An Analysis of the Effects of a Technology Program on Students' Academic Performance:
Are These Vygotsky's Children?

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August 2009

Martin and Scribner (1991) wrote that the appropriate unit of analysis for cognitive studies of technology initiatives cannot be confined to the technology itself or to discrete tasks independent of the context(s) of their performance. Rather, they argued, researchers should adopt a broader view that includes institutional settings and the activity structures into which new tools are being introduced. One ubiquitous institutional setting is the public school, so to that broader view we would add that it is also appropriate to include potential academic impact as a unit of analysis in evaluations of school-based technology initiatives – particularly in light of the widely held view among policymakers and the public alike that the integration of technology into virtually every area of the curriculum is a matter of urgency.

In the 18 years since Martin and Scribner addressed research methods for technological phenomena, many states, inspired by both the turning of the calendar and a growing dissatisfaction with the federal government's understanding of "accountability," have prepared both new curricular and new technology plans. Many include "21st century" in their titles. While their patience with narrow interpretations of student achievement may have worn thin, however, the notion of technological determinism and its role in economic development remains largely unchallenged in these plans. Zhou and Conway's 2001 study of statewide technology plans, for example, revealed a reductionist view of technology's perceived contribution to students'

learning, focusing more often than not only on its potential to raise test scores. Their examination also noted a privileging of economic progress over other possible goals.

This paper reports the outcomes of four mixed-method case studies conducted in schools which have implemented the My GLife technology initiative developed by Globaloria, part of the World Wide Workshop Foundation. My GLife [My Global Life], as do many such ventures, utilizes emerging technologies to help students learn how "to interact productively" with technology and to acquire and demonstrate "appropriate workplace skills" (Globaloria, 2008). It is, thus, consistent with the interests of those who see technology integration in schools as a means of preparing students for the workforce. The question is whether the skills students are acquiring can be transferred to their other curricular or co-curricular work, thus broadening their value. If so, the case for incorporating these kinds of technology initiatives in schools is strengthened as it moves beyond economic instrumentalism.

This study incorporates the use of Vygotsky's activity theory as a lens through which to examine the following: the selected schools' implementation of My GLife (e.g., curricular vs. co-curricular); its effect(s), if any, on students' learning, both within My GLife and in their other academic pursuits; and its effect(s), if any, on levels of student engagement. To address those issues, our mixed-method analysis involving both quantitative and qualitative measures focuses on this primary question: Does participation in My GLife improve students' overall academic performance?

<center>Background</center>

In 2005 West Virginia became the second state in the nation to join the Partnership for 21st Century Skills based in Tucson, Arizona. The Partnership provides this description of its purpose:

The Partnership for 21st Century Skills is the leading advocacy organization focused on infusing 21st century skills into education. The organization brings together the business community, education leaders and policymakers to define a powerful vision for 21st century education to ensure every child's success as citizens and workers in the 21st century. The Partnership encourages schools, districts and states to advocate for the infusion of 21st century skills into education and provides tools and resources to help facilitate and drive change. (Partnership for 21st Century Skills, 2008, p.2)

Among the first steps the West Virginia Department of Education (WVDE) took as a member of the Partnership was state publicly its instrumentalist goals: "The West Virginia Board of Education's vision of developing a 21st century school system aligns with the West Virginia Jobs Cabinet, established by the Governor's Executive Order, to link educational improvement and economic development in West Virginia" (WVDE, 2008, p. 3). To assure the involvement of important stakeholders, the Department established a 21st Century Advisory council:

Central to the vision of creating a 21st century education system is ensuring that the education system is connected locally and globally to business, industry, and other key stakeholders. To that end, the WVDE established the 21st Century Advisory Council to provide input and guidance on the state's 21st Century Learning Initiative. The Advisory Council is composed of 33 business and community leaders from all regions of the state. The Council has provided input and focus to the 21st Century Learning communications plan in an effort to make the public aware of the initiatives and the benefits it will bring to their community's economic growth. (WVDE, 2008, p. 3)

The Department goes on to explain that ensuring a 21st century education requires the appropriate technology tools for students to "access information … acquire new knowledge, and construct products, reports and systems" (WVDE, 2008, p. 43), and announces two initiatives designed to accomplish that goal. The 21st Century Tools for 21st Century Schools Technology Initiative and the Tools for Schools Initiative, codified by the West Virginia Legislature in the 2007 session (Providing for 21st Century Instruction), provides hardware and software to K-12 schools and professional development for teachers. Both are reported to have been" studied and documented by researchers as providing a positive impact on student achievement, student learning capacity, and student development of specific skills" (WVDE, 2008, p. 43), although no documentation is offered as confirmation.

