Globaloria

Pilot Study:

The Relationship of Globaloria Participation and Student Achievement

January 2010

Revised September 2011

Kristine Chadwick, Ph.D.

Jessica Gore

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For information about Edvantia research, products, or services, contact

EDVANTIA®

P.O. Box 1348, Charleston, WV 25325 • 304.347.0400 • 800.624.9120 • fax 304.347.0487
One Vantage Way, Suite D-210, Nashville, TN 37228 • 615.565.0101 • fax 615.565.0112
info@edvantia.org • www.edvantia.org

This publication was prepared for the World Wide Workshop (WWW) Foundation. Its contents do not necessarily reflect the position of policies of Edvantia.

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Executive Summary

The World Wide Workshop (WWW) Foundation contracted with Edvantia, Inc., a not-for-profit education research and development organization, to conduct a pilot study of the effects of Globaloria participation on student achievement. The purpose of the study was to provide preliminary data concerning the performance of students participating in the Globaloria pilot project in West Virginia (referred to as WVGlobaloria) relative to the Global21 standards, which are encapsulated in West Virginia's content standards and objectives (CSOs) and measured by the state's standardized test, the WESTEST2.

From 13 participating schools/education institutions, five schools (three high schools and two middle schools) were selected by the research team to serve as a representative group for this small-scale pilot study. Edvantia researchers then identified comparison schools (schools not participating in the WVGlobaloria program) using the following criteria: percent of students performing at or above reading and math proficiency on the 2008 WESTEST, school enrollment, and percent of low-income students (i.e., students qualifying for free or reduced-price meal status). The five WVGlobaloria schools included 184 participants. Researchers collected West Virginia Education Information System (WVEIS) student identification numbers from their schools, and demographic and assessment data (sex, race, free or reduced-price meal eligibility, limited English proficiency status, 2008 WESTEST[1] scale scores, and 2009 WESTEST2 scale scores) from the West Virginia Department of Education (WVDE). Participating students were matched with demographically similar students at matched comparison schools using the following criteria: grade, sex, race, and low-income status (i.e., students qualifying for free or reduced-price meal status). Not all participating WVGlobaloria students had all of the necessary information (e.g., 2008 WESTEST and 2009 WESTEST2 scores) or could be matched with a student at a comparison school. However, of the 184 participants, a total of 100 matched pairs were available for analyses.

Edvantia researchers conducted a series of analyses of covariance to determine the probable effects of WVGlobaloria participation on students' 2009 WESTEST2 scores for each of the four core subject areas (mathematics, reading/language arts, science, and social studies). Past performance was controlled by using 2008 WESTEST scores as the covariate. Participants in WVGlobaloria performed significantly better on 2009 WESTEST2 science and social studies subtests than those who did not participate in the program. These findings provide compelling preliminary evidence that Globaloria may have positive effects on student performance in these domains.

Further research is warranted to assess the stability of the effects on social studies and science and to examine the processes involved in Globaloria that may be contributing to its impact on student achievement. Establishing the stability of program effects is beyond the scope of this pilot study, but would provide substantive context for examinations of Globaloria effectiveness and should be

[1] WESTEST stands for the West Virginia Educational Standards Test, the state's standardized achievement test. WESTEST2 is the test version active as of spring 2009.

considered as a future research endeavor. To determine specific next steps in the research agenda, the WWW Foundation staff may refer to the logic model prepared by Edvantia in 2008.

Introduction

The World Wide Workshop (WWW) Foundation is a global, nonprofit educational organization that seeks to address challenges of global education through technology in collaboration with corporations, foundations, education institutions, and research centers worldwide [1]. The mission of the WWW Foundation is committed to "developing open-source application of social media technology and game production, to enhance learning, innovation, entrepreneurship, and an understanding of the world in economically-disadvantaged and technologically-underserved communities" [1]. In 2006, the WWW Foundation created a social network, called Globaloria, for learning Web-based game design and simulation production. The goal of Globaloria is to create technology-based educational opportunities through a series of virtual learning networks. It targets students in developing nations as well as economically disadvantaged and technologically underserved communities. It is hypothesized that through participation in the Globaloria program, students develop 21st century skills in digital literacy and social media while gaining a deeper understanding of curricular areas, such as science, mathematics, health, and global issues [2].

