Sample Grant:
Virtual Reality in Education

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Specific Aims

The goal of this project is to develop and disseminate a new generation of educational pedagogy created by the Virtual Schools Initiative. The initiative will include a consortium of public and private enterprise, ranging from public schools, community organizations, computer manufacturers, and software companies. The consortium is combining to produce an innovative, comprehensive strategy to increase at-risk and impoverished student performance and motivation. These objectives will be accomplished through introducing teachers to learner-centered technology, using virtual reality-based engaged learning techniques to immerse students in their studies.

No single school, agency, corporation, or technology will solve the problem of chronic underachievement of at-risk students on the West Side of Chicago. Schools lack the resources to engage in technology-based innovation; educators have specific ideas but not the ability to implement themselves; technology companies are awash in innovation- but understand little how their innovations can be used in the classroom. It is possible, however, to make substantive progress when all of the above collaborate to accomplish a goal. Partnerships must move beyond the existing education system.

The Virtual Schools Initiative was created out of a need to better involve at-risk children in their education. The purpose of our proposed program is to teach at-risk children with engaged, experiential, and self-directed learning methodologies supplemented by advanced interactive technologies, as well as to assist and develop teachers in delivering these methodologies.

Ultimately, our goal is that students come to understand their education as an active discovery process where they are given the freedom to explore and make decisions, while easing the burdens on inner-city teachers as they become learning facilitators rather than merely supplying answers.

The first year objectives of this effort will be accomplished through:

- The creation of the Virtual Schools Initiative, a collaborative effort between schools, community organizations, computer manufacturers, and software companies to provide a fresh approach to motivation and achievement problems among at-risk students.

- The development of an Advisory Committee. Initially we will organize a committee including teachers, school administrators, psychologists, and technology experts which will manage and evaluate the program on a monthly basis.

- Providing a comprehensive program focused on fifth through eighth grade students in five Chicago Public Schools located on the West Side of

Chicago in which virtual reality-based engaged learning will be implemented.

- Integrating self-directed, interactive engaged learning methodologies and technologies into the curriculum across different subject areas.

- Providing a comprehensive series o professional development programs. Teachers will go through intensive professional development to learn how to, integrate principles of engaged learning into the curricula, beginning the transition to learning facilitation, and integrating powerful new technologies into the classroom.

- Integrating virtual reality-based engaged learning labs into target schools

- Serving as a training center to disseminate knowledge to other educators and professionals on the results of the initiative.

We anticipate this project will have the following, wide-reaching educational and environmental benefits:

- Advanced engaged learning methodologies and technologies will be pioneered and implemented.

- VSI students will become, self-directed, lifelong learners.

- Burdens on teachers will be reduced as they become learning facilitators.

- The VSI will export an innovative model of educational excellence and novel public-private cooperation to schools nationwide.

- An extensive framework to increase at risk and impoverished student motivation for learning through learner-centered, engaged learning methodologies will be developed.

- Teaching practices will be improved as teachers are introduced to technology supported engaged learning methodologies.

- Learner-centered initiatives will be integrated into the curriculum.

- Virtual reality technologies will be introduced into education.

Specific Objectives Include:

Objective 1: To develop a new public-private partnership model

Objective 2: To increase motivation for learning among at-risk students

Objective 3: To increase student performance and retention through hands-on learning activities and visual-based presentation of subject matter.

Objective 4: To integrate technology-based engaged learning into everyday curricula and learning plans.

Objective 5: To lessen burdens on inner-city teachers and transform their role to “learning facilitators.”

Objective 6: The widespread implementation of technology-based engaged learning activities across different grade levels and subject areas.

Objective 7: To establish technology-supported engaged learning labs in target schools.

Objective 8: To create an effective, multi-tiered dissemination plan harnessing a combination of both interactive and traditional forms of media.

BACKGROUND AND SIGNIFICANCE

"Today, in most industrial countries, most people are doing jobs that did not exist when they were born. The most important skill determining a person's life pattern has become the ability to learn new skills, to take in new concepts, to assess new situations, to deal with the unexpected. This will be increasingly true in the future; the competitive ability is the ability to learn."
-Seymour Papert

Across the nation, there is a growing concern that traditional models of learning based on the assembly line are not aligned to the needs of the 21st Century (Jones, Valdez). Engaging, technology-based student learning is essential in better serving the unique educational needs of at-risk children. If we expect wholesale change in the lives and education of at-risk students, we must undertake fundamental and comprehensive change (Smith and O'Day, 1990).

