Stop the increasing bureaucratization of schools

My name is Ken Johnston.

In October of 1991, I was asked to participate in a collaborative alliance that was being formed which linked public and private educators and citizens in an effort to restructure education in the state of Florida.

I presented this paper, which I offered to the collaborative alliance. The vision presented was not well received. I'm not sure why. Perhaps because it seemed threatening to the educational bureaucracy.

Many of the concepts for education in the future that were envisioned twelve years ago are beginning to be realized today. Unfortunately, many other of the ideas are not yet being implemented.

The vision of education in the future remains a vital and lively contribution for educators planning future school initiatives. As you read this paper, remember that it was written twelve years ago. At the time it was written it may have seemed so futuristic as to be unachievable. Today, the technology necessary to make it a reality is available and in common usage. Perhaps someone reading this will pass it on to someone that could use a better vision of the future of education.

A Vision of Education in the Future

By Ken Johnston

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This vision of a new paradigm in public education begins with the commitment to be "customer focused."

The commitment to make the educational system "customer focused" leads to the rather obvious conclusion that the student (or some combination of parent/child) is the "customer."

Once it is clear that the student is the customer, then one becomes very interested in what students want out of a learning experience.

What students want in a learning experience (or, how to attract them to education):

1. Students want a choice about what they learn; they want a feeling of having some control.

2. Students want to learn at a rate that is "just right" for them; they want to learn at their own rate.

Virtually all students want the rate to be challenging enough so learning isn't boring, and yet not so challenging that it produces frustration. They seek a learning rate that allows them to remain balanced between boredom and frustration. The delicacy of this balance dictates that the student must be the one that controls the learning rate. (The correct learning rate produces something called "flow" by the

wonderfully insightful psychologist Mihaly Csikszenthihalyi in his book entitled "Flow.")

3. Students want to experience one (or more) of a set of desirable feelings during the learning experience.

    a. The learning could be interesting (satisfying curiosity).

    b. The learning could be fun (exciting, stimulating, challenging, and rewarding).

    c. The learning could be inspiring (creates models, shows that obstacles can be overcome, illustrates loving nurturance).

    d. The learning could be dramatic (capturing interest through dramatic tension, and ultimate resolution).

    e. The learning could promise a future desirable reward (driver's training, sports, homemaking, career training, enhanced attractiveness, increased social acceptance, etc.).

4. Students want to set and achieve their learning goals, and they want to be safe from failure (when they invest as much effort as they are willing to invest).

    a. They want the freedom to set low or high goals, and they want to be free to change from one mode to another.

    b. They want to succeed, by investing as much effort as they are willing; they are willing to reduce their goals, or take longer than planned, but they want to succeed, not fail.

Therefore, to be customer focused, learning must be:

•   Individualized (under the students' control)

•   Student paced

•   Interesting, stimulating, challenging, inspirational, dramatic, promising, or fun (or a combination of these)

•   Assured of success, or free of failure

•   Flexible, with the degree of challenge and effort demanded being changeable and always determined by the student

Conclusion: The vision that follows is revolutionary, challenging, and futuristic. It is not so by choice. It is so because such a transformation is required if we are to reform education and make education "customer focused."

This paper is organized into three sections:

    1. A vision of the new paradigm

    2. The principles underlying the new paradigm

    3. How the vision can be realized

Also: a postscript

Section 1: A vision of the future with a restructured educational system

Introduction to the "vision"

This purpose of this section is to provide a "vision" of what schools will be like when schools have been restructured.

It begins with an imaginary visit to a school of the future. As you will discover, public education — after restructuring — will be very different from the existing system. The differences are so great that they make up an entirely new paradigm of education.

The concepts that underlie the new paradigm are detailed following the description of the imaginary visit to a new paradigm school.

The most important single concept in the new paradigm is the idea that education will become "customer focused." By that we mean that the entire system will be designed to serve the student. Since the student will play such an important role in the new paradigm, it is fitting to view the new paradigm first from the viewpoint of the students.

A Visit to a School in 2022

Imagine that the steps proposed by the collaborative alliance for school restructuring have been realized, and we are able to visit a "new paradigm" school thirty years from now.

The "silent" cubicles

Let's begin our tour by observing a typical room, full of students engaged in learning. The students in this room represent ages ranging from the elderly, with some adults, some teen-agers, and some younger children.

Each student has a "silent" cubicle (booth or module). Each student may be speaking, or listening, even singing, or practicing an instrument, yet, electronic noise suppression is eradicating all surrounding sounds, and so no student hears any sounds made by others.

Each cubicle contains a computer, a computer display unit (high-resolution digital television screen), with several input devices. The student can use the keyboard, a note pad which reads handwritten inputs, a microphone which accepts verbal inputs, a scanner which reads text and photos or drawings, a mouse, a joystick, and gloves which allow the computer to sense complete hand movements. All of this equipment has been installed by computer companies on a "pay for performance" plan under which the computer suppliers keep the equipment at a "state of the art" level and accept the risk of technological obsolescence.

Juan — The "New Kid"

The first student we observe is Juan, a new enrollee whose family recently immigrated to our town from a small town in Argentina where the new paradigm schools have not yet spread.

Juan is just now getting acquainted with the new paradigm learning system. The system is speaking to Juan in his native language. The computer program and Juan are having a conversation in which the computer is determining Juan's present level of reading speed, comprehension, and vocabulary. In addition to language skills, the computer is assessing Juan's ability to deal with numbers, and other assorted skills.

The computer is "making friends" with Juan. The goal is to teach Juan how to use the computer, and to teach the computer a great deal about Juan. In answer to queries, the computer determines that Juan's deepest concerns are about making friends in this new school, and about his ability to learn in spite of his limited knowledge of English.

The computer is very reassuring about being able to understand Juan's Spanish, and assures Juan that he will be able to learn in both his own language, and English. The computer explains that it will use Spanish for his initial instruction and gradually teach Juan English. The computer will be able to keep track of Juan's progress in English and will transition to English as quickly as Juan is able to absorb it. The computer asks Juan to listen to several different "accent" modules to see which accent of Spanish Juan finds most understandable when spoken by the computer. None of the accent modules are exactly right for Juan, but he finds one that he feels is closest to Spanish as it is spoken in his part of Argentina.

The computer also has asked a number of personal questions about Juan, his interests, his goals, his concerns, his beliefs, and what he looks for in friends. The computer selects the closest match it can find from a file of volunteers, and assigns another student to be Juan's initial mentor.

After several preliminary sessions, the computer will have a base line of existing skills and learnings for Juan. As Juan learns in future lessons, he will be given regular feedback with comparisons against the base line, so Juan can track the progress he makes.

The computer teaches Juan how to use the computer's tools. Each of the input devices is demonstrated and Juan will learn how to use each one. Juan will have a great deal of choice about which input devices he uses for the various lessons. Because Juan doesn't yet type, the computer offers to teach him, and will intermix typing exercises along with accepting voice inputs and handwritten inputs.

Whichever input Juan chooses to use, the computer will gradually refine Juan's inputs so there will be continuous and gradual improvement. When Juan uses the slate for handwritten inputs, he will discover, over time, that his handwriting gets better and better as he is gently forced to write with better and better handwriting so the computer will be able to understand him. As Juan learns keyboard skills, the computer will patiently cue him and coach him to gradually develop Juan's keyboard speed, and accuracy. As Juan uses voice inputs, the computer will gradually and patiently give Juan feedback about his clarity and articulation and grammar. Juan will, almost without being aware of it, gradually develop good verbal skills in both Spanish and English.

While Juan may not be aware of the many ways in which the computer will help him develop his written, verbal, and language skills, Juan will be aware that the

computer is his friend, coach, mentor, and guide. Juan will learn that the computer is patient and always attentive. Juan will also learn that the computer is there to support and encourage Juan to learn.

After getting acquainted with the computer, Juan's first real order of business will be to select some learning goals. All he needs to begin is one short-term goal, though he may select intermediate and even long-term goals as well. When Juan has selected his first learning goal, the computer will present Juan with his first set of responsibilities. Working together, the computer and Juan will agree on who will do what, on what Juan's role will be, and ask for Juan's commitment to spend the necessary time with the computer to reach his learning goal.

Juan's Mother — Also Registers with the System

Juan's mother, Mrs. Gomez, is delighted to learn that she can enroll Juan immediately. The school operates virtually year around, and students may start at any time, without waiting for the beginning of a semester or other such period.

Juan has chosen his mother as his "coach," and it is as Juan's coach, rather than as a student, that Mrs. Gomez signs in to the computer.

The computer "makes friends" with Juan's mother in much the same way that it makes friends with Juan. She will learn how to operate the computer, using whichever input devices she prefers, so she can communicate easily with the system.

Once the computer and Juan's mother can communicate with each other, the computer begins to teach Mrs. Gomez the role of "coach" that she will play in the education of her son.

Mrs. Gomez learns the importance of her role, and how she can support her son to achieve his learning goals. She is given a variety of ways in which she can be helpful, and in cooperation with the computer she agrees to a commitment with which she feels comfortable.   Mrs. Gomez agrees to access the computer at least every two weeks for consultation on Juan's learning achievement and her role as coach. Mrs. Gomez is pleased to find that she can consult the computer after work, or before work, or, when the family gets their own home computer, she will be able to consult the computer from home.

