



CENTRAL OFFICE

1055 TORREY PINES ROAD
SUITE 203
LA JOLLA, CA 92037 USA
TELEPHONE: (619) 456-0103
FAX: (619) 456-0197
BITNET: MILLERJ@SDSC

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Mr. W. Frank Blount
President
New American Schools
Development Corporation
1000 Wilson Blvd., Suite 2710
Arlington, VA 22204

Dear Mr. Blount:

The University of the World puts a high priority on the development of a new form of high-tech school for the 21st century. This rates near the top in a set of more than a dozen of such priorities for national and international education. Student learning stations are being developed in several countries and international and research networks are being developed to circle the globe. Though labeled a University, we are much involved in improving education at the K-12 levels as well higher education.

A team under the direction of Dr. Martin Chamberlain and Mr. John P. Reisman has spent much effort in developing this design and we believe it can have a major impact in improving quality and cutting costs of education not only in our country but in the rest of the world.

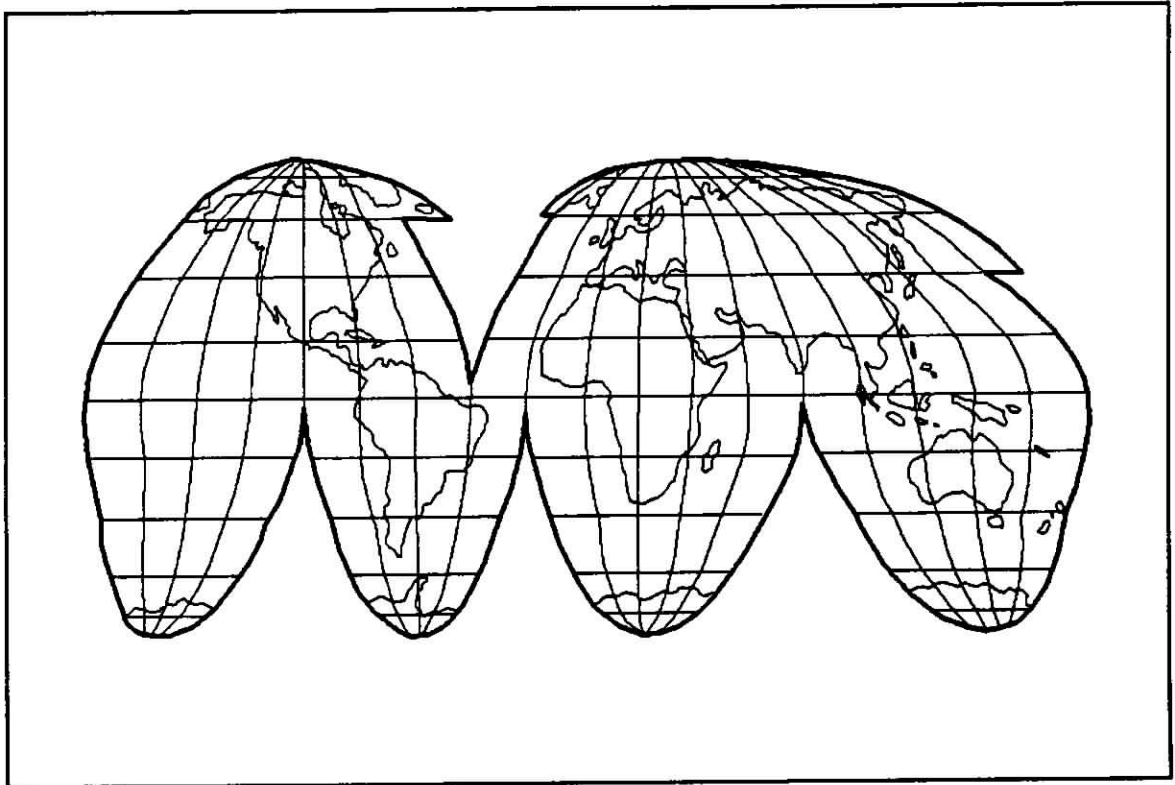
Cordially yours,

James Grier Miller
Chairman of the Board

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SCHOOL 2000
THE LEARNING CENTER



**A Project of the University of the World
developed by a team consisting of:**

**JOHN REISMAN
LOUISE SCHMIDT
AURELIA PROVVEDINI
and MARTIN CHAMBERLAIN**

1055 Torrey Pines Road, Suite 203
La Jolla, California 92037
Telephone: (619) 456-0103
Facsimile: (619) 456-0197

**SCHOOL 2000
ABSTRACT**

The School 2000 concept utilizes educational technology, principally computer and video courseware, as the principal means of instruction which enables students to enjoy self paced instruction and which guarantees that each subject will be mastered by all students. Teaching by lecture will be retained for some subject matter but generally the role of the teacher will change. Teachers at School 2000 for the most part will be mentors, facilitators, guides and counselors rather than presenters. The design team believes that these ideas will result in more highly motivated students who will enjoy their school participation more and produce better results.

Many classrooms will be restructured to provide learning stations to fully utilize the opportunity for independent or team learning that the use of technology allows. The administration of School 2000 is greatly improved through the use of a Program Master which controls much of the activity in the school and provides continuous data for use by teachers, administrators, parents and students. There is an effort at School 2000 to involve parents and the surrounding community in activities and decision making at the school.

School 2000 is a project of the University of the World. Its' design team functions as a volunteer group on the staff of the University. The University of the World is dedicated to improving education at all levels and in all parts of the world through networking and exchanges of information, resources and data. It has offices and representatives in 25 countries. It is a non-profit corporation with a 501(3)(c) status from the IRS.

The University of the World is located at: 1055 Torrey Pines Road, Suite 203, La Jolla, CA 92037, Tel: (619) 456-0103, Fax: (619) 456-0197. The agent, and design team member for this project is Martin N. Chamberlain, Ph.D., Executive Vice President. ,

**THE SCHOOL 2000 PROPOSAL
EXECUTIVE SUMMARY**

This proposal, from a project team of the University of the World, suggests that the use of educational technology, principally computer and video courseware, as a primary source of instruction rather than an administrative resource, will make a substantial improvement in the enjoyment, motivation and results for students at all school levels. There are a number of innovative ideas contained in the proposal involving and changing the role of teachers and administrators and re-designing the classrooms or creating complete new schools.

In this new setting students become much more involved in the planning of their own curricula and in the self-paced execution of these study programs. Students study individually or in teams, and for some subject matter, in normal classes. Teachers, parents and administrators are much advantaged by the flow of data about each student made available by the Program Master, the controlling element in the technology assisted school. Much of the world of learning becomes immediately available to the student seated at a learning station with instant communication available to teachers, team members, library material, and through networks, to other schools almost anywhere in the world.

Because the facilities at the school can be utilized 24 hours a day, if desired, they become available to members of the community on a continuing basis and provide opportunity for schools to become community centers where persons of all ages can be beneficially involved.