Globaloria: Underlying Theory and Structure

The Globaloria program was established to address the "two digital divides" that exist in the United States and worldwide. The first digital divide is defined by access, or lack thereof, to high-speed Internet. The ability to create, not just consume, digital media, coined as "digital literacy," is the second divide [3, 4]. Whether students work alone or in a team, through participation in Globaloria, students share ideas, resources, and game files, and they participate in each other's design process. Globaloria is designed to foster the following six essential Contemporary Learning Abilities (CLAs) inherent to digital literacy [3]:

- Invention, progression, completion of an original project: program an educational game, wiki, or simulation
- Project-based learning in Web 2.0[2] environments and processing complex project management (programmable wiki systems)
- Producing, programming, publishing, and distributing interactive purposeful digital media
- Social learning, participation, and exchange
- Information-based learning, search, and exploration
- Thoughtful surfing of websites and Web applications

These CLAs are based on the constructionist educational philosophy developed by MIT social cognitive scientists Seymour Papert, Idit Harel Caperton (WWW Foundation founder), and their colleagues [3, 4]. A constructionist approach to learning operates from the view that "building knowledge structures ('in the head') goes especially well when the subject is engaged in building material structures ('in the world')" [4, 5]. Through this approach, "children learn how to learn, and

[2] A Web 2.0 environment is the shift in the way users think about technology from consumers to creators.

they learn how to think about thinking." This is accomplished through "publicly shared, long-term projects that are complex, computational, immersive, and innovative" in which students learn by doing [3]. Research has shown that constructionist programs result in deeper forms of learning, cognitive integration, and improved approaches to learning [6]. Specific to Globaloria, the application of new Web technologies allows students to construct and share their own digital media products with others [4].

Globaloria designers describe Globaloria as the "next step in an evolutionary process of developing education interventions that integrate technology applications and a 'constructionist approach' to learning" [4]. Globaloria seeks to integrate technology applications by "engaging learning in daily participation in an education social network in which students design games using Flash software." Flash was chosen by Globaloria designers because it allows students to "develop interactive projects that can be readily distributed, viewed, and played in Internet contexts" [4, 7]. Students design games around various education topics; consequently, students learn about those topic areas while also learning the skills necessary to design and program digital media. Globaloria offers a host of resources, such as curricular resources, face-to-face and virtual collaboration in online environments, open-source Web applications, wikis, and blogs [4]. By providing these resources, Globaloria intends to leverage the social learning opportunities that creative Internet environments provide to prepare students for living and working in the 21st century" [4, 7].

The Globaloria program incorporates multiple platforms, each with its own website, network, and active communities. Each network focuses on a theme, and the games that students develop are created around that theme. Each theme has its own networked community, described by the WWW Foundation as a "purposeful, goal-oriented global community of young people" [4]. The WWW Foundation contends that digital learning is "best furthered by embedding activities in topics relevant to those students" [4]. For this reason, Globaloria consists of the following six platforms [1]:

- *MyHLife* (My Health Life)
- *MySLife* (My Science Life)
- *MyGLife* (My Global Life)
- *MyRLife* (My Human Rights Life)
- *MyALife* (My Art Life)
- *MyMLife* (My Math Life)

Globaloria Research

In August 2006, the WWW Foundation developed its first platform in collaboration with a group of 23 high school students in the Globaloria-Israel pilot project. In 2007, the WWW Foundation launched a follow-up platform called *MySLife,* centered on the theme of the global climate crisis [7]. In 2007, a pilot study was initiated in West Virginia using *MyGLife*. This implementation effort is in its second year and will be the focus of the current study; consequently, it will be discussed in more detail in the following section. During the summer of 2008, the *MyHLife* network was piloted in a six-week summer camp for students in New Orleans [8].

MyGLife and WVGlobaloria

Throughout 2007 and 2008, *MyGLife* was developed and refined through two pilot tests at the American University (AU) School of Communications. The platform was revised based on student feedback. Students at AU provided "valuable information on both the technology platform and the gaming curriculum, based on their experiences" [4]. According to the WWW Foundation, *MyGLife* was designed to help youth 13 and older [1]:

1. learn Internet media technology and game development skills
2. hone professional and life skills
3. experience positive virtual communication with other communities
4. foster social change

MyGLife allows participants to interact with games, puzzles, and creative tools, while also thinking as game developers. Participants have the opportunity to modify game code and learn programming skills. Additionally, participants can learn Flash, HTML, graphic design, wiki design, blogging, and project development skills through a series of tutorials available on *MyGLife*. The website for *MyGLife* also provides links to recommended online resources and suggested readings that can help participants develop their skills. When participants create their own games, they are encouraged to share their work on the site [3].

