

*Collaborative Tools and Virtual Schools:
Engendering higher order thinking through collaboration in the elementary &
secondary online environment*

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Abstract

As the cyberwave of online learning reaches primary and secondary schools, educators will need tools to ride this wave. Online learning has made great headway in higher education, and research has been done extensively at that level. Much of the research points to the benefits of collaboration online enhancing the development of higher level thinking skills (Gokhale, 1995). With the extensive growth of primary and secondary online schools over the last eight years, educators need to be able to utilize tools that will encourage that collaboration and the development of higher level thinking skills in this new environment. This paper will give an overview of emerging online collaboration tools and an analysis of their use and application in K-12 Virtual Schools.

I. *Introduction: Education joins the CyberWave*

As education rounds the corner of the millennium and heads down the straight way for future generations, medical, political, and technological changes are causing a major shift in how education is delivered to students. As high stakes testing pressures cause parents to examine the success of their schools closely, and since the No Child Left Behind legislation gives parents more choices, virtual schools have become a viable alternative for primary and secondary students. Russo (2001) states that virtual schools could solve such problems as teacher shortages, limited course offerings, dropouts, and the need for individualized learning. The individualized curriculum provided makes virtual schools a prime vehicle in this paradigm shift. These vehicles, while still in the visionary stage, are starting to become a reality, and their final appearance is currently being shaped.

This chapter will explore some technological tools that may shape virtual schools. Particular focus will be on emerging tools that aid in collaboration and the development of higher order thinking skills, as well as preventing the problem of social isolation mentioned by Russo (2001).

II. *Overview of K12 online learning:*

A. Overview of Primary and Secondary Online Learning

From the debut of The Virtual High School in 1996, funded by a five-year grant in Hudson, Massachusetts (Hammonds, 1998), to the doubling of enrollment in online courses between 2001 and 2002 (Taylor, 2002), the history of online learning in primary and secondary schools has been very brief, but is currently experiencing a meteoric rise.

The slow grass roots movement included only 30 online schools across the nation in the year 2000 with only five percent of educators being aware of online programs (Russo 2001). According to the Center on Education Policy (Fulton, 2002) between 40-50,000 primary and secondary students enrolled in an online course in the 2001/2002 school year. In addition, 28 percent of leaders surveyed by National School Boards Foundation believe that one out of every five students will receive a part of their instruction over the Internet in the next three years. In addition, Kalmon (2002) points out that 90 percent of American children and teenagers currently use the Internet.

From the students who take online courses in a lab in their district school, to home school students, or students who need a special challenge, a wide range of students occupies this new environment. Students in the original Virtual High School were high school students with schedule challenges or students who needed to take a special course from a teacher at a distance. Current students range from primary students attending from home, to advanced placement students who take college courses while in high school. In addition, state funding has encouraged more students to jump on board including those who found challenges in the regular classroom, whether these challenges were academic or socially grounded. The current political climate influenced by the No Child Left Behind Act, allowing students in “failing” schools to choose their school, has given states the latitude to fund computers and internet connections for virtual students, which also adds to the variety of students in the environment.

The types of online environments vary as much as the mixture of students. The delivery of online courses can take place by teleconferencing in a TV lab set up just for this purpose, in a computer lab, or the comfort of home. Hammonds (1998) pointed out

that some schools combine motion video with music and sound, while maintaining a humanistic environment. Although in the beginning virtual schools utilized the teleconferencing set up, this use has been limited due to heavy price tags, as well as the expertise needed to run the equipment. The limitations of teleconferencing need to be taken into account but should not rule out teleconference labs as useful tools. The next developmental step taken by the virtual schools was the establishment of online courses in the local school offering students alternative courses. The original arrangement involved the district school having one teacher from the cooperating school teach online courses for every twenty students enrolled from that school in online classes. This setup gave students more variety and flexibility, yet kept them under the guidance of their local school system. More recently, the mandates of the No Child Left Behind (NCLB) Act have given parents and schools even more alternatives. School systems are applying their per pupil expenditure to develop charter or alternative schools with an online provider (Eng, 2003). The online provider supplies the curriculum, while the local school supplies a computer and Internet access for the student, as well as paying teachers to teach in this environment. These environments can be based in the student's home or in a local school lab. Parents who have a job allowing them to work from home, as well as home school parents, are the most frequent users of this type of school environment. In addition, parents who have students who had challenges in public school, whether the challenges were social, mental, religious, or physical, take advantage of this environment to give their children the benefit of one-on-one attention and assistance. With this variety of types of environments, a question is raised about the curriculum being studied by the students, and the teaching or learning strategies being applied.

