | Information-based learning, research, purposeful search | 4.50 | 0.99 | 4.76 | 1.07 | -1.65 | |
| CLA 6: | Surfing websites and web applications | 4.60 | 1.48 | 4.90 | 1.46 | -1.36 | |

Source: Globaloria West Virginia Pre-and Post-Program Survey, STUDENTS, Pilot Year-3

**N = 41**

Two-tailed statistical significance at the $p \leq .05$ level is indicated by an asterisk (*).

Survey item scale (*How Often Do You ...*): 1 = Never , 2 = A few times a month, 3 = About once a week, 4 = A few times a week, 5 = About once a day, and 6 = Several times a day.

**Students' motivation towards practices in the 6 CLA categories**

In the self-determination theory of E.L. Deci and R.M. Ryan, motivation is directed *towards* various activities, and having motivation towards something indicates a tendency toward repeat engagement with it over time (Deci & Ryan, 2000; Ryan & Deci, 2000a and 2000b). The construct *intrinsic motivation* is composed of the individual's perceptions of 1) competence (confidence), 2) autonomy (freedom of choice) and 3) social relatedness (feelings of connectedness and sharing with others). These qualities are inherent in the individual, but can also be supported by the environment. Research has yielded observations of intrinsically motivated, individual interest-driven behavior in learners engaging in a Constructionist intervention, which has been linked to supports that were designed into the environment that

afford learners opportunities to experience their own competence, exercise autonomy and share project-based artifacts with others (Reynolds, 2008).

Evidence of increases in student motivation towards activities across the range of CLA categories indicate a likelihood that they will continue engaging in activities inherent or related to Globaloria after the program has ended. It also indicates that the program was engaging for them and presented a meaningful context in which to experience the role of game designer, and the many practices associated with it, reflected in the CLAs.

Motivation has been operationalized in past surveys as interest/enjoyment in certain activities (e.g., Ryan, Mims, Koestner, 1983). We operationalize student motivation as student enjoyment of a range of CLA-related activities. Enjoyment was measured using a 5-point scale in which a 6th "Don't Know" category of responses were combined with "not at all true" responses (=1). We asked students to respond regarding their enjoyment in specific CLA-related activities. In our data analysis we report findings for enjoyment in each CLA category.

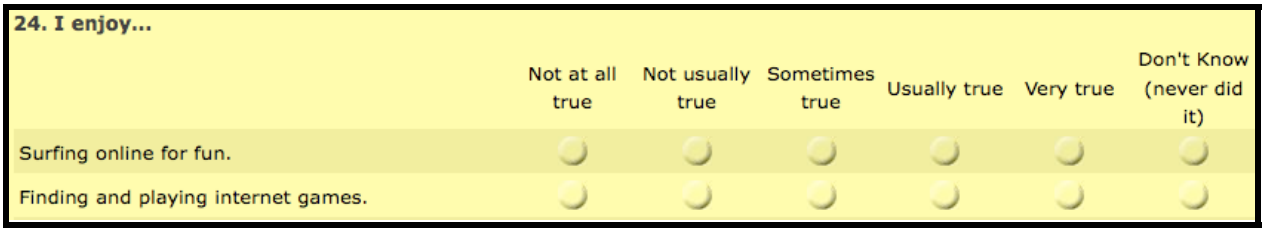



Figure 3. Survey question on students' motivation towards 6-CLAs (screenshot)

**Motivation results**

Our pre and post-program self-report survey analysis using t-test statistics indicates that *middle school students* report statistically significant increases in their enjoyment of Globaloria activities within all CLA dimensions 1 – 3, but not 4 - 6. Similar to the frequency results, it appears that Globaloria participation positively influenced middle school students' enjoyment of the more Constructionist dimensions of the CLAs in particular. It is also important to note that the N for middle school students was lower than that for high school, which can affect the significance level; the group means for CLAs 4-6 trend upwards.

*Prior to Globaloria*

As reflected in the pre-survey means reported in the tables below, prior to Globaloria, middle school high school and community college group means for their motivation towards practices in the less-constructionist CLAs 4 – 6 (learning with social media, information-based learning and purposeful research, and surfing the internet) appear to be higher than the group means for the more constructionist CLAs 1 – 3 (invention progression & completion, project-based learning (creating and collaborating), and publishing/distribution digital media). This result was expected, since CLAs 1 – 3 reflect practices that are more complex, constructionist and project-based, representing activities, which most students have not experienced prior to participating

in Globaloria. Also, these activities are more effortful, and thus may be perceived as less enjoyable.

*From Pre to Post*

Our pre and post-program self-report survey analysis using t-test statistics indicates that *middle school students* report statistically significant increases in their enjoyment of Globaloria activities within all CLA dimensions 1 – 3, but not 4 - 6. Similar to the frequency results, it appears that Globaloria participation positively influenced middle school students' enjoyment of the more Constructionist dimensions of the CLAs in particular. It is also important to note that the N for middle school students was lower than that for high school, which can affect the significance level; the group means for CLAs 4-6 trend upwards.

*High school students* report statistically significant increases in their enjoyment of Globaloria activities within CLA dimensions, except CLAs 5 and 6. A ceiling effect for CLAs 5 and 6 again appears to be a factor.

For enjoyment, results for *community college students* indicate no statistically significant increases in their enjoyment of Globaloria activities. It may be that age is playing a moderating role in the motivational shifts we are seeing among younger students, and the non-significant results we are seeing with college students. More research is underway to explore this finding.

Table 11. Middle school students' pre- and post-program change in motivation towards (enjoyment of) practices in the 6 CLA categories

Note: N reported below each table reflects the number of student pre/post survey respondents in each grade level for whom we have available matched-case data

| CLA # | CLA Name | Pre-Survey Mean | Std Dev. | Post-Survey Mean | Std Dev. | *t* | Statistically significant t-value? |
|---|---|---|---|---|---|---|---|
| CLA 1: | Inventing creative project ideas | 1.82 | 1.24 | 2.30 | 1.39 | -2.73 | * |
| CLA 2: | Project-based learning and project management | | | | | | |
| 2a: | *Creating digital media with software* | 1.94 | 0.98 | 2.69 | 1.07 | -4.21 | * |
| 2b: | *Collaborating with team members* | 2.54 | 1.32 | 2.61 | 1.12 | -0.34 | |
| CLA 3: | Publishing/distributing digital media | 1.85 | 1.24 | 2.94 | 1.39 | -4.31 | * |
| CLA 4: | Learning with social media | 2.76 | 1.11 | 2.85 | 1.21 | -0.527 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| CLA 5: | Information-based learning, research, purposeful search | 2.95 | 1.17 | 2.79 | 1.19 | 0.76 |
| CLA 6: | Surfing websites and web applications | 2.49 | 1.28 | 2.46 | 1.31 | 0.16 |

Source: Globaloria West Virginia Pre-and Post-Program Survey, STUDENTS, Pilot Year-3. Alternative education schools Pressley Ridge and Crittenton are omitted.

N = 57

Two-tailed statistical significance at the $p \leq .05$ level is indicated by an asterisk (*).

Survey item scale (*I enjoy …*): 1 = Not at all true, 2 = Not usually true , 3 = Sometimes true, 4 = Usually true, 5 = Very true.

Table 12. High school students' pre- and post-program change in motivation towards (enjoyment of) practices in the 6 CLA categories

| CLA # | CLA Name | Pre-Survey Mean | Std Dev. | Post-Survey Mean | Std Dev. | *t* | Statistically significant t-value? |
|---|---|---|---|---|---|---|---|
| CLA 1: | Inventing creative project ideas | 2.16 | 1.34 | 2.87 | 1.12 | -8.15 | * |
| CLA 2: | Project-based learning and project management | | | | | | |
| 2a: | *Creating digital media with software* | 2.12 | 1.19 | 2.97 | 1.06 | -9.74 | * |
| 2b: | *Collaborating with team members* | 2.16 | 1.16 | 2.99 | 1.23 | -7.98 | * |
| CLA 3: | Publishing/distributing digital media | 1.78 | 1.16 | 2.91 | 1.23 | -10.81 | * |
| CLA 4: | Learning with social media | 2.85 | 1.11 | 3.15 | 1.07 | -3.67 | * |
| CLA 5: | Information-based learning, research, purposeful search | 3.86 | 1.13 | 3.80 | 1.07 | 0.71 | |
| CLA 6: | Surfing websites and web applications | 3.33 | 1.35 | 3.38 | 1.25 | -0.51 | |

Source: Globaloria West Virginia Pre-and Post-Program Survey, STUDENTS, Pilot Year-3. Alternative education schools Pressley Ridge and Crittenton are omitted.

N = 208

Two-tailed statistical significance at the $p \leq .05$ level is indicated by an asterisk (*).