Administrators and teachers in School 2000 will be concerned with multi-disciplinary learning. While we stress competence in core subjects such as English, mathematics, science, history and geography, and place much emphasis on reading and writing skills, we strive to have these learnings take place in courses that interweave the subject matter. Indeed we hope that students will find the resulting courses sufficiently inviting that they may not realize that they are learning math concepts or geography.

The Program Master will try to make the teachers fully aware of developmental changes in their pupils so that they may be advanced at points of readiness. Classrooms will be full of activities of groups moving through subject matter at different levels. Teachers will have to orchestrate all of these different activities.

The role of most teachers will change from that of a presenter to one of being a mentor to individual students, a counselor, guide or tutor and facilitator. Teachers will have to supervise groups and teams rather than whole classes and be able to manage several things happening at the same time in classrooms or in different areas throughout the school. This will require some re-training of teachers which will be accomplished in several ways--summer workshops, video conferences and computer or video courses which can be undertaken at any time throughout the day or night when both the teachers and facilities are available.

The role of administrators will change also but probably not as drastically. The Program Master computer will provide much data on each student and teacher which will enable administrators to have access to information which had not been available in earlier school systems. Reports will be readily compiled and dispatched. There should be fewer student problems to cope with. Perhaps fewer administrators will be needed.

The source of administrative data is the Program Master, which consists of the main computer database and ancillary equipment. The Program Master serves many purposes but the principal purpose is to supply computer courses to student learning stations from its storage area. Secondary purposes include providing administrative and security data to those who need it. The Program Master can accumulate student records, monitor student progress, locate area video cameras. It can even perform such routine administrative chores as mailing, information processing or telephoning numbers of parents, teachers and students.

In the main computer database/server are stored the course materials for courses used at the school. The multiplicity of programs available in the database enables teachers and curriculum planners to develop course sequences tailored to the needs and interests of individual students. A distribution means for course materials is known as the cache system. Students and/or teachers can order a particular course or program to be made available to the learning station at a specific time. The Program Master, on receiving such a request, will access the main database and load that program into the cache system at a time which it designates. This arrangement can manage multiple orders for the same program.

The Program Master is a computer program utilizing databasing (and

eventually artificial intelligence) techniques to monitor all internal (within the school) and external digital data transference at the electronic school. It has the ability to analyze, sift and sort data, make decisions, delineate tasks and interact with data storage and retrieval systems.

By utilizing simple databasing technology and tracking student progress through time the Program Master can run a series of comparative analysis tests to determine student progress. If a student is noted to be performing out of his/her usual range or the expected range of comprehension and achievement, the computer will report this information to teachers and counselors. The Program Master can monitor and evaluate interaction between students and teachers. Should the computer determine that a particular student has been inadvertently neglected it can notify the teacher so that corrective steps can be taken. The Program Master also will be able to recognize changes in behavioral patterns of individual students and notify teachers and/or counselors of those changes.

For students or teachers the Program Master can be a source of reference material and resources contained in the system which could help in a particular subject area. Other databases could be connected to learning stations--such as the Community Learning Network. It can also provide access to host computers via Internet and similar resources.

The Local Area Network enables student, teacher and administrative communications with each individual having an assigned code and address carried in the Program Master file. The code will allow users to access the system. This access may be recorded in instances where community members use the system and ultimately will be billed for the time spent on the system. Communications outside the school can be restricted by blocking access at any local gateway. This arrangement will require students to obtain permission for example to make long-distance telephone calls.

All of this new technology will dramatically change many aspects of traditional schools. With computer-assisted or video studies students can move along at their own pace. Groupings of students in team projects and seminars will stem from their achievement levels in particular subject areas. But for such activities as physical education eating lunches, and on the playground, students will be involved with their own

age groups. Where possible, School 2000 designers would prefer to have all traditional grade levels (K-12) in one facility where from the onset students can be grouped by achievement. Thus at each level there would be students working at the next higher levels who could be grouped with students doing similar work. Slower learners would be able to receive more individual attention and encouragement so that all students would progress at a faster pace than is normal in the traditional class structure. Also there is an advantage in using older students to tutor and otherwise assist younger students. Learning from peers can be motivating.

There are many evidences in the US and other countries that elements of the School 2000 project are already being used effectively. There are in progress some exciting developments such as the Community Learning Network and the Consortium of School Networking which will dramatically increase the availability of electronic based resources to schools. School 2000 is designed to take full advantage of these developments.

Though the project team has not spent a great deal of time investigating research which deals with elements of our proposal, we have made searches of published research in areas pertinent to the School 2000 concept and cite the references for those concerned. We have been interested in evidences of successful application of our ideas and documentation of these successes.

The project team has strengths in many appropriate areas but none have been actively involved in public schools in this country. We consider this to be an advantage in our thinking and planning, neither of which has been fettered by limitations which a more involved role might bring forth. Yet we have been aware of the need to reality-test our ideas with teachers and administrators currently working in public schools and have altered our ideas as needed to satisfy their criticisms. The project team does have considerable skill in educational administration, research, technological considerations and facilities design.

The Budget is supplied in the requested detail for the first two phases of the NASDC design. The third phase details will emerge during the project's first three years and enable a more specific delineation of expenditures in plenty of time to meet NASDC needs.

The School 2000 project envisions Year I being spent in perfecting the project design, arranging for its' installation with representative school districts, designing a variety of models which school districts could use in modifying their facilities, writing publications encouraging teachers to use educational technology and designing teacher seminars and workshops to acquaint teachers with the new mode of teaching in School 2000 applications. During Year I an effort will be made to identify and judge the quality of educational technology resources presently available and creating a resource catalogue. Year I will be used to set the stage for intensive applications of the School 2000 concept in the following years. The Year I budget is \$351,083. A major expense is creating the software to operate the Program Master.

Year II will be the year in which the concept becomes reality. Initially the project will be developed in remodeled classrooms in a variety of schools with differing student bodies. Agreements to do this will have been negotiated during Year I so that implementation can proceed expeditiously--if Phase II funding is received. Year II budget is \$544,150 and a major element is for construction and renovation of school classrooms.

Year III will see a continuation of the concept in existing schools but will focus on the creation of a new school designed to provide full implementation to the School 2000 concept. Thus the major element of Year III's budget of \$2,375,639 is allocated to constructing and equipping a new school, built to showcase the concept from designs developed during the previous two years.