The WVDE's "Chronicle of West Virginia's 21st Century Learning Initiative" (2008) specifically mentions Globaloria and its developers, the World Wide Workshop, as having been invited by the Office of the Governor to partner with the state in its pursuit of 21st century learning. Since that time, 11 secondary schools have participated in the initiative.

<div align="center">Globaloria[1]: My GLife</div>

In 2006, the My GLife program was launched in Netanya, Israel with 38 Arab, Jewish and Russian immigrant students from five Israeli cities. By 2007, the Globaloria program had expanded to 10 active communities on four continents, including groups in Trinidad, the United States (West Virginia), India and Bolivia. The program's developers describe Globaloria's programming platform as being grounded in constructionist theory of learning (Papert & Caperton, 1991), a merging of constructivist theory with the idea that learning is more

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[1] Within the umbrella of the Globaloria program are components focused on specific topics or curricular areas including My GLife which focuses on global awareness, My SLife relating to science, My HLife for health, My RLife for human rights, My ALife for art and My MLife for mathematics. These curricular components were scheduled to be made available at different times for pilot testing. The first component to be made available was the global awareness component, My GLife.

meaningful when it is part of an activity in which the learner creates a product or artifact. Both elements can be seen in Globaloria's conceptualization of My GLife.

My GLife is described by its developers as allowing individuals in developing countries and underprivileged communities to gain an understanding of and familiarity with Web 2.0 skills. "Web 2.0" typically refers to a second generation of web design and development tools that allow for information sharing or collaboration, such as social networking and video sharing sites (e.g., Facebook or YouTube) as well as wikis and blogs. Such "open-source" technologies are made available for users to adapt and refine for their own purposes by benefit of an open copyright (Caperton, Shannon & Oliver, 2008). The program also, however, makes use of software that requires licensing fees (e.g., Flash). Students participating in My GLife construct online games and simulations around the content of their choice.

Six public school pilot sites across West Virginia began implementing the project during the 2007-2008 school year. Fourteen educators were trained for these six sites and seventy students participated in the first year program. In the second year of the program, six additional educators were trained and a total of two hundred sixty nine students participated.

For purposes of this investigation, four school sites were selected for case studies. City High School, one of the original six sites, provided the My GLife program to 27 students. Nine of the students, in grades 10 and 11, participated in an after-school course for the Health Sciences and Technology Academy (HSTA). This group met for 90-minutes twice per week. The remaining 18 students in grades 10 through 12 participated for academic credit through their business curriculum courses. They met for 45-minutes five times per week.

Twenty-three students at Countryside High School in grades 10 through 12 participated in three separate My GLife courses, with each meeting for five 45-minute classes per week for

two semesters. The first group included 11 students, the second 19, and the third accounted for three students.

Southern Middle School had two groups of My GLife students in the 8th grade. The groups were composed of seven and eight individuals respectively and met for five 82-minute classes per week one semester and five 40-minute classes per week for the second semester.

Finally, students at the Technical High School met for five 90-minute classes per week for a semester. First semester enrollment was 22 students, while three students participated during the second semester.

Theoretical Framework

There are several various and complementary epistemological theories that could provide suitable lenses through which to view the Globaloria project and provide some structure to this investigation. Among them are constructionism, constructivism, and activity theory. Each will be examined briefly in this section, with the theory selected for use receiving a more thorough explication.

Constructionism

Constructionism, developed by Seymour Papert in the 1980s, is the framework identified by the Globaloria design staff as the foundation for the program. It is a theory that posits that learners are more likely to acquire new understanding and knowledge if they are actively engaged in the creation of an external artifact, such as the computer games constructed by students in the Globaloria program.