The curriculum can consist of hands-on lessons presented by a parent in the home, a student following a multimedia lesson on the computer, or individually paced lessons followed by immediate feedback after a lesson with an online assessment. Teaching strategies can include systematic presentation of materials via online text or multimedia files, collaborative projects, or independent study. Hammonds (1998) pointed out that some online students utilize inquiry learning while creating, designing and working in teams, but have to adapt to higher stimulation and a faster pace. Thomas (2002) summarized that individual courses taught at state schools have certified teachers while online charter-schools depend on parents to help to monitor student instruction.

Barriers and Issues

The limitations of online learning include technical challenges, lower-than-average completion rates, equity issues, lack of evaluative data, and objections from teachers' unions. Technical limitations include email challenges due to an unresponsive partner, or the challenges of working with partners across time zones. Technical requirements for providing rich and interactive online content can sometimes exceed the current technical capacities provided by districts. This lack of technical capacity limits the ability of districts to provide equitably for all students, no matter how much technology is available in the home or district.

The list of negatives against virtual schools can include the prohibitive time and money needed for teacher training and developing courses. Teachers' unions worry about the amount of time teachers will need to teach online.

Cifuentes, (2001) added that another limitation comes from the student's sense of detachment to other students as well as to the instructor. This will become an especially

important issue in the primary and secondary virtual schools due to the nurturing that needs to occur at that level, as well as the need to learn collaboration skills.

The lack of evaluative data on the successes and failures of virtual schools should cause educators to proceed slowly in accepting this method of delivering instruction. The loss of accountability due to some students not showing up to take state tests have caused some educators to be concerned about this medium. In addition, the belief that some districts were using online programs to recoup revenue losses from declining attendance, adds to the political unrest on this issue.

B. Overview of Research on Collaborative Online Learning

The growth of virtual primary and secondary schools has been so fast, that research results are still in process, with publications reaching the press on a regular basis. Much of the previous research has centered on online learning in higher education (Porter, 2002; Taylor, 2002; Thomas, 2002). Many researchers point out the benefits of online learning as including anytime, anyplace learning (Abramson, 2000), authentic language learning (Cifuentes, 2001), active and just-in-time learning (Dringus, 2000), "vicarious learning", or observing another student's learning experience and relating it to their own (MacDonald, 2001). Confirming Russo's (2001) comments on social isolation, the Center on Education Policy (Fulton, 2002) states that one of the many topics needing research is on the type and quality of social interactions taking place in virtual schools. Collaboration online would be a viable way to increase social interactions.

Research in the face-to-face classroom has studied collaboration as a teaching strategy extensively, and research on online learning confirms the validity of its use in that environment. Dringus (2000) stated that creating a sense of presence in any

educational setting has an essential need to promote communication with peers. Gokhale (1995) pointed out that group interaction makes students' scholarship, skills, and experiences beneficial to others in the group because students had to validate their opinions by giving reasons for decisions, and reflecting on the criteria behind the judgments. Lotan (2002) further stated that by giving "group-worthy tasks", teachers give their students' opinions and views a sense of legitimacy in the eyes of their peers. In contrast, Jackson's (2000) study showed no direct evidence that "collaboration within immersive virtual environments aided the process of conceptual change", however, evidence was shown of the possibilities of conceptual change occurring due to dealing with conflict, expressing opinions, and collaborating on theories.

Kaplan (2002) gave suggestions for improving the community feeling in online learning. These suggestions included clearly defining the roles of each group member by detailing the responsibilities of each. A second suggestion was to create an individual profile for each member of the group. Lastly suggested was to set guidelines for online and offline etiquette, and successful group behaviors for reaching learning outcomes.