The **"engaged" learning vision** (Means, Olson et al, 1995; Jones, Valdez, 1995) is one we believe will inspire greater performance in at-risk students, of which the status quo and scores of other learning methodologies have previously failed. The "engaged learning" model has student involvement through new learning technologies in complex, meaningful projects at its core.

Advances in cognitive psychology have shaped our understanding of the nature of high-level intellectual performance, and give us a solid foundation in designing environments which allow for more sophisticated learning. There is now widespread agreement among educators and psychologists (Collins, Brown, Neuman, 1989; Resnick, 1987) that the advanced skills of comprehension, composition, reasoning, and experimentation are developed not by the passive reception of facts, but by the active processing of information, as in the "engaged" learning model.

Means says that "educational reform calls for a shift away from organizing instruction around short blocks of time devoted to lecture or practicing discrete skills in specific academic disciplines towards an emphasis on engaging students in long-term, meaningful projects."

A major rationale for using the approach is the idea of **realistic, complex environments for inquiry**. Means reports "teachers can draw on technology applications to simulate real world environments and create actual environments for experimentation, so that students can carry out authentic tasks as real workers would, explore new terrain, meet people of different cultures, and use a variety of tools to gather information and solve problems."

"Authentic tasks" are described as the ordinary practices of the culture that engage students in sustained exploration. With simulations, students can get involved with a problem through visual media which provide integrated contexts and help students comprehend ideas more easily (Hasselbring, Goin, Zhou,

Alcantara, and Musil, 1992). Authentic tasks are almost always more complex than the task assigned with a traditional skills approach. Complex tasks permit students to take a more active role in defining their own learning goals and regulating their own learning. Students explore ideas and bodies of knowledge, not in order to recite verbal formalizing on demand, but to understand phenomena more deeply and search for information. (Means).

> "Will public education lead the way or, as in most things, will the change first enhance the lives of the children of the wealthy and powerful, and only slowly and with much find its way into the lives of other children?"
> -Seymour Papert

In a hearing before the Senate of the United States, the General Accounting Office testified that "schools in central cities and those with a 50-percent or more minority population were more likely to have more insufficient technology elements than other schools." Schools without sufficient technological infrastructures are "not providing even a roughly equal opportunity to learn. This is particularly true in central cities and in schools that serve high percentages of minority and poor students."

Jones and Valdez state that the danger is that many poor schools will be precluded from engaged learning activities because, 1) schools don't have the funds to buy needed technology, 2) curricula and assessment programs focus on low-level skills even when technology is applied, 3) teachers do not have the support necessary to develop instructional strategies, and 4) the private business community is not active in poorer schools.

The problem is exacerbated by large differences in access to computers at home (Means, Blando). When youth are not sufficiently mentally stimulated in the home, schools become additionally burdened. This is where "youth" become "'at risk' youth." Further complicating the problem is the fact that in many a part of the African-American community, education is not looked upon in a favorable light. Many parents, sadly equate education with the loss of African-American culture. When over eighty percent of a school's population is filled with children in this situation, it is imperative that new means of engaging these types of children are developed.

One of the most powerful and promising learning technologies ever created is virtual reality. About the potential of virtual reality in education, Vice-president Al Gore said that it would be very important in how we "reach our children." Virtual reality is an immersive technology that allows students to step through the computer screen into a three-dimensional, interactive environment. By putting on a special headset and glove, it places students inside of a simulated environment that looks and feels like the real world. Through virtual reality, we're convinced

we're in another world experiencing some event, and doing things that don't physically exist.

A helpful analogy to better understand the educational promise of virtual reality is that of a child exploring a forest for the first time. A child will best learn about the forest not from reading about it or listening to a teacher lecture, but by walking into it- becoming a part of it. The child is free to explore the forest any way she likes. Self-guided discovery and experience become the best teacher.

To date, virtual reality technology has been used primarily in the military and training. Now, however, the means to produce immersive, interactive virtual environments have developed to the point where it is feasible to use virtual environments in schools to help students learn. (Furness, Winn, 1998)

Virtual reality is a departure from traditional computer use- most "educational" computer programs are merely slews of text and graphics thrown onto a computer screen

Virtual reality, contrasted from existing computers, puts students *inside* of their subjects. From their own point-of-view, students have their own self-guided personal experience with their studies. They step inside (literally) of Independence Hall (in 1787) while studying the Constitution, or travel through a computer to learn how it operates. They become a part of what they are learning, which can happen only in virtual reality. "Virtual reality creates learning environments that cannot be created using traditional strategies, and it is this quality that makes it superior to other kinds of pedagogical method (Winn, 1996)."