Papert studied with Piaget in Switzerland in the 1950s and 1960s, modifying his constructivist theory to encompass the study of learning with technology. The focus on product

(artifact) rather than prerequisite developmental stages denotes the primary difference between the two theories. Papert offers this explanation:

> Constructionism — the "n" word as opposed to the "v" word — shares contructivism's view of learning as 'building knowledge structures' through progressive internalization of actions … It then adds the idea that this happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe. (1991, p.1)

Papert's constuctionist theory is also complementary to Dewey's (1916) constructivist philosophy that one must harness a student's existing knowledge in order for that student to be able to acquire new concepts. Constructionists add to the concept of applying existing knowledge the belief that the creation of an artifact allows the student to develop a deeper understanding of the particular concept on which she is working.

Constructivism

Constructivism – Papert's "v" word (1991, p. 1) – refers to a process of learning through which the learner applies prior experience(s) and knowledge to new events to develop new understandings. Constructivists cast the student in the role of active participant rather than passive recipient, believing that it is only the learner who creates knowledge. The learner accesses his current understanding to imbue new situations with meaning (Lambert, Walker, Zimmerman, Cooper, Lambert, Gardner, & Szabo,1995).

As a philosophy of learning, constructivism can be traced to the 18th-century work of Italian philosopher Giambattista Vico, who believed that humans can understand only what they have themselves constructed. A number of others worked with his ideas, but among the first to

articulate the implications of constructivism as it applied to child development and to classroom learning were Jean Piaget, John Dewey, and Lev Vygotsky. It is far beyond the scope of this study to offer an extensive account of these theorists' work and the numerous points at which they intersect and overlap, but a brief explication of the relevance of their thinking to the investigation follows.

Jean Piaget

Piaget is referred to by many as the pioneer of the constructivist theory of knowing (Beck & Kosnik, 2006; Duckworth, 2006; Lambert et al., 1995), a title he sometimes shares with his contemporary John Dewey. Piaget's constructivism grew out of his interest in the psychological development of children. For him, children's development must necessarily precede their learning and the developmental stages he identified (i.e., sensorimotor, pre-operational, concrete operational, and formal operations) he viewed as necessary progressions.

While Piaget (1970, 1978) felt strongly that children must form their own understandings by being active participants in their learning, the process of knowledge acquisition was secondary to the existence of the necessary developmental stage – that is, development precedes knowledge. A child simply cannot acquire a concept that is beyond her developmental level. For the most part, Piaget also favored self-initiated discovery over social learning.

John Dewey

Dewey is remembered as a relentless reformer of public education who argued that it was too prescriptive, too tied to tradition, and too unconcerned with understanding how children really learn (1916, 1938). It was his position that education should be an exchange – a dialogue between and among students and teachers – rather than a one-way transmission that renders students impassive recipients. Thus, education depended on active participation for Dewey as

well, but for him the action was more social than solitary, occurring through students' (and teachers') creating communities of learners who built their knowledge together.

Lev Vygotsky

A number of theories or hypotheses for rethinking cognitive development and psychology surfaced in the 1920s and 1930s from the Moscow Institute on Psychology and Moscow University, most of which were consistent with the work produced by Piaget and Dewey. Russian philosophers and researchers also focused on the premise that the human mind can be understood only within the context of interactions between people and between people and their material environments. Vygotsky's activity theory is representative of that work and is especially useful for the analysis of phenomena, such as Globaloria, that involve individuals interacting not only with each other but with the tools of their material environments.

Essentially, activity theory (formally Cultural Historical Activity Theory, or CHAT) posits that learning activities are conducted through collaboration with others and/or mediated through the use of the available tools of the culture which they have learned to use. Culture, for Vygotsky, makes two sorts of contributions to individuals' intellectual development. First, individuals acquire much of their thinking, information or knowledge from the culture. Second, they acquire the processes or means of engaging their thinking (i.e., the "tools of intellectual adaptation") from the surrounding culture. Culture, therefore, is a source of what to think or think about as well as the source for the various methods and tools for thinking and problem-solving. Simply stated, Vygotsky's perspective was that children are only as cognitively developed as the culture they inhabit allows them to be. For him, culture outweighed both the developmental stages proposed by Piaget and Dewey's emphasis on language.

The distinctions between and among Piaget, Dewey and Vygotsky are, for the most part, more subtle than sharp. All three, for instance, believed that children are naturally curious and are actively involved in their own learning. Vygotsky, however, believed they relied more on their interactions with others than on self-discovery (as Piaget thought) and that they relied not only on social interactions (as Dewey suggested), but on the tools of the culture as well. Still, all three theorists are considered critical to the development of constructivism.