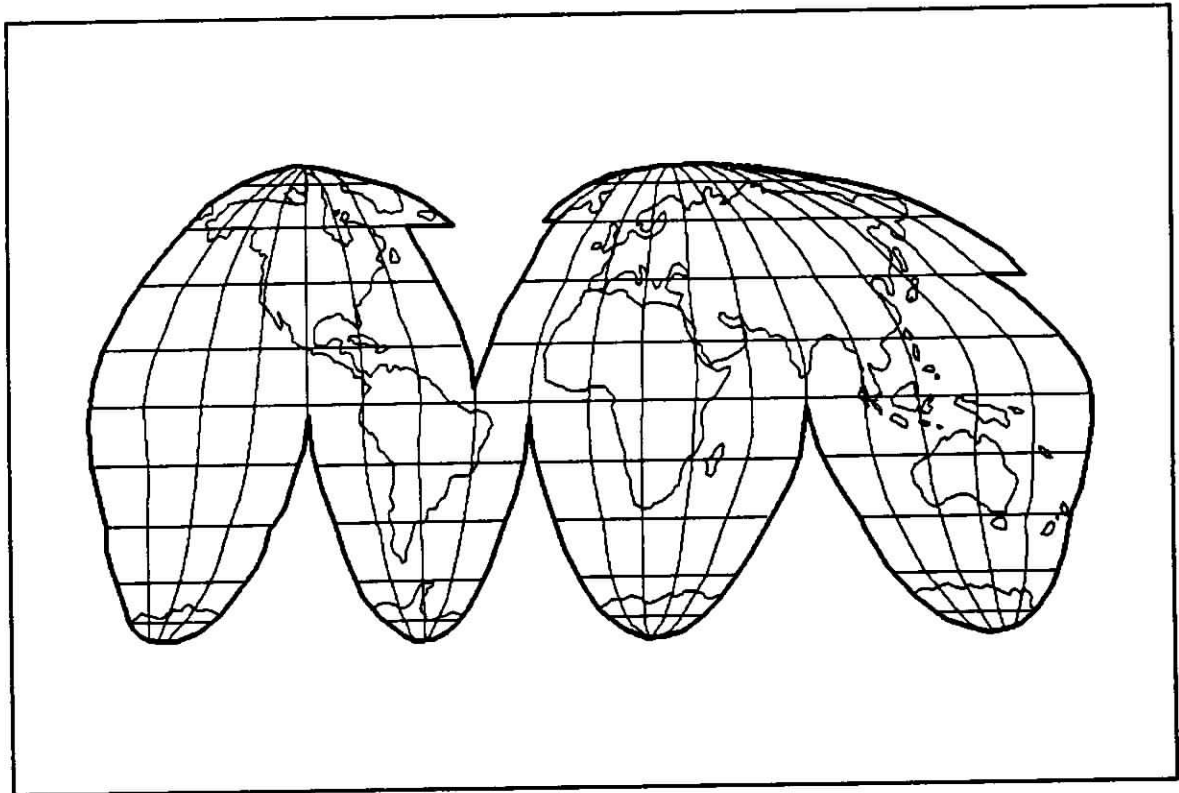
Years four and five will be devoted to publicizing the concept and developing ways of getting it widely implemented throughout the US and abroad. No detailed budget for this phase is provided here as it will evolve during phases I and II.

The contractor for the project is the University of the World, a non-profit corporation located at 1055 Torrey Pines Road, Suite 203 in La Jolla, California 92037, telephone (619) 456-0103, facsimile (619) 456-0197. The person responsible for the project implementation is Martin N. Chamberlain, Executive Vice President.

"Over a period of time, as values change, so will relationships, and, with them, institutions. The challenge that we presently face in adapting to the future is to allow new values to emerge and to modify institutions appropriately."

Jonas Salk

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SCHOOL 2000 INTRODUCTION

Imagine a school where students progressed at their own pace, yet completely mastered every subject and what's more, enjoyed it; Where teachers were freed from class preparation and grading papers to enable them to tutor, encourage and help wherever help is needed. Such a school is possible now. What is needed is the motivation to create it.

Computers have revolutionized almost every aspect of our society except education. The worlds of commerce, health, and manufacturing have made dramatic uses of computer technology to improve their abilities to provide better, quicker and more accurate services and products. But the education community has shown resistance to using the computer as a teaching resource. There is fear among teachers and professors that they may be replaced by computers. Yet the likely outcome of adapting such technology is just the reverse. Teachers will be needed just as much as in traditional schools, but are able to work in the areas of their greatest strengths and interest. Teachers who excel in lecturing will be presenting the course material by electronic media to all students. Other teachers will have the close contact with students that is equally needed in this setting. Besides being teachers they would act as tutor, mentors, guides, counselors, and role models.

Instructional technology can improve the learning process in many ways. Indeed it is now being used successfully in schools, but mostly as a resource—peripherally. There are many new developments which, if used intensively, could revolutionize schools just as they have done in business and the military.

School 2000—the Learning Center—proposes to take full advantage of existing and developing technology. It plans to utilize learning stations in large numbers where students can

interact with subject matter in a variety of ways. A learning station is a fully equipped cubicle which provides a student with the electronic hardware that will enable him/her to interact with course materials by computer, video tape or combinations of both. Computer courses, video courses, interactive compact discs will provide both teachers and students with many options in planning curricula and monitoring progress.

As an important bonus the learning stations will provide administrative data which will supply teachers, counselors and administrators with information that will enable them to note student progress and see changes taking place which need review. Problems can be identified and dealt with in incipient stages.

By using modular design in the School 2000, new developments in instructional technology can be incorporated without expensive alteration of learning stations or classrooms. Three dimensional viewing, described as "virtual reality" is seen as an ultimate connection between computers and people and a magnificent teaching tool. Though too expensive now—it ultimately will be adapted for use in electronic schools.

The purpose of the learning station is to enable the student to pursue the learning process independently and in teams which can be put together by criteria set by the teacher. It provides at fingertip all of the equipment needed to utilize a wide variety of available course materials. It also allows the student while at the learning station to communicate by telephone directly with a teacher or counselor and to have questions answered as they arise. Computerized voice-mail and E-mail systems make possible an efficient messaging system. The privacy of this exchange is a boon to students who have been timid about posing questions in a public forum which might cause embarrassment and discouragement.