In August 2007, the WWW Foundation released the Globaloria pilot program into classrooms throughout West Virginia (referred to as WVGlobaloria) through a statewide implementation of *MyGLife*. Some of the sites are in communities with significant economic disadvantages, and all are underserved in terms of technology capacity and infrastructure [7]. The first implementation intended to stimulate economic and social development, foster job creation, and position the state as a leader in 21st century education [9]. By the second pilot year, WVGlobaloria had more than 300 participants in 14 schools across the state of West Virginia [3].

The WWW Foundation staff chose West Virginia for the pilot because of the state's high proportion of economically disadvantaged students and its rural context, both of which create access issues. Due to the lack of technological access, students appear to be unable or disinclined to participate in the use of social media technologies as supported by a 2007 Pew Internet study of American teens. The Pew study found that rural students in less well-to-do families are less likely to be digital 'content creators' than are their richer, suburban counterparts" [4, 7]. The WVGlobaloria pilot was initiated in seven schools, with 18 educators and school administrators and 89 students across West Virginia. The program included three high schools, one middle school, a technical school, a community and technical college, and an afterschool club [4, 10]. For Year 2 of the WVGlobaloria pilot study, the program was expanded to 14 sites across the state, adding three middle schools, three high schools, and an alternative learning facility serving students in Grades 6-12. The Year 2 additional sites bring the total number of WVGlobaloria participants to 30 educators and more than 330 students across West Virginia [4, 8].

At the end of the first semester of pilot Year 2, Marshall Community and Technical College students reported "mean levels of home computer use as much as five times higher than students at other Year 2 sites, and approximately 30% higher than the next highest school mean, reported by the Pressley Ridge alternative school" [4, 10]. With regard to the six CLAs, "self-reported levels of knowledge addressing creation of digital media (publishing and project-based creation) were lower than levels for CLAs addressing consuming online content." A review of the game data shows that student product development increased. In the first half of Year 2, students initiated 80 game designs, almost half of which address the global social issues targeted by the *MyGLife* network [4, 10].

Purpose of this Study

In December 2008, Edvantia developed a research agenda to guide future study of the Globaloria education intervention [4]. The agenda is provided in a report based on the researchers' review of extant data, such as project descriptions, evaluation reports, and participant artifacts. The researchers also performed a series of graphical semantic analyses, resulting in a multilevel logic model. The logic model includes boxes indicating activities and outcomes, and lines indicating hypothesized causal or correlational relationships among activities and different phases of outcomes. Because each relationship illustrated in the logic model describes one or more hypotheses associated with the intervention, the model helps define potential research questions, from which a research agenda was developed [4].

While the WVGlobaloria program has shown promise for improving digital literacy in West Virginia students, greater support for this program could be ascertained if it was shown to be related to Global21 standards, encapsulated in the state's content standards and objectives (CSOs), and measured by the state's standardized exam, the West Virginia Educational Standards Test (WESTEST). The WESTEST2, the current iteration of the WESTEST, is a custom-designed assessment for West Virginia students that measures student performance on clearly defined standards, objectives, and skills. The WESTEST2 is an updated version of the 2008 WESTEST in which questions have been developed and are more closely aligned to the West Virginia 21st century CSOs [11]. This version of the test is a more challenging and accurate assessment of Global21 standards. Because of the added rigor, students may not perform as well as they did on previous state standardized tests [12]. The results provide information about a student's academic strengths, as well as areas for improvement. Additionally, the West Virginia Department of Education (WVDE) has provided instructional benchmarks designed to assess student progress over the course of the school year [11].

In the fall of 2009, the WWW Foundation contracted with Edvantia to conduct a pilot study of the effects of Globaloria participation on student achievement. See Appendix A for how this study relates to the previously developed logic model and research agenda [4]. The purpose of this study is to provide preliminary data concerning the performance of students participating in WVGlobaloria relative to the Global21 standards, as measured by the 2009 WESTEST2. The WESTEST2 provides a valid measure of the effects of the Globaloria program because the WESTEST2 is designed to measure 21st century skills, as represented by the CSOs, while Globaloria is designed to increase them. Specifically, the study explores possible relationships between participation in the WVGlobaloria program and

student performance on the WESTEST2. If relationships are established between participation in WVGlobaloria and the West Virginia Global21 knowledge and skills in the core content areas, further research should be conducted to examine the hypothesized mechanisms, mediators, and moderators of the participation-achievement relationship.