Vygotsky's work was chosen as the theoretical framework for this study for two reasons: his emphasis on how culture influences cognitive development and his emphasis on the importance of social interaction in cognitive development. The combination of constructionist (the use of "tools of intellectual adaptation" to create meaning) and constructivist elements (teams of students working collaboratively) in the Globaloria project, however, made Vygotsky's activity theory the most suitable choice. Activity theory's central premise that learning activities are best undertaken through collaboration with others and/or mediated through the use of the available tools of the culture is perfectly aligned with Globaloria's purpose.

Methods

In an effort to discern what effect, if any, participation in My GLife had on students' overall academic performance, a mixed-methods case study was conducted with four of the 11 public schools that participated in the Globaloria program over the 2008-09 academic year. The selected sites were chosen based on education level in order to get as broad a representation as possible: two high schools (one rural and one urban), a middle school, and a vocational-technical school. Quantitative data were made available for all four sites; interviews were conducted at only three of the sites, however, as one of the schools in question did not respond to inquiries to arrange interviews. Each school's No Child Left Behind data appear in Table One.

Table 1

No Child Left Behind Data for Globaloria Pilot Schools 2007-2008[2]

	GD	ENR	SES	W	ATT	GR	GN	DO	CS
City High	9-12	1203	47.46	65.50	95.37	72.95	240	7.0	17.8
Countryside High	9-12	1158	35.49	98.45	95.08	79.85	218	5.6	23.3
Southern Middle	6-8	293	81.23	100.0	94.32	N/A	N/A	1.0	22.0
Technical High	Non-NCLB school – no data reported								

For quantitative analyses, pre- and post-Globaloria academic data were requested from each school for each student participating in the program at the selected sites. These data were requested by the Globaloria staff and included academic transcripts (i.e., grade point average (GPA) in the state-required core courses and overall), attendance records (as a proxy for engagement), and the state's standardized test scores. Analysis of these data proved to be problematic for a number of reasons that will be explicated in the section on findings.

The qualitative portion of the mixed-methods case study included one-on-one interviews with teachers and focus group interviews with students who participated in Globaloria during the 2008-09 academic year. Nine questions were developed for the student focus groups and ten

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[2] Data reported include grades served (GD), enrollment (ENR), percentage of students receiving free and reduced lunch (SES), percentage of white students (W), attendance rate (ATT), graduation rate (GR), number graduated (GN), drop-outs (DO) and class size (CS.) Technical high is a non-NCLB school and therefore does not report these data.

questions for the teacher interviews.[3] Each of the interviews and focus groups was recorded with

a portable digital voice recorder, and in some cases, a laptop computer. For the vocational-

technical school and the high school, the interviews were conducted face-to-face while

interviews with the middle school students and teacher were conducted via telephone. Once all

of the interviews were completed, the recordings were then transcribed and analyzed for

emergent themes.

Findings

To provide a preliminary answer to the question of whether participation in My GLife

improves students' overall academic performance, the study analyzed both quantitative and

qualitative data. This section offers the results of those analyses.

Quantitative Analyses

The academic records of participating students for whom consent had been obtained by

the Globaloria staff were requested and analyzed. These records presented an unanticipated

problem: the responding schools used different collection and reporting formats. Of the records

requested (i.e., grade point average in core subjects and overall, state standardized test scores,

class rank, and attendance), only the grades reported showed any consistency among schools.

Some reported test scores, others didn't; none had state standardized test scores for the 2008-09

academic year (which were not available until August or September, 2009); some either did not

provide or do not have students' rankings in their classes (middle schools, for example, did not

record that information); and methods for recording absences seemed to be as unique as the

schools. That being the case, across-schools analyses/comparisons could not be conducted.

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[3] Details of both student focus group questions and teacher interview questions may be found in Appendices A and B respectively.

Within-school analyses of students' grades in the core (i.e., English/language arts, social studies, mathematics and science), overall GPAs, and absences however, could be conducted with the records from three of the four case study schools. These records allowed the comparison of individual students' records pre- and post-Globaloria using paired-sample t-tests. There were, however, no findings of significance for any of the schools in either grades in the core or in overall GPA.