Mrs. Gomez instructs the computer regarding her beliefs about Juan's instruction in certain sensitive areas. Mrs. Gomez is raising Juan in the Catholic religion, but has no reservations about Juan learning about other religions, (if he chooses) or about issues such as scientific creationism or evolution.

Mrs. Gomez does, however, have strong views about sex education, and wishes to reserve her son's sex education for her and her husband. The computer acknowledges her choice, and confirms that it will respect her wishes. The computer points out, however, that by a certain age, to be agreed upon between Juan, Mrs. Gomez, and the computer, Juan's knowledge about sex will be examined, and the computer will make available to Juan any additional instruction that he has not attained through his home instruction.

The final issue on the agenda is Mrs. Gomez' concern that Juan might learn South American history from the perspective of the North Americans, and that he will be

given a distorted view of his native land. The computer assures Mrs. Gomez that Juan will receive special instruction about his native land, and in that special instruction, history will be presented from an Argentinean perspective. The computer points out that Juan will also receive instruction in the North American historical perspective, and assures Mrs. Gomez that Juan will be guided through the integration of the two views. The computer assures Mrs. Gomez that Juan will gain a unique perspective by being able to see that historical perspectives can differ, and that the most complete education is achieved by seeing more than one side to issues.

Jimmy — Loves Adventure Games

In the next "silent" cubicle, Jimmy is playing an adventure game. Adventure games, starting back in the early 1990s, were one of the most popular types of computer game that young people used for entertainment.

As the new paradigm schools evolved, instructional programmers started first with the existing set of computer "games" and added instructional strategies. The idea behind this was to harness the motivation, flow, and fun elicited in student by their games.

Jimmy is somewhere in a medieval castle, striving to defeat a variety of enemies in order to rescue a Japanese princess. He gives the computer instruction "go left." The computer responds, "do you mean Ôturn left'?" Jimmy responds, "Yes, turn left." The computer responds, "You've come to an oak door, with no visible doorknob. What do you want to do?" Jimmy types in "Nock on it." The computer responds, "Do you mean Knock?"

As we watch Jimmy play the game, the computer is engaged in two activities at the same time. The computer is challenging Jimmy to solve the puzzle and rescue the princess, and at the same time, the computer is gradually introducing new words in English, as well as Japanese, which Jimmy has chosen to learn. The computer requires Jimmy to use and spell words in each language correctly, and to use good grammar.

As we watch, the computer prints "You've entered a room with a tatami mat. Your partner has a wound on the arm and is bleeding dangerously. There is nothing in the room but a kimono with an obi, what will you do?"

Jimmy is about to discover that he needs to take his shoes off before entering a room with a tatami mat. He is about to discover that an obi can be used as a tourniquet. He'll learn a new Japanese word, he'll be refreshed on a couple of Japanese words he's already learned, and he'll learn what a tourniquet is, and how to spell it. It could even be suggested that he'd learned some first aid skills as well.

Felicia — Really Loves Languages

Next to Jimmy is Felicia, who is fascinated with languages. She is currently learning six languages and is at a very advanced level of learning in all of them.

The computer has told her that she could satisfy the language requirement for a work certificate in any of five languages, yet she keeps adding new capabilities.

Felicia has no interest in math, nor does math play a role in her career goal. She wants to be an interpreter for the United Nations, and has determined that she will need only rudimentary math skills to achieve her career objectives.

In her "living skills" module, she demonstrated the mathematics skills necessary to be a capable consumer and do everything she could expect to need as a fully functioning adult.

At her request, the computer has stopped introducing new math skills. The computer does reinforce her existing math skills by quizzing her in math problems in different languages. This has the purpose of extending Felicia's capabilities as a capable consumer into several additional cultures and languages other than her own, and it also serves to refresh and strengthen her basic skills.

Today, Felicia is working on a "good citizen" module. She is learning what she will need to know in order to be a good citizen. The computer is instructing her in how the US government is organized. As quickly as she learns a piece, she confirms that she has learned it by feeding back the piece in the proper context to the computer. Since she has elected to learn cultures as well as languages, the computer is teaching her the differences and similarities between the way her native government is organized and how various other governments are organized.

Without being aware of it, while learning new vocabulary words in her chosen languages, Felicia is also learning cultural differences, and differences in the ways that other governments are organized. Felicia doesn't even notice that she is cementing an understanding of her own country's government as she learns how it compares to five other systems of government.

One important thing to notice is that Felicia thinks she is primarily studying languages, and qualifying for certain certificates of learning. Within the context of language instruction, Felicia is learning all of the other disciplines (math, science, history, social sciences, etc.) that were often taught separately in the old paradigm.

Tom — Tries out Being a Pro Athlete

Tom has chosen instruction in what he would need to know in order to be a successful professional athlete. Tom is too young to know whether he has the necessary physical skills to become a professional. Tom simply has an interest in that career objective.

The computer will guide Tom's learning of the basic reading, writing, math, science, and core studies, in the context of what a professional athlete would need to know. His math training will take the form of calculating batting averages, or quarterback ratings. His science will be taught in the context of why a curve ball curves, or why a golf ball travels further at higher altitudes.

 Tom will be encouraged to "try out" many careers before he leaves school for college or the work world. Each potential career will provide a new context for learning and a new demand for specific learnings, which Tom may or may not choose to pursue. For example, the "pro athlete" module offers limited mathematics, and certainly doesn't include trigonometry. If, however, Tom later chooses to "try out" being a surveyor, he will certainly learn trigonometry. And, he will learn

trigonometry within the context of surveying, where it has a definite use and purpose.

Leon — Learning Higher Levels of Thinking

Leon has demonstrated difficulty in being "open minded." The computer has found Leon to be strongly opinionated and to be resistive to new learnings that contradict what Leon already "knows."   In addition, Leon's team mates — in certain team learning exercises — have given Leon constructive feedback about his skills in being a "team player."

The computer has suggested — and Leon agrees — that it would be useful to learn how to be more open to the opinions and suggestions of other people. Leon has been following a series of learning goals aimed at being an engineer, and he has come to understand that effective engineers need team skills, and they must be open to input from other people.

As we observe, Leon is taking an instructional module, which teaches higher orders of thought (the work of Edward DeBono). Because Leon's interests are directed at engineering, the examples and illustrations, which Leon will learn, are taken from engineering situations. Leon is presently learning how to be open to input from others, and to use group process to arrive at consensual solutions.

The computer is simulating a group meeting. Computer-generated individuals appear on the screen and make their contributions toward solving a problem that is just beyond Leon's skills to solve. The group process will take place in "slow motion," so Leon can be aware of his "automatic" responses, as well as the new responses that he has chosen to substitute for the unproductive ones. Leon will work through computerized simulations of group process until he feels confident and comfortable.

Once Leon is confident of his new skills, Leon will be called into a series of group process workshops where he will apply his new skills in a real life setting, along with others who have completed the modules on group process, higher order thinking, or both.

Cindy — Trying Out Teaching

Cindy has been going through the "helping" professions. She has tried out being a nurse, being a mother, being a therapist, and now she is trying out being a teacher.

The context of teacher will allow Cindy to use the skills she has developed in the other helping professions, and in addition teach Cindy some new skills related to helping others to learn.

As we observe, Cindy is interacting with a simulated student group. The simulated student group is made up of demanding and reactive students. As long as Cindy is interacting with the group, and using facilitative skills, the group reacts well. Any time that Cindy lapses into "teaching" mode, and lectures, the group reacts badly. In ways that real students might never react, the simulated students respond with their inner thoughts. We hear them say things like, "boring!" Or, "Says who?" whenever Cindy shifts to lecture mode. When Cindy asks questions, draws out the

answers from the group, and is facilitative in her interactions, the group responds will equally unusual feedback "Ah! I get it" or "Now I understand."

The use of immediate and exaggerated feedback through simulation allows Cindy to get the inputs she needs to develop her ability to facilitate learning.

The simulated sessions, paced by Cindy's learning rate, are used to build skills in the safety of the "silent" cubicle. They will be followed by a series of instructional opportunities, ranging from one-on-one tutoring for fellow students, to full group facilitations that she will conduct. Each of the practice sessions will prompt computer-mediated feedback from the participants. So, when Cindy works with a real group of students, they will offer feedback to the computer about their reaction to Cindy's facilitation, which the computer will use to guide Cindy's development.

Ms. Barnard — Learning More About Music

Ms. Barnard is retired and is studying music. She has loved music all of her life, and never had the time or opportunity to study it. She is exploring the classical literature and learning to understand the music she loves.

As we observe, Ms. Barnard is listening to a Beethoven sonata. On her screen, she can watch a variety of images. She can watch the pianist playing the sonata in one corner of her screen. In another corner, she can watch the music as it is written in musical notation. In another corner, she can watch the musical notation with descriptive phrases flashing. An arrow flashes at a bar of music, and the description says "beginning of second theme." Another descriptor changes from "harmonic" to "contrapuntal" to "fugue" as the music moves and changes. Another message shows the current key, and flashes every time the key shifts from major to minor or from one key to another.

At any time, Ms. Barnard can stop the action, back up, listen again, or skip forward.