Survey item scale (*I enjoy …*): 1 = Not at all true, 2 = Not usually true , 3 = Sometimes true, 4 = Usually true, 5 = Very true.

Table 13. Community college students' pre- and post-program change in motivation towards (enjoyment of) practices in the 6 CLA categories

| CLA # | CLA Name | Pre-Survey Mean | Std Dev. | Post-Survey Mean | Std Dev. | *t* | Statistically significant t-value? |
|---|---|---|---|---|---|---|---|
| CLA 1: | Inventing creative project ideas | 2.89 | 1.45 | 2.93 | 1.23 | -0.15 | |
| CLA 2: | Project-based learning and project management | | | | | | |
| 2a: | *Creating digital media with software* | 2.88 | 1.29 | 3.11 | 1.15 | -0.96 | |
| 2b: | *Collaborating with team members* | 2.88 | 1.46 | 2.89 | 1.28 | -0.05 | |
| CLA 3: | Publishing/distributing digital media | 2.32 | 1.52 | 2.90 | 1.37 | -1.96 | |
| CLA 4: | Learning with social media | 3.59 | 1.07 | 3.19 | 1.17 | 1.81 | |
| CLA 5: | Information-based learning, research, purposeful search | 4.22 | 0.85 | 3.90 | 1.30 | 1.38 | |
| CLA 6: | Surfing websites and web applications | 4.05 | 1.02 | 3.85 | 1.41 | 0.79 | |

Source: Globaloria West Virginia Pre-and Post-Program Survey, STUDENTS, Pilot Year-3

N = 41
Two-tailed statistical significance at the $p \leq .05$ level is indicated by an asterisk (*).
Survey item scale (*I enjoy* …): 1 = Not at all true, 2 = Not usually true , 3 = Sometimes true, 4 = Usually true, 5 = Very true.

**Students' self-reported *knowledge* of practices in the 6 CLA categories**

We hold as an objective that students begin to develop mastery over the tasks and activities in which they participate in Globaloria through sustained engagement across the year in game design. Participants build skills in a productive ongoing workshop setting that espouses a culture of expression, collaboration and sharing. We hypothesize that building students' immediate knowledge of Globaloria activities strengthens their understanding of complex, computational project-based technology work in a social setting, in a way that will be transferable and applicable in new contexts they may encounter moving forward.

Increases in students' self-reported knowledge of Globaloria activities from pre- to post-program begin to provide initial support for the cognitive dimension of CLA development. It is important to note that increases in self-reported knowledge may also reflect affect (e.g., confidence towards a given activity), and in this case, self-reports of knowledge are worthwhile to consider, but not as valid as an actual knowledge test. Currently, no validated knowledge test exists reflecting the full range of CLA categories. Student project artifacts also provide evidence of knowledge gained, and our research also involves content analysis of their wiki publishing and final game projects.

To measure self-reported knowledge we developed items using an adaptation upon a measure validated as predictive for actual knowledge by Hargittai (2005).[4] The question for self-reported knowledge on the pre-survey presented a list of 21 technology terms that were chosen to reflect a broad range of CLA activities. Student responses for all the terms were combined into a composite variable.[5]

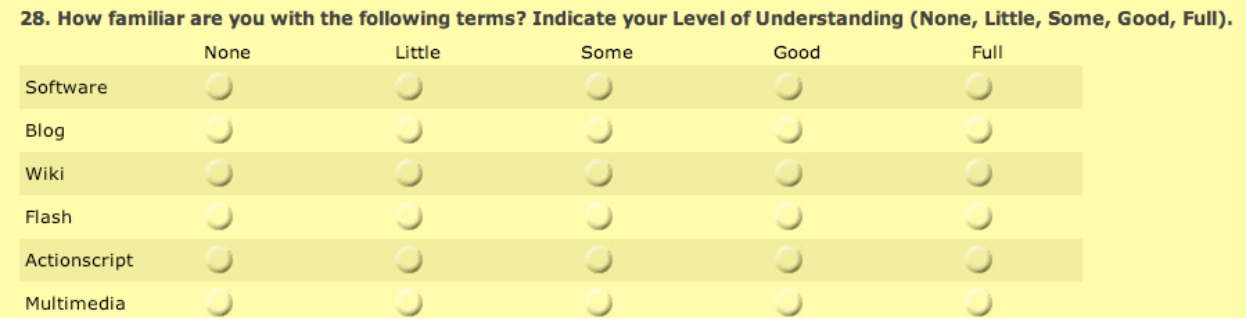



Figure 4. Self-Reported Technology Knowledge

*Prior to Globaloria*

The pattern of means for student self-reported knowledge prior to Globaloria across the CLA categories parallel those for frequency and enjoyment; means in the less-constructionist CLAs 4 – 6 (learning with social media, information-based learning and purposeful research, and surfing the internet) appear to be higher than the group means for the more constructionist CLAs 1 – 3 (invention progression & completion, project-based learning (creating and collaborating), and publishing/distribution digital media).

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

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

*From Pre to Post*

Findings for *middle school students* indicate statistically significant increases in their self-reported knowledge of Globaloria activities in CLAs 1-4.

Results for *high school students* parallel those for middle school students.

*Community college student* findings indicate statistically significant increases for CLAs 1 and 2. For CLAs 3 – 5, a ceiling effect appears to be a factor. On the whole it appears that prior to Globaloria, older students are more likely to have greater experience engaging in technology activities within CLA categories 4-6 . However, prior to participating, few students regardless of age/grade level have experience engaging in the more Constructionist activities unique to Globaloria.

Table 14. Middle school students' pre- and post-program change in self-reported knowledge of practices in the 6 CLA categories

| CLA # | CLA Name | Pre-Survey Mean | Std Dev. | Post-Survey Mean | Std Dev. | *t* | Statistically significant t-value? |
|---|---|---|---|---|---|---|---|
| CLA 1: | Inventing creative project ideas | 1.88 | 0.85 | 3.05 | 1.16 | -7.40 | * |
| CLA 2: | Project-based learning and project management | | | | | | |
| 2a: | *Creating digital media with software* | 2.11 | 0.87 | 3.25 | 0.98 | -7.40 | * |
| 2b: | *Collaborating with team members* | NA | NA | NA | NA | NA | |
| CLA 3: | Publishing/Distributing digital media | 2.66 | 1.01 | 3.77 | 0.85 | -7.29 | * |
| CLA 4: | Learning with social media | 3.40 | 1.12 | 3.63 | 1.00 | -2.34 | * |
| CLA 5&6: | Surfing websites and web applications, Information-based learning, research, purposeful search | 4.49 | 0.93 | 3.80 | 0.94 | -1.09 | |

Source: Globaloria West Virginia Pre-and Post-Program Survey, STUDENTS, Pilot Year-3. Alternative education schools Pressley Ridge and Crittenton are omitted.

N = 54

Two-tailed statistical significance at the $p \leq .05$ level is indicated by an asterisk (*).

Survey item scale (*How familiar are you with the following terms and activities?*): 1 = None, 2 = Little, 3 = Some, 4 = Good, 5 = Full.

Table 15. High school students' pre- and post-program change in self-reported knowledge of practices in the 6 CLA categories

| CLA # | CLA Name | Pre-Survey Mean | Std Dev. | Post-Survey Mean | Std Dev. | *t* | Statistically significant t-value? |
|---|---|---|---|---|---|---|---|
| CLA 1: | Inventing creative project ideas | 2.22 | 1.15 | 3.14 | 1.05 | -10.85 | * |
| CLA 2: | Project-based learning and project management | | | | | | |
| 2a: | *Creating Digital Media with software* | 2.43 | 1.08 | 3.26 | 0.97 | -11.00 | * |
| 2b: | *Collaborating with Team Members* | NA | NA | NA | NA | NA | |
| CLA 3: | Publishing/Distributing Digital Media | 3.20 | 1.07 | 3.83 | 0.93 | -7.89 | * |
| CLA 4: | Learning with social media | 3.80 | 1.01 | 3.96 | 0.93 | -2.33 | * |
| CLA 5&6: | Surfing websites and web applications, Information-based learning, research, purposeful search | 4.08 | 0.90 | 4.12 | 0.91 | -0.69 | |

Source: Globaloria West Virginia Pre-and Post-Program Survey, STUDENTS, Pilot Year-3. Alternative education schools Pressley Ridge and Crittenton are omitted.

N = 210

Two-tailed statistical significance at the $p \leq .05$ level is indicated by an asterisk (*).

Survey item scale (*How familiar are you with the following terms and activities?*): 1 = None, 2 = Little, 3 = Some, 4 = Good, 5 = Full.