To date, virtual reality-supported engaged learning has "already seen practical use in an estimated twenty or more public schools and colleges, and many more have been involved in evaluation or research efforts (Youngblut, Institute for Defense Analysis, 1998)." The Human Interface Technology Lab at the University of Washington reports that "research has shown that students are capable of learning curriculum content by interacting with objects in virtual reality and that they learn more in interactive environments than in non-interactive ones. All results indicate that learning in immersive virtual reality leads to a better conceptual understanding of the subject (as compared to recall of facts) than learning in other ways."

The Human Interface Technology Lab at the University of Washington concluded, "virtual reality allows students to create their own experiences, the type of knowledge that has so far been possible only through direct experience with the world, never through computer interfaces or any of the third-person experiences that predominate in school."

Virtual reality-based engaged learning has the potential to profoundly influence the education of at-risk youth. Students who are labeled "at-risk" often are better served by teaching styles which are more visual and experiential, and virtual reality is more aligned with these non-traditional teaching styles. This could be a dramatic difference for all students, especially those "at-risk" (Byrne, 1996).

When material is presented in non-traditional forms such as virtual reality, at-risk students have responded positively and showed up for school. In pilot studies, tudents saw interaction with virtual reality as a natural extension of their interests and were eager to continue (Bynes, Holland, Furness, 1997). The Human Interface Technology Lab states, "we have concluded that virtual reality offers new ways to learn that may help students who do not learn well in traditional ways."

Virtual reality-based engaged learning will raise the educational standards at at-risk children. At-risk children are commonly assumed not to have the capacity to learn sophisticated ideas, further adding to the cesspool of academic and personal underachievement. NASA's Software Technology Branch says, "by using multi-sensory virtual reality in education, many researchers believe that complex, abstract material now considered too difficult for many students and taught even to advanced learners only at the college level could be mastered by most students in middle school and high school."

Students accept multi-sensory learning very quickly, and this fact is increasingly true of at-risk students who have been bombarded with images from television, movies, and videogames.

Traditional teaching methods have often not been effective in the goal of seizing these students' attention, often relegating them to a passive role in the classroom. This is contrary to the wisdom that learning is much more effective when it is an active discovery process. Reporting a 1998 Chicago Public School Pilot study of virtual reality, Sykes reports, "using virtual reality in the programs was an effective response to pressing educational needs. First and foremost, students, especially at-risk students, must become more involved with their studies. To many students today, school is boring."

Similarly, new teaching methods and technologies must be pioneered to relieve teachers of the growing burden placed upon them by the today's classroom and its changing role in society. From a teacher's perspective, virtual reality creates a structured environment that focuses students on specific learning objectives, similar to good teaching. Using an engaged approach to learning greatly heightens the relevance of traditional teaching, including classroom participation and reading text.

One of the main barriers to classroom learning in at-risk schools is antisocial behavior. Children from broken-homes and impoverished environments often

use schools as a form of ”lashing-out,” expressing adjustment problems, creating barriers for other children to learn. Teacher’s jobs are made harder because they not often have trouble controlling the learning environment. These problems often express themselves by the time students are ten to twelve years old, the middle-school period. Fortunately, many of these problems can be minimized. When students are immersed in the virtual reality-based engaged learning environment with a headset, there are no distractions to learning. Students are totally focused with no unruly behavior. (Sykes, Reid, 1999).

Means has specified eight indicators for engaged learning, all of which are supported by the proposed virtual reality-based engaged learning model.

Variables of Learning and Instruction	**Indicators for Engaged Learning and Reform Instruction**	**Role of Virtual Reality (VR) Technology In Engaged Learning**
Vision of Learning	Responsible for Learning Strategic Energized by Learning Collaborative	VR is based on self-directed learning (Brown, Mikropoulos, Kerr, 1997). Student motivation is greatly increased when learning is supplemented by VR (HIT, 1997)
Tasks	Authentic Challenging Integrative/ Interdisciplinary	Stuart and Thomas (1993) report the age of television has bred passive and disengaged students with short attention spans. VR captures student attention (Byrne et, al 1994, Sykes, Reid, 1999)
Assessment	Performance-Based Generative Seamless and Ongoing Equitable	VR learning focuses students on specific learning objectives, and is easily integrated into existing curricula (Sykes, Reid, 1999)
Instructional Modes	Interactive Generative	VR supports true learning-by-doing. Students actively control the environment and directly experience resulting behaviors (Dede, 1997).
Learning Context	Collaborative Knowledge Building Empathetic	VR offers the facility for shared-experiences between both students and teachers (Brown, et al).
Grouping	Heterogeneous Equitable Flexible	The VR lab structure allows flexible grouping arrangements (Sykes, Reid, 1999)