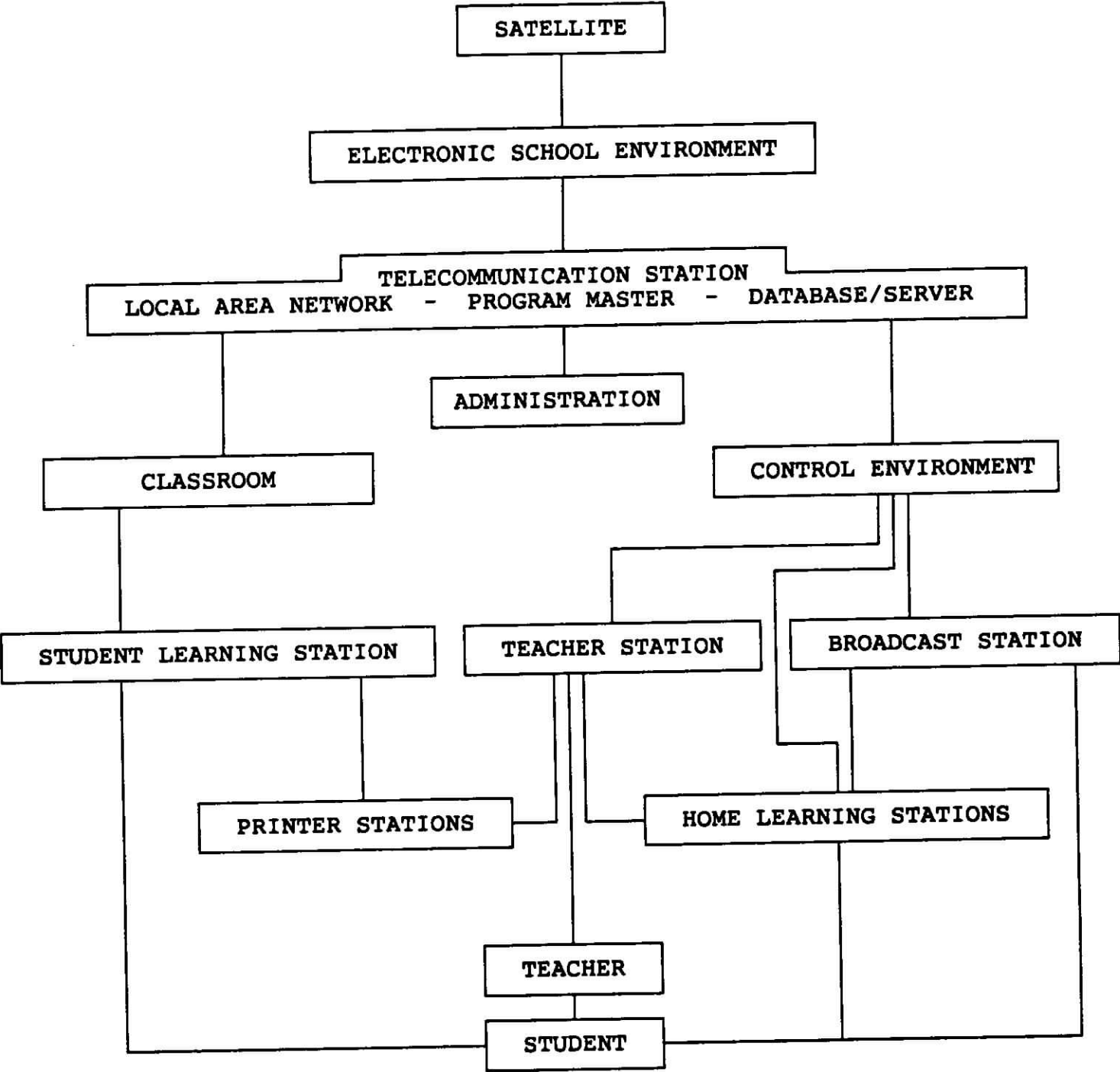
Learning stations can be operated on a twenty-four hour basis which greatly enhances the utility of The Learning Center. If learning at home is utilized along with attendance at an electronic

school, many more students can be served by a single school than is currently possible. All sectors of the population may learn at electronic schools and the endless variety of subject matter makes possible learning at all levels of education at the same location. Thus a grandfather may be in an adjacent learning station to his granddaughter—both pursuing courses appropriate to their stage of development, interest, and ability.

The School 2000 is feasible now. Nothing in the proposed system is currently unavailable. What is required is a School Board and administrators bold enough to see the advantages to the students and teachers, to be aware of the eventual savings in costs of construction, maintenance and operation, and the willingness to be innovative despite possible adverse reaction from parents, teachers, and administrators. The gains in a better educated society certainly outweigh any dislocations which will occur during transition from the outmoded to the state of the art in education.

Back in 1968 George Leonard created the notion of "free" learners. In his book Education and Ecstasy he describes a school not unlike the School 2000. He was ahead of technology when he posited what learning could be like. Perhaps now the first learning center should be called The George B. Leonard School—a school for free learners.

ORGANIZATION CHART OF THE SCHOOL 2000



DESCRIPTION OF THE SCHOOL

School 2000, The Learning Center, looks superficially like a traditional school. They have many areas in common such as classrooms, administrative areas, gymnasium, lunchrooms, library and laboratories. Where the electronic school differs is that it will contain areas filled with individual student cubicles called learning stations. These cubicles are the heart of the electronic school and the place where much of the learning takes place.

The School 2000 could be instituted in any of three ways: 1) it could be incorporated into an existing school; 2) it could be adopted for all schools within a school district or; 3) ideally, it could be erected as a new campus working in conjunction with the schools in the district.

If brought to an existing school or campus one of the buildings (or rooms within a building) would be remodeled or replaced so as to contain the electronic components and learning stations. If adopted by a school district, each school would have a building (or rooms) with electronic equipment and learning stations and the central components installed in one school which would be linked with the others.

The component areas which are unique to the Learning Center, each of which will be described shortly, are: (1) student learning stations, (2) the control environment, (3) the program master system, and (4) the telecommunication system. Other areas are more typical of traditional spaces, for example the gymnasias, may be designed in such a way as to allow the use of the structure to be utilized for a variety of purposes including sports, drama, and the arts i.e. choir, painting, and sculpting, as well as an auditorium for large formal and informal gatherings.

To fully achieve the potential for the Learning Center, however, this group believes that it should be a separate structure or campus of several structures providing educational services to students from K through 12, as presently organized.

Present ideas for the Learning Center design suggest a structure of one or two stories with wings projecting out from a central hub. Each of these wings would contain what in traditional concepts would be a separate school, namely kindergarten and elementary, junior and senior high schools.

The hub or central core of the system would contain administrative areas, teacher stations, broadcast stations, the program master system and communication center. The Learning Center cafeteria might be located on top of the building with landscaped areas attractive for outdoor eating and socializing.

Each wing would contain learning station areas, classrooms, laboratories, studios and a library. The library would provide both printed and electronic books. The gymnasias could be placed centrally or peripherally. A basement under the central core could contain a recycling center, a garage and maintenance facilities.

STUDENT LEARNING STATIONS

Learning station areas will contain a large number of individual cubicles containing the necessary equipment to enable the student assigned there to work productively. Such stations are designed to retain privacy while allowing visibility within the learning station areas. Each station will have a twelve inch partition surrounding the work space which will contain a video/computer monitor, keyboard, communications headset, and controlling device such as a "mouse". Other equipment might include a compact disc drive, a laser light pen, a graphics pad, electronic books and an intercom headset.

In the learning station area will be several large screen video monitors placed in ways that all students in their cubicles will be able to see at least one of these. These screens can contain administrative messages for all students, lectures of general interest, teleconferences and special events. Also, strategically placed in these areas are video cameras which provide teachers with the ability to visually link with the student allowing for a more personal interaction. The teacher will also have a camera so that the student will be able to see the teacher on screen.

Several areas in the large learning station space will be designated as Student Aid Stations where students can go for technical or academic counseling and administrative purposes. These areas will also contain computer printers, xerox machines and other aids for students and teachers.