Table 16. Community college students' pre- and post-program change in self-reported knowledge of practices in the 6 CLA categories

| CLA # | CLA Name | Pre-Survey Mean | Std Dev. | Post-Survey Mean | Std Dev. | *t* | Statistically significant t-value? |
|---|---|---|---|---|---|---|---|
| CLA 1: | Inventing creative project ideas | 2.81 | 1.14 | 3.53 | 1.09 | -4.02 | * |
| CLA 2: | Project-based learning and project management | | | | | | |
| 2a: | *Creating Digital Media with software* | 2.92 | 0.90 | 3.59 | 0.97 | -4.89 | * |
| 2b: | *Collaborating with Team Members* | NA | NA | NA | NA | NA | |
| CLA 3: | Publishing/Distributing Digital Media | 3.99 | 0.96 | 4.20 | 0.92 | -1.28 | |
| CLA 4: | Learning with social media | 4.12 | 0.83 | 4.22 | 0.84 | -0.66 | |
| CLA 5&6: | Surfing websites and web applications, COMBINED with Information-based learning, research, purposeful search | 4.28 | 0.89 | 4.28 | 0.94 | 0.00 | |

Source: Globaloria West Virginia Pre-and Post-Program Survey, STUDENTS, Pilot Year-3

N=41

Two-tailed statistical significance at the $p \leq .05$ level is indicated by an asterisk (*).

Survey item scale (*How familiar are you with the following terms and activities?*): 1 = None, 2 = Little, 3 = Some, 4 = Good, 5 = Full.

Overall, the pre and post program survey results partially confirm our hypothesis that student attitudes towards the range of practices in each CLA category are positively influenced by their participation in Globaloria. Especially for practices representing the more Constructionist CLAs 1-3, our pre and post-program self-report survey analysis using t-test statistics indicates that student frequency of engagement in, motivation towards, and understanding of these practices increased significantly as a result of participation. That is, their post-program engagement was greater than their pre-program engagement for the practices within CLA categories 1-3, indicating a measure of success in the program at meeting the stated learning objectives.

For CLAs 4-6, the results were more varied with regard to statistically significant increases. Ceiling effects may have played a role in this; pre-survey means were higher for practices in CLA categories 4-6 than 1-3. It also appears that older students were more likely to already have some initial experience prior to Globaloria engaging in practices representing CLAs 4-6 than the younger students.

This program is unique in its focus on project-based game design learning among students, therefore increases for attitudes towards the practices representing CLA categories 1-3 are notable.

## Student Wiki and Blog Activity

Pilot locations varied in the extent of their wiki and blog activity. One key factor in this activity was their number of participation months. Another was the N of students at the location. However, even when standardizing metrics controlling for these factors, we see differences that allow us to make relative comparisons across locations.

The results that follow present the aggregate, unstandardized data at each location for wiki and blog activity. Standardized wiki and blog data controlling for N of students and average participation months are provided in the tables in Appendix B.

*Wiki Edits*
Students engage in wiki editing for the following purposes:

- To create their online identity on their Profile pages,
- To complete assignments on their Projects pages,
- To embed uploaded files to their Projects pages using wiki code,
- To edit and embed uploaded files to their team project pages,
- To communicate with each other on Talk pages and other pages, providing feedback on project assets, and
- To add playful social commentary.

The top three pilot locations for wiki edits were Pressley Ridge, Sandy River Middle School, and Riverside High School. See Table 17 below for details. It appears that Pressley Ridge students used the wiki mostly for experimenting with developing online identities, and posting static image files, whereas the two other pilot locations, Sandy River Middle School and Riverside High School, used the wiki in a more comprehensive way; both of these latter locations were also in the top three for Flash file uploads.

*File Uploads*
Metrics on file uploads to the wiki are a behavioral measure that partially reflects extent of Flash game design activity, because uploading such files requires that students have created these files first in the Flash project software. The top three pilot locations for number of Flash file uploads were Sandy River Middle School (with by far the greatest number of uploads for

both file types), Riverside High School, and Liberty High School. It appears that students at these locations were particularly active in using Flash. Riverside High School had an average number of participation months of 4, whereas the other locations worked for 9 months. This result is notable and we are exploring activity at this location.

*Blog Posts*

Students in Globaloria write blog posts to reflect on their process, write reviews of games they test, address topic prompts posed by their educators, and engage in free writing. The program provides a context and purpose for students to develop and practice their reflective writing and typing skills informally, using blogs as an interactive medium where they can receive feedback. Other students in their own class, in other classes, educators, and World Wide Workshop Foundation staff post comments offering responses to student posts.

We tallied all blog activity across the school year for all students. Without analyzing the substance, we found that the top three pilot locations for number of blog posts were Spring Valley High School, Greenbrier East High School, and Eastern Greenbrier Middle School. Educators at Spring Valley HS in particular emphasized blogging this year. The educators at SVHS required frequent blogging, posting weekly prompts for the students to answer as their part of their grade.

**Table 17: Wiki and Blog Participation, by school, in Pilot Year 3**

| | | WIKI TALLY | | | | | BLOG TALLY | | |
|---|---|---|---|---|---|---|---|---|---|
| Schools | Avg. partic. months | Wiki Edits | FLA uploads | SWF uploads | Other Uploads | TOTAL Uploads | Blog Posts | Comments | TOTAL Blogs |
| Braxton County High School | 4 | 998 | 6 | 7 | 71 | 84 | 111 | 44 | 155 |
| Bridgeport Middle School | 4 | 1582 | 160 | 148 | 79 | 387 | 330 | 221 | 551 |
| Capital High School | 9 | 462 | 170 | 177 | 26 | 373 | 431 | 25 | 456 |
| Eastern Greenbrier Middle School | 9 | 4057 | 257 | 558 | 595 | 1410 | 607 | 200 | 807 |
| Florence Crittenton Center for Girls | 6 | 2163 | 136 | 152 | 1683 | 1971 | 112 | 20 | 132 |
| Greenbrier East High School | 9 | 4145 | 273 | 421 | 586 | 1280 | 765 | 197 | 962 |
| Greenbrier West High School | 9 | 3938 | 192 | 200 | 156 | 548 | 403 | 89 | 492 |
| Liberty High School | 9 | 2181 | 454 | 537 | 172 | 1163 | 459 | 285 | 744 |
| Man High School | 4.5 | 753 | 138 | 133 | 83 | 354 | 45 | 0 | 45 |
| Marshall Community & Technical College | 4 | 1307 | 256 | 332 | 95 | 683 | 279 | 4 | 283 |
| Oak Glen High School | 4 | 4141 | 23 | 70 | 514 | 607 | 166 | 61 | 227 |
| Pressley Ridge School | 6 | 7162 | 5 | 3 | 631 | 639 | 296 | 13 | 309 |
| Randolph Technical Center | 4 | 4142 | 367 | 646 | 363 | 1376 | 560 | 76 | 636 |

| | | WIKI TALLY | | | | | BLOG TALLY | | |
|---|---|---|---|---|---|---|---|---|---|
| Schools | Avg. partic. months | Wiki Edits | FLA uploads | SWF uploads | Other Uploads | TOTAL Uploads | Blog Posts | Comments | TOTAL Blogs |
| Riverside High School | 4 | 5963 | 507 | 489 | 980 | 1976 | 589 | 213 | 802 |
| Sandy River Middle School | 9 | 6409 | 1185 | 1127 | 1051 | 3363 | 649 | 278 | 927 |
| Shepherd University | 3.5 | 1683 | 116 | 163 | 191 | 470 | 429 | 51 | 480 |
| South Harrison High School | 9 | 1675 | 37 | 177 | 64 | 278 | 444 | 549 | 993 |
| Southern West Virginia Community & Technical College | 4 | 447 | 105 | 140 | 23 | 268 | 236 | 5 | 241 |
| Spring Valley High School | 9 | 4988 | 217 | 954 | 859 | 2030 | 3405 | 5 | 3410 |
| Wheeling Park High School | 9 | 610 | 25 | 58 | 132 | 215 | 291 | 0 | 291 |
| Woodrow Wilson High School | 4 | 1712 | 107 | 122 | 48 | 277 | 169 | 64 | 233 |
| WV Northern CC | 3.5 | 1114 | 70 | 74 | 82 | 226 | 211 | 194 | 405 |
| **TOTAL** | | **61632** | **4806** | **6688** | **8484** | **19978** | **10987** | **2594** | **13581** |

Total monthly wiki activity in aggregate for all Year 3 participants is provided in the following table, to show how activity varies across the year.

For wiki editing, on the whole, the most active months were September, February, and March, all months in which new students were starting up a new semester, and making edits to their profile and projects pages, developing an online identity.

The most active months for FLA and SWF uploading were March, April and May, indicating months during which students were actively presenting their final best work on the wiki.

Blog postings appear fairly uniform across the timeframe; however, blogging was not uniformly adopted by all locations. Thus, we will look at blogging at the location level to discern possible cross-time patterns.