Ms. Barnard is aware of the joy of listening to music that is new to her as well as music that she loves. She may be virtually unaware that she is listening and "seeing" music at a variety of levels. She is simultaneously observing performance; she is relating the music she hears to the notation she sees; she is learning the underlying structure that makes music "classical;" she is refining her ear as she has her listening attention directed to what she is hearing.

Ms. Barnard has many choices ahead of her as she learns more about the music she loves. She may choose to learn how to play an instrument. She may choose to learn how to conduct. She may choose to learn to compose. She may simply choose to shut off all of the instruction and listen to the classical literature she loves.

As schools have come to replace the libraries of the past, Ms. Barnard can use the school as support for what truly is "lifelong learning." As Ms. Barnard gains in knowledge about music, she may qualify as a "coach" or "mentor" or "tutor" for young people learning music. If she chooses to volunteer her time to help others and is willing to complete instruction in being a coach, mentor, or tutor, Ms. Barnard can make a useful contribution to her school, the community, and to young people who can benefit from her knowledge.

Mrs. Swanson — Counseling Angela

Mrs. Swanson is the teacher in support of this room full of "silent cubicles." Angela is having difficulty working through her reading. The computer keeps using words that are new to Angela. When Angela points to the word and asks the computer to define it, the computer patiently does so, but then reminds Angela that she already has learned the word, used it in context, spelled it, and that it has been part of her vocabulary for a long time.

Mrs. Swanson quickly discovers that the computer thinks Angela is a different student, and resets the computer so Angela can sign on and verify that the computer is using Angela's vocabulary and skill record, rather than one for another student.

While Mrs. Swanson is working with Angela, she asks Angela to access any "helps" that Angela has stored up for discussion with a teacher. Angela accesses her library of stored requests and finds two items.

Angela is trying out being a writer, and the first item is a question that she noted while reading Shakespeare's Romeo and Juliet: "How can I find out more about family feuds, how they could be stopped, and why people continue them?"

Mrs. Swanson quickly verifies that Angela is not asking her for that information, but wants to do a little exploring on this subject and seeks guidance or advice on how to approach her exploration.

Mrs. Swanson accesses the master "pathing" program (akin to an encyclopedia index), that maps all of the depths to which a student could explore the word "feud." Mrs. Swanson discusses the various options shown, and offers several suggestions for a path which might satisfy Angela's curiosity, yet not go far beyond what Angela is curious about. Angela makes some notes of their conversation and tells Mrs. Swanson that she is satisfied with the answer to that question.

The second question was about a poem that Angela had written. The poetry module had offered a critique that Angela didn't understand. Would Mrs. Swanson please help her understand what the poetry critique meant?

Together, Angela and Mrs. Swanson study the comments from the poetry module, and Mrs. Swanson doesn't understand the comments either.

Mrs. Swanson accesses the history of the poetry module and discovers that the module is fairly new, relatively unproven, and prior students had given it mediocre satisfaction scores. In the comments section there are several references to critiques that were not clear and sometimes didn't seem to relate to the poem being analyzed.

Together, after reading the record of the poetry module, Angela and Mrs. Swanson agree that Angela will use the poetry module for those things that the prior students felt were positive about the module, and expect to get some strange responses from time to time. Angela decides that her interest is strong enough, and the value is sufficient for her to finish the module, taking what benefit she could from the instruction. They both agree that poetry is a particularly difficult form of human expression for a computer to deal with.

The Hobart Twins — Reading French Novels

The Hobart twins, Jill and Jane, took an early interest in languages and started learning French when they began school. They are both fluent to the point that their vocabularies rival those of native French speaking students and their accents are virtually flawless.

Both girls have dozens of certificates showing mastery of entry-level requirements into 20 or more career possibilities. They have both decided to delay career decisions until later, but lean toward the publishing field where they could satisfy their interest in reading, editing, and possibly even writing, novels.

The girls are already qualified for college entrance, and they have mastery of a number of subjects at a level of college graduates. The monitoring portion of the coach-and-monitor program has identified as a potential problem that the only activity the two students want to do is read French novels. The twins are identical and are very close, so their need for socializing with others seems minimal.

Both girls have chosen their mother as their coach, and their mother is well aware of the choices the girls are making. Neither has chosen a new learning module in some months, and they make little use of group sessions, workshops, laboratories or anything other than their library. The twins are preparing for a summer in France beginning in several months, and have little else on their minds.

Over the past several years they have been using French when they talk to each other, because it gives them good practice and it allows them to talk between themselves without being understood by others.

Mrs. Swanson has consulted Mrs. Hobart and school counselors and together they have gone over the computer records with regard to whether an intervention might be valuable.

They have decided, however, that the twins are making informed choices that suit their learning goals. They girls have well mastered every subject and life skill that they can see they might want. Their choice to remain in school and read novels in French must be respected.

Rusty — Being Coached by Randy

Rusty is having trouble with geometry. Rusty is trying out being a pilot. Part of being a pilot is understanding points on a compass and degrees of angle relative to landing fields.

All of the material on geometry is being taught in the context of what a pilot would need to understand to be able to navigate safely. Rusty isn't getting it. The computer has backed up and simplified the concepts until it is working at the most basic level. Rusty still doesn't get it.

Rusty doesn't want to quit and choose another path that wouldn't require geometry, because he really wants to be a pilot, and he is very successful in using the flight simulators. He is becoming a very good pilot, but he has difficulty solving practical problems such as entry into holding patterns.

The computer has suggested that he take on a tutor, and has offered a list of volunteers. Some are students who are proficient, some are adults, and some are students who seek to be teachers and need practice. Others on the list might be volunteers that have attained easy mastery of the topic, as well as some that have struggled before mastering geometry. From that list, Rusty has chosen Randy to be his tutor.

Ralph — Learning to be a Shopkeeper

Ralph lives in the heart of what used to be called the "ghetto," and is an example of a youngster that once would have been considered "at risk." Ralph is learning to be a shopkeeper. He began with the introductory module, which surveyed the skills, and competencies that a good shopkeeper needs. Much of his primary education was given in the context of being a shopkeeper. He learned to read by practicing reading labels on clothing, or invoices, or advertisements. He learned his math by pricing stock, calculating mark-ups, calculating discounts, and determining percentages of profit on revenues. Ralph has progressed through the modules, which offer insight and understanding into the complexities of inventories, bookkeeping, customer satisfaction, and managing shop employees. Ralph has now reached the level of application for the skills he has learned, and is deeply involved with a computer simulation of running a dry goods store.

He orders stock, he balances his cash, and he instructs, coaches, and encourages simulated store employees. He moves easily between the "street" dialect and the "television" dialect in English, and he has built a limited facility with Spanish and Korean, the other languages of his neighborhood.

Ralph practices good customer skills in dialogs with a variety of simulated customers. He speaks to the customers in their preferred language, and understands enough of what the customers are saying to him to conduct business.

When Ralph began school he chose a man from his apartment building, Mr. Baker, to be his coach. Mr. Baker learned to be an effective and supportive coach, and soon became a student himself. Mr. Baker studied and learned office skills, and found a good job in a neighboring suburban community. Even from a distance, Mr. Baker has continued on as Ralph's coach.

Mr. Baker is convinced that Ralph has the ability to become a lawyer, or accountant or any of several other high status professions. Mr. Baker is concerned that Ralph seems increasingly committed to becoming a shopkeeper in his old neighborhood. They disagree on strategies for using education. Mr. Baker argues that education is the key to escaping poverty, and Ralph argues that people who gain a good education best serve their community by staying in the community to make life better for those in the community.

Mr. Baker has asked the school counselor and Ralph's teacher to support him in helping Ralph choose more ambitious educational goals. He wants the school to force Ralph to cut back on his studies of shopkeeping, and require Ralph to "try out" careers such as lawyer or public accountant. Ralph's teacher finally resolved the issue by illustrating why new paradigm schools don't dictate or force students to learn what the students don't choose to learn. The teacher did this by asking Mr.

Baker to study a module about "old paradigm" education. Mr. Baker learned that one of the reasons for the failure of old paradigm education was the idea that educators should require students to learn what educators felt they needed, rather than letting students control the choice of what to learn. Mr. Baker learned that the result of "top down" dictates by educators led to schools filled with teaching about subjects which some students couldn't relate to their own real worlds.

Mr. Baker learned a great deal about good intentions gone awry, and the concept of "unintended consequences." Mr. Baker gradually changed his thinking as he understood the damage that had been done to his own community as the needs and the interests of the students became further and further removed from the teachings offered by old paradigm schools. He grew to understand that the alienation from learning that resulted in wholesale "dropping out" was, in part, caused by students not seeing schooling as enabling them to achieve their goals. Mr. Baker finally understood that education is most appealing when the student can see a strong link between the learning and the individual's goals. Mr. Baker then agreed with Ralph's teacher that Ralph was entitled to choose his own goals, and take responsibility for his learning choices.

As we observe, we can see how motivated and energized Ralph is by the opportunity to apply his skills toward his goal. Ralph is clear about his goals, his values, his commitment to his community, and is making instructional choices that are right for Ralph. With a supportive Mr. Baker as his coach, we can be confident that Ralph will have the skills to achieve his dream.