Teacher Roles	Facilitator Guide Co-learner	VR greatly eases teaching burdens as they become learning facilitators as students explore and learn in VR. Teachers guide students' self-discovery process and assist in building ideas (Osberg, 1995; Sykes, Reid, 1999).
Student Roles	Explorer Cognitive Apprentice Teacher Producer	The exploratory quality of VR provides a capability that is fundamental to the learning process (Dewey, 1916;Brunner, 1962; Silberman, 1970; Papert 1980; Byrne, et al 1995).

PROJECT APPROACH

The goals of the Virtual Schools project are threefold; to better engage and challenge at-risk students, to relieve burdens on inner-city teachers, and to create a new model of public-private cooperation for the benefit of American children.

At its core, the Virtual Schools Initiative is about trying new, untested models for educational excellence. It is about taking the best of existing educational pedagogy and pairing it with the world's most powerful learning tools, many of which have never been used in schools before at a meaningful level. It is about taking methodologies and technology such as virtual reality, which was previously confined to the military and world's wealthiest corporations, and using it to enrich the lives of the country's poorest children.

The Virtual Schools Project is about building new partnerships at different levels- not merely collaboration among non-profit organizations, but also including the most innovative companies of our age. These companies are driving the world's economy- now they have come together to create a new era in education. Through these diverse and powerful resources, the Virtual Schools Initiative was born, ready to work together and pioneer a new age in education, the likes of the world has never seen before.

The VSI Model was built around seven major documents:

Technology and Education Reform (Means, Olson, 1995)
Using Technology to Support Education Reform (Means, Blando, 1993)
Designing Learning and Technology for Educational Reform (Jones, Valdez, 1994)
Virtual Reality and At Risk Students (Byne, Holland, et al, 1997)
Virtual Reality: The Ultimate Educational Technology (Sykes, Reid, 1999)
The Educator's Guide To Virtual Reality (Sykes, Reid, 1999)
Educational Uses of Virtual Reality Technology (Youngblut, 1998)

The VSI model evolved from a public-private collaboration between the Chicago Public Schools, The New Functional Learning Institute, and SUNRISE Virtual Reality in which at-risk summer school students experienced engaged learning in virtual reality environments. (for a detailed description of the program See Appendix)

The Virtual Schools Initiative is a collection of talented voices who have combined together to stimulate the education of at-risk children, and represents a total, diverse educational and technological community to provide a holistic view of the problem.

Our intent was to involve substantial educational, economic, technological, and know-how sources from the start, as well as an ability to "think out of the box" about existing educational shortcomings. Each public and private member of the VSI was chosen on their intent to totally involve themselves, and to help support the program financially. Technology companies with a substantial influence in education and had a history of concern for the community well being were being targeted (See Appendix).

Our intent was also to involve the larger technology companies' training and support programs, since they have some of the best in the country. Also, the larger technology companies have far-reaching abilities to disseminate details of the VSI model and further involve additional resources. Our interest was to solicit their help in the to provide technological know-how, as well as in-kind support. Our shared vision was that initial funding would be used as seed money and that the Virtual Schools Initiative would eventually become self-supporting through extensive involvement of the public and private communities.

To ensure that the planning process will address the diverse educational, technological, and community needs, an advisory board will be created to provide guidance and support for this effort with the following goals: (1) collectively analyze educational, engaged learning, and virtual reality needs and issues from a coordinated, integrated approach; (2) set achievable goals and measurable objectives; (3) determine the educational areas of at-risk children which need immediate attention through conducting sound needs assessments; (4) identify and promote the sharing and linking of resources both monetary, physical, time, talent, and technological; (5) provide oversight in the strategies developed to meet the goals; (6) coordinating the efforts of VSI members.

The mission statement of the advisory board is to "create innovative new models of collaboration and instruction which will engage and motivate every student through the imaginative applications of the world's most advanced learning methodologies and technologies."

The main staff component for the VSI is the coordinator position. The coordinator will be responsible for carrying out the long-term planning of the advisory board as well as the day-to-day running of the program. As the overseer of the VSI, the coordinator will oversee professional development programs, coordinate virtual reality lab scheduling within individual schools, and coordinate maintenance of the virtual reality labs. In carrying out these responsibilities, the coordinator will be able to draw upon the expertise of in-kind consulting and technical services provided by VSI members. The coordinator position has three primary qualifications; (1) extensive educational experience; (2) experience with computers and virtual reality technologies; and (3) demonstrated community commitment and involvement.

