The New Frontier in Education:

Software and Support at Home for Preschool-Age Children

There is a new frontier emerging in education that will allow societies to improve the education of their young by harnessing the capabilities of the emerging new technologies in homes during the preschool years. In order to insure the success of these new technologies, new organizations will have to be developed to provide interactive and proactive services using the Internet and telephone to train and support the children and parents in these homes. The state and federal government will ultimately pay for these services for all families (no matter what their financial status) because the return on this investment, which is less than 10% of the cost of preschools, will guarantee government support once experimental trials establish the efficacy of the technology-home based-model. This program will not replace the universal preschool movement which is already underway in over 80% of the states; instead, it will supplement and support existing pre-K programs while providing a cost-effective option to states without pre-K programs.

This new frontier will be adopted widely as the most economical and practical means to solve a serious educational problem that is being generated by three societal conditions that are surfacing: (1) societal changes in the **home** (the disintegration of the family unit), (2) a changing **economy** (the need for an educated workforce), and (3) **lessening student motivation for disciplined study** (the result of increasing national prosperity and the desire for entertainment).

America's schools are facing an increasingly unsolvable problem of having **too many uneducable children** entering kindergarten. These children are uneducable because they have received **too little preliteracy training** at home because of family circumstances (including language barriers), and the result is that teachers are simply overwhelmed by student needs. The students are uneducable not because they lack basic intelligence, but because (1) their environments have restricted their exposure to rich language and vocabularies, particularly academic English, and (2) they have failed to receive critical skill training in both **cognitive** (e.g. alphabet, numbers), and **noncognitive** subjects (e.g. patience, deferred gratification, sharing) during their critical early-learning years at home.

These problems are unsolvable under standard teaching conditions because the schools are unable to provide the students enough individualized instruction (estimated to be less than a minute a day) to make up for their lack of preliteracy training.

We make a dreadful error if we think this is simply a problem of preparation that can be rectified with a little support and attention to parents or a new school reform. Once they enter Kindergarten most of these children are for all intensive purposes uneducable. This cadre will live uneasily in the system until the end of the elementary years when they begin to drop out in droves (between a quarter and a third of all students drop out of school from the 8th through the 12th grade-or fail to graduate) leaving them in a precarious position to succeed in a knowledge-based society. Their inability to perform successfully economically also negatively impacts their nation's productivity and hence hurts all citizens.

The New Learning Environment: The Home Portal

Generally we take for granted what constitutes a learning environment and assume that it includes teachers, books, and schools. Going one level deeper, however, we can see that people and technologies (books, paper, pens, pencils, audio, TV, computers) are used to produce, store, and organize information for students to master. Of these options, teachers are the preferred primary source of instruction, but they come with two drawbacks: (1) They are the most expensive of the available options for student learning, and (2) their availability to the children is limited by school schedules. To gain access to their instruction, children have to leave home and travel to a school where the teachers are available for less than half the days in a year for only six hours a day. And once in school the students find they must share the access to the teacher with 20 to 30 other students which means that at best they can expect to receive an average of about one minute a day of individual instruction from the teacher, a condition which insures they will have difficulty ever making up their preliteracy training limitations.

Fortunately, there is a new learning environment emerging, **the home portal**, which will be available for all waking hours every day of the year for young children at home before they enter Kindergarten which will give them access to new technologies and software. This home portal will be a computer with powerful educational software connected to the Internet **and** a special support organization for all families and their children. If the children access this portal for just 15 minutes a day, they will be provided with over 90 hours of individualized instruction a year compared to the 3 hours they currently receive in any formal school setting, a **thirty times improvement.** The depth of this learning experience will be of inestimable value in securing a successful set of learning habits and skills for each child in literacy, numeracy, and science at a minimum, with the possibility of training children in additional areas, including languages, as a future option.
The potential of this approach is so profoundly powerful that those societies that ignore it will find it difficult to compete economically because those that implement it will enjoy a number of advantages:

(1) Access to quality instruction: Most young children have little access to knowledgeable instruction in their preschool years because most of their parents or teachers lack the time and knowledge to provide outstanding curriculum to them. There are many national organizations and university scholars dedicated to teaching the parents or caregivers how to teach their children, but because of the prohibitive cost, they are unable to travel to homes or preschools and actually teach the children themselves.

By way of contrast, the software will be available in the home to give parents a ready-made curriculum for preschool use in an attractive artistic format individualized for each child every day of the year any time of the day the children are awake.

Only software will be able to deliver affordable interactive instruction to our increasingly dysfunctional homes. This new access to inexpensive individualized interactive instruction is what will define the context and setting of the new educational frontier. And although this frontier will likely emerge first in the United States, with electrifying speed and impact the new instructional paradigms will spread globally through all nations. The only limiting factor will be the speed of software development.