Lori — Learning To Be a Good Spouse

Lori is trying out being a wife and mother. All of her current instruction is within the context of those roles.

She has completed a module designed to examine her expectations and realign them more with reality than with family life as shown on television. In the course of this instruction she has enhanced her mathematical skills by increasing her comprehension of statistics. She now has a good grasp of the various probabilities associated with success or failure in a relationship. The module progress test shows that she has changed her estimate of the probabilities of a successful marriage, and she has displayed a good understanding of the factors that would most likely determine success or failure.

She is presently working on strategies for "coping" with things in her situation that she can't control or change. The pre-test for the coping module tells the computer module where to put its emphasis. She is discovering that she relies heavily on a single strategy for coping with upset. She is becoming aware that she uses "avoidance" as her primary coping strategy and the module is helping her to discover and learn to practice a wider range of coping skills, such as negotiation or choosing acceptance.

The life skills series aims at giving individuals a balanced set of behaviors, so they can demonstrate mastery of a wide range of human behaviors, and can choose those most likely to produce the outcomes they seek.

Again, as with all other contextual learning, life skills are simply a context through which the individual is open to instruction in verbal and written communication, math, the sciences, history, the arts, and other fields of human learning.

As we observe, Lori is practicing dialogs with a simulated spouse on her television screen. Without being aware of it, Lori is developing and practicing valuable techniques in the fields of inter-personal relations, verbal communications, and psychology.

Lori is free to take all the time she needs to frame optimal responses to the simulated spouse. The computer is ever attentive, behaves in a caring manner, and is ever patient as Lori slowly thinks through her possible responses so she can choose the most productive one.

True to the best simulators, the simulated spouse will react negatively when Lori chooses provocative or critical responses, and will react in a caring and accommodative manner when Lori chooses productive responses. Also true to the best in simulation, Lori will learn the unique nature of the simulated individual, and will learn how to produce in each simulated individual the best responses that that individual has to offer. Lori will learn a great deal about herself, and she will discover how to be effective in communicating with others.

As she progresses in her skills, the computer will match her with other students who have mastered the same skills for some face-to-face, real life, exercises.

Angela — Writes to Her "Identical Friend"

Angela is now back in her silent cubicle writing a letter to her identical friend.

Some time ago, Angela chose to find her identical friend, somewhere in the world. The module offers hundreds of qualitative questions for the participant to answer. The questions are designed to explore opinions, judgments, expectations, likes, and dislikes, learnings, experiences, perceptions, behaviors, and every possible emotion. The goal is to help the individual discover a great deal about himself or herself and at the same time build a unique profile.

In the same way that there are never two snowflakes exactly alike, there are never two humans exactly alike. However, Angela is curious to find the one person (who has taken the same series of questions), who is most like her.

The computer has reported that the closest match to Angela's profile is a girl named Sally — about Angela's age — from a city half way across the country. Sally wrote to Angela, via computer mail, and Angela is writing Sally a letter in return.

As Angela is writing the letter, she is only aware of her interest in her pen pal and her curiosity to discover how alike they are. Angela doesn't feel self-conscious about sharing her inner most feelings with the computer, because she knows the computer isn't human, or a real person and she trusts it.

If we could observe the process closely, we could see the computer helping out by monitoring the grammar, spelling, clarity, and use of vocabulary. With access to the vocabularies of both parties, the computer can prompt Angela if she uses words unfamiliar to Sally. With access to multi-cultural rituals, the "identical friends"

could have different languages, and different cultures, and the computer could still facilitate a caring and sharing communication. At the very least, the computer can help Angela develop an awareness of the importance of rituals in human communications, if differences become an issue.

The important thing for us observers to notice is that even personal tasks, such as writing letters to a friend, become opportunities for instruction and learning.

Mr. Hubert — Learning Accounting

In the next silent cubicle, Mr. Hubert is learning a new life skill. He has been working as an industrial worker, but he injured his back and can no longer do what he was doing. He has come to school to find a new marketable skill. While he was working, he observed people doing accounting work in his company. He thought he might like to do that kind of work.

Mr. Hubert graduated from an old paradigm high school, so he was unfamiliar with new paradigm learning. With help from the computer, Mr. Hubert has become comfortable with new paradigm instruction and has even learned to type on the keyboard.

Mr. Hubert was only slightly aware that as he learned to type that the computer was helping him improve his spelling and use good written grammar.

Mr. Hubert selected the same learning module that is used by students "trying out" being an accountant. After a survey of the skills needed, and a little practice at the kind of work accountants do, Mr. Hubert reaffirmed his choice, the computer supported him, and he has been learning the skills he needs to get his certificate. Mr. Hubert meets with other students trying out accounting, and he has become comfortable learning along with teen-agers. The young people were already comfortable with Mr. Hubert, because they have been accustomed to learning with people of all ages.

In their initial session together, the computer has helped Mr. Hubert make a complete assessment of his reading, writing, math and work skills. He knows that he needs to broaden his vocabulary, and that he needs to learn to write business correspondence more clearly. The computer is introducing the needed vocabulary at a rate which is comfortable to Mr. Hubert, and which keeps him challenged, without being frustrated. The computer also discovered that Mr. Hubert never learned team skills. The computer probes to be certain that Mr. Hubert understands the new emphasis on teamwork, and team problem identification and problem solving that have become the "norm" in the office of the 2020's. Mr. Hubert is aware of that change in the work skills needed, and is willing and eager to learn more of this new way of working.

Mr. Hubert is very focused on his instruction. He wishes he had the time to explore some of his other interests, but he is eager to get his certificate and find work. So, Mr. Hubert and the computer stay within the relatively narrow set of learning goals that Mr. Hubert has selected. Mr. Hubert is intense, motivated, and able to move quickly in certain areas. The computer accommodates his desires.

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Glenn — Can't Decide What to Do Next

Glenn has finished trying out six different careers and hasn't found anything that interests him. The computer, with access to the assessment module, has proposed several possibilities, but none of them sound appealing to Glenn.

Glenn communicates that he has lost interest in learning. He can't think of any life goal that seems right for him. He doesn't even want to play with any of the myriad computer games that most students choose as rewards when they complete their committed learning time for the day.

The computer accesses the "mood" test, and asks Glenn to participate as a favor to the computer. The computer begins a series of questions, some serious, some outrageous. Some questions are so bizarre that Glenn can't help but laugh. Some questions are so "on target" that Glenn feels overwhelming sadness. As the computer targets Glenn's mood more and more accurately, the questions become more and more reflective of what Glenn is thinking and feeling. The computer tests for thoughts of suicide, and Glenn confirm that he has thought about suicide, and even more so recently.

The computer accesses an "expert" system created by a suicide prevention team of therapists and proven effective in preventing suicides in clinical situations.

Together, the computer and the "expert system" take Glenn through the steps necessary to assure Glenn's safety, decide on the best action plan to get Glenn the help he needs, and alert Glenn's coach, counselor, mentor, and any other people that Glenn has asked to be contacted in case of emergencies.

Felicia — Called To Her Spanish Group

Unaware of the drama playing out in the cubicle next to her, Felicia is busy speaking in German to a computer-simulated person speaking in Italian. The computer interrupts the dialog with a request that Felicia attend a session of advanced Spanish speakers and act as the group's facilitator.

The computer prints out a series of exercises and a facilitation plan, and Felicia goes off to the assigned group room to conduct the group session. It might surprise those of us accustomed to the old paradigm that meetings can be called and held at the convenience of the students participating. None of the individual or group learnings have to wait for school periods to begin or end.

Fred — Applies for His Zoologist's Certificate

Fred has completed the final exercises in his zoology module, and the computer reports that in its judgment Fred is ready to take the national standards test for an entry level position as a beginning zoologist.

The computer asks for attendance by a certified monitor, and Fred alerts Mrs. Swanson that he is taking a national test. Mrs. Swanson signs on as Fred's certified monitor and commits to attend to the process for the duration of the test. All tests are "open book" tests, in which the applicant has access to any materials he or she needs to access, including computer lessons. The monitoring is simply to assure

that Fred is the individual taking the test and that he doesn't have others assisting him during the examination.

There is little tension or stress produced by the testing process. The tests are produced by a national standards team of people operating in the chosen field, along with renowned experts, and scholars. Many versions of each test are prepared, each one sampling a wide range of learning objectives within the discipline.

The student is tested across the entire spectrum of learning objectives taken from Dr. Bloom's famous taxonomy. Some questions test recall. Some test understanding. Some questions test the ability to apply what has been learned. Some questions examine the ability to synthesize and some ask the student to demonstrate the ability to evaluate within the discipline.

Testing in the new paradigm has different purposes than testing in the old paradigm.

In the new paradigm there is hardly any student failure. When the computer reports the student ready to test for certification, the student can be fairly certain of passing the test. In a world where every student learns at his or her own pace, and learning continues until mastery, then every student masters the material.

Testing in the new paradigm serves as a "rite of passage" or opportunity for celebration. Testing marks mastery of a learning goal. Certification assures people in the work world of certain verifiable learnings. And, very importantly, testing for a great range of learning objectives (recall through evaluation) makes it possible to "score" the computer programs that perform the instruction. Over a wide spectrum of students, the "elegance" of a learning program can be measured by examining the time that students take to complete the instruction, and examining the depth of learning produced. When reinforcement of prior learnings and remediation are figured in, all the factors needed to evaluate the teaching "elegance" of any instructional program are there.