Table 18. Pilot Year 3 Student Wiki Activity, Aggregated By Location (unstandardized)

| | | |
|---|---|---|
| **September** | Wiki Edits | 8087 |
| | FLA | 405 |
| | SWF | 664 |
| | Other | 1067 |
| | Blog | 1483 |
| | Comments | 434 |
| **October** | Wiki Edits | 6311 |
| | FLA | 444 |
| | SWF | 546 |
| | Other | 976 |
| | Blog | 1382 |
| | Comments | 354 |

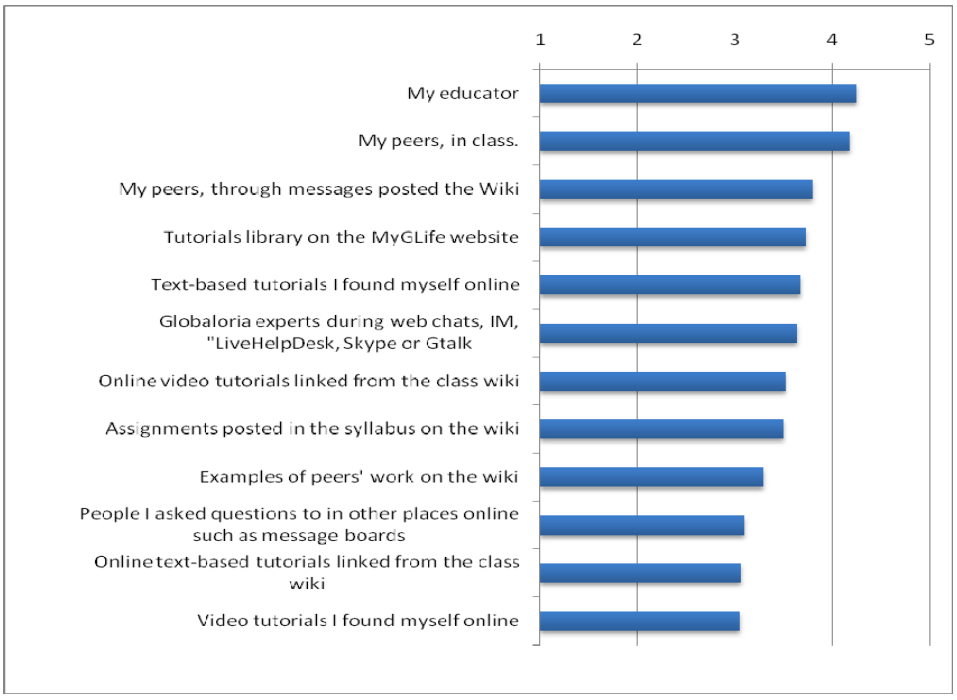
| | | |
|---|---|---|
| **November** | Wiki Edits | 4779 |
| | FLA | 525 |
| | SWF | 789 |
| | Other | 324 |
| | Blog | 1293 |
| | Comments | 185 |
| **December** | Wiki Edits | 5338 |
| | FLA | 495 |
| | SWF | 748 |
| | Other | 510 |
| | Blog | 886 |
| | Comments | 151 |
| **January** | Wiki Edits | 4610 |
| | FLA | 203 |
| | SWF | 302 |
| | Other | 917 |
| | Blog | 1045 |
| | Comments | 197 |
| **February** | Wiki Edits | 7146 |
| | FLA | 346 |
| | SWF | 468 |
| | Other | 1068 |
| | Blog | 1045 |
| | Comments | 300 |
| **March** | Wiki Edits | 11040 |
| | FLA | 820 |
| | SWF | 1168 |
| | Other | 1346 |
| | Blog | 1789 |
| | Comments | 629 |
| **April** | Wiki Edits | 7465 |
| | FLA | 772 |
| | SWF | 994 |
| | Other | 1339 |
| | Blog | 1271 |
| | Comments | 256 |
| **May** | Wiki Edits | 4771 |
| | FLA | 700 |
| | SWF | 892 |
| | Other | 586 |
| | Blog | 646 |
| | Comments | 71 |
| **June** | Wiki Edits | 822 |
| | FLA | 93 |
| | SWF | 106 |
| | Other | 182 |
| | Blog | 97 |
| | Comments | 3 |

In our continuing analysis of student wiki activity, this year we are beginning to use wiki log files to determine patterns of online behavior by students, based on page type. This ongoing data analysis will allow us to better understand what pages and features of the wiki are particularly useful and interactive for students, and how we might further develop the wiki to scaffold and support student learning and collaboration.

**Student Utilization of Learning Resources**

In our post-program survey, we also asked students to respond to a question regarding what learning resources they found most useful in their learning process. The chart below indicates their responses to the question, "In Globaloria, I learned by interacting with…" [Scale, 1=strongly disagree, 2=disagree, 3=neither disagree or agree, 4=agree, 5=strongly agree]. On the whole, students strongly agree that they learn from their educator and peers face to face, and through wiki messages. They also appear to agree but to a lesser extent that they learned using the tutorials library, by engaging with game design experts, video tutorials. It appears they are more neutral about the extent of their learning of syllabus assignments, examples of peer work posted to the wiki, online message boards, text tutorials on the wiki, or video tutorials they find themselves. We will use these measures as predictor variables for student outcomes, to explore the extent to which uses of different types of resources might contribute to and be predictors for wiki and game evaluation achievements.

Figure 5. Students survey responses to "In Globaloria I learned by interacting with…"




## Student Game Development

Student work in Pilot Year 3 yielded 216 games. The table below reports the game genres, analyzed by a trained PhD student coder.

We are currently engaged in further evaluating all games. We have revised our Year 2 content analysis coding scheme for evaluation of student games to include analysis of Actionscript

programming code in student FLA files in addition to design attributes of the SWF, with the help of an expert Flash game designer. The scheme provides both researchers and educational practitioners with a common metric of comparison for student game-design and programming performance. We report on our evaluation of student games, the coding scheme, and the inter-coder reliability findings thus far in a separate document.

Table 19. Year 3 final games created

| | **Pilot Year 3** |
|---|---|
| **Total Game Projects Created** | 216 |
| **Student Games by Focus** | |
| **Games on Core Curriculum Topics** (spelling, mathematics, science, financial management) | 99 (46%) |
| **Games on Global Social Issues** (climate change, pollution, poverty, health, complex life choices, community) | 36 (17%) |
| **Entertainment Games** (puzzles, trivia, humor, action, adventure) | 67 (31%) |
| **Mixed Genre** (educational + social issue, educational + entertainment, social issue + entertainment) | 14 (6%) |
| **Student Games Focusing on STEM and Civics** | |
| **STEM Games** | 106 (49%) |
| **Civics Games** | 36 (17%) |
| **Individual vs Team Games** | |
| Total Games made by an Individual | 59 (27%) |
| Total Games made by a Team | 157 (73%) |

*Game quality.* In order to evaluate student game quality, we engaged in content analysis of all student final games, and then added the final outcomes at the individual level to our pre/post survey dataset as a combined, additive value. Neuendorf defines content analysis "as the systematic, objective, quantitative analysis of message characteristics" (2002, p.1). 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 "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). In the case of web games created in this program, the text is the social or educational message students build into them (such as global warming, or social / cultural themes local to West Virginia). Also, the game files demonstrate student production techniques. That is, the medium itself (the game design and mechanics of the game evidenced in the SWF and FLA files) is part of the message we evaluate.

Therefore, we evaluate functionality built into students' completed games (mechanics), as well as the game's cultural content and design. Game artifact content indicates student engagement in the program, and signals CLA development of the more Constructionist CLAs 1 and 2 (while

also partially indicating CLAs 3, 4 and 5). The purpose for evaluating games is to better understand the range of game mechanics and messages students achieved in their particular school setting, identify patterns, and explore explanations. We also evaluate games to better understand the extent of knowledge students are gaining.

*Coding Scheme Development.* Rourke and Anderson (2004) provide five steps to developing a theoretically valid scheme. The first step is to identify the purpose of the coding data; the second step is to identify behaviors that represent those constructs. They suggest that a literature review can help to identify representative behaviors. The six CLAs (especially the first three), and the literature that we drew upon for formulating these CLAs, served as a guide for determining which types of variables to incorporate into our coding scheme.

Rourke and Anderson (2004) also note in their second step that studying the data itself can help in identifying behaviors and themes (also known as open coding). In developing the scheme, we reviewed student games and wiki interactions to refine the scheme to record the game genres and the main topics students reflect in their game, to see if any patterns emerged based on cultural themes and messages expressed.