The emerging technological tools available to encourage or enhance collaboration online are of great interest to educators since collaboration is strongly supported as a means to decrease social isolation in virtual schools and encourage higher-level thinking.

III. Literature review on emerging online collaboration tools

Since the days of FredNet, before the dawn of the World Wide Web, teachers have been interested in developing online collaborative activities for their students. Most early collaboration online took place using a text based gopher and listservs or email. These activities usually wore the guise of online projects, and involved communication

across countries with e-pals or experts in a field. Some examples of the projects and history can be seen at the I*EARN (<http://www.iearn.org/projects/index.html>) and Kidlink (<http://www.kidlink.org/KIDPROJ/>) websites. However, since the communication depended on the technological expertise of the teachers involved, as well as being extremely time consuming, relatively few classrooms participated in these projects. As the Internet exploded in the mid 1990's, publishers and other entities became involved in developing such projects as Scholastic's Global Trek (<http://teacher.scholastic.com/activities/globaltrek/index.htm>) or Global Schoolhouse Network's (<http://www.gsn.org>) Project Registry. These projects involved a large investment of time and revenue. While these projects became popular with teachers, wide spread use of the projects were prohibited due to the technological limitations of having only one computer in the classroom, or the unavailability of the school lab. Since the late 1990's with the federal investment in e-rate funding, and the commitment of getting all schools connected, the technological challenges have diminished, but the pressure for high stakes testing has simultaneously drained the energy of districts and teachers, thus still limiting participation in online collaboration. At the turn of the century, with the No Child Left Behind legislation, schools and districts are trying to find alternative ways to meet the needs of students. One of these alternative methods has been the development of virtual online schools. In the beginning, high school students primarily utilized the virtual schools by accessing online courses developed by teachers in the Virtual High School (Hammonds, 1998). Once again, vendors joined the cause creating curriculums for virtual schools. Most of these programs, however, while creating curriculums that encourage individual learning by students, are not clear about

involving the students in collaborative activities. This has caused virtual schools to become a focus of state and federal agencies (Carr, 2001; Kalmon, 2002; Thomas, 2002; USDE, 2002), which have developed a national vision and recommendations for virtual schools. The national vision highlighted the need for “Social cohesion and shared culture” (USDE, 2002). But how can virtual schools meet this principle? Rather than being limited to the business world, technological advances have progressed and the educational arena is finally applying them. While most of the advances are happening with online training for businesses, they can be adapted to fit the educational mold. Gordon’s (2003) “List of Collaboration Tools” (<http://www.gilgordon.com/resources/products1.htm>) gives a solid alphabetical list of online conferencing and meeting software utilized in the business and training environment, which could be adapted for use with virtual students. Most of these tools include presentation software, online videos, chatting, and file-sharing capabilities, which are the basics needed for any online collaborative learning to occur. However, Barnett (2002) contends that while online videos aid in learning, videos lack interactivity, so the presence of the teacher gives depth to the learning process. An additional tool that may be included in some of the above mentioned tools is the whiteboard, which Kahn (1994) claims is the most important of these tools as it allows participants to write, type, and draw on a shared drawing window as well as scrolling back to earlier versions of the contents to show growth. While Kahn was discussing synchronous collaboration, Isenhour (2000) supported asynchronous collaborative authoring, stating that centralized repositories for shared documents needed to be included. Isenhour (2000) also indicated

that scheduling challenges cause erratic interaction patterns thus reinforcing the need for smooth transitions between synchronous and asynchronous modes of collaboration.

With the need to adapt these business solutions to the educational environment, Portugal (2000) suggests using metaphors in the development of virtual environments. For example, the designation of virtual places such as halls, collaboration rooms, offices, and so on, would ease the student into the virtual school. Yehezkel (2002) takes this easement one step further with the “InCA information system” which would keep track of the user preferences and goals. A user model would utilize diagnostic agents to collect and analyze information submitted by users. Then learner's needs would determine the interface in which the information is presented, and learning activities complete with intervention strategies matched to the student's needs .