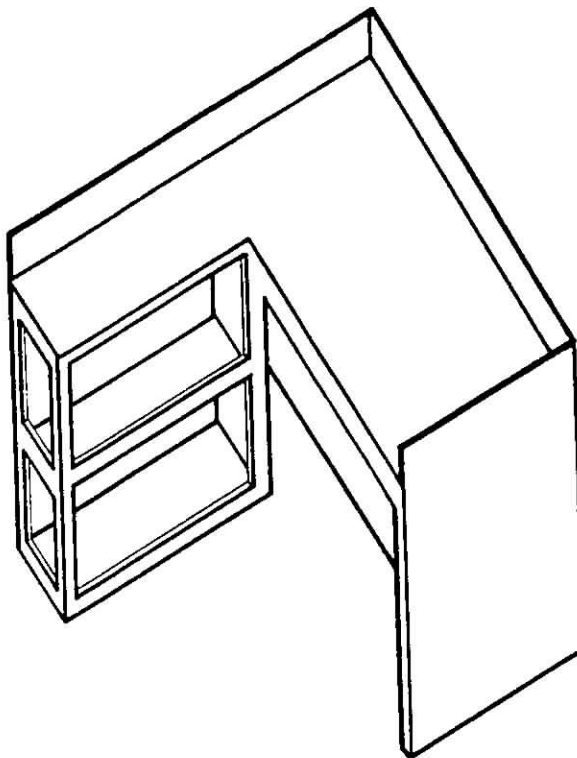
Students will be able to suspend current work and participate in a lecture or other activity intended for all or many students that comes over the computer monitor at a scheduled time. When finished, students will be able to resume their earlier work as they will have "stayed resident" on their computers.

A student with problems or questions can type a question to a teacher. If the teacher is immediately available his/her image can be made to appear on a video window on the student's screen. The student can talk directly with the teacher, otherwise the teacher can respond when convenient and the response will be stored in the student's computer or student file. The student at his/her option can also contact the teacher in the Student Aid Station.

By allowing the student a variety of choices with regard to how he or she interacts with a teacher and subject matter, the student may be more likely to feel in control of his/her own education. Also, by eliminating the pressure of having to raise one's hand in class, students will be more likely to interact with their teachers when questions arise.

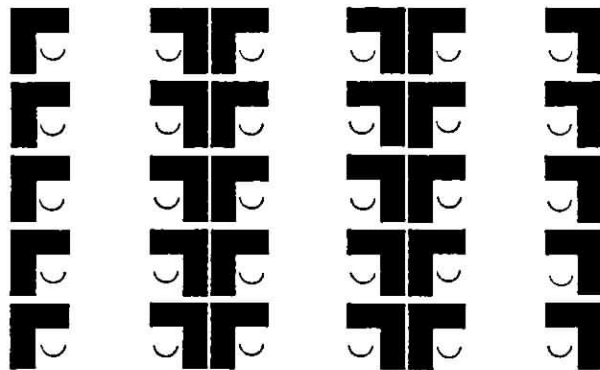
Students may log-on at any learning station. The Program Master provides each student with a file, stored on the Mainframe, which will have limited security. These files allow students to store their projects and work for later access. Student files could be limited by security devices such as passwords, numbers or fingerprint identification.

The ratio of students to learning stations might be one station for three students up to age 11 and two students per learning station beyond that age. For the younger students the dimensions of the stations would be smaller and the tables lower. Adjustable chairs would enable each student to be comfortable at each learning station.

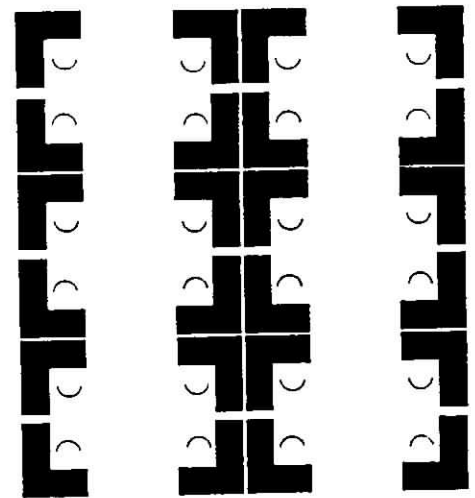


The learning stations are modular units. Each station has a generous working area which allows for the computer equipment as well as for the student's notes. On the side of the desk a smaller space allows for notebooks and tools. Two shelves enable the students to store their extra books, bags and personal items. Each station is finished with laminate of different colors, such as red,

blue, yellow and green. This feature makes them more personal, easy to maintain and gives the school a cheerful atmosphere. The learning stations can be grouped in various arrangements to fit each particular teaching situation. The following diagrams show some examples of possible arrangements:



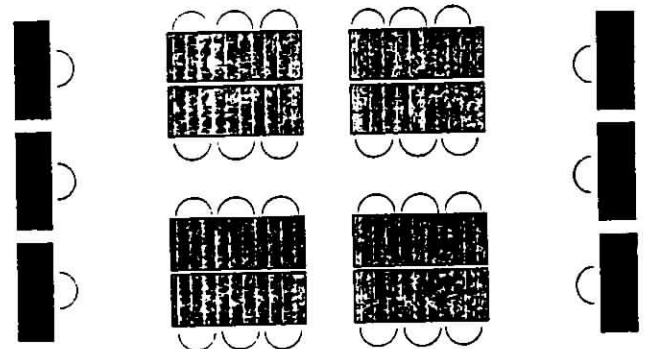
A THE STUDENTS ARE FACING A SCREEN OR THE TEACHER FOR A LECTURE.



B THE STUDENTS ARE FACING INWARD FOR ADDED CONCENTRATION; THE TEACHER CAN WALK THE ISLE AND ADDRESS EACH STUDENT INDIVIDUALLY.



C A STUDY GROUP HAS FOUR LEARNING STATIONS AND A CONFERENCE TABLE FOR DISCUSSIONS; THIS ARRANGEMENT SERVES A TEAM OF MORE THAN FOUR STUDENTS, SINCE THE COMPUTER EQUIPMENT CAN BE USED IN TURN.



D FOR YOUNGER STUDENTS, THE CONFERENCE TABLES ARE PLACED IN THE CENTER OF THE CLASSROOM; THE LEARNING DESKS ARE PLACED AT THE PERIPHERY AND THE STUDENTS TAKE TURN IN USING THEM.

CLASSROOMS, LABORATORIES AND STUDIOS

Classrooms will be much like those in use today but to aid flexibility in teaching we propose to use tables rather than desks. The tables can be used in seminar format or rearranged for other teaching needs. Laboratories and studios again will resemble traditional models but the addition of a few learning stations will make possible the use of computer technology to amplify the teaching options.

CONTROL ENVIRONMENT

The Control Environment, located in the central core or hub of The Learning Center, makes the system effective. It consists of teacher stations, broadcast studio, and administrative space. The Teacher Stations are a place for teachers who will be acting as tutors or counselors to assemble. It will provide desks for each teacher equipped similarly to student learning stations and also an area comfortably equipped for teachers on "breaks".