These evaluations will then form a part of the criteria which students will use when evaluating which program — from a variety of programs available in the computer library — they will choose. Obviously, another important part of the criteria that students will use is how satisfying or pleasurable the program is to work with. The third major factor that students will use in choosing which programs to use is the program's ability to balance challenge with mastery to produce "flow." ("Flow" is the balance point that offers enough challenge to keep it interesting, and not so much that it is frustrating.)

We can feel confident that Fred will pass the test, get his certificate, and celebrate the achievement of a learning goal.

The Group Rooms

Leaving the silent cubicles, we move on to a series of larger rooms available for meetings of groups. Groups are used for a variety of purposes in the new paradigm schools. Groups are necessary to the students for purely social reasons, serving society's goal of socializing students. Groups congregate based on common interests, or for the purpose of performing, or observing a performance. Groups

form for the purpose of celebrating achievements, school victories, birthdays, transitions to the work world or to college, and other milestones.

Groups form for the purpose of practicing skills such as languages, musical instruments, art, woodworking, etc.

An Interest Group

In this room is an interest group meeting for the purpose of discussing the career that they are each "trying out." Each person in this group is studying what it would be like to be an architect. Each has been assigned to choose a house layout. Each has been asked to study a chosen design and bring it to the group session, prepared to discuss what is different or special about that particular residential design and why it was chosen.

Without being aware of it, each student is participating in what would have been described as an exercise in a speech class in the old paradigm.

It doesn't matter that the group is made up of students of different ages, or different levels of prior education. The participants expect to find students of different ages. All of them share the common interest of learning about becoming architects.

The fact that one student is an adult, while another is a sub-teen doesn't embarrass the adult, or late teenagers. They all understand that each has chosen this common learning, and could do so at any age. Unlike old paradigm sorting of groups by age, achievement, or learning speed, the new paradigm brings groups together dynamically, based on factors not related to age or the speed at which one learns.

A Synthesis Group

The next group room contains a synthesis group. Students in synthesis groups are all somewhat advanced in whatever context they are studying. These students are all trying out what it would be like to be attorneys, and they have all advanced past the recall and understanding modules and are deep into application of their skills.

Synthesis groups give students the opportunity to add on to the building blocks that they have mastered, and combine two or more concepts from the building blocks to form newly created conclusions.

Teachers who have mastered the advanced instruction in the career, interest, or life skill being studied, guide all synthesis groups. These special teachers have also received specific instruction in conducting synthesis groups. In the old paradigm teaching skills at this level wouldn't be required until perhaps graduate school. In the new paradigm, where instructional depth at the level of synthesis can occur in pre-teens, virtually all teachers will be challenged to hone and use advanced facilitating skills.

In the group we are observing, the students have mastered American common law at the level of understanding, and they have mastered the U.S. legislative process at the level of understanding. They are being challenged to synthesize from these basic building blocks to arrive at conclusions, ideas or thoughts about the impact these two forces have in producing "justice" in resolving civil disputes.

We won't learn much by observing this group, since we don't share their common knowledge base, but we can be amazed that young people, even some children, are capable of insightful inquiry and thoughtful dialogue. In the old paradigm, such insights were not expected, developed, or drawn out of students until perhaps college.

A Performance Group

In the next room, we can observe a play being performed for a small audience. People who are trying out what it would be like to be an actor, are putting on the play. The play was written by an individual who has mastered what it would be like to be a playwright. The audience is made up of other students who are also learning what it is like to be actors; they will observe the play as part of their learning. The rest of the audience is made up of people who have chosen to watch plays as one of their ways of taking a break from the intensity of their own instruction.

A Celebration Group

In the next room we find a group of young people gathering to celebrate the achievement of learning goals. Each of the people, in turn, is asked to tell what they have learned, describe something valuable that they discovered in the learning, and tell the group what they intend to learn next.

Certificates of achievement are passed out for each of the learning goals achieved.

Some students compete for the number of certificates they can achieve before leaving for the world of work or college. Most students, however, value depth of learning more than breadth of learning. As a consequence, there is less academic competition between students than in the old paradigm. Where there is competition, it is focused not on grades, but on depth or breadth of learning.

A Language Group

In the next group room we find Felicia leading a group of students in Spanish. She is facilitating the group as it follows the instructions for exercises that each individual has been given by the computer.

The group combines people of all ages who have achieved similar levels of achievement in Spanish as a second language. The exercises assure that the students stay within their "comfort zone" in terms of vocabulary, and they all feel fairly confident about their accents, because the computer has helped them become relatively free of accent.

The learning purpose of the group is to build confidence that the students can functionally communicate using Spanish outside of the silent cubicle and in normal conversation or story-sharing with their fellow students.

A Choral Group

In the next room we find a choral group practicing. Each of them has practiced the individual parts in harmony with the computer driven chorus. It is now time to gain confidence that they can perform well with real people and with others listening.

One of the Laboratories

The laboratories in new paradigm schools are similar to the silent cubicles, but different in terms of equipment. The laboratories are equipped with very expensive computer stations that are extraordinarily powerful as individual computers.

The powerful computers are needed because the laboratories are conducted via "virtual reality."

Virtual reality is a world that is only possible with high-powered computers and special programming. The idea of virtual reality is for the computer to simulate reality in such a way that the student can interact with it, and the virtual reality reacts in the way that real reality would.

Some examples will be useful.

Shannon — Examining Molecules with a Virtual Reality Electron Microscope

Shannon is using the video display to simulate the view presented by an electron microscope when it is examining real objects.

Shannon can adjust the viewfinder to show the object, or zoom in on any level she chooses, down to and beyond the atom. A "real" electron microscope is very expensive, and would not be available to a student in an ordinary school.

Computer simulations of electron microscopes, however, can simulate an electron microscope and make that simulation available to any student in any laboratory, in any school, anywhere.

Virtual reality allows students to discover for themselves what others have previously discovered using real instruments. Virtual reality can even go beyond what reality can accomplish. Perhaps a real microscope can someday be created to "see" an atom. Odds are good that one could never see a "quark" or sub-atomic particle.

Using virtual reality, however, it will be possible for any student to observe the display of an electron microscope powerful enough to "see" a quark.

Sandy — Dissecting a "Live" Frog

In old paradigm biology classes students could only work with dead animals. Public sentiment, as well as natural human squeamishness, both argued against dissecting animals while they were alive.

Using "virtual reality," however, we can observe Sandy opening up a "virtually live" frog which exists only in the creative imagination of the computer program. By donning a pair of glasses that beam video pictures into her eyes, Sandy truly feels as though she is in a laboratory. She has entered a world of virtual reality created by the computer. Using her computer "glove," she can guide the hand that she sees using a scalpel to dissect what seems to be a live frog. When Sandy cuts it, it bleeds. When she opens it up, she can observe all of the functions operating normally. And, when she finishes her dissection, she can, at her option, back out of the procedure and find the "virtually real" frog untouched by her exploration.

Through the use of virtual reality chemistry students can conduct their experiments in laboratories as well equipped as any in the world. No school could afford to have real laboratories such as the ones that could be available to every student through "virtual reality."

Mr. Gillig — Changing a Tire on His Car

In the next cubicle, Mr. Gillig has come in to learn how to change the tire on his car. Mr. Gillig feels helpless around mechanical things and has allowed them to terrify him for much of his life.

Mr. Gillig has now discovered virtual reality, and its power to simulate the most complex, or most simple realities. With the computer screen, an automobile maintenance program, and computer "gloves," he can simulate each step in the process of changing a tire. He could also open up the engine and watch it while it works, if he so chose. At this stage, however, he is content to just learn the basics that will make him feel safer while driving.

Dorothy — Playing her Viola with the Israel Philharmonic Orchestra, Conducted by Zubin Mehta

Dorothy practices each day with the ordinary computer simulation at her own learning cubicle. She feels ready now to discover what it would be like to play with a world-class orchestra.

Using virtual reality, the computer recreates an orchestral performance of Mozart's Sinfonia concertante (k.364) with Itzhak Perlman and Pinchas Zukerman playing the solo parts. Through the magic of virtual reality, she can substitute for Pinchas Zukerman and play with Perlman and the orchestra.

Combining the magic of computer driven glasses, and the magic of computer driven digital television, she can watch her fellow musicians, and hear the music as she would hear it if she were, indeed, truly playing with the Israeli Philharmonic.

Henry — Landing a 747 At Heathrow Airport in the Fog

Henry has moved from the relative comfort of small screen simulation at his silent cubicle to the power of virtual reality to simulate landing a Boeing 747 at London's Heathrow Airport.

We could stay and watch, but we could only watch on the computer monitor, and we wouldn't be experiencing the same "virtual reality" that Henry is experiencing through his computer driven video glasses.

The Cafeteria

The cafeteria is very similar to old paradigm cafeterias, with a few notable exceptions. As the educational system was de-bureaucratized, it became clear that schools could serve a broader role in society than simply providing teaching. The schools are now used all day as part of the food delivery system for the elderly and the needy. Anyone is welcome at the school cafeteria. Parents come sometimes to have meals with their children. Grandparents come sometimes to visit and eat with their grandchildren.