There was, however, one significant finding from Countryside High School. Differences in attendance returned a significant finding, but in a direction that was unexpected. The mean number of absences in the academic year prior to participation in My GLife was 14.53, but rose to 20.36 for the academic year during which students participated in Globaloria. A paired-samples t-test returned a p-value of .012 showing significance at the $p \leq .05$ confidence level (see Table 2). The reason for this difference is unclear, but it is likely a result of a number of factors beyond participation in the Globaloria program. This is probably holds true for the pre/post grade analysis as well.

Table 1

		Paired Samples Test – Pre and Post Attendance							
		Paired Differences							
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair	Days Absent 2008 Days Absent 2009	-5.822	14.909	2.223	-10.301	-1.343	-2.620	44	.012

Qualitative Findings

Our qualitative findings are drawn from interviews with teachers and focus groups with students of the schools selected for this case study, as well as a thorough examination of what the students have written through their blogs and wiki pages. From the broad perspective, these sources of data provided a remarkable consistency as issues raised by both groups focused on their perceptions of the skills acquired and application of those skills in other contexts. There were, however, within the text of the student blogs, some indications of frustration.

Skills Acquired

The acquired skills cited most often by students were improved organizational abilities, better time management, enhanced presentation or interpersonal skills, and collaborative processes. "Working together in groups" was mentioned as a benefit by some students at all three of the schools where focus groups were conducted. When asked to blog about what liked about working in groups, one student mentioned the "pool[ing] together our knowledge of a subject [which] enables us to help one another." Another wrote, "I am able to learn what each person from the group knows and then apply that to what I learn. We each get the opportunity to learn new things from each other hands-on, rather than watching a tutorial."

Several students blogged specifically about learning ActionScript, with one noting that "each of us knows how to do different things in Flash and all that, so putting it all together and working together is a great way for us to work together and learn each others' strengths and weaknesses." Another agreed, pointing out that "if there was something someone didn't get, someone else probably knew how to do it and could show them. It was a collaborative intelligence for the whole class." Even one of the middle school students added that "we … teach each other," evidence of constructivist learning at work. They were particularly enthusiastic about being able to talk with professionals in the field of game design.

It was, however, working in groups that was a source of friction for some students:

> I don't really have a team either because ____ is a cry baby and tries to pretend like nobody helps him. Even though it was me that rallied the team from the beginning when nobody else was trying to work. I was the first person to make anything in flash. ____ tried to act like he didn't know how to help at all. I taught ____ how to use Flash and I supported ____'s negative Flash videos. I have withstood ____'s negative attitude and tried to help as much as possible, but he continues to be a cry baby. So I don't know what else to do to try to save this group. I believe it is going to collapse …

Another student wrote that she was "feeling some really negative vibes":

> My group is very competitive about who is doing all the work, but I know who really does all the work, but SHE does not brag. This is all really bad. I hope we can come out of this to be a real team.

A third student was experiencing some of the same frustration:

> My group is out of control. All they do is complain and complain. ____ and ____ think they do it all, but we all know I'm the back bone of the team. I'm the one who has held our group together and gotten us to where we are. It may not seem like it, but I have done all the behind the scenes work. I have dedicated my life to this group and all the thanks I get is these two freeloaders claiming my work. And there's ____. Everything was fine until she came along. Like the woman she is, she has gotten our group to argue and disagree. What happens from here? Who knows? Maybe if some of our group members (____) would grow up, everything

would be ok. The [other team], all they do is distract our team and try to destroy

our hard work and gloat in our faces and brag about their button usage skills.

These frustrations notwithstanding, based on what we read in students' blogs the majority

of comments re: My GLife tended to be positive. In addition to feeling as if working in groups

was mostly beneficial, students also liked the fact that "the course didn't use books" but rather let

them work through on-line tutorials "at [their] own pace" and "set [their] own schedules." One of

the middle school students said she was "always learning something new – it's not like the same

old stuff you learn from year to year." One student mentioned "the challenge of figuring things

out for yourself" as something she particularly relished about My GLife.

While the students didn't mention either wiki or blog creation or participation as a

specific benefit, a teacher cited wikis as one of the students' favorite aspects of My GLife

"because they're able to participate in a community and see what other students have done,

unlike more traditional courses in which students do not share their work." To the extent that

public schooling has historically favored working independently over working collaboratively,

her observation that students enjoy working in teams – that they didn't find it difficult – is

encouraging.