We may discover that teachers in the School 2000 system find themselves working in ways similar to the manner in which university professors interact with their students. Teachers will hold regular classes and assign office hours for direct or indirect interaction with the students.

It is possible that any single teacher may become inundated with student questions. That teacher, directly or through appeal to the Program Master, may then enlist the assistance of other teachers to help with the overload. The Program Master will be able to automatically handle these needs.

Through their own equipment teachers will be able to access any group of students regardless of where each student is located. Proximity is not necessary. Regardless of the size of the required

group the Program Master will be able to connect the teacher to the equipment of students who comprise that group.

As the Program Master knows the qualifications of the teachers assigned to the school, when a student asks a question it can quickly identify the most qualified teacher currently logged into the system. The Program Master can also determine which teacher is busiest and distribute student questions to teachers less occupied. This will enable students to interact with several teachers while studying a particular subject, but the student could also relate to only one teacher.

There are many options involved in a student's academic career. The School 2000 is designed to allow the student to exercise these options and changes with less complication than is currently possible. We envision that all students will have one mentor teacher that oversees his/her progress though many teachers will attend to the learning needs of that student. This will allow maximum multi-disciplinary learning as well as a focused center for the student to rely upon.

The teacher's role remains the same: to assist the students in the learning process. One of the major differences from teachers in more traditional schools is that teachers here have more opportunity to help the slower learners on a one-on-one basis while the faster learners are enabled to progress at a pace that suits their ability. Teachers would be more able to be available for students of all ability levels for more intensive interaction according to their needs.

The broadcast studios enable teachers to create lectures using multi-media programs and hardware. The studio provides teachers with a wide array of tools and lecture helps for any given class. Possibly students could also utilize these stations for multi-media reports and presentations.

THE PROGRAM MASTER

The Program Master consists of the Main Computer Database and ancillary equipment. It is directly connected to the telecommunication system and Local Area Network and will provide all kinds of information to teachers and administrators on request. It consists of several elements and could be located in any area of the school where sufficient space exists to house it.

Its' purposes are many, but the principal activities are supplying computer courses to student learning stations from its storage area and providing administrative and security data to those who need it. The Program Master can accumulate student records, monitor student progress, locate logged-on students, control learning station area video cameras. It can even perform such administrative chores as mailing, information processing or telephoning the numbers of parents, teachers or students.

In the main computer database/server are stored the course materials for courses used at the school. The multiplicity of programs available in the database enables teachers and curriculum planners to develop course sequences tailored to the needs or interests of individual students.

Another component is the Cache System which is an interim data storage system that provides for rapid and efficient dispersion of course materials on request. Students and/or teachers can order a particular program or course to be made available to the learning station at a specific time. The Program Master will, upon receiving this request, determine the optimum time in which to upload the program. This arrangement can handle multiple orders for the same program and reduce traffic on the network.

The Local Area Network & Communication Switchboard will allow teachers to connect with a student's terminal that is logged-on. Students will similarly be able to connect with teachers. Connections may be made with many stations for conference-type calls, so

that groups of students working together as teams can communicate telephonically if that is desired.

The Program Master is a computer program utilizing databasing (and eventually artificial intelligence) techniques to monitor all internal (within the school) and external digital data transference at the electronic school. It has the ability to analyze, sift and sort data, make decisions, delineate tasks and interact with data storage and retrieval systems.

By utilizing simple databasing technology and tracking student progress through time, the Program Master can be set to run a series of comparative analysis tests to determine student progress. If a student is seen to be performing out of his/her usual range or the expected normal range of comprehension and achievement, the computer will report this information to teachers and counselors. As artificial intelligence programming becomes available the Program Master may learn to make suggestions and assist the teacher in locating alternative programs for the student. The Program Master also can monitor and evaluate the interaction between students and teachers. Should the computer determine that a particular student has been inadvertently neglected, it can notify the teacher of this situation and the teacher may determine what steps, if any, are needed. This provides better checks and balances to ensure that students don't slip through the cracks. The Program Master also will be able to recognize changes in behavioral patterns of individual students with regard to study habits and notify teachers and/or counselors of these changes.

The Program Master provides an isolated and controlled testing environment which will enable secure testing for accurate measures of student progress.

For a student or teacher the Program Master can be a source of reference material and resources contained in the system which could help in a particular subject area. Other databases could be listed or connected to the Learning Station such as the Community

Learning Network and access to host computers via Internet and similar resources.

THE TELECOMMUNICATION CENTER

This center provides connections to networks, to other schools and to databases, enabling the Learning Center to access the very latest technologies and courses by accessing sources such as the University of the World Clearing house and the Community Learning Network of that clearing house. It also provides internal communications within the school.

Components include a satellite dish, microwave transceivers, telephone lines. This combined with: modem/fax cards; e-mail and voice mail, allow a wide variety of communication abilities with Internet and similar networks and providers of courseware.

The Local Area Network enables student and teacher communications, with each having an assigned code and address, carried in the Program Master file. The code will allow users to access the system. This access may be recorded for billing purposes. Communications outside the school can be restricted for student users by blocking access at any local gateway.

The satellite dish allows direct communication links to any participating system. Inter-school teleconferencing and access to global lecture halls would become possible with this equipment.

SUMMARY

We believe that the introduction of new technology will dramatically change many aspects of a traditional school. With computer-assisted studies students can move along at their own pace, therefore the traditional class structure is not necessary. Physical proximity is no longer required to form a "student body".

Therefore students can be physically grouped according to their age while following classes according to their intellectual abilities.

Thus the schools can enjoy the advantages of keeping age level grouped (emotional ties with ones peers, school size, graduating to another school, physical education, lunch and play activities); while providing each student the opportunity to group according to their levels of achievement in particular subjects, in seminars and team projects. Thus at each component there would be students doing work at the next higher component and could be grouped with students doing similar work. Slower learners would be able to receive more individual attention and encouragement, so that all students would progress at a faster pace than is normal in the traditional class structure.

SCHOOL 2000 OPERATIONS

Basically the Learning Center operates quite similarly to traditional schools, the principal difference being that some students will spend much time singly, or in teams, in front of their computers at learning stations. They will be moving through courses at their own pace, using teacher tutorial help as needed. Other students will be in seminars, classrooms, laboratories, or involved with physical education activities.

Students at the beginning elementary level may spend as much as one third of their in-school-time at learning stations. As they advance in learning levels this will increase to one half or more of their time being spent in the electronic environment depending upon the individuals needs.

There is understandably a question as to the impact on school-age children of spending a considerable portion of the school day working alone at a learning station. We believe that we are able

to provide numerous opportunities for interaction with other students and other kinds of socializing to offset this possible impact. We believe that the system will encourage more interaction between the student and the teacher. The pros and cons of this kind of a school will be discussed later. Students will move through the system at their own pace rather than follow the traditional "lock-step" system of grades. Thus the usual grade arrangement is not necessary. Rather students will be grouped with their peers according to their progress, following a particular or generalized curriculum. They will be linked with other students in project teams and in classrooms, labs and physical education activities which will provide for peer integration. With the vast amount of resources available, curricula may readily vary from one school district to another, reflecting local needs and interests.