Some of these adaptations have become reality in tools like Tapped In, Moodle, 3DWriter, and KidSpace, which are discussed in detail below:

Tapped In is the most versatile tool, and best meets the needs mentioned by Portugal (2000) of a user interface that uses metaphors for its layout. It utilizes a virtual campus for an international community of education professionals. Primary and secondary teachers and librarians, as well as other education professionals attend “After School Online” (ASO) training workshops and discussions. The package has a separate campus for primary and secondary students, and allows teachers to set up locked office spaces that allow only their students inside for virtual chats and discussions. The layout includes the metaphors of rooms, buildings, and passageways for navigation. The ability to drop papers into the office for viewing by others encourages an online discussion about a piece of work (See figure 1 for details). It allows synchronous and asynchronous

communication, and automatically drops a copy of transcripts into a participant's email box for follow up later. While designed for adult users, this environment has already had a student version added to it, and could be easily adapted for use in primary and secondary virtual classrooms.

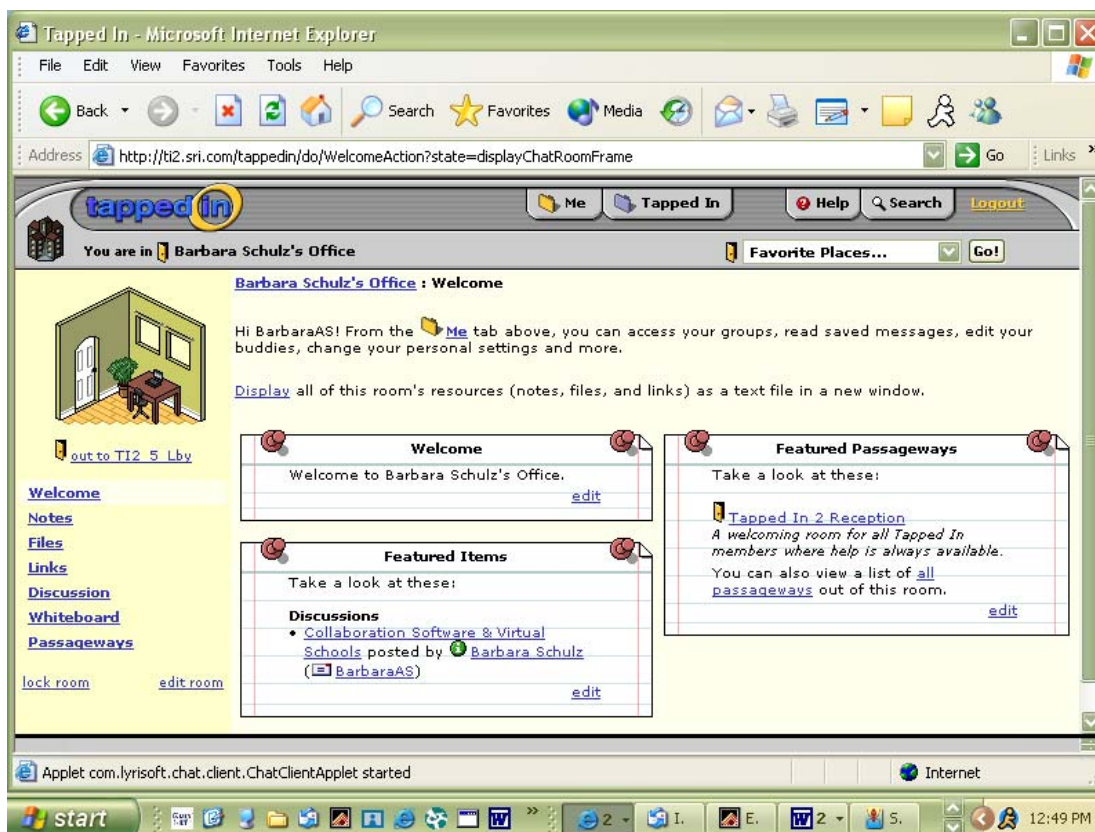
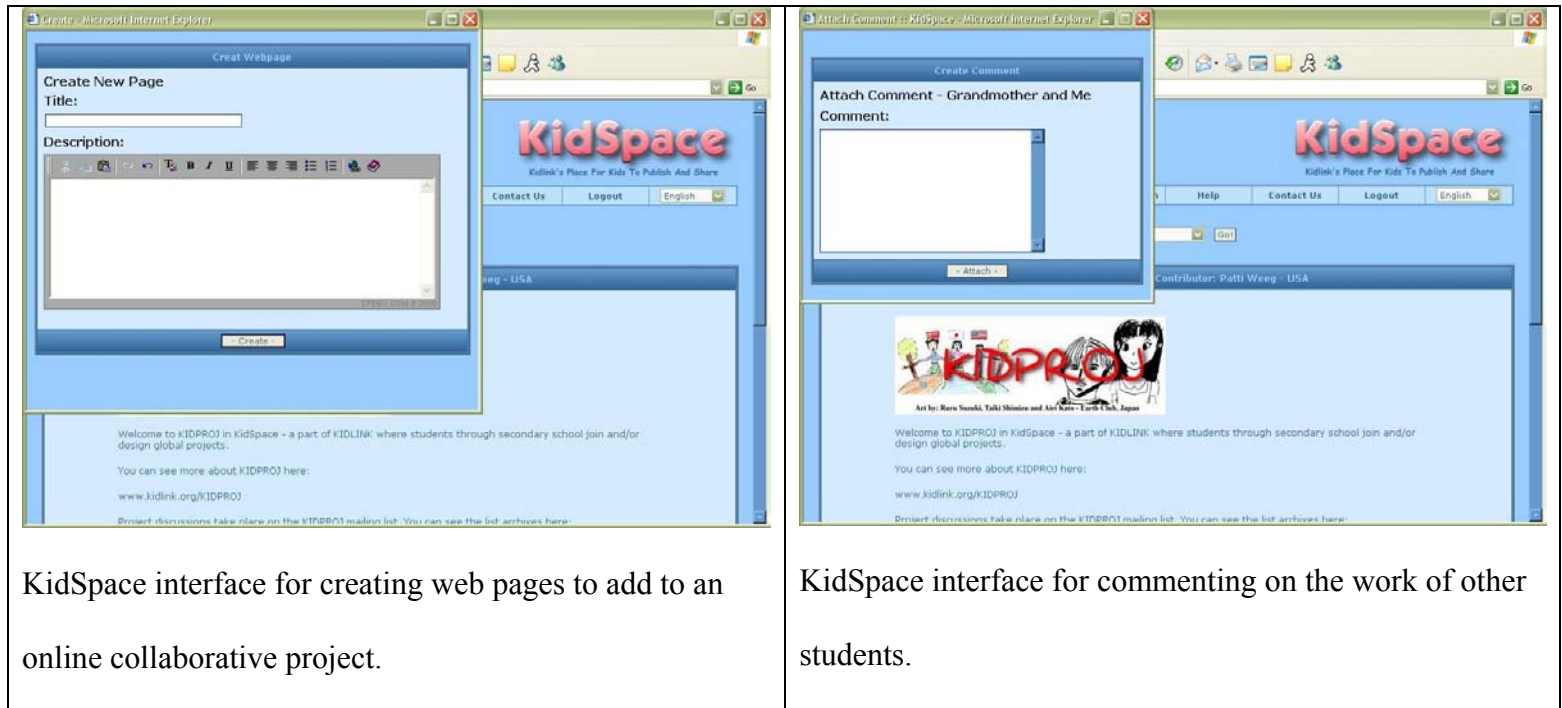


Figure 1 Tapped In's User Interface

Kidlink's KidSpace is an old program reinvigorated and adapted to meet the modern needs of students. While Kidlink was utilized for online projects throughout the 1990's, its developers have kept up with the technological advances by adding a new interface to the program. The old online projects still exist and many are still active today, but

submitting student work and commenting on the work of others has become much easier for participants. The addition of a discussion board and a voting tool, adds more versatility to an already strong interactive program.