Study Design and Methods

From 13 participating schools/education institutions, the research team selected five representative schools (three high schools and two middle schools) to be included in this pilot study. Selected schools were not outliers based on achievement data or student demographics. Edvantia researchers then used the following criteria to identify comparison schools (schools not participating in the WVGlobaloria program) that were demographically similar to participating schools: percent of students achieving reading and math proficiency on the 2008 WESTEST, school enrollment, and percent of low-income students (i.e., students qualifying for free or reduced-price meal status). See Table 1 below for a list of participating schools and their matched comparison schools. See Appendix B for specific school selection criteria.

Table 1. Participating and Matched Comparison Schools

Participating Schools	Matched Comparison Schools
Capital High School	Point Pleasant High School
Eastern Greenbrier Middle School	B-U Middle School
Greenbrier West High School	Richwood High School
Sandy River Middle School	Philippi Middle School
Spring Valley High School	Hampshire Senior High School

The WWW Foundation provided Edvantia researchers with a list of 184 participants for which project staff had obtained informed consent[3] for participation in the study. Researchers collected student identification numbers used in the West Virginia Education Information System (WVEIS) from the five participating schools and demographic and assessment data from the WVDE. WVEIS numbers for students who had graduated in 2009 were not available; 18 students were excluded from this study for that reason. The following information for students at participating and comparison schools was requested from the WVDE: sex, race, free or reduced-price meal eligibility, limited English proficiency status, 2008 WESTEST scale scores, and 2009 WESTEST2 scale scores. Fifty-nine students were excluded[4] due to unavailability of their 2008 WESTEST or 2009 WESTEST2 scores. Researchers used Euclidean Distance Dissimilarity Measures to identify similar students. Participating students were matched with demographically similar students at matched comparison schools using the following criteria: grade, sex, race, and eligibility for free or reduced-price meal eligibility. Seven students at

[3] All students who participate in the Globaloria program are required by the WWW Foundation to return parental consent to participate in the program and all research activities related to the program; students who do not return consent cannot participate.

[4] It is important to note that not all students take all subtests each year; additionally, not every grade level takes the WESTEST each year. For this reason, only students who were missing ALL four subtests of one of the two testing periods were excluded. Students who were missing only one subtest were included for overall analyses, but were excluded from the analyses of the test they were missing (e.g., if a student was missing only the science subscore, he or she would be included in all analyses except the science analyses).

participating schools who were unable to be matched with students at comparison schools were excluded from the study; this provides a sample of 100[5] participating students.

It is important to note that missing data are a common occurrence; however, it can have a significant effect on the conclusions that can be drawn from the data. Missing data reduces the representativeness of the sample and can distort the inferences that can be made about the population as well as the generalizability of the sample to other populations. One of the most common approaches to dealing with missing data is to simply omit those cases with missing data, as in this study. This approach often results in a substantial decrease in the sample size, which can decrease statistical power to detect significance. This is important to consider when reviewing the conclusions and recommendations of this report.

The performance of the WVGlobaloria students and the matched comparison students was compared using 2009 WESTEST2 scores,[6] after controlling for prior achievement using the 2008 WESTEST performance levels. Researchers also conducted follow-up analyses to examine achievement by different subgroups, including sex and free or reduced-price meal eligibility. Race and limited English proficiency were not included for further analyses because minority youth could not be matched with students in the comparison schools and there were no limited English proficient students in the sample.

[5] 184 students [starting total] – 18 [WVEIS number not available] – 59 [WESTEST information not available] – 7 [unable to find matched comparison] = 100 [ending total].

[6] The WESTEST2 was selected for this preliminary study because it is based on the new Global21 standards and there are data to support the test's reliability.

Findings

Edvantia researchers conducted a series of analyses of covariance to determine the probable effects of WVGlobaloria participation on students' 2009 WESTEST2 scores for each of the four core subject areas (mathematics, reading/language arts, science, and social studies). Past performance was controlled by using 2008 WESTEST scores as the covariate.

Demographic information was collected for each participant and comparison student. All of the students were White/Caucasian (100%, *N* = 200). Participants included 116 males and 84 females. The majority of participants (78%, *n* = 156) attended middle school, while the other 22% (*n* = 44) attended high school. About half (51%) of students were considered low-income students (i.e., students qualifying for free or reduced-price meal status). None of the participants were considered to have limited English proficiency. Table 2 presents the demographic information of these students.