(2) Access to diagnostic information on the status of the child: Having actual knowledge of a child's learning status is a critically motivating variable for all parties involved in the learning process, particularly for the children who are at either end of the learning curve and are either bored or terrified by the pace of learning. This knowledge will be very motivating to parents and encourage them to use the new technologies, software, and services, including the training available to them to support the child's learning path.

(3) Access to a multisensory tutoring program for the 20% of children who need tutoring. The latest research suggests that at least one child in five needs tutoring because he or she is having difficulty learning with the standard approach. If this difficulty can be identified and remediated when the child is young, a great deal of anguish and future trouble is averted. One of the great strengths of the home program will be its ability to offer a new multisensory tutoring program to a child who is struggling and has no idea why he or she cannot "get" it. Research has shown that a good multisensory program can help rewire a child's brain to foster learning instead of leaving the child frustrated and consumed by shame because of the failure of the traditional teaching approach.

(4) Training for parents and caregivers: Having a portal available to provide instruction to the adults in the child's life is extremely important because it can help harness the resources that adults can provide in a nurturing family setting. This will be a valuable channel for scholars and heads of organizations that want to reach the parents and teach them how best to work with the children. The curriculum will ultimately contain a broad spectrum of options that goes beyond reading, math and science to also include such subjects as nutrition, how to read a book interactively to a child, and how to use the Internet. Experts will develop a broad array of useful information for parents and learn how to motivate them and hold their attention.

(5) Access to ongoing motivation: Because a network portal can communicate in both directions, there will be new types of organizations constructed to interact frequently with the homes to provide strong motivation for the users to use the instructional materials on a regular basis. For example, a state program could provide the materials and support free of charge as long as the parents or caregivers schedule the children to use the materials for at least 15 to 20 minutes a day. The organizations will also help the parents understand the importance of education for the future success of their child. The challenge of using the portal optimally and successfully will be to learn how to provide compelling motivational strategies that retain the children's and caregivers' attention and commitment.

(6) Provide a portal to other organizations and resources: Other organizations will be encouraged to use the portal to the home to help support their programs. Schools, colleges,

parent organizations, researchers, social services, public service nonprofits, and state agencies will find value in providing information, training, help, and a myriad of other services to this audience of users. Other community organizations such as libraries, churches, and community centers will also find this portal useful in helping to make people aware of as well as dispense their services.

(7) Cost effectiveness of delivering superior services: The portal has the primary advantage of being able to provide services for a fraction of the cost of any alternative that only uses people to deliver goods and services. The portal will use fewer people and support them with technology. Typically a strategy mixing technology with people will cost less than 10% of a strategy using just people as the delivery mechanism.

(8) Ability to Scale Educational Excellence: In addition to the primary cost advantage of using technology, there is a secondary advantage which is that in certain circumstances it can scale excellence far better than people can. Once a well-designed instructional sequence is developed in software, every student has access to it, as compared to only a few having access to excellent instruction in a typical home or school setting. The lack of technological scaling invokes a social cost because only those with financial means, political influence, or talent are provided access to this scarce excellence.

(9) Access without constraints: The issue of educational access is a profound one. After centuries of experimenting, humans have developed the extremely useful concept of a school with teachers and supporting supplies such as tablets, paper, books, etc. In the past few centuries most nations have been able to build schools for their children, but there are still many populations such as India where the expense is too great and upwards of half the children are unable to attend school. As these nations strengthen economically they will be able to provide schooling for most of their young. But then they will discover the same educational problems that America is facing where optimal access turns out to be limited to those with wealth or unusual intelligence.
Technology and its ability to scale excellence will extend access to educational excellence and equity for all populations. This suggests that those who are interested in furthering educational excellence should begin to transition their educational efforts to include software development, new educational models such as the construction of home portals for the young, and the architecture of a new type of support organization that is proactive.

The neediest young scholars in their preschool years tend to move frequently because their parents are having financial difficulties. Often these moves interrupt a solid instructional sequence, and the early instructional effort is wasted because of the instructional interruption. The home portal avoids this problem because the technology follows the children and their records are stored on file servers allowing them to enter their instructional sequence from any location**.**

The New Partnerships with the Home Portal Provider:

The original portal will be funded and constructed to insure that the children's educational success will be significantly enhanced; however, as other groups realize that there is an operating portal in position to help facilitate the delivery of their specialty services, a series of

unique partnerships will appear which will be the hallmark of this new frontier.

To begin with, however, the organization running the educational portal will have to build a new type of learning environment which is interactive and proactive in its relationship with the families it serves. This two way interaction will help facilitate user motivation and training for the young children and their families. Unlike a typical Internet support organization which is passive in relation to users except when there are problems and questions to be solved, this educational portal will maintain frequent contact through written materials, DVD and online training, emails and telephone calls. The strategy will be to provide the families with a steady stream of data on the children's usage, performance, and needs as well as introduce other motivational strategies to maintain parent and student interest. New users groups will form to recruit, motivate, and train members to benefit from the technological portals being constructed.