We learned, however, that at some sites teachers are assigning topics for students to write

about in their blogs. Interestingly, students seemed to write about Globaloria only when

explicitly asked to do so. One student began a blog entry with "[t]oday we have to post a blog

about our favorite computer game," and another introduced an entry with an answer to a

question: "What I think about this class is …" On some occasions, however, students got

opportunities to freestyle, as was the case here:

What frustrates me? Oh boy! … [C]omputer illiterate people. OK, I get that you

may be 60 years old and weren't raised on the web, but if you are in a position

where you have to use a computer, which today is pretty much anywhere, take an

hour or two out of your life and read some tutorials.

One development we thought interesting is that there were few, if any, responses to any

of the students' blog entries. We also thought it unusual that the middle school students wrote

more in their blogs than students at the three high schools in this case study.

Application of Skills

When asked whether they had developed skills that they were able to apply in their other

classes, students' answers were essentially the same as those they'd listed for the skills they'd

acquired in general (i.e., they were better organized, managed their time better, improved their

presentation skills, and were more able to work as part of a group).

One of the teachers felt that simply "having Globaloria in [the] school was advantageous

since it exposed the students to new technologies … and to professionals that use and teach those

technologies. " The students used web conferencing to discuss development tools with members

of the Globaloria team. This experience also helped the students meet and learn from

professionals outside West Virginia.

A teacher also shared her perception that students had improved both their presentation

skills and their confidence, and had "gained a lot being involved with the program." Students

seem to share that view, with one writing "I think that ____ would agree that this time around the

presentations were better." Another wrote of watching other teams' present their games:

> I felt that the presentations on Tuesday went really well! I felt the Team ____ did
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> an excellent job in presenting their power point and their game. And Team ____
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> did a good job as well, even with the little mishaps they had with their power
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> point.

A recent study focusing on administrators in the 11 pilot schools also revealed a perception that students' grades are improving. A middle school principal reported that "[s]ome of our students who are sort of laid back with education have gone from being a 'C' student to an 'A' student just because of the program and utilizing it and seeing what's out there and [being] given the freedom to do it." A high school principal agreed:

> I think it can have an effect on attendance if students enjoy what they are doing.
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> They look forward to coming to school. These kids really seemed to enjoy the
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> game design that they did. As far as [standardized test] scores, I think it indirectly
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> could affect those simply through problem-solving skills and being able to work
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> through problems individually and in groups. I think it can have an indirect effect
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> that way. (Chapman, 2009, p. 76)

There were a few disadvantages to the program raised by teachers. The primary problem was the "increased work load, specifically preparing extra reports." Resource issues came up as well, specifically the cost of licensing some of the required software (i.e., Flash) and having sufficient hardware available for all of the students. One teacher offered as a pedagogical suggestion "allowing students to develop some small games by themselves before moving on to the larger, more complex team games." Overall, however, the data gleaned from the interviews and focus groups were overwhelmingly positive.

Discussion

While the results of the interviews and focus groups suggest primarily positive benefits accruing from the integration of Globaloria's My GLife initiative into schools, these findings must be viewed with some caution. For example, while the four schools described in this case study may be representative of MyGLife schools, they remain nonetheless a small number. Moreover, the total population is only 11 schools and all are obviously in the same state. Consequently, the study's findings may not generalize to the implementation of the program in other states or in schools with different demographics.

Additionally, any perceived increases in Globaloria students' academic performance outside of Globaloria may be simply a result of intellectual maturation of the student or other curricular reforms implemented by the school or district that occurred simultaneously. These findings are limited to understanding the perceptions of only a few students and teachers rather than being generalizable to the larger population of students and teachers involved in the initiative. It is also important to note that as MyGLife remains in its pilot phase, the participating students and teachers are likely receptive to technology initiatives. This may indicate a predisposition that is not generalizable to all students and teachers who may be asked to participate.

Still, the positive responses to the interview and focus group questions suggest a level of enthusiasm not often seen for curricular reforms. Teachers' perceptions that the program is exerting or will exert a positive effect on the academic outcomes of their students combined with students' perceptions that their participation is reaping curricular (i.e., better understanding of math or science) and co-curricular (i.e., improved organizational, time-management and presentation skills, increasing comfort levels with technology, and "the challenge of figuring things out for [themselves]") benefits are encouraging. Should this perceived improvement in

grades be borne out, that improvement could be consistent with Vygotsky's theory that student gains skills through collaborative problem-solving activities that involve the use of available cultural tools which are not gained by students working independently.