The third step (Rourke & Anderson, 2004) in constructing a coding scheme, which consists of reviewing the categories and indicators of the scheme, is to enlist experts to evaluate the codes and/or indicators to determine which are relevant and representative. Scholarly works by experts that use content analysis to study games largely focused on commercial games with the intention of understanding gender roles and levels of violence in *gameplay* (for example, Beasley and Standley 2002; Dietz 1998; Ivory 2006; Thompson and Haninger 2001). Walker and Shelton (2008) created a rubric for assessing problem-based learning outcomes and characteristics in video game play. Rice (2007) constructed an evaluative rubric to assess the amount of higher-order thinking required in video game *play*. We applied Walker & Shelton's (2008) general coding strategy of measuring presence or absence of the variables (1=Yes, 0=No) for our evaluation of Actionscript inclusion in games. We also observed that these authors (2008) and Rice (2007) had codes that were more parsimonious than those used in a previous coding scheme draft the year before, prompting further refinement. Through review of this literature we also realized the need to explicitly define what constituted a web game in the program context.

Here 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 format of the game files students post online include both .SWF (Small Web Format / Shockwave Flash) and the .FLA project file format. To be evaluated files must reflect at least an actionable button and response screen, or an object that moves based on player actions. Distinguishing and defining a "game" at this most minimal level of interactivity allows us to code the full range of game files created by students, basic to advanced.

We also consulted with an award-winning industry expert on Flash game and simulation design. Her consulting process was as follows:

1. Reviewed online syllabus to identify main areas of focus in the game design curriculum
2. Reviewed the SWF and FLA files for 5 games, and thought about the range of student abilities reflected in the games
3. Developed an initial set of Actionscript elements that were commonly used by developers and reasonable to be expected in a student game.
4. Revised the previous version of design / visual / game content codes that was used in the year before, to evaluate SWF files (refined language, revised main header categories)

The result was a new draft of the coding scheme improving upon that used in the year before. Practice coding is the fourth step (Rourke and Anderson, 2004), and this was conducted by four coders (three experienced Flash designer, and one lead researcher), who all analyzed a set of five common games. The group reviewed discrepancies, and further revised the coding scheme, removing redundant categories, refining language, establishing a 3-point scale for the design evaluation instead of 0/1 to more fully capture the breadth of data.

*Final Coding Scheme Categories*.

While some basic elements from our original coding scheme in Pilot Year 2 remained, it was largely our inductive approach of playing many of the games, considering their composition, and exploring the processes that students go through to create them, that influenced our final coding scheme. Ultimately, we found that we had a parsimonious group of codes that accurately and precisely reflected key dimensions of a finished web-game produced. The final coding scheme contained two main types of analysis:

1. Evaluation of Actionscript programming codes that could reasonably be expected from introductory game design students (1=present, 0=absent);
2. Evaluation of design attributes built into the game (visual and sound design elements, game play experience, concept development, genre) (1=Not present / insufficient representation; 2=basic / introductory representation; 3=well-developed representation)

*Final Coding Scheme*

The final coding scheme is presented in Appendix D at the end of the paper. Inter-coder reliability was conducted on 30 student games created in Pilot Year 3 (out of 221 games in total). To establish reliability we trained a coder, discussing and establishing best process for analyzing Flash code to ensure that code on both frame layers and movie clip objects were taken into consideration. The 30 games were then coded by two people: a) an experienced Actionscript programmer and b) a post-doctoral researcher. We achieved reliability of greater than 80% agreement, using the percent agreement statistic (2m / n1 + n2), where:

m = the number of coding decisions upon which the two coders agree

n1 = total number of coding decisions made by rater 1
n2 = total number of coding decisions made by rater 2

*Game Evaluation Results By Location*

Out of the total set of student participants (N=534), 415 students either participated in teams that created games, or created games individually. Students at Pressley Ridge School did not create any final games, nor did students at Crittenton Center. Further, students at Capital High School created files that were more reflective of simulations than final games. These students created game design plans, however, and did begin to create Flash files that exhibited introductory levels of interactivity, and were organized well on the class wiki, thus, we evaluated these files in our evaluation process. The files at Capital HS however do not fit with our stated definition of a game. Interestingly, though, several of the Capital HS simulation files achieved higher scores than students' files at other locations, due to the greater emphasis on graphic design that the Capital HS files reflect, and their thorough and organized design plans.

The three tables below feature the game evaluation findings for all participating Pilot Year 3 schools, segmented by grade level (MS, HS, community college). In each grade level table, the schools are presented in rank order from highest to lowest, according to the total mean game evaluation value (which was additive of all the game categories). Additionally, the tables feature the by-location means for each category in the coding scheme (Programming, Visual and Sound Design, Game Play Experience, and Concept Development).

Below we see that Liberty High School had the highest mean game evaluation value out of all the schools. The school with the second highest game evaluation value was actually a middle school – Sandy River. While we separated the schools by grade levels, we see that the results are largely intermixed and grade level does not appear to be a strong factor in the outcomes.

For all games grouped together, the low was 16 and the high was 52. The highest possible value in the coding scheme is 61. Overall, the game values reflect a wide array of variation. The mean for the entire set of 216 games was 26.73. The standard deviation for the games was 8.10. LHS had the highest mean with 47. Among all games, the highest scoring game was called Deceptive Cadence, created by students at LHS, and achieving the high value of 52. The second highest scoring game had a value of 49 and was created by students at SRMS, called "It's Your Choice." Both of these games reflected a large proportion of the attributes we were coding for in our scheme (see Appendix D for the codes). On average, however, the mean evaluation value among all 216 games of 26.73 represents a relatively low average score in relation to the maximum value of 61 in the coding scheme. Also, it is important to note that 199/534 or 22.3% of students did not complete a final, evaluable game.

Table 20. Game Evaluation Results for Globaloria Middle Schools

| Middle Schools | N of Games Created | Total Mean Game Evaluation | Programming | Visual and Sound Design | Game Play Experience | Concept Development |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| Sandy River Middle School | 11 | 35.73 | 7.09 | 8.64 | 9.27 | 10.73 |
| Eastern Greenbrier Middle School | 17 | 29.53 | 3.94 | 7.35 | 8.53 | 9.71 |
| Bridgeport Middle School | 5 | 27.40 | 2.60 | 7.60 | 7.80 | 9.40 |

Table 21. Game Evaluation Results for Globaloria High Schools

| High Schools | N of Games Created | Total Mean Game Evaluation | Programming | Visual and Sound Design | Game Play Experience | Concept Development |
|---|---|---|---|---|---|---|
| Liberty High School | 4 | 47.00 | 7.75 | 14.50 | 10.25 | 14.50 |
| Randolph Technical Center | 13 | 32.08 | 4.77 | 8.38 | 8.62 | 10.31 |
| Woodrow Wilson High School | 12 | 29.83 | 4.92 | 8.08 | 8.25 | 8.58 |
| South Harrison High School | 7 | 28.71 | 5.14 | 7.00 | 7.71 | 8.86 |
| Braxton County High School | 5 | 27.80 | 3.20 | 7.20 | 8.00 | 9.40 |
| Greenbrier West High School | 4 | 27.25 | 5.50 | 7.25 | 6.25 | 8.25 |
| Greenbrier East High School | 18 | 26.22 | 4.56 | 6.44 | 7.33 | 7.89 |
| Riverside High School | 16 | 25.13 | 2.94 | 6.63 | 7.56 | 8.00 |
| Capital High School | 14 | 23.36 | 2.50 | 5.93 | 5.79 | 9.14 |
| Man High School | 5 | 22.20 | 1.60 | 6.80 | 6.80 | 7.00 |
| Wheeling Park High School | 2 | 22.00 | 4.00 | 5.50 | 6.00 | 6.50 |
| Spring Valley High School | 36 | 19.08 | 0.44 | 5.64 | 6.03 | 6.97 |
| Oak Glen High School | 7 | 18.57 | 0.86 | 5.14 | 6.00 | 6.57 |

Table 22. Game Evaluation Results for Globaloria Community Colleges

| Community College Game Evaluation | | Total Mean Game Evaluation | Programming | Visual and Sound Design | Game Play Experience | Concept Development |
|---|---|---|---|---|---|---|
| Southern West Virginia Community & Technical | 9 | 26.89 | 4.00 | 8.22 | 6.56 | 8.11 |

| College | | | | | | |
|---|---|---|---|---|---|---|
| Marshall Community & Technical College | 15 | 27.47 | 4.60 | 8.00 | 7.07 | 7.80 |
| Shepherd University | 11 | 28.00 | 5.09 | 7.55 | 7.27 | 8.09 |
| WV Northern CC | 7 | 27.86 | 4.57 | 7.43 | 7.86 | 8.00 |

## Conclusion

In this report we have provided by-location descriptive data reflecting student and school characteristics and demographics. This data serves the following purposes:

- Provides background details that can be used to anticipate / explain student performance at the locations
- Facilitates comparisons across locations, allowing the World Wide Workshop to more closely scaffold the schools, teachers and students who need it with learning supports including training, game design resources, course sequencing recommendations, and encouragement -- personalized to their implementation context.
- Sets the stage for continued analysis using all of the factors identified, measured, and described herein, as contributor variables in further quantitative statistical analyses.