KidSpace interface for creating web pages to add to an online collaborative project.

KidSpace interface for commenting on the work of other students.

Figure 2 Kidlink's KidSpace Interface

Moodle (Dougimas, 2003) is a tool that can be utilized to set up and conduct online courses, and has been designed to be compatible with any computer platform. The tool is open source so available to any teacher that has the time to learn how to use it. The software gets set up using the teacher's own computer as a server, which gives total control to the teacher. The software uses a modular layout, and has shared libraries, abstractions, and cascading style sheets, which can be linked to other services such as mail servers, or student directories. While this program may take some time to learn, it puts the development of online courses in financial range for educators.



Figure 3 Moodle Interface

3DWriter - While this package is NOT a collaboration tool in itself, it is a reasonably priced software package, which enables students to create web pages from a text document. It will essentially allow virtual students to easily share their work with peers via a web page without having to learn HTML editing. However, the creators do not give pointers about how to get the pages created onto the web, nor do they suggest how to collaborate in the writing. The virtual teacher would need to have students submit the pages to be placed on a class web site. The fact that the pages are transformed to HTML will ease the burden on the teacher.

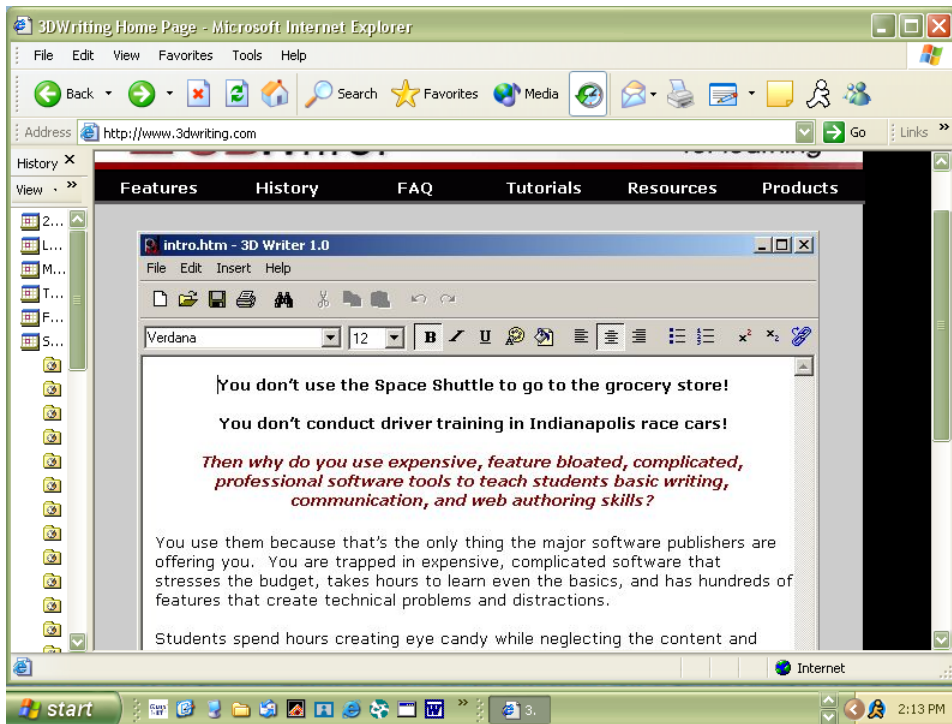


Figure 4 3DWriter interface

Virtual reality, simulations and holograms are additional tools that have a high potential for use with virtual students. Sykes (1999) states that students must become more involved in their studies in virtual worlds because the headsets limit distractions from learning. As students immerse themselves into their virtual worlds or simulations, teachers become facilitators in student's self-discoveries. Patterson (2001) adds that the use of VRML (Virtual Reality Modeling Language) makes interactive 3D worlds a viable possibility for use in the near future by a student using a dial up connection. In addition, Layng (1995) advises that the use of Hologram technology to give students 3D training in such fields as mechanical and medical studies, is on the horizon. The merging of virtual reality, holograms, and artificial intelligence will create new virtual worlds in the not too distant future that will open many new possibilities. With the addition of the above-

mentioned collaborative tools, the look and feel of the educational virtual environment will morph before our eyes!