NEEDS ASSESSMENT

The needs assessment will be conducted through six approaches: (1) Teacher and Administrator Interviews and Surveys; (2) Case Studies; (3) Social Indicators; (4) Target Population Surveys; (5) VSI Member research

Needs assessments will also determine:

- How do we link public and private agencies, groups and individuals to serve the educational needs of at-risk students?
- How do we shift the educational process to include private industry?
- Who are the target groups?
- What will be the stumbling blocks in our efforts?

The anticipated outcomes of the needs assessment include the following:

- Identifying the causes of educational underachievement in VSI schools
- Selecting and prioritizing professional development training for VSI teachers
- Producing an exportable product or report that school administrators around the country can comprehend and apply in schools

PROGRAM IMPLEMENTATION

Because of the ambitious and experimental nature of the project, as well as pedagogical and technological complexity, implementation of the Virtual Schools Initiative will be done in three distinct phases. Dividing program components into three parts is appropriate from an organizational perspective, and will also serve to focus VSI schools, members, and teachers on the component at hand.

PHASE I: PLANNING

The planning phase of the VSI will feature two concurrent activities: the professional development component, and the conversion of virtual reality software.

Training in virtual reality-based engaged learning will be delivered to approximately 40 5th to 8th Grade teachers across the five target schools. The professional development component will include five workshops of two hours each. The workshops will be facilitated by the program coordinator, engaged learning specialists, and virtual reality education developers. Workshops will be delivered off-site (away from schools) in positive environments.

Incentives for teachers to attend the workshops include:
-Participants who complete the seminars will receive a Virtual Schools Initiative certificate
-Certificates being awarded at a special ceremony with Congressman Danny K. Davis as speaker and presenter
-Each participant being allowed reimbursed time off from work to attend the workshops, and reimbursement for travel expenses to each site

Specific workshops will include the following:

1) Engaged Learning Workshop

This workshop will introduce teachers to the principles of engaged learning and their applications in the classroom. Teachers learn how to create instruction and present information around the principles and indicators of engaged learning. Case-studies will be given, as well as highly interactive workshops featuring role playing and roundtables.

2) Virtual Reality: The Executive Overview Workshop

The Executive Overview is the first step in using virtual reality-based learning. It provides teachers with an overview on virtual reality, its components, and its applications. Once the program is completed, participants continue independent learning with reference materials and web site updates.

3) Curriculum Integration Workshop

Integrating technology-supported engaged learning into the curriculum is the primary goal of the professional development program. Integrating virtual reality-based engaged learning into a teacher's curriculum plan is a means of improving the learning environment by using virtual reality as another tool to present information, and allowing the student to have experiences that they could not ordinarily have in the classroom. Teachers will learn the many different ways virtual reality-based engaged learning can be integrated into the curriculum: as a primary resource, as a supplement to classroom learning, or as a student study aid. Teachers will select virtual reality programs to complement existing curriculum plans. In selecting a particular virtual reality program, teachers will understand and identify the learning goals and sub-goals of the program in order to integrate it into their curriculum plan, where they have similar or identical goals specified.

4) The Virtual Reality Lab Workshop

Teachers learn how the virtual reality lab is best used as an engaged supplement to existing coursework. For example, the biology class where students are learning cell structure is supplemented by a trip to the virtual reality lab where students enter and explore a human cell. The scheduling board in the virtual reality lab identifies which virtual reality stations are available and where they are located, ensuring that space is available during the times and days when it is needed. Simple logistical planning will ensure that all classes and programs able to use the virtual reality lab. As most schools have limited computer resources for virtual reality labs, good planning is an important component to making the most of resources.

5) Learning Facilitators Workshop

Using virtual reality-based engaged learning in schools greatly eases the burden of teachers, and can be a powerful tool for teachers to keep the attention of students. Teachers become learning facilitators as students explore and learn in virtual reality. As opposed to merely supplying answers, teachers guide students' self-discovery and assist in building ideas. Teachers discover a learning environment where students explore, discover, and make decisions, while teachers assist and guide. Finally, virtual reality-based engaged learning can help ensure that all students have similar experiences to facilitate learning and discussion, further integrating it into the larger curriculum and focusing students on subject matter.