Table 2. Demographic Information for Participant and Comparison Groups

Demographics	Participants *n*	Comparison *n*
Race		
White	100	100
Sex		
Male	58	58
Female	42	42
Grade		
Middle School	78	78
High School	22	22
Low-Income Students		
Yes	51	51
No	49	49
Limited English Proficiency		
No	100	100

Table 3 shows 2008 WESTEST and 2009 WESTEST2 performance for the participant and comparison groups by grade level in the core subject areas. Participating middle school students scored slightly higher than comparison middle school students on three of the four subject areas (math, reading/language arts, and social studies) on the 2008 WESTEST. On the 2009 WESTEST2, participating middle school students performed better than comparison middle school students in all four core subject areas. High school participants performed slightly better than comparison high school students

in all four core areas of the 2008 WESTEST. Participating high school students scored considerably better than comparison high schools students in all four core subject areas on the 2009 WESTEST2. See Table 3 for mean scores and standard deviations.

Table 3. 2008 WESTEST and 2009 WESTEST2 Mean Scores and Standard Deviations by Grade and Subject Area

	2008 WESTEST			2009 WESTEST2		
	N	*M*	*SD*	*N*	*M*	*SD*
Experimental Group						
Middle School						
Math	78	685.96	39.25	77	623.83	51.76
Reading/Language Arts	77	678.52	34.63	78	463.15	54.02
Science	77	690.31	36.21	78	584.78	40.45
Social Studies	77	677.40	30.05	77	406.88	29.02
High School						
Math	22	756.64	32.42	22	691.27	38.30
Reading/Language Arts	21	728.71	33.35	22	498.73	67.34
Science	22	730.41	29.05	22	639.00	52.53
Social Studies	0	--	--	22	424.95	36.41
Comparison Group						
Middle School						
Math	78	677.36	44.53	78	609.53	58.75
Reading/Language Arts	78	669.90	57.03	77	458.43	61.85
Science	77	691.95	29.60	74	577.91	40.55
Social Studies	77	676.86	32.23	75	398.16	33.39
High School						
Math	22	724.77	27.01	22	643.18	54.32
Reading/Language Arts	22	695.00	30.88	22	463.95	65.59
Science	22	710.86	31.38	22	595.77	64.77
Social Studies	0	--	--	22	411.36	30.46

Note. *N* = total number of participants, *M* = mean, *SD* = standard deviation.

Mathematics

Scores were assessed using an multivariate analysis of covariance (MANCOVA) to determine if a difference in 2009 WESTEST2 math scores existed between those who participated in WVGlobaloria and those who did not after controlling for past performance (on the 2008 WESTEST math subtest). Results of the MANCOVA did not indicate a significant difference on 2009 WESTEST2 math scores between individuals who participated and those who did not, $F(1, 198) = 2.55$, $p = NS$. Further analyses were performed to determine if other factors, such as LSES or sex, were related to a difference in 2009 WESTEST2 math scores. Using an MANCOVA, the relationships among these variables were tested. Results indicated no significant differences among participation based on low-income student status (i.e., students qualifying for free or reduced-price meal status) or sex on 2009 WESTEST2 math scores after controlling for their past performance. There were also no significant interactions among these variables. See Table 4 for *F* values.

Table 4. Multivariate Analysis of Covariance of 2009 WESTEST2 Math Scale Scores as a Function of Participation in WVGlobaloria, Low-Income Student Status, and Sex, with 2008 WESTEST Math Scale Scores as Covariate

	df	*SS*	*MS*	*F*
Covariate	1	307400.06	307400.06	193.15**
Participation	1	4058.50	4058.50	2.55
Low-Income Student (LIS)	1	11.59	11.59	0.01
Sex	1	3573.51	3573.51	2.25
Participation* LIS	1	35.02	35.02	0.02
Participation* Sex	1	6.59	6.59	0.00
LIS* Sex	1	41.46	41.46	0.03
Participation* LIS* Sex	1	136.82	136.82	0.09
Error	190	302393.36	1591.54	
Corrected Total	198	683233.49		

*$p < .05$. **$p < .01$

Reading/Language Arts

As shown in Table 6, an MANCOVA was conducted to see if participation in WVGlobaloria resulted in a difference in 2009 WESTEST2 reading/language arts scores after controlling for 2008 WESTEST reading/language arts scores. Results of the MANCOVA did not indicate any significant differences between those who participated and those who did not on 2009 WESTEST2 reading/language arts scores after controlling for their past performance, $F(1, 196) = .20$, $p = NS$.