School cafeterias in the new paradigm are managed using the strategies and techniques being used in the private sector. In private sector restaurants, the management has to predict daily how many customers may appear, and yet, somehow, they almost always have enough food to handle the crowd.

The Day Care Center

The day care center is where pre-schoolers and after school children stay until there is an adult at home. Buses run throughout the day on planned schedules, bringing adult students to and from school and carrying children to and from school. In situations where parents find it difficult to deliver or pick up their children from school or day care, they are transported by school buses.

As schools put integrated learning, socializing, experiencing, and playing into the learning process, the distinction between "school hours" and "after school" hours has been virtually eliminated.

School buses are also integrated into the public transportation system of the community and, where possible and practical, school buses serve the public as well as students.

Because every new paradigm school has access to the same quality and level of instruction, equality of education has been realized without the necessity of "busing" children far from their homes. Any child may choose any school, so those fearful of being socialized only with those of their own race may choose a school that is more integrated. The money that school systems have saved by eliminating extensive busing has been used to hire more teachers.

The national standards for instructional development assured that the people shown on the computer video programs represent a good and fair racial, ethnic, and religious balance. In other words, the people that populate the videos, and the computer simulated people are drawn from a wide range of races, religions and ethnicity's.

The Gymnasium

Less has changed in the physical education section of the school plant. Young people show up for sports or exercise better prepared than they did in the old paradigm because they have learned more skills through simulation and life skills instruction. There has been little significant change, however, in sports or games or exercises that develop the student physically.

The Library: the "Brain" Center

There are still books in the library, but much less use is made of them. Since virtually all textual resources are now available through the computer and pages can be printed out at will, there is less need for books.

The major use of the library in the new paradigm is to house the computer equipment and data that is used locally at the school.

The Computer Networking Equipment (Hardware)

Every school has its own local network that links all computers into a local area network. The equipment in the school is top-of-the-line, state-of-the-art equipment. One of the precepts of the collaborative alliance joining private sector and public sector together to create the new paradigm was the understanding that private sector computer companies would compete to supply schools with equipment. Further, it was understood from the beginning that schools couldn't afford the capital to invest in top of the line equipment, and couldn't afford to bear the cost of obsolescence in a fast changing technology. From the beginning, computer companies rented the equipment to schools on a "pay for performance" plan. A plan that made it profitable for the private sector to produce equipment that facilitated optimal learning.

As new technology is invented, or breakthroughs are achieved, the computer suppliers will introduce the new equipment to schools as part of their lease agreement. Computer vendors may be changed periodically, and those that do not keep their technology current will be replaced by computer suppliers who do.

Changing computer suppliers is not a traumatic event within a school because of the national standards for "open" systems that were established in the 1990's. Computer hardware can be used interchangeably. The standards assure that all hardware can use all of the established software. There are exceptions for technological advances made since the standards were created, and every school may have one or two "orphan" systems which do not fit the standard, but are so revolutionary and powerful that they are utilized for special purposes outside of the standard.

The Student Data Base

All local databases, such as the individual database for each student, are stored locally as part of the specific school's internal network. The entire database, however, is also stored remotely and recopied anew at least once a day. The databases are the heart of the learning system and are too valuable to risk having in only one place. Duplicating the student's database centrally also makes it easy for students to study on their home computer systems and have full access to everything on the school system. Children use this capability to study via portable computers when they travel or vacation.

The Computerized Coach and Monitor

The individual coach and monitor programs that are accessed by each student are housed in the central computer at each school site. This makes them available continuously and in real time, to all students at the site. Again, copies are also made every night into the central data banks, so students who are studying at home have access to their personal computer coach.

The Centralized Program Banks

All of the instructional programs are housed in public databases similar to the 1990's "Source" or "Prodigy" systems and are available to be accessed by any school via satellite transfer. The individuals and companies that have invested billions of dollars to create the library of instructional programming have the opportunity to

recoup their investment based on the actual usage of their programs. A nationally-defined royalty system is used to distribute part of the municipal money for education based on the learning programs their students choose and use.

Each time a student completes a learning module, the publisher of that module receives a payment, credited automatically to that publisher, and charged automatically against the individual student's programming account, which follows him or her from school to school as the student chooses his or her school of choice.

No payment is made for students who are not satisfied with a module, or who begin it but do not complete it. This discipline forces publishers to produce programs that are appealing and user friendly for the students.

The national data base of learning modules adhere to programming standards that have been established globally to assure that any given program will work on whatever equipment the school uses.

The national standards for equipment and software — as well as the national payment mechanism — were enough protection for the private sector to become comfortable to undertake the risk of competing to produce the most appealing and the most effective learning experiences for students.

Success was no longer dependent on "selling" every individual school district in the nation. As soon as a program was complete and had been validated to meet the established national standards for compatibility — and to assure that the program could meet its defined learning objectives — the program was entered into a single national data base, and instantly available to any student in any school who was aware that it was accessible.

The successful publishing organizations have become very profitable, and the authors of particularly popular learning modules are the 2020's version of celebrities. In the 1990's as the defense establishment began to wind down, the nation's brightest and most talented designers and engineers were re-directed toward the compelling opportunity to apply technology to learning instead of defense.

The Collegiate Tutorial Cubicles

Collegiate tutorial cubicles are similar to the synthesis group sessions, except that the other students and the teacher are in different locations and brought together through teleconferencing.

Colleges and universities have been greatly affected by the new paradigm. Young people now routinely learn more by the time that they enter the work world than graduate students knew in the old paradigm.

No longer do people go to college or university to learn work skills or life skills. Those are all taught in the public school system. In the new paradigm, colleges and universities are used for true scholarship. People enroll for college level courses when they have decided to do research, or become scholars and advance the course of knowledge.

New paradigm colleges are filled with scholars seeking to be taught by other scholars. No longer is scholarship intermingled with employment preparation.

The introductory courses and survey courses that colleges once taught are now better done and more effectively delivered by technology, and because they are available through technology, they are available to any student at any school.

Some advanced instruction in life skills or career skills does require tutors who are not available in every school. For example, students pursuing accounting or architecture or engineering at an advanced level might need tutors who are not available in the local school.

One-on-one tutoring can be established through computer links arranged by the computer through the network of schools. So, if a chemistry tutor is needed for a student who has advanced into and beyond what would once have been college level chemistry, the computer can find and arrange for a teacher (or advanced student), somewhere on the network to do one-on-one tutoring via computer dialog.

The collegiate tutorial cubicles are special-purpose cubicles similar to the 1990's version of teleconferencing, where people from many different sites can come together for meetings via video conferencing.

Students who have advanced in a specific discipline beyond what is today the collegiate level, and who need graduate level tutorials, can arrange for them through the use of the collegiate tutorial cubicles. Videoconferencing makes it possible for an advanced student to study with a professor of great renown while attending his or her local public school.

The collegiate tutorial sessions resemble traditional teaching more than they resemble the individualized instruction used for more basic work. The difference is the material is not well structured, but rather responds to inquiry and synthesis generated by the students.

The National Standards Tests

At the beginning of the new paradigm the Federal government saw its role as "steering" rather than "rowing." In that light, the U.S. government put together collaborative alliances of people from the private and public sectors to create "real world" tests, which could be used as national standards.

From the beginning it was seen that the national tests would serve primarily to assure that learning modules produced the learnings that the public and private sector alliance agreed would be valuable for each type of learning certificate.

Parents and teachers in the early years of the new paradigm were concerned that if learning choices were left up to the students that they would choose learning modules that entertained but didn't produce learning. There was a widespread consensus that the private sector programming publishers would work harder at enticing young people to choose their programming than they would work at transferring skills. There was concern that the programming publishers needed some form of oversight. The oversight finally chosen came in the form of the national standards tests. They are produced fresh each year by collaborative

alliances which change panels each year to assure that the tests stay up with changing needs.

As a result, students earn certificates in each of the career or life skills areas that they choose to study. Work world employers can be confident that a student with a given certificate has attained certain competencies — regardless of which school was attended, or which learning modules were chosen.

Section Two: The Principles Underlying the New Paradigm

With the "vision" of the school of 2022 in mind, it may be helpful to examine the underlying principles of the new paradigm.

Make Education Customer Focused

In the old paradigm, it can be effectively argued that the mission of the school is to serve "the public."

The problem with serving "the public" is that it is too amorphous. The "public" is everyone. So, the schools end up serving the superintendent, or the school board, or the legislature, or worse yet — attempting to serve all of the above.

It can be effectively argued that the problems that exist with the present educational system are based in large measure on the fact that the mission is "up focused" (toward teachers, school boards, etc.) rather than focused on the customer — the student.

The new paradigm is based on the idea that schools must have specific customers, and must serve those customers effectively. The most obvious choice for "customer" is the student. (Or, in the early years the team of child/parent, or child/parent surrogate)

Convert from a concentration on "teaching" to a focus on learning

The present paradigm educational system concentrates on teaching. Whether the teaching results in learning is not seen to be the responsibility of the teacher, the school, or the school system.

The new paradigm focuses on learning. Teaching is seen to be good if it results in learning. Learning is the goal. Teaching may or may not be the best way to achieve that goal.