The second, concurrent part of Phase I is the conversion of existing virtual reality programs to classroom use. Twenty virtual reality programs are planned for the inauguration of the VSI. Subject matter will include, both core curriculum areas and other subjects. Virtual reality programs are designed to meet specific state curriculum objectives and standards, and be easily integrated into any curriculum. When a subject is being studied, virtual reality is used as a supplement. Programs and tutorials are chosen from a mix of the library of

existing virtual reality programs and custom-designed programs made especially for certain subject areas and occupational programs.

Students, to build a solid understanding of subject matter can repeatedly experience individual virtual reality programs. The traditional cursory textbook treatment of sophisticated ideas is not sufficient for deeper learning. Student learning flourishes when practiced- as we all forget things we do not have an opportunity to use, virtual reality programs facilitate learning by providing numerous opportunities for students to apply new ideas.

Supplementary materials are also used to integrate virtual reality into the curriculum, providing a bridge between virtual reality and the traditional classroom. Students can be guided in developing their own skills and attitudes by following and answering supplementary questions provided with virtual reality programs. Supplementary materials such as guides, questions, and lists of things to “see and do” help prepare and focus the student on the content. These materials can also be used to set up “post-virtual reality” discussions in the classroom between students and teachers.

Proposed Virtual Reality-based Engaged Learning Programs

Subject	Virtual Reality Program	Supplementary Materials	Standards (Base)	Hours of Instruction
Math	Fundamentals			
	Pre-Algebra			
	Algebra			
	Geometry			
English	Parts of Speech			
	Shakespeare			
Science	Earth Science			
	Physics			
	Chemistry			
	Biology			
Social Studies/ History	U.S. Constitution			
	Geography			
	Environment			
	Chicago			
Language/ Virtual Travel	Pyramids of Chichen-Itza			
	Egypt			
Technology	Computers			
	The Internet			
Cognitive Skills	Critical Thinking			
	Study Skills			
Other	Virtual Solar System			
	Black History			
	School to Work Simulations			
	Diversity			

PHASE II: IMPLEMENTATION

Means reports that “the vision for technology-supported classrooms is one which students groups work together on multidisciplinary projects involving challenging content that is interesting and important to them with the support of technology tools for collecting, analyzing, displaying, and communicating information.” The challenge that is central to making engaged learning activities take hold at the school level is giving students and teachers adequate access to technology tools.

To meet this challenge, virtual reality-supported engaged learning labs will be established at each of the five participating schools. The configuration of the labs is based on specific sate standards- 25 student workstations, one teacher workstation, and a large screen monitor to view the teacher’s computer screen. The lab structure is designed to (1) give students adequate access to technology tools, and (2) to involve a majority of teachers in project-based instruction and the incorporation of technology tools.

Means reports, “one of the major decisions that schools embarking on a technology implementation must make is whether to group the computers in separate laboratories, which allow students to work individually on computers, or whether to disperse the among the regular classrooms. There is a wide range of strategies for allocating computers.” To serve a large number of at-risk children, the computer lab model is ideal. It is appropriate for the VSI model of instruction, as it allows for greater access by a number of different classrooms and grades, a more efficient use of technology resources. Furthermore, it allows an entire classroom to explore together, simultaneously, an important facet of engaged learning pedagogy.

The disadvantage of the computer lab setup is that when computers are not located in the immediate classroom, teachers may be dangerously isolated from technology and find it easier to ignore. The lab is also less likely to affect the core program as it is less integrated into teacher lesson plans.

To combat these tendencies and difficulties, the teachers who will be using the lab will be involved in all facets of the VSI plan, from extensive professional development, to integration in to lesson plans, evaluation, and dissemination. Through these activities, an engaged-learning culture will be created, with teachers having a great personal interest in executing the VSI program.

Following Means’ engaged learning model, the virtual reality lab will be open from 8 a.m. to five p.m. daily. In addition to 24 scheduled classes each week (three one-hour sessions per classroom) the lab is open to students during school hours between scheduled classes and through lunch, as well as before and after school. Students will make heavy use of these flexible periods of access for project-related work, clarification of subject matter, and personal exploration.