In addition, the pre- and post-program survey results provide support for the hypothesis that student participation in Globaloria results in positive student changes in attitudes towards the practices in which they engage. The findings indicate that student role-taking and meaning-making activity leads to a growing motivation towards this style of learning. The self-reported knowledge findings provide initial support for students' mastery of the CLAs. These preliminary findings on mastery need further support with measures of actual knowledge.

And, our descriptive data on student wiki activity and game creation presents further initial evidence of student mastery. Our ongoing evaluation of these outcomes will provide further insight in this regard.

Our next steps include integrating our wiki activity and completed game evaluation data into our survey datasets, and investigation of the inter-relationships among school-level implementation context factors, educator factors, student demographics, students' changing technology attitudes as a result of participation, student uses of varied learning support resources, participation factors such as wiki engagement, and their project-based learning outcomes (game evaluation). Journal articles in progress will ground this work theoretically, linking to relevant scholarship in several disciplines. At the Symposium, we welcome greater discussion of strategies for situating this work in the literature, and further developing our theoretical linkages.

Appendix 3 outlines the changes in the Pilot Year 4 survey, and rationale for each change. In addition to these changes, I also propose to undertake the following new research streams on student activity and learning. Further investigation of:

- **Student Decision-Making Processes:** I propose to conduct interviews and focus groups with students at three points in the year to explore student decision-making processes, choice of game topics, and interest development. I would also like to ask students to contextualize / link their discussion of their game topic to the specific game design and programming decisions they have made to support the build out of the game's central message. This linkage and student expressions in this regard, unfolded across 3 points, will offer rich insights into their learning and evolution in the program.

- **Wiki Data Mining:** We will engage in data-mining and visualization of wiki log files, using Excel pivot tables to re-structure the log files based on page type, and run descriptive statistics to better understand what areas of the wiki students are using. We will also use cluster or motif analysis to explore the ways in which certain types of students engage in wiki activity and online interaction behavior in ways that vary from other types of students. We will merge student survey data with wiki behavioral data for designated page types, using student usernames as a common linking variable. This will allow us to analyze whether certain student characteristics predict particular wiki behaviors.

- **Research Framework, 6CLAs:** We will continue to refine the 6CLAs as we map our program domains of expertise to established frameworks of digital, information and media literacy, and to the growing literature on computational thinking. We are also linking our work to literature on situated learning (e.g., Brown, 2005, 2006), social learning systems (e.g., Wenger, 2003), and epistemic learning (e.g., Shaffer, 2006).

APPENDIX A

*Survey Variable Composites: CLAs*

To begin to validate our theoretical categorization of the 6-CLAs, prior to combining constructs we applied factor analysis to the pre-program survey items representing each CLA category, within the full WV dataset (N=472).

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

**CLA 6**

**Survey Items for *FREQUENCY***

| **CLA 6. Surfing websites and web applications**<br>How often do you…<br>7-point scale: 1=Never, 2=less often but sometimes, 3=a few times a month, 4=about once/week, 5=a few times/week, 6=about once/day, 7=several times/day |
|---|
| **Activities** |
| Surf online for fun |

**Survey Items for *MOTIVATION***

| **CLA 6. Surfing websites and web applications**<br>How true are the following statements for you, personally?<br>5-point scale: 1=Not at all true, 2=Not usually true, 3=Sometimes true, 4=Usually true, 5=Very true |
|---|
| **Activities** |
| I enjoy surfing online for fun. |

**Survey Items for *KNOWLEDGE***

| **CLA 6. Surfing websites and web applications**<br>How true are the following statements for you, personally?<br>5-point scale: 1=Not at all true, 2=Not usually true, 3=Sometimes true, 4=Usually true, 5=Very true |
|---|
| **Activities** |
| Internet Explorer |

**CLA 5**

**Survey Items for *FREQUENCY***

| **CLA 5. Information-based learning, purposeful search and exploration** |
|---|
| **Activities (1 Factor)** |

| |
|---|
| Use a search engine to find resources when you think of a question about something? |
| Use Wikipedia? |
| Use a search engine to find resources for help with a digital design project? |

**Survey Items for *MOTIVATION***

| **CLA 5. Information-based learning, purposeful search and exploration** |
|---|
| **Activities (1 Factor)** |
| Searching for and using online resources when I think of a question about something. |
| Searching for and using tutorials and online resources to help with digital design projects. |

**Survey Items for *KNOWLEDGE***

| **CLA 5. Information-based learning, purposeful search and exploration** |
|---|
| **Activities (1 Factor)** |
| Wikipedia |
| Google |

**CLA 4**

**Survey Items for *FREQUENCY***

| **CLA 4. Social-based learning, participation and exchange in a networked environment** |
|---|
| **Activities (1 Factor)** |
| Exchange messages in email? |
| Exchange messages in instant messenger or chat? |
| Use social network sites like Facebook or Myspace? |

**Survey Items for *MOTIVATION***

| **CLA 4. Social-based learning, participation and exchange in a networked environment** |
|---|
| **Activities (1 Factor)** |
| Socializing with friends using internet tools like email, instant messenger, Facebook, MySpace. |
| Commenting and giving feedback to others online |

**Survey Items for *KNOWLEDGE***

| **CLA 4. Social-based learning, participation and exchange in a networked environment** |
|---|
| **Activities (1 Factor)** |
| Myspace |
| Email |
| Instant Messenger |

**CLA 3**

**Survey Items for *FREQUENCY***

| **CLA 3. Publishing and effective distribution of digital media** |
|---|
| **Activities (1 Factor)** |
| Post content/messages on a wiki? |
| Post content/messages on a blog? |
| Post graphics/animations/games you've created to the internet? (MyGLife.org, etc.) |
| Post digital video to the internet? (Youtube, etc.) |

**Survey Items for *MOTIVATION***

| **CLA 3. Publishing and effective distribution of digital media** |
|---|
| **Activities (1 Factor)** |
| Developing a blog. |
| Posting/publishing files you created to a Wiki. |

**Survey Items for *KNOWLEDGE***

| **CLA 3. Publishing and effective distribution of digital media** |
|---|
| **Activities (1 Factor)** |
| Wiki |
| Blog |

**CLA 2**

**Survey Items for *FREQUENCY***

| **CLA 2. Project-based learning and online project management in a wiki-based networked environment** |
|---|
| **Activities (2 Sub-Factors)** |
| *Factor 1: Creating digital media* |
| Make graphics, animations and/or interactive games? |
| Make digital music or video on a computer? |
| Program on a computer? (Actionscript, etc.) |
| *Factor 2: Collaborating with team members* |
| Work with a team on a digital design project, communicating with team members ONLINE? |
| Work with a team on a digital design project, communicating with team members FACE-TO-FACE? |

**Survey Items for *MOTIVATION***

| **CLA 2. Project-based learning and online project management in a wiki-based networked environment** |
|---|
| **Activities (2 Sub-Factors)** |
| *Factor 1: Creating with digital media* |
| Planning a digital design project. |
| Creating a digital design project. |

| |
|---|
| Creating an interactive game, from beginning to end.<br>Computer programming (e.g., ActionScript). |
| *Factor 2: Collaboration with project team members* |
| Working with a team on a project, communicating FACE-T0-FACE.<br>Working with a team on a project, communicating ONLINE. |

**Survey Items for *KNOWLEDGE***

| **CLA 2. Project-based learning and online project management in a wiki-based networked environment** |
|---|
| **Activities (2 Sub-Factors)** |
| *Factor 1: Creating digital media* |
| Flash software<br>Actionscript<br>Graphic design<br>Digital design project<br>Programming<br>Animation<br>Software |
| *Factor 2: Collaborating with team members* |
| Collaboration |

**CLA 1**

**Survey Items for *FREQUENCY***

| **CLA 1. Invention, progression, and completion of an original digital project idea (for an educational game or simulation)** |
|---|
| **Activities (1 Factor)** |
| Work on creating a digital design project, from beginning to end?<br>Think up an idea for a creative project involving computer technology?<br>Think up an idea for an interactive game? |

**Survey Items for *MOTIVATION***

| **CLA 1. Invention, progression, and completion of an original digital project idea (for an educational game or simulation)** |
|---|
| **Activities (1 Factor)** |
| Creating the storyline for a digital design project.<br>Thinking up ideas for a digital creative project.<br>Thinking up ideas for an interactive game. |

**Survey Items for *KNOWLEDGE***

| **CLA 1. Invention, progression, and completion of an original digital project idea (for an educational game or simulation)** |
|---|
| **Activities (1 Factor)** |
| Thinking up ideas for the storyline of a game<br>Designing an interactive game from beginning to end |

APPENDIX B

The appendix tables below present standardized wiki metrics by location, allowing for relative comparison of student efforts for an average student in an average month -- controlling for N of students and N of participation months.