An additional MANCOVA was performed to examine the relationship between other factors, such as low-income students (i.e., students qualifying for free or reduced-price meal status), sex, and

performance on the 2009 WESTEST2 reading/language arts component. There was a significant difference based on sex on 2009 WESTEST2 reading/language arts scores, $F(1, 196) = 12.50$, $p = .001$. Females ($M = 483.35$, $SD = 46.36$) scored significantly higher than males ($M = 451.74$, $SD = 66.64$) on the reading/language arts portion of the 2009 WESTEST2. Results indicated no other significant main effects, nor was there an interaction between participation and sex. See Table 5 for *F* values.

Table 5. Multivariate Analysis of Covariance of 2009 WESTEST2 Reading/Language Arts Scale Scores as a Function of Participation in WVGlobaloria, Low-Income Student Status, and Sex, with 2008 WESTEST Reading/Language Arts Scale Scores as Covariate

	df	*SS*	*MS*	*F*
Covariate	1	377333.17	377333.17	269.82**
Participation	1	274.73	274.73	0.20
Low-Income Student (LIS)	1	2844.30	2844.30	2.03
Sex	1	17477.06	17477.06	12.50**
Participation* LIS	1	2425.97	2425.97	1.74
Participation* Sex	1	15.28	15.28	0.01
LIS* Sex	1	2091.69	2091.69	1.50
Participation* LIS* Sex	1	0.07	0.07	0.00
Error	188	262907.68	1398.45	
Corrected Total	196	726078.39		

*$p < .05$. **$p < .01$

Science

Scores were assessed using an MANCOVA to determine if a difference in 2009 WESTEST2 science scores existed between those who participated in WVGlobaloria and those who did not after controlling for 2008 WESTEST science scores. There was a significant difference between those who participated and those who did not on 2009 WESTEST2 science scores after controlling for their past performance, $F(1, 194) = 6.517$, $p = .01$, partial $\eta^2 = 0.033$. Students who participated in WVGlobaloria ($M = 597.11$, $SD = 48.74$) scored significantly higher on the science section of the 2009 WESTEST2 than their comparisons ($M = 582.00$, $SD = 47.41$). Further analyses were performed to determine if other factors, such as low-income student status (i.e., students qualifying for free or reduced-price meal status) or sex, were related to a difference in 2009 WESTEST2 science scores. Using an MANCOVA, the relationships among these variables were tested. The results indicated no significant differences among low-income students or sex on 2009 WESTEST2 science scores after controlling for their past performance. See Table 6 for *F* values.

Table 6. Multivariate Analysis of Covariance of 2009 WESTEST2 Science Scale Scores as a Function of Participation in WVGlobaloria, Low-Income Student Status, and Sex, with 2008 WESTEST Science Scale Scores as Covariate

	df	*SS*	*MS*	*F*
Covariate	1	191110.63	191110.63	153.45**
Participation	1	8116.41	8116.41	6.52**
Low-Income Student (LIS)	1	3108.94	3108.94	2.50
Sex	1	25.98	25.98	0.02
Participation* LIS	1	1217.73	1217.73	0.98
Participation* Sex	1	268.70	268.70	0.22
LIS* Sex	1	837.92	837.92	0.67
Participation* LIS* Sex	1	1.89	1.89	0.00
Error	186	231645.04	1245.40	
Corrected Total	194	457491.00		

*$p < .05$. **$p < .01$

Social Studies

An MANCOVA was performed to see if a difference in 2009 WESTEST2 social studies scores existed between those who participated in WVGlobaloria and those who did not after controlling for 2008 WESTEST social studies scores. There was a significant difference between those who participated and those who did not on 2009 WESTEST2 social studies scores after controlling for their past performance, $F(1, 150) = 3366.12$, $p = .01$, partial $\eta^2 = 0.04$. Students who participated in WVGlobaloria ($M = 407.41$, $SD = 28.85$) performed significantly better on the 2009 WESTEST2 social studies subtest than did demographically similar students who did not participate in WVGlobaloria ($M = 398.16$, $SD = 33.39$).

In addition, there was a significant difference between low-income students (i.e., students qualifying for free or reduced-price meal status) and 2009 WESTEST2 social studies scores, $F(1, 194) = 3.917$, $p = .05$. Students who were considered low-income students ($M = 410.85$, $SD = 31.18$) scored significantly lower than students who were not low-income students LSES ($M = 397.37$, $SD = 30.58$). However, there was no interaction between participation and low-income students' status. See Table 7 for *F* values.