Conclusion

Learning is a socially mediated activity in Vygotskyan thought, and one that involves the tools of contemporary culture. Leontjev (1978), expanding Vygotsky's work, writes that consciousness and meaning are always formed in joint, collective activity. The proper unit of analysis in studying human mediated activity, thus, is an activity system – a community of actors who have a common object of activity. The Globaloria project constitutes such a system, which makes it an excellent venue in which to investigate Vygotsky's work.

For Vygotsky, children can be only as cognitively developed as their culture will allow, and the learning experiences in Globaloria's My GLife program reflect the broad cultural perception that one of the skills – if not the primary skill – necessary for students to navigate the job market or postsecondary education in the 21st century is a familiarity with emerging technologies. A recent survey, for example, reports that three in four parents agree that the proper use of digital media is at least as beneficial to students' future success as are skills in traditional areas such as reading and math. When asked if these digital skills are critical to success in the 21st century, 83% responded that they are (eSchool News, 2008).

The program stresses the importance of teaming and collaboration as well, also recognized as "21st century" skills (Partnership for 21st Century Skills, 2008; West Virginia Department of Education, 2008). Students in the My GLife project engage in their collaborative work using the most ubiquitous of our contemporary Vygotskyan "tools of intellectual adaptation" – the computer.

Cultural perceptions aside, however, My GLife is grounded in a long-standing theoretical premise: the constructivist principle that students have already acquired a range of knowledge and skills and that they can enhance their understanding of them as they access what they already know to synthesize the new concepts introduced by My GLife. It is these processes that are engaged as participating students take on the creation of their technology products.

The culture in which Globaloria students are developing "21st century skills" confirms Vygotsky's thinking regarding the importance of culture in learning. By capitalizing on students' inclination to interact using online social networks, the Globaloria program brings the students' own culture into the classroom and allows that culture to enhance the learning environment. By utilizing contemporary "tools of intellectual adaptation," in this case hardware, software and the internet, students appear to be developing new and expanding already acquired skills.

We reiterate the need for caution, however, in interpreting the findings reported herein. In order to confirm this preliminary analysis, large numbers of students will have to be tracked for a long period of time in order to generate genuinely meaningful results. As the program continues its integration in schools with the goal of expanding first statewide and then nationwide, however, continued evaluation is imperative. The number of technology initiatives aimed at public school students, who constitute the largest captive audience in the country, is likely only to proliferate. It is critical that schools accept only those that can provide evidence of epistemological value.

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Appendix A

STUDENT FOCUS GROUP QUESTIONS

1. How long have you participated in Globaloria?

2. How did you become involved with the program? (*Was it required? An elective? Neither? Were they recruited? If so, by whom?*)

3. If you were asked to describe the program to someone who knows nothing about it, what would you say?

4. What do you think the purpose/objective of the program is? (*You may not need this depending upon the responses you get from #3.*)

5. What do you like best about Globaloria?

6. What do you like least?

7. Do you think participating in Globaloria has affected your performance in your other classes? If so, how?

8. Has participating in Globaloria affected your post-graduation plans? If so, how?

9. Are there any changes to the program you'd suggest?

Appendix B

TEACHER INTERVIEW QUESTIONS

1. How long have you been involved with Globaloria?

2. How did you become part of the project? (*Were you recruited? By whom? Principal? WVDE? Another teacher?*)

3. What role do you believe technology should play in the classroom? (*That's the generic classroom, not the Globaloria classroom.*)

4. How would you describe the purpose(s)/objective(s) of Globaloria? Are they consistent with your view on the role of technology in the classroom?

5. What do you think your students like best about the program? What do you think they like least?

6. Are there aspects of Globaloria that you think have the potential to help students in their other classes? If so, what are they?

7. Are there advantages to having Globaloria in your school? If so, what are they?

8. Are there any disadvantages to having Globaloria in your school? If so, what are they?

9. If you could change one thing about Globaloria, what would it be?

10. What advice would you give to a teacher who will be implementing the program for the first time?