IV. Application of the tools in Virtual Schools

While the vision of online learning morphs to its future, how can educators harness this mutation to aid students? Salmon (2000) describes 5 steps to successful online learning – access, motivation, dissemination of knowledge by an instructor with the students showing evidence of learning, knowledge construction, and using shared knowledge to create something new. Virtual schools have the access, students are motivated, and the dissemination of knowledge is presently occurring. With the first three steps already occurring in virtual schools, the addition of collaborative learning to the environment will put virtual schools well on their way to becoming successful learning environments.

The literature is full of references to activities that can make the virtual school curriculum a powerful experience for students. Sykes (1999) gives examples of students taking virtual reality trips back in time to experience the War of 1812, visit the ancient ruins of Mayan Chichen Itza, or virtually be present at the writing of the Constitution in 1787. For scientific experiences, a student can be virtually set adrift around the sun to understand the solar system, or explore inside a virtual cell to find out about diseases. McLester (2001) suggested that remote controlled microscopes could allow learners to see the tile of a space shuttle up close, or the bone of an ancient creature. Indeed, many such learning experiences that are realities today, such as Global Schoolhouse's (www.gsn.org) Field Trips, Geo Game, and CyberFair (Anghem, 2001) or Multi User

Virtual Environments (MUVE) such as the Bike Rally by National Science Foundation (Crystal, 2001) could be utilized in the virtual school environment.

The addition of asynchronous chat can scaffold that rich learning, and the learning experience can expand and deepen by following several threads at once (Bober, 2001). Sharing the rich learning experiences through discussion, and MacDonald's (2001) "vicarious learning", or observing another student's learning experience and relating it to their own, will serve to move the students to Salmon's (2000) fourth step of knowledge construction in online learning. Utilizing such interfaces as Tapped In, 3DWriter and KidSpace will help students move to Salmon's fifth step of using shared knowledge to create something new for an authentic audience (Rea, 1999) thus developing their higher order thinking skills.

V. Conclusions and suggestions for future research

As the visions for virtual schools morph through the next decade, educators need to be sure that this new environment is meeting the needs of students. With all the research pointing to collaboration as a strong point in the online educational process, the use of collaboration tools should become part of that vision. The directive from the Center on Education Policy (Fulton, 2002) to develop "Social Cohesion and shared culture", should be a strong incentive for virtual schools to be sure that they include collaboration as a learning strategy. Students using virtual environments will be entering the same work force as "brick and mortar" students, and will still have the same need for skills such as collaboration with peers, and thinking skills to be able to solve problems.

The few tools evaluated here are just the tip of the iceberg of what is available as evidenced by Gordon's (2003) "List of Collaboration Tools" being utilized now in businesses. Each of those applications have the potential to be adapted to the virtual school environment if vendors can find a way to lower the price tags or find additional funding for schools.

In addition, the development of virtual reality, holograms and artificial intelligence as teaching tools needs to be observed closely as those fields mature, and are applied in academic settings, as their potential for use in virtual schools is powerful.

However, as educators examine these tools before applying them in the virtual school environment, several directions for research become apparent. The research questions to consider are:

1. Is the collaboration proven necessary in higher education online learning, as necessary in primary and secondary virtual schools?
2. What assistive adaptations are needed to enable virtual students with physical handicaps to collaborate online?
3. Does collaboration truly increase higher level thinking skills in virtual primary and secondary school students? Will the research done at the higher education level be consistent when applied to K-12 students?
4. Does collaboration decrease the risks of social isolation for primary and secondary virtual education students?
5. Does collaboration improve cultural awareness in primary and secondary virtual education students?

6. How does the role of the online teacher effect the virtual student's learning competency?

These questions are just a few of the many topics which will shape the vehicle which the primary and secondary virtual schools will become as future students ride through this cyberwave of educational change.

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