Table 7. Multivariate Analysis of Covariance of 2009 WESTEST2 Social Studies Scale Scores as a Function of Participation in WVGlobaloria, Low-Income Student Status, and Sex, with 2008 WESTEST Social Studies Scale Scores as Covariate

	df	*SS*	*MS*	*F*
Covariate	1	59340.93	59340.93	109.30**
Participation	1	2694.16	2694.16	4.96*
Low-Income Student (LIS)	1	2126.92	2126.92	3.92*
Sex	1	278.71	278.71	0.51
Participation* LIS	1	469.13	469.13	0.86
Participation* Sex	1	3.80	3.80	0.01
LIS* Sex	1	150.39	150.39	0.28
Participation* LIS* Sex	1	18.03	18.03	0.03
Error	186	77098.00	542.94	
Corrected Total	194	148156.81		

*$p < .05$. **$p < .01$

Conclusions and Recommendations

The WWW Foundation contracted with Edvantia to conduct a pilot study of the effects of Globaloria participation on student achievement. The purpose of the study was to provide preliminary data concerning the performance of students participating in the WVGlobaloria project relative to the Global21 standards, per 2009 WESTEST2 scores.

Edvantia researchers conducted a series of analyses of covariance to determine the probable effects of Globaloria participation on students' 2009 WESTEST2 scores for each of the four core subject areas (mathematics, reading/language arts, science, and social studies). Past performance was controlled by using 2008 WESTEST scores as the covariate. Participants in WVGlobaloria performed significantly better on 2009 WESTEST2 science and social studies subtests than did demographically similar nonparticipating students in demographically similar schools after controlling for prior achievement.

The findings that WVGlobaloria students performed significantly better on the science and social studies sections of the WESTEST2 than did similar students in similar schools suggests that Globaloria may positively affect student performance in these domains. Notably, these are the subject areas that one would predict Globaloria to have a positive effect because Globaloria facilitates the development of logic through teaching students to make connections among varying and disparate points [1]. It could be that this skill is more useful to autonomous areas (i.e., science and social studies) than those that are more regimented (i.e., mathematics and reading/language arts.). Further research is warranted to assess the stability of the effects on social studies and science and to examine the processes involved in Globaloria that may be contributing to its impact on student achievement. Although the mechanisms through which participation in Globaloria is potentially influencing student achievement are beyond the scope of this Edvantia study, studies of this nature would provide substantive context for examinations of Globaloria effectiveness.

To determine specific next steps in the research agenda, WWW Foundation staff may look to the logic model prepared by Edvantia in 2008 [4]. According to this logic model, the act of building a game, which involves the development of content knowledge as well as technological skills, leads to higher student achievement. Given the preliminary evidence that Globaloria participation positively affects achievement on the WESTEST2, there are several logical next steps:

- Replicate the current study in another state to determine whether the relationships between participation and achievement in science and social studies hold up in another context. Replication in other states should attend to the degree to which the states' content standards and standardized achievement tests incorporate 21st century skills, as West Virginia does.

- Implement a series of studies that examine sequentially the mediating and moderating variables that influence the relationship between participation and science achievement, and between participation and social studies achievement.
- Examine in-depth the role of educators and the impact of educator participation in Globaloria.
- Develop and test assessments of the skills and attitudes hypothesized to be developed through participation in Globaloria.
- Identify/develop instruments valid for measuring the intervening variables noted in the logic model.