1. Wiki Edits

Minimum, maximum and mean number of wiki edits at each location, IN AN AVERAGE MONTH. Metrics have been standardized to account for varying participation months at each location

| | | Descriptive Statistics | | | | |
|---|---|---|---|---|---|---|
| **school** | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** | |
| OGHS | 20 | 12 | 160.75 | 51.76 | | 51.69 |
| GWHS | 9 | 10.11 | 137.67 | 43.05 | | 41.20 |
| RIVHS | 35 | 5.5 | 287.5 | 40.77 | | 50.95 |
| PRS | 27 | 21.11 | 81 | 40.22 | | 12.57 |
| RTC | 27 | 6 | 184.75 | 37.58 | | 42.94 |
| WWHS | 13 | 20.75 | 94.25 | 32.92 | | 19.12 |
| WVNCC | 10 | 4.29 | 116.57 | 31.83 | | 32.74 |
| SRMS | 26 | 14.33 | 45.22 | 27.39 | | 9.16 |
| BRPTMS | 16 | 11.25 | 38 | 24.72 | | 6.87 |
| EGMS | 19 | 4.67 | 52 | 22.77 | | 13.59 |
| SHEPU | 24 | 2.57 | 64.86 | 20.04 | | 14.02 |
| BXCYHS | 13 | 5.25 | 42.25 | 17.10 | | 11.04 |
| LHS | 15 | 3.56 | 36.22 | 16.16 | | 9.79 |
| MCTC | 24 | 0.25 | 46.57 | 15.42 | | 12.94 |
| MANHS | 11 | 4.67 | 23.56 | 15.21 | | 6.32 |
| SHHS | 14 | 3.33 | 27.22 | 13.10 | | 6.69 |
| SWVCC | 10 | 0 | 24.75 | 11.18 | | 8.22 |
| GEHS | 42 | 0 | 44.11 | 10.87 | | 10.12 |
| FCCG | 25 | 0.71 | 36.67 | 10.00 | | 9.11 |
| SVHS | 76 | 0.11 | 34.44 | 7.57 | | 6.08 |
| WPHS | 10 | 0.89 | 15.11 | 5.79 | | 4.60 |
| CAPHS | 33 | 0 | 7.56 | 1.55 | | 1.89 |

2. FLA Uploads

Minimum, maximum and mean number of FLA uploads at each location, IN AN AVERAGE MONTH. Metrics have been standardized to account for varying participation months at each location

| | | Descriptive Statistics | | | | |
|---|---|---|---|---|---|---|
| **school** | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** | |
| SRMS | 26 | 1.78 | 8.22 | 5.06 | | 1.75 |
| RIVHS | 35 | 0 | 12 | 3.57 | | 2.92 |
| LHS | 15 | 0.78 | 7.22 | 3.36 | | 2.26 |
| RTC | 27 | 0.67 | 18 | 3.33 | | 3.47 |
| MANHS | 11 | 0 | 11.78 | 2.79 | | 3.42 |
| MCTC | 24 | 0 | 8.86 | 2.63 | | 2.82 |
| SWVCC | 10 | 0 | 8.25 | 2.63 | | 2.79 |
| BRPTMS | 16 | 1 | 6 | 2.50 | | 1.40 |
| GWHS | 9 | 0.78 | 3.67 | 2.28 | | 0.96 |

| | | | | | |
|---|---|---|---|---|---|
| WWHS | 13 | 0.75 | 3.25 | 2.06 | 0.87 |
| WVNCC | 10 | 0 | 4 | 2.00 | 1.31 |
| EGMS | 19 | 0.33 | 7.67 | 1.43 | 1.73 |
| SHEPU | 24 | 0 | 5.43 | 1.38 | 1.32 |
| GEHS | 42 | 0 | 2.67 | 0.72 | 0.80 |
| FCCG | 26 | 0 | 4.33 | 0.62 | 0.97 |
| CAPHS | 33 | 0 | 3.89 | 0.57 | 0.75 |
| SVHS | 76 | 0 | 1.44 | 0.33 | 0.34 |
| OGHS | 20 | 0 | 1 | 0.29 | 0.31 |
| SHHS | 14 | 0 | 0.89 | 0.28 | 0.31 |
| WPHS | 10 | 0 | 1 | 0.24 | 0.32 |
| BXCYHS | 13 | 0 | 0.25 | 0.08 | 0.12 |
| PRS | 27 | 0 | 0.33 | 0.02 | 0.07 |

## 3. SWF Uploads

Minimum, maximum and mean number of SWF uploads at each location, IN AN AVERAGE MONTH. Metrics have been standardized to account for varying participation months at each location

| | | **Descriptive Statistics** | | | |
|---|---|---|---|---|---|
| **school** | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** |
| RTC | 27 | 1.33 | 14.75 | 5.80 | 2.95 |
| SRMS | 26 | 1.78 | 8.22 | 4.82 | 1.58 |
| LHS | 15 | 1 | 8.11 | 3.98 | 2.19 |
| MCTC | 24 | 0 | 22 | 3.56 | 5.13 |
| SWVCC | 10 | 1.25 | 8.25 | 3.50 | 2.30 |
| RIVHS | 35 | 0 | 8.5 | 3.28 | 2.20 |
| EGMS | 19 | 0.22 | 8.56 | 3.12 | 1.90 |
| MANHS | 11 | 0 | 11.33 | 2.69 | 3.32 |
| WWHS | 13 | 0.25 | 5 | 2.35 | 1.22 |
| BRPTMS | 16 | 1 | 5.75 | 2.31 | 1.31 |
| GWHS | 9 | 0.67 | 4 | 2.30 | 1.12 |
| WVNCC | 10 | 0.29 | 4.29 | 2.11 | 1.39 |
| SHEPU | 24 | 0.29 | 5.14 | 1.94 | 1.52 |
| SVHS | 76 | 0 | 7.56 | 1.47 | 1.44 |
| SHHS | 14 | 0.22 | 2.11 | 1.35 | 0.66 |
| GEHS | 42 | 0 | 3.78 | 1.11 | 0.97 |
| OGHS | 20 | 0 | 2.25 | 0.88 | 0.61 |
| FCCG | 26 | 0 | 5 | 0.70 | 1.00 |
| CAPHS | 33 | 0 | 4.78 | 0.59 | 0.88 |
| WPHS | 10 | 0 | 1 | 0.54 | 0.35 |
| BXCYHS | 13 | 0 | 0.5 | 0.10 | 0.16 |
| PRS | 27 | 0 | 0.33 | 0.01 | 0.06 |

## 4. Blog Posts

Minimum, maximum and mean number of Blog posts at each location, IN AN AVERAGE MONTH. Metrics have been standardized to account for varying participation months at each location

| | | Descriptive Statistics | | | | |
|---|---|---|---|---|---|---|
| **school** | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** | |
| SWVCC | 9 | 1.25 | 10 | 6.56 | | 2.75 |
| WVNCC | 10 | 3.71 | 8.57 | 6.03 | | 1.82 |
| SVHS | 71 | 0.89 | 14 | 5.53 | | 2.19 |
| BRPTMS | 16 | 3.75 | 6 | 5.16 | | 0.69 |
| SHEPU | 24 | 0.57 | 14.29 | 5.11 | | 3.72 |
| RTC | 27 | 0.5 | 9.33 | 4.94 | | 1.77 |
| GWHS | 9 | 2.22 | 8.89 | 4.69 | | 2.31 |
| RIVHS | 35 | 0 | 12.75 | 4.09 | | 1.91 |
| CAPHS | 12 | 0 | 8.33 | 3.82 | | 2.58 |
| LHS | 14 | 2.56 | 4.33 | 3.64 | | 0.51 |
| WWHS | 12 | 2.5 | 4 | 3.52 | | 0.39 |
| EGMS | 19 | 1 | 8.22 | 3.47 | | 2.13 |
| SHHS | 14 | 1.22 | 4.56 | 3.41 | | 0.98 |
| WPHS | 9 | 0.67 | 7.78 | 3.35 | | 2.50 |
| MCTC | 24 | 0.25 | 9.14 | 3.00 | | 2.56 |
| SRMS | 26 | 1.67 | 3.56 | 2.77 | | 0.48 |
| PRS | 16 | 0.22 | 4.89 | 2.62 | | 1.68 |
| GEHS | 36 | 0 | 7 | 2.36 | | 1.68 |
| OGHS | 20 | 0.5 | 4.5 | 2.08 | | 1.27 |
| BXCYHS | 13 | 0.75 | 4.75 | 1.96 | | 1.29 |
| FCCG | 13 | 0.11 | 4.71 | 1.35 | | 1.63 |
| MANHS | 11 | 0.67 | 1.11 | 0.91 | | 0.12 |

## Appendix C

Edits to Survey Design, Year 4 Pre-Survey

1. Removed all "self-reported knowledge" items, because they are self-reports, and we already ask other attitude questions so they aren't giving us more info. A goal in Year 4 will be to develop measures of student mastery and actual knowledge gained.