Children come to school at vastly different stages of mental and physical development. School 2000 must be able to help each child move forward from the stage they are in. Some children cannot spell or count or recognize colors. Others are experienced on computers and well advanced in early learning reading and writing skills.

The School 2000 classroom, for the early grades especially, will be a place where many groups of similar skill levels operate independently of other groups. The teacher must orchestrate all of these different activities while having a sense of each groups' needs and progress.

Teachers will need to become child development specialists along with their teaching skills in order to be able to monitor each child's readiness to move to a new skill area or learning level. And the teacher will need to be supported by aides who can bring needed skills such as a foreign language of children new to this country and who will need special help. Some schools today are confronted with having to integrate children from as many as twenty different cultural backgrounds and as many different first languages. No single teacher is likely to be able to span such a

broad spectrum, but usually people can be found to aid the teachers by explaining to students in their own language and cultural patterns what is happening in their classroom or study group. This, then, is a good example of how community resources could and should be used in schools. School 2000 will make a major effort to involve parents, business leaders, service clubs, and interested individuals in the learning process where such assistance is appropriate and controllable.

The need for elementary teachers particularly, to have child development skills suggests seminars for imparting these skills. Teacher training and retraining will be an essential part of School 2000's operations.

An important difference from traditional schools lies in the methods of evaluation and achievement. Computer and video courses will be designed to promote mastery of the course material and more advanced concepts or ideas will be withheld until the earlier concepts have been fully understood. This requires all students to learn the material and to apply it in a variety of situations. Thus the familiar grading systems are not useful. All students will remain with a subject until it is passed. Another difference is the ease with which multi-disciplinary courses can be utilized in the electronic school.

By having students of all ages at the school concurrently it will be possible to utilize older students to teach or tutor younger students. Peer group teaching is facilitated through the availability of data which show strengths and weaknesses of students in any given subject area.

Student data, which can be provided by the Program Master, makes it easy to form teams or student groups, for example by proximity of their homes, by similarity in interests or needs, by psychological characteristics—in many ways.

The environment for the youngest children will be different from that of those who become experienced in this school; their introduction to learning in the cubicles will be gradual, and their integration will depend upon their skill and success in the learning stations. During the first years they will only have one teacher, but after that should be ready to interact with an increasing number of teachers.

The fast learners in the secondary school or students with special interests can be allowed to take college-level courses.

Graduation from each level of School 2000 will occur when students successfully complete the core subjects and required number of elective courses. This will occur at different times for different students. For students who complete most requirements but have problems with a particular subject, intensive special help will be available to ensure graduation. For students planning on University careers, counseling and testing services will be made available.

It would be possible for students whose homes have computers to connect them to the Learning Center and to enable them to study from home. Initially, at least, it would seem desirable for such students to do home study for only a portion of the week and attend school for the balance. Handicapped, sick or rural children could do a large part of their studies in this way. Home study, which follows the work undertaken at school, allows students to progress faster. It would be desirable for schools or school districts to develop funding sources so that home-bound or rural students could acquire computers and modems through the school.

School 2000 would operate year-round and it could be open for 16-20 hours a day, including weekends, if a substantial community or adult education interest developed. It would be possible for individual students to spend more time at the school if they so desire.

With a year-round school plan vacation times become more flexible and may be more readily made to fit into students and parents' needs and schedules. Also students wanting to progress at a faster rate, or that have special interests, and those that need to catch up could take shorter vacations.

SCHOOL 2000 ADMINISTRATION

The administration of School 2000 will be different from managing traditional schools though the staffing likely will be of the same order. The focus on the use of computer technology and the administrative data it will provide will change the way the tasks are handled, but until some experience is gained in using these resources it is not fully clear how. Perhaps the most difficult administrative challenge will be the range of ages of students at the one facility. It probably will be necessary to have assistant principals assigned to oversee the pre-school and elementary, the middle and the high school age groups.

The counseling functions should be simplified because of the amount of data which will be generated on students. This will allow counselors to be aware of changing patterns of learning and involvement and to bring students in for interviews before real problems emerge.

School discipline problems are expected to be reduced because students will be engaged with subject matter—and enjoying it. There will be systems in place for monitoring students which will help those concerned with truancy and school discipline.

Teachers continue to be a very important aspect of the Learning Center. Training teachers to function in the environment is vital to its effective operation. Because of the constant increase in knowledge, the Learning Center will assist and encourage

teachers to become themselves lifelong learners, both for their own benefit but also to serve as exemplars for their students. We would like to see students graduate from the Learning Center having experienced joy in learning with a commitment to continue learning throughout their lives. The teachers will be a strong influence in achieving this goal.

It will be necessary to include as a component of the teacher training studies the use of computers in the instructional process. Just as students at the electronic school will need to be computer literate so will teachers, counselors and administrators.

Teachers will need to learn how to function in their new role as tutors, mentors and counselors. Some will continue to function as teachers as we now think of them but most will find new roles and will need to learn how to perform in this new situation. Summer training programs prior to the inauguration of School 2000 in any community would be a useful way to introduce teachers to the new concepts.

To achieve true multi-disciplinary learning we need to provide an environment for our teachers that will facilitate their working collaboratively and will enable them to continue their personal advancement. By placing all age groups in one centralized structure we are able to bring teachers together on a regular basis and provide opportunity for teamwork which crosses both disciplines and age grouping.

However cooperative and collaborative projects can be achieved by teachers in different schools by networks within the school district (MAN—metropolitan area network) or within different parts of a learning center school by local networks (LAN—local area network). E-mail can be utilized for quick communication and video conferences for more intense or complicated projects. These technologies allow teachers to exchange ideas and reach decisions without being physically together. Teachers also may reach outside the school district to a vast array of resources through Internet.

In all of these technologies the computer is the communication medium.

SCHOOL 2000 LIBRARIES

Libraries in The Learning Center will include book libraries and well as electronic libraries. How reading will be done in the future is anyone's guess. We will not presume that students will feel comfortable with electronic books. However we will not preclude the wide acceptance of that medium if the learning value and ease of use of the electronic book matches or surpasses that of the paper book. More than likely they will both work together towards the enlightenment of our students. Specific subjects and data may be more accessible in electronic books while it may be more convenient to use paper books for stories.

Electronic libraries offer many advantages over conventional libraries. From electronic libraries students can do bibliographic searches for texts and subjects within that text. These searches can be performed from school, home or from any computer with a modem. Internet access also allows for access to University & host computers library systems around the world (currently more than 315,000 host computers are available through this system).

Another advantage of the electronic Library is that the students don't have to leave their seat to access the information that they seek. Whichever form of reading the student feels comfortable with and benefits that student most will be the form that that student utilizes.