Schedule: Virtual Reality-Based Engaged Learning Lab

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 a.m.	I	I	I	I	I
9:00 a.m.	C-1	C-7	C-1	C-7	C-1
10:00 a.m.		C-2		C-2	C-2
11:00 a.m.	C-3		C-3		C-3
12:00 p.m.	I	I	I	I	I
1:00 p.m.	C-7	C-4		C-4	C-4
2:00 p.m.	C-5	C-8	C-5	C-8	C-5
3:00 p.m.	C-8	C-6	C-6	C-6	
4:00 p.m.	I	I	I	I	I
5:00 p.m.	I	I	I	I	I

I = Individual Student Time

C-1 = 5th Grade, Classroom 1
C-2 = 5th Grade, Classroom 2
C-3 = 6th Grade Classroom 1
C-4 = 6th Grade Classroom 2
C-5 = 7th Grade Classroom 1
C-6 = 7th Grade Classroom 2
C-7 = 8th Grade Classroom 1
C-8 = 8th Grade Classroom 2

Three hours per classroom, per week: 24 total classroom periods

30 Classroom Periods

20 Hours of Individual Student Time

Breakdown Of Lab Learning:
Focus- 15 minutes
Exploration- 15 minutes
Discussion- 15 minutes
(Varies by teacher discretion)

PHASE III: POST-IMPLEMENTATION

Technical maintenance and service of the virtual reality lab will be provided on three levels. Low-level system maintenance training and development will be provided for school technical personnel. The on-site system maintenance training program will covers the technical and maintenance aspects of virtual reality technology. Each peripheral of virtual reality is covered in-depth: virtual reality headsets, gloves, cards, and the connections between them. This facet of professional development also includes integrating virtual reality technology into existing computer labs, which kinds of PC's are ideal, and retrofitting an older PCs.

Secondly, a permanent virtual reality technical support group will be established for VSI members which will consist of individuals knowledgeable and experienced with the technical aspects of hardware, virtual reality peripherals, and software who will maintain, troubleshoot, and repair equipment on a regular basis. The VSI Project Coordinator will oversee the technical support group.

Finally the corporate members of the VSI who have provided that particular technology component will address major support issues. Dividing the technical maintenance and service of the labs into three separate levels corresponding to levels of potential problems, will allow the labs to run smoothly, even while encountering a myriad of potential pitfalls. The unique service arrangement is also necessary because of the new-to-the-world nature of virtual reality technology.

INFORMATION DISSEMINATION

The dissemination plan is an integral component of the VSI. The project will provide substantial findings and outcomes (both positive and negative) that can be shared in both Chicago and other communities across the country. Means reports, "the major obstacle to dissemination are lack of funds and time. The process makes tremendous demands on administration and teachers."

To avoid these obstacles, the dissemination plan will be divided up into three coordinated efforts, each spearheaded by different participants in the VSI. One of the goals is to create a new model of dissemination. New approaches to education cannot stop with a program- imaginative new approaches to telling the world about it are also necessary. Like any other commercial product, effective dissemination requires more than one medium to reach a large audience.

- Teachers, the personnel who have the most experience with students and labs, will coordinate **on-site visitation**. Additionally, it will give teachers a further, more personalized incentive to integrate virtual-reality supported engaged learning into their classrooms.

- **Off-site dissemination** at conferences, along with conference presentations will be done by the VSI Coordinator and interested teachers to provide additional incentive. Off-site dissemination will also be undertaken by VSI members to demonstrate applications of their particular technology and educational efforts.

- The creation of **three-dimensional web site**. The function of the web site is to provide information on the VSI, disseminate results, and demonstrate VSI programs. One of the advantages of the partnership is the ability to leverage members' expertise. A cutting-edge web-site will be designed by VSI members as an in-kind donation.

- Periodical and annual progress reports will be shared with the Chicago Public School District, Illinois State Board of Education, North Central Regional Educational Laboratory, and the U.S. Department of Education. We intend to develop a strong linkage between this project and the preceding agencies.

- The evaluators, consultants, and other other participants plan to publish academic and informal reports about the coalition.

- A public relations plan will be developed and extensively utilized to keep the public informed about the project. As they are not yet commonplace, virtual reality technologies attract much media attention, which we plan to harness to disseminate details of the project.

EVALUATION PLAN

As the VSI collaborative model and virtual reality-based engaged learning are in their infancy, evaluating their effectiveness is critical in future implementation and growth. The evaluation is designed to study the process and outcomes of three primary subjects: (1) the VSI collaboration model; (2) technology-supported engaged learning; and (3) the integration of virtual reality learning programs and technology into schools.

The VSI evaluation is three different evaluation processes examining collaborative effort, educational pedagogy, and technology respectively. Multiple methodologies are needed for the evaluation, and attention must be given to the specific audiences that the evaluations are addressing (Uhruh, 1984). Information from the evaluation will be fed back to staff, teachers, VSI members, and the advisory board in order to assess activities and strengthen strategies and plans.