A growing National Consensus Supporting a Preschool Portal:

While this document is the product of the Waterford Institute's thinking, a survey of scholars and social commentators suggests that this initiative could offer a collective model that utilizes the best of many insights and responds to many needs.

NIH (the National Institute of Health) has analyzed the available data and concluded that more than a third of children in 4th grade are unable to read at a **basic level**, more than two thirds cannot read at a **proficient level**, and very few are capable of reading at an **advanced level.** A solution to this problem is a high priority for our nation's future. NIH also concluded that at least one child in five requires tutoring, a much higher percent than had been previously understood.

Eaton Conant has demonstrated that a typical elementary setting is hard pressed to offer more than a minute a day of individual instruction for each child. This eliminates the possibility of offering adequate individual support in schools for the children who are hopelessly behind their peers and heightens the importance of using the home to supplement school efforts.

Betty Hart and Todd Risley, two experienced researchers, show in their research that the children from the families living in poverty are spoken to 32,000,000 words less by the age of four than the children whose parents work in the professions, and that two thirds of the words spoken to the children in poverty are negative in tone as contrasted with only one-sixth for those from professional families. Their data clarify the problem and suggest that if it is not solved, schools will continue to fail many students from impoverished backgrounds. The only viable and affordable solution appears to be the home preschool portal.

Marilyn Adams, a leading reading scholar suggests that the children raised in poverty have less than 7% of the preliteracy training in reading from their families than the professional class. Along with Hart and Risley's data, Adams stresses the need for early intervention for preliteracy training and believes that technology can help solve the dilemma.

Robert Sampson, the chairman of Harvard's sociology department, with his colleagues from other universities has shown that children in isolated and dangerous neighborhoods lose as

much as 4% of their I.Q. because their vocabularies are limited by the mandatory isolation required for their safety. Having a portal to the home with a direct link to instruction and support is an ideal solution because it offers a bridge out of verbal and educational isolation to a safe and interesting space for the child to explore, interact, and learn in.

James Heckman, the economist and Nobel Laureate, has demonstrated the importance of concentrating financial investments on the youngest preschool children where the return on investment is greatest. As a consequence of Heckman's research about 80% of the states have introduced some version of a universal preschool approach. Since the home portal will offer superior training in reading, math, and science, its introduction will provide an even greater cost-effective approach for the remaining states as well as supplement and improve the existing preschool efforts.

Susanna Loeb, a Stanford scholar, writes in a PACE report (Policy Analysis for California Education) that about two-thirds of children in America attend a preschool, and their attendance generates modest intellectual gains with some mixed data on the behavioral impact of the preschool on the children. The implications of the research on preschools (including Head Start) are that while they can contribute modestly to the children's improvement, they will not solve the "uneducable" problem and the three variables causing it. Her work heightens the importance of finding other solutions.

Herb Walberg, the noted scholar and evaluation expert, notes that the home has a great potential for influencing the child because from birth until graduation from high school, only about 13% of the waking hours of children are spent in schools. This suggests that an inexpensive program that could use the time and resources available at home might be the wisest investment for addressing the problem.

Dustin Heuston, the chairman of the Waterford Institute and the author of this paper, argues that the current educational delivery system (which is primarily human or manually delivered) is unable to generate enough instruction in a school setting to meet the needs of many of the students. Trying to spend more money by sponsoring new reforms that try to use the available resources more efficiently in a delivery system that has reached a mature limit is a waste of capital. Only technology which is increasing in potential at 1% a week (doubling every two years) without an increase in cost can solve the educational resource shortfall problem by dramatically increasing the amount of available resource for educating each child.
He notes that the improvement in the mature communications system using the horse (the pony express) did not come from investing more money in making the horse and rider more efficient. Instead it came from introducing a new technology (the telegraph) that delivered the message about 45 million times faster. Both the school and the home (which will be the new educational frontier) will benefit from the use of technology and software.

Clayton Christensen, the successful Rhodes Scholar, entrepreneur, prize-winning author, and professor at the Harvard Business School, believes that **only software** can individualize instruction to the degree required to insure the successful education of American students whose prosperity has reduced their **extrinsic** motivation for academic achievement. By catering to their **intrinsic** motivation and addressing their individual interests and talents, those

offering software will provide a promising educational path that will enable America to remain competitive on an international stage where access to an education is a life and death issue for many of the players. Because of his outstanding reputation, Christensen will have a strong impact on educational policy in the years ahead. He has just published an important book entitled *Disrupting Class* that will contribute to an acceleration of the understanding of the importance of the new technologies and software for educational success.