Switch from teacher controlled teaching to student controlled learning

The old paradigm places the control — and thus the responsibility for teaching — on the teacher.

The new paradigm places the control — and thus the responsibility for learning — on the student. Teaching is measured as good or bad based on its usefulness to the student in helping the student learn.

Convert from the Bureaucracy Model to the Mission-Driven Model of Organizing

The old paradigm educational system is organized based on the bureaucratic organizing model. The bureaucratic organizing model imposes the following principles upon the educational system:

1   Hierarchical organization — Decisions are made at the top of the organization (i.e.: the state, the school board, the superintendent), rather than at a level close to the student.

2. Control via Rules — Rules are the way that bureaucracies can control lower levels and assure that they implement the decisions made at the higher levels. The judgment of the teacher may be superseded by rules made by people far away from the place where students learn.

3. An up-focused mission — The mission of a bureaucratic entity is to serve those that charter it, or fund it, not necessarily those it serves

4. Purposely impersonal — The idea is to assure equal treatment for everyone, regardless of human differences or individual need.

5. Organized by specialty or function — Each discipline is taught separately (math, science, language, history, etc).

It can be effectively argued that the bureaucratic organizing model is not the optimal model for organizing a learning community. The new paradigm proposes to adopt the "mission driven" model as the optimal organizing model for a learning community.

The mission-driven model structures entities in a way that allows them to be totally customer focused.

1. Empowered, multi-disciplinary teams make the decisions at the closest possible level to the student. (This replaces the hierarchical structure.)

2. Guidelines are used, where possible, to replace rules. Teachers, mentors, guides, and other learning support people are empowered to put aside the guideline, and use their own judgment in situations where the guideline interferes with mission achievement — learning.

3. The mission in a mission driven school is customer focused, rather than up-focused, as stated above.

4. Instead of being purposely impersonal, the school and its staff are encouraged to consider the human and individual needs of each of their students, and their co-workers. Equal treatment for all is not valued, because equal treatment produces unequal satisfaction. The preferred goal is equal satisfaction. Equal satisfaction can only be achieved through unequal treatment. (We evade the issue of preferential or prejudicial treatment because the decision power is vested in the customer — the student.) This means that students will have many choices, and they will decide between those choices. This results in unequal treatment because each student takes a different path, but it produces equal satisfaction because the students are each making their preferred choice.

5. Instead of organizing by specialty or function the mission driven organization organizes people into multi-disciplinary teams, and it organizes information into multi-disciplinary "contexts."

Offer Individualized Instruction via Technology, Using a Central Global Library of Programs

It has long been known by educators of every discipline that the optimal way of learning is through individualized instruction. In the existing paradigm this was not possible because it would require a teacher for every student, and thus was financially impossible. The only practical way that public education could offer individualized instruction is through the use of technology (i.e. teaching machines, computers, etc.). In the present educational system, individualized instruction delivered via technology has failed to become wide-spread for several reasons.

1. Early experiments in CAI (computer aided instruction) and "teaching machines" were built on the old paradigm model of teaching. They simulated "teaching." They often didn't produce learning. They weren't as concerned with motivating, stimulating, or even interesting the student. Many students learned well. Most found them very boring.

2. Even though there were some wonderful successes, the idea of teaching machines was sometimes threatening to the bureaucracy. Some saw their jobs at stake. Even those who welcomed the entry of CAI found it difficult to integrate individualized instruction into a rigidly regimented system of dividing students into groups by age or learning speed. Bells that rang every hour to signal a gigantic swirl of group movements were not compatible with students working as individuals on computer terminals.

3. Money for technology and for software was a problem. Schools tended to have the oldest equipment, often obsolete. The budget for acquisition of software had to be "taken" from existing budgets and every existing bureaucratic sub-unit fought hard to keep its budget from being reduced.

The vision for the new paradigm is based on several assumptions that seem possible and reasonable:

1. The technology exists today for everything illustrated in the "vision" presented above. No new technological breakthroughs are required to realize the vision as presented.

2. If a national set of "open" standards were chosen, software producers could feel comfortable about producing programming that wouldn't be made obsolete by technological changes. Programs would only be subject to risk from competitors producing more elegant programs.

3. If a global library of programs were accessible by every school, then producers of programs wouldn't be required to "sell" to each individual school system to make their programs available to students. Reducing the selling costs would reduce the return program producers would need in order to invest. The central library would also assure that even the poorest school, in the poorest land, would have access to the most powerful learning, if their school had the necessary equipment. -

4.   We assume an international computer market, in which the computer manufacturers accept the risk for technological obsolescence, and for capital investment. We think that this is possible if the companies can protect their investment by agreeing on "open systems" standards. We think that manufacturers will choose modular and upgradeable design strategies for producing school hardware to minimize the costs of obsolescence.

5.   We assume that dissatisfaction with the existing educational system is so widespread that educators and citizens alike will be open to allowing private sector firms to join in alliance with educators to produce a joint public/private solution.

Convert from Offering "Subjects" to Providing "Contextual" Learning

Those who have studied "natural" learning have found that people are motivated to learn by a variety of sources (curiosity, survival, economic or social gain, the need for stimulation, etc.).

When learning occurs "naturally" (learner driven, unaided by teachers), it virtually always occurs within a "context." For example, a person who is unable to read normally doesn't choose to learn to read solely for the purpose of reading. People decide to learn to read so they can achieve practical objectives e.g. qualify for a job, read street signs so they can find their way, etc.

If we are to entice, motivate, stimulate, and otherwise attract students to learning, we must offer them instruction that "fits" naturally into the context of what they want to know.   Few students might be attracted to learning about geometry as a subject on its own. Yet, many will learn it eagerly if it will help them navigate an airplane.

Heuristic Student Monitor Programs Will Gradually Move to Remediation if Needed

The new paradigm assumes that computer programs can be produced which will use heuristic learning strategies to gradually learn how to guide a given student through sets of learnings. We assume that these programs could be made to serve the student by monitoring the students' activities, attention, and learning rates.

We assume that these monitoring programs could adjust the rate of instruction up or down to keep the individual student in a balance of "flow." Flow exists when the students learning rate is sufficient to keep the student from being bored and yet not so rapid that the student becomes frustrated. Flow is the optimal balance of challenge and capabilities. The learning rate that will produce flow differs for each person, and it differs from one day to the next, and it differs based on the type of discipline being learned (math, verbal, written, etc.).

Offer Students a Wide Variety of "Contexts" Through Which to Learn.

The desire to learn partly depends on the "flow" produced by the learning — which attracts students by itself — and by the potential gain the student sees from achieving the learning. Students will only be strongly motivated if the learning offers them some benefit that they seek. Students seek a variety of different benefits, and each student is different. Beyond that, each students needs changes over time.

To maintain a constantly stimulating, exciting, and motivating learning environment, the learning modules must aim for a wide range of possible student benefits. Some modules might offer economic gain by equipping the student for well-paid work. Other modules might offer the opportunity to help others by equipping the student to become part of the helping professions. Some modules might offer increased social acceptance by equipping the student to make friends easily or work well with others. Some modules might offer help in finding a significant other by equipping the student with social and bonding skills.

The idea is a wide variety of contexts that meet a wide variety of perceived needs in students. Each context offering continuous improvement in the basic skills of reading, writing, experimenting, and calculating. Each context would include a survey of the core studies that would aid in understanding human, group, and organizational, national, and international events.

Change Graduation Requirements from "Grades" Passed to Competency Certificates Earned

The idea is that students will leave school when they see that the benefits of leaving school are greater than the benefits of staying in school. Students will stay as long as they are challenged, motivated, and stimulated by learning — and as long as the learning is leading them to some desired outcome.

When learning is sufficient for the student to achieve the desired outcome, the student can enter the work world, the service world, government, or scholarship. If, over time, the students' needs and desires change, or the work world changes, they can always come back. The new paradigm is built on the idea of "lifetime learning."

Stop Grouping Students Into Classes By Age, Learning Capacity, or Speed of Learning

Instead of grouping students into classes by age, learning capacity, or speed of learning, group them by common interest, learnings achieved, or roles required.

Old paradigm thinking forces young people into rather "fixed" groups based on age, speed of learning, or student goal.

New paradigm thinking allows for dynamic groups that are formed, work, achieve, and then break up. As learning progresses, and needs change, the groups a student works with change as well. This idea assures that each participant in a group is equipped to contribute, and that each participant is highly valued.

Channel the Brainpower and Entrepreneurship of America's Most Creative and Talented People to Create Instructional Materials for the World

The United States is shifting away from its enormous investment in defense, at the same time that the critical national need for reform in education is being recognized.

The new paradigm offers a solution to the problem of what to do with all of the capital, talent, and brainpower that have been assembled in the defense establishment.

With government taking on the role of "steering" instead of "rowing" it makes sense as a matter of national educational policy to stimulate the redirection of those

talents to the creation of the hardware and software systems which can produce individualized learning.

Those concerned about the United States' ability to compete globally should notice that the United States already leads the world in the creation of computers, and the design and usage of software. If the US decides to capitalize on these strengths, it is possible that it could take a global leadership role in providing "space age" educational opportunities to students throughout the earth.