2. Removed "enjoyment in CLAs activities" items, and replaced with "self efficacy" items:
   - Self-efficacy towards school subjects
   - Self-efficacy towards Globaloria activities and practices (6-CLAs)
   - I adapted these items from an established validated scale for children's self-efficacy (Bandura article on social cognitive theory in which self-efficacy is a main variable; adapted these scales)
   - Self-efficacy has a more direct theoretical link to social cognitive theory than self-determination theory

3. Added an index on STEM interests that asks briefly about student interest in traditional math, science, civics/social studies/history, english/writing/reading. Goal is to see if STEM or other interests change at all from pre- to post, especially for students participating in Globaloria classes focused on specific subjects. These items were adapted from:
   - Simon, S. (2000). Students' attitudes towards science. In M. Monk, & J. Osborne (Eds.), Good practice in science teaching: What research has to say (pp. 104–119). Buckingham: Open University Press.;
   - Stokking, K.M. (2000). Predicting the choice of physics in secondary education. International Journal of Science Education 22(12), 1261–1283.
   - Lavonen, J., Byman, R, Juuti, K. Meisalo, V., & Uitto, A. 2005. Pupil Interest in Physics: A Survey in Finland. *Nordina 1(*2), 72-85.)

4. Elaborated and expanded on the items addressing interests in engineering/ computing/ programming/game design/digital creative projects, so we can see if student interests in these specific Globaloria-oriented questions changes from pre to post -- especially girls, etc.

5. We maintain the Frequency for 6-CLAs variables. The frequency variables maintain the Never option, which in the Pre-Survey, tells us which activities / technologies students have no prior experience with, prior to Globaloria. The corresponding Post shows us which ones students now use with frequency, and how this changes.
   - Further, I have addressed recent conference paper feedback that recommended we ask about student home computer use vs. school computer use, to see whether their use patterns change at home which will reflect extension/transfer.
   - I separated the frequency questions into blocks, and ask each block At Home, and At School.

**Appendix D.**
**Coding Scheme to Evaluate Student Game Design Proficiency**

| **Game Programming Evaluation (Sources: SWFs and FLAs): For the following content analysis 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.** | | | | **Code** |
|---|---|---|---|---|
| **Events – items that trigger code to execute** | *Must look in FLA code to detect | | | (0=not present, 1=present) |
| **CATEGORY** | **How it looks in the game file SWF / FLA** | **FLA Code** | **related syl. topic** | |
| roll over/roll out | In SWF, when you place the mouse over or move the mouse off an object without pressing, does something happen? | myGame_mc.onRollOver **or** myGame_mc.onRollOut | http://myglife.org/usa/wv/rtcwiki/index.php/Code_Library | |
| on press/ on release | In SWF, when you press on or release an object on the screen, does something happen? | myGame_mc.onPress **or** myGame_mc.onRelease | http://myglife.org/usa/wv/rtcwiki/index.php/Code_Library | |
| hit test/collision detection | In SWF, when two objects on the screen overlap or collide, does something happen (such as points gained/lost, color change, etc) | myGame_mc.hitTest(myGame1_mc) | http://myglife.org/usa/wv/rtcwiki/index.php/Collision_Detection | |
| key press | In SWF, does something happen when you press the keys on the keyboard (like the arrow keys) | on (keyPress "somethingsomething") | http://myglife.org/usa/wv/rtcwiki/index.php/Adding_Interaction | |
| on enter frame * | Coder will have to check the fla for the code at right | onEnterFrame | http://myglife.org/usa/wv/rtcwiki/index.php/Score_Keeping | |
| on mouse move | In SWF, when you move the mouse, does something happen? | onMouseMove | couldn't find, but student games reflect this. | |
| timer * | In SWF, 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(); | http://myglife.org/usa/wv/rtcwiki/index.php/Timer | |
| **Additional code commonly found in games** | | | | (0=not present, 1=present) |
| drag and drop | In SWF, can you press on an object to move it and the release the mouse button to drop it? | myGame_mc.startDrag(); ***and*** myGame_mc.stopDrag(); | http://myglife.org/usa/wv/rtcwiki/index.php/Drag_and_Drop | |
| dynamic text or input text | In SWF, the text changes depending on your actions. NOTE: might have to find in actionScript to ensure it's dynamic text.<br>In SWF, Input Text: you can type text into a text field. | Dynamic Text: somethingsomething.text = ////////<br>Input Text: output = input; or, .htmlText | http://myglife.org/usa/wv/rtcwiki/index.php/Text,<br>http://myglife.org/usa/wv/rtcwiki/index.php/Score_Keeping | |

| | | | | |
|---|---|---|---|---|
| preloader | In SWF, is there a preloader before the game appears? | something like this: var total = this.getBytesTotal();<br>this.onEnterFrame = function(){<br>loaded = this.getBytesLoaded();<br>percent = Math.round((loaded/total)*100);<br>preload_txt.text = percent+"%";<br>mask_mc._yscale = percent;<br>if (loaded >= total) {<br>this.play();<br>delete this.onEnterFrame;<br>//gotoAndPlay("stLynn")}} | http://myglife.org/usa/wv/rtcwiki/index.php/Preloader | |
| load sound | Coder will have to look in actionscript to see whether sound is loaded dynamically or placed on the timeline, searching for code at right. If it is placed on the timeline, please code as 0. | var my_sound:Sound = new Sound();<br>my_sound.loadSound("song1.mp3", false); | http://myglife.org/usa/wv/rtcwiki/index.php/Adding_Sound | |
| get url | In SWF, does the game link to another URL? | getURL("www.google.com"); | Student games reflect this. | |
| tween classes | Coder will have to look in the code | import mx.transitions.Tween;<br>import mx.transitions.easing.*; | Student games reflect this. | |
| if statements* (conditional executions) | Coder 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. | if (somethingsomething) {<br>something happens<br>}<br>switch (condition) {<br>case a: something happens;<br>case b: something else happens;<br>break; } | http://myglife.org/usa/wv/rtcwiki/index.php/Intro_to_ActionScript | |
| arrays* | Coder will have to look in the code | var myArray:Array = new Array(somethingsomething) | http://myglife.org/usa/wv/rtcwiki/index.php/2007-2008_Main_Page | |
| for loop* while loop | Coder will have to look in the code | for (somethingsomething) {something happens for the movieclips refered to in parentheses} | http://learnthat.com/488/computers/internet/macromedia-flash-mx-2004-course/http://www.myglife.org/usa/wv/resources/en/learn/tutorials/flash#animation | |
| variables | Coder will have to look in the code | var somethingsomething = | http://www.myglife.org/usa/wv/resources/en/learn/tutorials/flash/scuba-variables | |
| **content evaluation: For the following codes, please evaluate the quality of the representation on a scale of 1 to 3.** | | | | |

| **Visual and sound design elements….1=Not present / insufficient representation;<br>2=basic / introductory representation;<br>3=well-developed representation** | **1,2,3 [additive score]** |
|---|---|
| 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) | |
| 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) | |
| 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) | |
| Animated objects in the game provide dynamism to the game play (e.g., graphic animation elements are created and included as files) | |
| Sprites, animations and sounds are presented in a form coherent with their design plan and game story, they represent relevant elements for players to immerse themselves in play | |
| **Game play experience** | **1,2,3 [additive score]** |
| Game instructions are clear and helpful to the viewer | |
| 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.) | |
| Game is navigable and intuitive to use | |
| Game mechanics are simple to understand and learn, but challenging to master | |
| Students have a clear idea of their “audience”, and how they expect them to play the game | |
| **Concept development** | **1,2,3 [additive score]** |
| Students have a clear “end in mind” when designing, they can articulate what the structure of the game mechanics will look like | |
| Game concept and storyline are coherently integrated with the mechanics | |
| Game concept, storyline and progression of ideas are clearly expressed. | |
| Any facts / quiz questions included are presented accurately. | |
| Any facts are presented in a context and form relevant to the game mechanics, not as isolated quizzes | |

| | |
|---|---|
| Game has an ending/conclusion that provides closure to the player. | |
| The conditions defining the game closure are clearly communicated to the player from the beginning, either through story or mechanics | |
| The game design document on the wiki is clear and understandable | |
| **Genre** | |
| Is the game a Social Issue game, an Educational game, or an Entertainment game? (write out which) | |
| 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? | |
| The game mechanics, and storyline are clearly integrated within the genre of the game. Student displays an understanding of why this genre fits his or her design. | |

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