OECD (The Organisation for Economic Co-operative Development) is a respected international organization that collects data that compares the practical educational abilities of the students from different nations every few years in different categories. It rates the United States as 15th of 31 countries in literacy, 24th of 41 in mathematics, and 21st of 57 in science. However critics might disagree about the meaning of the statistics, there appears to be a discernable need for the United States to improve its educational delivery system, particularly when it already spends more per pupil than any nation.

Paul David, a Stanford economist, has suggested that it takes about forty years for a new technological invention to penetrate an existing mature delivery system. Schools are probably still a decade away from integrating technology wisely and well, and given the importance of starting children on an equal playing field, Waterford believes the most fertile approach for the foreseeable future will be the use of the new technologies and the Internet to give the children at home a huge resource bonus to supplement the efforts of their parents and any preschools that they attend. However, as David points out, once the multiple variables required to engineer, architect, install, support, and train a work force to use the new potential is in position , then there is a rapid adoption of the new technology and explosive improvements in productivity for the delivery system. David is very helpful in explaining why technology has not yet had a strong impact in schools, but also useful in alerting us to the stunning improvements it can offer once it is in position.

Alvin and Heidi Toffler, futurists, whose book *Revolutionary Wealth* makes two important relevant points: (1) On a scale of 1 to 100, with 100 being the fastest, schools change at the maximum rate of 10. Businesses must change and adjust at 100 in order to survive. Hence both David and the Tofflers are suggesting we cannot look short term at making fundamental changes in schools. (2) Fortunately the capability to provide a new source of energy and work to the home (the computer) and connect it to the world (the Internet) will empower the home to again become a source of production and useful work just as it was before the industrial revolution. The Tofflers note that schools mimic and were formed to serve the industries, and both were built to share their expensive resources which required daily commuting to gain access and obsoleted the home as a source of productive work. But now this will change!

Ray Kurzweil, our greatest technology futurist, in his book *The Singularity is Near* has drawn on the ideas of John von Neumann to note that human technological progress is exponential, not sequential, and that as it doubles it is exponentiating the amount of energy and work available to help man. He also notes that these increases start slowly, but suddenly become "explosive and profoundly transformative." He estimates that during the 100 years of the 20th century we accelerated our rate of technological progress and averaged a doubling every 10 years. A constant doubling actually accelerates the rate of change. During the 100 years of the

21st century we "we won't experience 100 years of progress in the 21st century—it will be more like 20,000 years of progress (at today's rate"). This means that while people are debating the efficacy of using educational technology based on past experiences, they are missing the inevitable conclusion that what is available and improving will become "explosive and profoundly transformative."

The advantage of the use of technology in the home has been elaborated by the researchers at the **Waterford Institute** who have been at the forefront of software development for over 30 years. Having access to the home provides a multitude of educational benefits that are not available in the standard school or preschool environments. As part of its research Waterford has built a proactive interactive support team testing the home portal approach with a few dozen families and now intends to run a number of larger trials throughout the United States to establish the universal efficacy of this approach using diverse populations from isolated rural areas to inner cities. Waterford has the expertise, the software, the experience, and the dedication to help lead the development of this new frontier.

Experimental Trials to Establish the Efficacy of the Home Portal Approach:

As part of its research efforts, Waterford has developed **three software packages** over the last decade or so at a cost of over $125 million for young preschool children and the early elementary grades. **One** is a computer-based assessment program optimized for children who are learning to read and can be given to students without requiring adult participation to administer and score the test (The Waterford Assessment of Core Skills, or **WACS**).
The **second** is an award-winning combined reading, math, and science program called **Rusty and Rosy, Learn with Me** for the preschool years that in addition to providing excellent basic instruction for beginners in the alphabet, print concepts, and phonemic awareness areas has advanced materials (up through age 7) in reading comprehension and math and science for those gifted children who learn rapidly. Currently over 500,000 children a day are using these materials in preschools, kindergartens, and the early elementary grades in the U.S.

The **third** program is a multisensory tutoring program for children who need additional support to help them learn their basic skills. These children either come from a background where there has been too little preliteracy training by their families or caregivers, or they have a genetic profile that makes learning to read very difficult without explicit rule-based multisensory training. These programs have been tested over the last year by the Institute in a home setting in a few dozen families, many of whom had to have the Internet and computers provided by Waterford because of their low SES status.

The most important lesson Waterford has learned is that a new type of support organization had to be constructed which was both proactive and interactive as it initiated an ongoing dialog with the families. Waterford discovered that it must hold the participant's attention, train them,

provide constant ongoing feedback through the telephone and the Internet, and offer encouraging motivational strategies for the parents, caregivers, and children.

Waterford now desires to initiate trials designed to include children from rural areas; children from our inner cities; and children identified with learning difficulties in various parts of the country to prove the efficacy of our approach before launching a national campaign.