Endnotes

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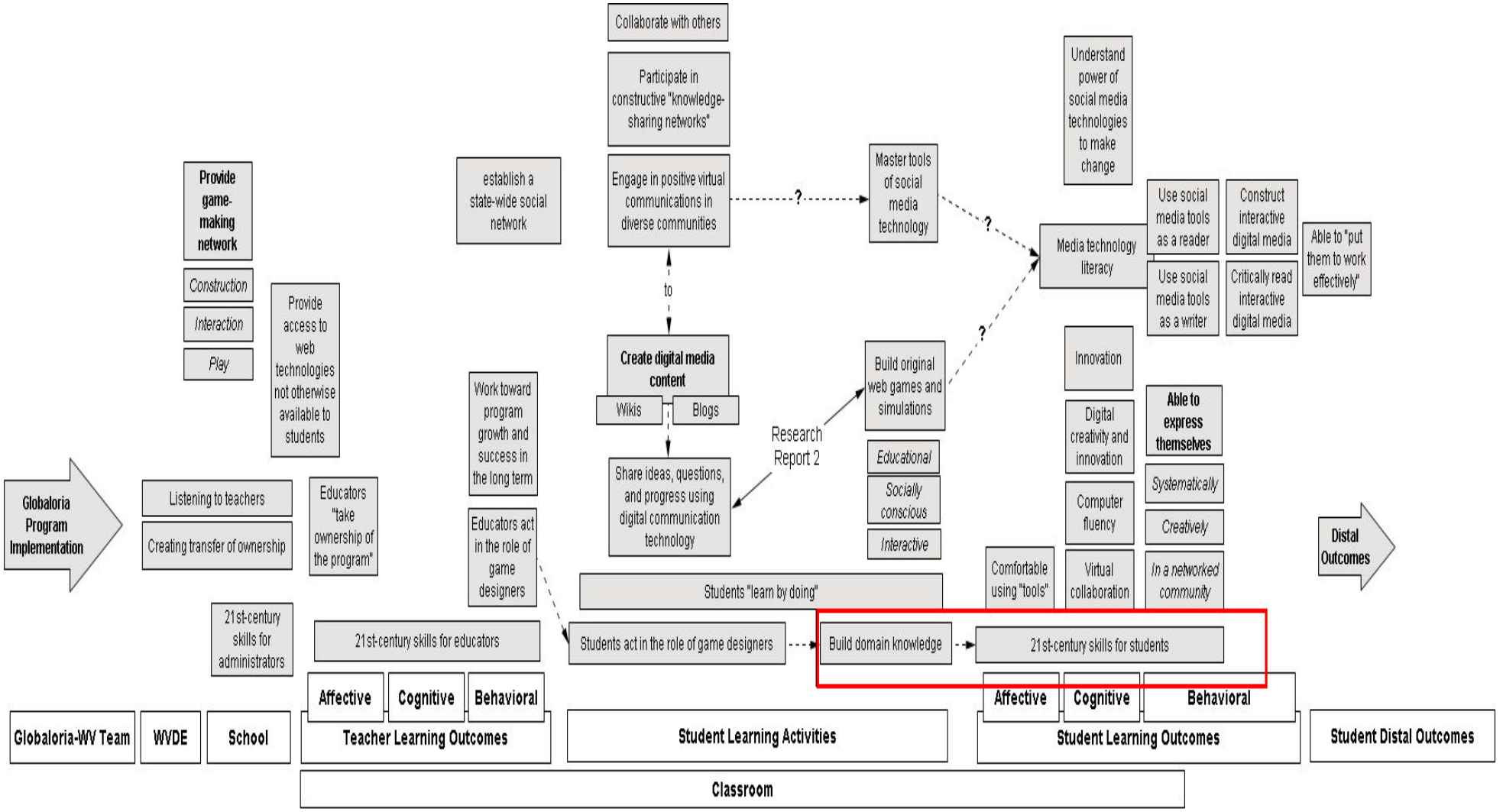
12. West Virginia Department of Education. (2010). *How do we measure student progress in the 21st Century?* Global21 Educators Flyer. Retrieved from http://wvde.state.wv.us/global21/publications/Global21%20Educators%20Flyer%20How%20Do%20We%20Measure%20Progress.pdf on January 14, 2010.

Appendix A

School-Level Globaloria Implementation and Learning Outcomes Logic Model

School-Level Globaloria Implementation and Learning Outcomes Logic Model



Appendix B

Participating and Matched Comparison School Selection Criteria

Participating and Matched Comparison School Selection Criteria

Match	School	County	Reading Proficiency Percent	Math Proficiency Percent	School Enrollment	Percent of Low-Income Students
Participating School						
1	Capital High School	Kanawha	72.51	63.98	1197	46.62
2	Eastern Greenbrier Middle School	Greenbrier	58.27	63.23	811	49.20
3	Greenbrier West High School	Greenbrier	64.64	57.57	416	58.41
4	Sandy River Middle School	McDowell	52.52	45.45	270	78.89
5	Spring Valley High School	Wayne	76.42	72.40	1101	31.52
Matched Comparison School						
1	Point Pleasant High School	Mason	68.61	62.03	1196	47.83
2	B-U Middle School	Upshur	53.33	56.00	825	53.94
3	Richwood High School	Nicholas	71.59	53.40	421	64.13
4	Philippi Middle School	Barbour	42.85	53.06	267	64.04
5	Hampshire Senior High School	Hampshire	70.99	66.16	1116	53.94