Open Schools to People of All Ages, In support of "Lifetime Learning"

The old paradigm schools "reject" as many as one of every three students that enter. These young people who fail to learn what they need to know to contribute to society and earn their own way, represent an enormous waste to our society.

If new paradigm schools are open to people of all ages, and "lifetime learning" becomes the new social norm, we stand a chance at salvaging many of those people that the old paradigm educational system has failed.

Give Schools a Role in a Broad Range of Social Support Services

New paradigm thinking is not limited by the bureaucratic thinking that limits schools to a single social contribution.

If we think beyond the limiting confines of the bureaucratic paradigm, we can imagine many creative roles that schools and the educational system could play in the future.

One could imagine:

- School cafeterias playing a role in feeding the elderly and the needy

- Schools playing a role as temporary housing for the homeless

- Schools playing a part in equipping welfare mothers with both the day care and the job training they need to become self sufficient

- The busing capabilities of the school system being used to create improved public transportation in communities that suffer from inadequate transport.

And on and on...

Create Technology Standards so the Private Sector Will Invest in Programming

To realize this vision we need enormous investment by private industry in the creation of learning technologies — both hardware and software.

Competition and free market choices must drive the system over the long run, and we believe it will.

Presently, the computer industry is still struggling with the concept of "open systems" in which a program written on one machine can work in any other machine. This is still mostly a dream, rather than a reality.

If the federal government sponsored a collaborative alliance made up of representatives of all of the parties at interest, it would be possible to design a set of standards which would assure that programming investment would not be made

obsolete by constantly changing equipment. The goal would be standards that are "open" to movement of a program from one piece of equipment to another, and open to new forms of equipment yet to be invented, and new capabilities yet to be imagined. The idea would be to give enough protection to foster investment, and yet stay open to new technological breakthroughs that will surely come.

Create a National Royalty Program to Incent Investment in Learning Technology

The federal government can help "steer" rather than "row" by outlining a system to channel royalty revenues from school budgets to the producers of the most successful programming. And to the investors in computing equipment who will equip schools with their investment — and at their risk of obsolescence — if they can see a simple way of getting a return on their investment through royalties based on student learning.

We do not suggest a cumbersome, bureaucratic system that interferes with the free market at work. We suggest another collaborative alliance that could bring all of the interested parties together to find a way to achieve the desired outcome with minimal involvement of government or interference with market forces.

Build "Continuous Improvement" Into the New Educational Paradigm

"Continuous improvement of quality or service," becomes the new paradigm for business and industry as it attempts to adjust to global competition.

Continuous improvement is the idea that any system or process can benefit from being continuously improved, and that teams of people need to work continuously on each process, product, or service to see that it gets better and better continuously. If "continuous improvement" is built into the new standards, and into the royalty system, and into the design of the learning modules and the hardware technology, and into the teachers and the students in new paradigm schools, then all parts of the system will allow for continuous improvement. Otherwise, we will be saddled with the traditional bureaucratic paradigm, which values consistency and constancy and one design "for all times."

Change Government's Role from "Rowing" to "Steering"

The new paradigm school is based on the notion that government does a better job when "steering" rather than "rowing." The state of the existing educational system is the result of asking government — which is based on bureaucracy — to operate an educational system that requires constant growth and change.

By thoughtful division of roles we can get the best from all parties to the equation. New paradigm education will require the capital investment needed to equip every child, in every school, with open access to a computer. It will require enormous investment in creative, motivating software that produces learning on an individualized basis. These investments — and the re-direction of the talents necessary to produce the hardware and software needed — are only available from private sector firms that would invest with hopes of profits from their success.

Government's role would be to set the standards that would make the marketplace work, and would make possible the investment needed. Government's role would be

to bring together, and perhaps assure the success of collaborative alliances between educators and the private sector. The government's role would be to set standards against which the continuous improvement of learning achieved by students could be measured — standards against which private sector programming could be assessed for its elegance in producing learning.

Offer Instruction in Virtually All Languages and For Virtually All Ethnicities through Centralized Programming

If the initial standards assume that the learning systems must eventually work in virtually every language, then program designers can plan from the beginning for a multi-lingual environment.

Any nation desiring access to the global learning systems could assure access by contributing the necessary translations into their language, and the insertion of their cultural perspectives. If these translations conformed to standards then they would be compatible with all of the instructional programming. By maintaining the standard, those additional translations would be available to all other global students who want access to learning in the new language.

We can expect, for example, that economic benefit will assure that all programs are available in the widely used languages, such as Spanish, French, German, Russian, Japanese, Chinese, Arabic, etc.

Smaller ethnic units, such as the Kurds, might well have to create their own translations in order to gain access to the global instructional library. If the Kurds do the necessary translations then they would be equally available to anyone in the world seeking to learn the language of the Kurds.

Do Pioneering Work on Dynamic Translation So Virtually All Languages Can Be Used To Learn

Computerized translation is in its infancy. We can take the steps needed to assure that creative minds and entrepreneurial investment will be put into improving dynamic translation so that the computer can teach in any of the major languages, and take inputs in any of those languages.

Give Parents Or Parental Surrogates Control — Albeit a Gradually Declining Control — Over Student Learning

The final important principle underlying this vision is the idea that parents, or coaches (parental surrogates) will have control over what learnings the younger students can access.

In the old paradigm, if a parent wanted their child to learn about evolution or "scientific creationism," they needed to force all the other youngsters in the school to be limited or freed in the same manner. These kinds of issues have divided communities. Sex education is another issue upon which parents are divided.

The new paradigm, with individualized instruction, will allow parents to prescribe or proscribe learnings for their child alone, without forcing their beliefs or choices on other children.

With a gradually reducing parental control as the youngster ages, it will be possible to postpone, rather than eliminate instruction that the child wants, but to which the parent/coach objects.

Section Three : How can this vision be realized?

The first step is the evolving consensus of a collaborative alliance including private and public sector educators, legislators, executives, union and association leaders, parents, and students.

We must complete the building of the initial collaborative alliance. If you have been invited to join the alliance, you will be asked to use this evolving document as a method of achieving consensus.

Please feel free to add what you feel is missing from this vision, and from the principles, and from the steps to realizing portions of this paper.

Also, feel free to register concerns, or alternative opinions. Your contribution may start out as a minority opinion, and by virtue of the consensus process, may be adopted by the rest of the alliance as a replacement for something that has evolved as part of the consensus to this point.

An Evolving Strategy for Restructuring into the New Paradigm

This section of this paper outlines a series of action steps to be taken to bring the vision to life, using the principles outlined above.

• Build model schools based on the new paradigm

• Stimulate the creation of "schools within schools" to transfer the new paradigm quickly to the existing network of schools.

Train everyone who migrates from the old paradigm to the new paradigm. In addition to the teachers and administrators, train the students and their chosen coaches in their responsibilities in the new educational paradigm

Assign a task force from the model schools and "schools within schools" to create the standards against which they will perform

Take the necessary legislative steps to "free" the new paradigm schools from the bureaucracy and "top down" rules that immobilize and suffocate the existing educational system

• Give parents and children the freedom to change schools and take their government-provided funding with them

• Give parents and children the freedom to change from one "school within a school" to another "school within a school" and take their funding with them.

• Give students the freedom to change their assigned teacher or coach within the school, and take their funding with them

• Make it possible for "non-certified" adults, (who are otherwise trained and in some way qualified), to serve as tutors, coaches and teachers in new paradigm schools

- Form other collaborative alliances of public and private sector parties to:

Establish the necessary "open" standards that will encourage private sector investment in instructional programming.

Create a "pay for performance" model which will provide "royalty-type" payments to those whose programs are chosen by students.

Create a "pay for usage" model that shifts the burden of obsolescence onto the manufacturers or distributors of hardware systems.

Create a long-range plan for integrating welfare and social service agencies, along with some of their funding, into the new paradigm school system.

The goal is to offer early use of the new paradigm programming to prepare those who were the "rejects" of the old paradigm, for useful and productive employment.

*****The end of the vision of education in the future*****

Postscript

In November of 2002, the residents of Florida voted for an amendment to the State Constitution which limits class size. The Governor is faced with spending many billions of state revenues that the state doesn't have.

The voters really just wanted better education for students. They became convinced that the only way to force better education was to limit class sizes to thirty students per class. As we can see by what the this paper, more teachers will not bring the desired results.

Florida's Governor has the opportunity to turn a disaster into a smashing success. Using this paper as a guide, the Governor could achieve smaller class sizes by adding individualized learning labs to do the primary instruction, and using teachers and traditional classrooms to do what only teachers can do to help students synthesize what they've learned from the computer. For less money that it would take to hire the number of teachers required to limit class size to thirty, the Governor could install the technology that would actually provide what the voters want: a better education for their children.

More teachers, with smaller class sizes, will simply produce more of the same unsatisfying educational results. To go beyond the mediocre educational results produced by the old paradigm, the new paradigm offered in the paper offers truly extraordinary opportunities.

Realistically, it is unlikely that educators of today will embrace the concepts envisioned in this paper.

If that turns out to still be the case, this paper is offered to people in the interim who may be able to guide the evolution of the world's educational system.

If you have comments or questions to be passed on, please feel free to do so.