Evaluation Matrix

Subject	Process Evaluation	Outcome Evaluation	Intermediate-Level Outcomes	Longer-Term Outcomes
Virtual Schools Initiative Partnership				
Technology-Supported Engaged Learning Model				
Integration and use of Virtual Reality Technology				

In evaluating framework measures, processes and outcomes will be assessed through a combination of qualitative and quantitative outcome and process evaluation methods. The qualitative and quantitative methods will provide a rich and significant descriptive history of the project's evolution. Methods will include case studies, surveys, observations, interviews, and review of archive records (meeting minutes, progress reports, education plans, and evaluation plans).

A Framework for Evaluating the VSI Approach

Evidence from work with integrating technology-based engaged learning into schools suggests seven variables that, when present in the classroom, indicate that effective teaching and learning are occurring (Jones and Valdez, Means) As shown in the table below, the seven variables are arranged into a set of eight categories of learning instruction: vision of learning, tasks, assessment, instruction, learning context, grouping, teacher roles, and student roles (Means). When these variables are present, technology applications can support higher order thinking and teaching by engaging students in authentic, complex tasks, and can be successful with disadvantaged students (Means). The variables represent valuable checks of the overall situation- whether conditions necessary to the success of the program are in operation or missing.

Variables of Learning and Instruction	**Indicators for Engaged Learning and Reform Instruction**
Vision of Learning	Responsible for Learning Strategic Energized by Learning Collaborative
Tasks	Authentic Challenging Integrative/Interdisciplinary
Assessment	Performance-Based Generative Seamless and Ongoing Equitable
Instructional Modes	Interactive Generative
Learning Context	Collaborative Knowledge Building Empathetic
Grouping	Heterogeneous Equitable Flexible
Teacher Roles	Facilitator Guide Co-learner
Student Roles	Explorer Cognitive Apprentice Teacher Producer

Previous applications of virtual reality technology into classrooms have suggested the successful integration of technology requires certain fundamental questions to be answered in a particular situation- how does virtual reality-based learning motivate students; do students experience success in learning; and which aspects of virtual reality-based engaged learning are most effective. Evaluating virtual reality learning should take a responsive approach, paying attention to outcome-oriented results as well as student, teacher, and administrator perceptions.

CONTINUATION FUNDING

In keeping with a fresh model of public-private collaboration in which VSI corporate partners supply components of the program, we envisioned that the program components could be further broken up to provide additional future support.

- The development of virtual reality-engaged learning programs will be supported by individual organizations and corporations. For example, the VSI would solicit an oil company to support the development of environmental programs to be used in VSI schools, or an automobile manufacturer to support an engineering program. This will ensure that the VSI is able to geometrically involve more partners and avoid dependence on single organizations.

- Schools can serve as an important test bed for new hardware and software. A major attraction of the VSI is to bring in other private industry such as education textbook companies that wish to gain experience with virtual reality technologies and applying them to education.

- A year 2 component would allow students and teachers to build their own programs for use in the classroom. This model has been successfully used by the University of Washington's Human Interface Lab, and will provide a valuable new source of learning programs.

- Employ a grants development specialist

- Emphasize volunteer development. Volunteer organizations are well established. One sector of the public that has lower levels of participation in volunteer events are computer technicians, programmers, and entrepreneurs. We hope to solicit volunteers from among the computer industry.

- Engage in local fundraising activities.

- Technical support is an important aspect of the VSI program, and partners have pledged to provide technical assistance in the future.

CONCLUSION

The road to true innovation is a rocky one. The VSI participants are ready to forge ahead in the quest to disseminate our learning model to educators regardless of the outcome. This grant is sought to supply the support to initiate our vision of learning in five schools. Our ideas are being implemented in schools at this moment, with more undoubtedly to come in the future. We believe that our learning model is one that will fuel learning for decades to come.

Many different communities- educational, commercial, and technological, along with some of the most capable minds in the country have come together as never before to try truly innovative, untested approaches to American education.

Our plan is an effort to bring together schools, educators, and the most forward-looking companies, applying their expertise to age-old educational problems. We think the VSI will not only foster an original learning model, but an example to other private corporations and technology companies in particular to delve deeper into the lives of children.

Applying our vision of virtual reality-based engaged learning will inevitably bring mistakes and problems- innovation demands them- but we will learn from them. Perhaps as important, we will tell the world how our vision has affected the county's poorest children- if it can be done on the West Side of Chicago, it can succeed anywhere.

Our vision of learning recognizes that every child- no matter how poor or underprivileged has the capacity to truly create and learn. All children have imaginations and want to explore- its just a matter of giving them the opportunity.