Electronic libraries will have the advantage of offering a wider variety of media to the student. Video Disc Interactive, Compact Disk Interactive and Multimedia programs will become more and more readily available as the producers of courseware discover

the advantage of the expanding market. Also video or video disk collections will give even more opportunity for the student to explore other worlds of information.

The Public Broadcasting System is now cataloging and offering their extensive collection of information to schools around the country. The BBC is doing the same thing as is The Turner Broadcasting Corporation.

Today's students, being raised on and in the world of high tech are becoming increasingly more able, as a seemingly innate ability, to utilize the array of new electronic hardware that becomes available each year. The School 2000 will have the capability of incorporating this hardware into its libraries or classrooms when it is financially able to do so.

SCHOOL 2000 CURRICULUM CONSIDERATIONS

Though the School 2000 concept agrees with Loris Malabuzzi, head of Italy's recognized progressive school program in Reggio Emilia that "a school needs to be a place for all children, not based on the idea that they are all the same, but that they're all different", the curriculum of an electronic school would not differ substantially from that of schools today. There would be a rigorous mandatory program in core subjects which would have to be mastered by every student: English, Mathematics, Sciences, Geography, and History. There would be a special focus on writing skills and the acquisition of a foreign language. Economics and political science courses should give students necessary tools for adult life. Other emphasis would be on interpersonal skills, group dynamics, negotiation, mediation, and discussion. The primary focus is to equip students with skills which will serve them well for life in the information age: the ability to evaluate informa-

tion, the ability to set priorities and the ability to make decisions.

Students also would be able to follow individual interests covering a wide range of elective subjects. For students not intending to go on to college, the school would provide a job-oriented curriculum. With video playback, students will improve their job interview skills. Apprenticeship training can be incorporated in some of these career paths with the cooperation of the business community.

Daily programs in physical education are planned along with classes that teach about the body, its development and healthy lifestyles.

Though the curriculum for different Learning Centers might vary to some degree because of local concerns and interests we have suggested in the following material the courses and subjects best suited, as we see it, for a totally new educational venture. Our aim is to equip students for the world into which they emerge as their schooling ends—a world in the information age with global communications and interdependence economically, environmentally and politically. Thus understanding the cultures, history, geography, politics, ways of thinking and living of other people is important. Students should know how countries live together, their alliances, resentments and wars, as well as similarities and differences. Understanding of what is happening in the present and the cultural and historical reasons for contemporary developments is important knowledge for students everywhere. We are convinced that ways will be found to combine the studies of history, geography, political and social sciences, biology, art, music, language and comparative religion through studies of regional cultures with interdisciplinary approaches.

The approach to learning in the School 2000 is one that gives the students a feeling that they actively participate in their own educational process instead of feeling that choices are imposed on

them. Even in mandatory subjects there can be a choice. There are nearly always several good computer or lecture courses for every subject and every level. Since every person has different approaches to the learning process, to let students have some choice in selecting these courses will give them a feeling of control and, with this, a greater willingness to learn and higher levels of achievement.

Another area of choice could be the close association with a mentor teacher. Students would interact with a large number of teachers for the different subjects, but it would be advantageous if they could be more closely associated with one teacher, where both teacher and student feel a special bond and the teacher can, for a longer period, guide and encourage the student.

There is a general agreement that one of our most important tasks is to raise the level of achievement of our students in the core subjects and especially in math and science. A school that makes intensive use of the new technologies by using telecourses by eminent teachers and good courseware in these subjects would allow all students to have an excellent education. Since students would advance at their own pace and slower learners would receive more individualized training, the achievement level could be significantly increased for all students, and students with above average aptitude in certain subjects could advance into college level and get a head start on their college education. Self paced learning enables learners to be divided into different groups. For example in New Zealand's reading classes children are divided into emergent, early and fluent groupings with more teacher attention being given to emergent groups while fluent readers are encouraged to pursue more independent learning.

Beside computer aided instruction there will be an equal amount of studying in groups of similar achievement levels with hands on experience, research and discussions to develop critical thinking skills. Since science and technology advance so fast, of equal importance to learning the facts known up to today is the

development of the skills for lifelong learning to keep abreast of new ideas, research and innovations. There should be continuous discussion of new developments as they occur in all scientific fields.

To raise the achievement level of students in the core curriculum subjects, the School 2000 will use different approaches simultaneously. Beside of the concept of students advancing at their own speed and increased help for slower learners, there will be a greater amount of hours devoted to the core subjects. It would be mandatory for every student to have weekly, a minimum number of hours in English, math, science, history, geography and a foreign language. Some of these hours could also be included in interdisciplinary study approaches. Core subjects will have mandatory requirements that need to be achieved before passing on to electives on those same areas. To put it in a nutshell: first the basics, then the frills.

In the Realistic Mathematics system for math instruction developed by the Freudenthal Institute of Utrecht University in the Netherlands, students learn at their own pace and structure solutions in their own way. Students visualize a problem and estimate the answer rather than memorizing formulas. Algebra, geometry and statistics are integrated in the curriculum which introduces each subject with a discussion of a real world problem to show how integral a part of ordinary life mathematics really is. All Dutch children start with Realistic Mathematics and perhaps this is why they actually like math and score higher on the standardized tests which rank the performance of students in industrialized nations. These ideas are incorporated into School 2000 thinking.

Another area of emphasis is the development of writing skills. Though writing on the computer will come easily and naturally, it is important, too, that students develop penmanship skill which will enable them to write with pencil or pen on paper and to express their thoughts in rational ways by either means. Built

into most courses will be reports, critiques and essays which provide opportunity for students to express their ideas in writing.

The development of creative skills such as in art and music are important aspects of each student's education. Those whose talent is recognizable will be encouraged to fully develop that talent. Hands-on involvement as well as viewing and listening to some of the wealth of resources available through video and computer programs will ensure that students have ample exposure and gain a feeling of the importance of the arts through the ages and in all cultures.

Foreign language study will start early and each student should become capable of reading and writing and have some fluency in speaking of at least one language other than their native language. Students whose native language is not English can be helpful as peer teachers.

Dutch students learn English in school while many learn French and German also, for as many as eight years. True, as adults they will need to know these languages, unlike in the United States, but this lends an acceptance for the idea of learning other languages by the whole society. It is the thing to do and expected by everyone to happen. In the United States motivation has to come from within the student or his/her family.

The system of having older students help or guide younger ones has worked well in New Zealand's excellent reading programs. These classes encourage new readers to progress at their own pace in what is described as "natural language learning".

Interpersonal skills will be emphasized throughout the curriculum. These include leadership and followership training, self-esteem development, public speaking, discussion, negotiation and mediation skills. As students near the end of their studies they should learn interview techniques, the value and sound use of money, and preparation for studying at universities or colleges.

For students choosing to work rather than continue their education, apprenticeship programs, perhaps even alternations of work and study—in cooperation with the local business community—will be indicated.

The learning center would be connected via network with other schools, around the country and the world. Students and teachers would have access to the vast amount of information that is assembled in databases. This would not only further the students' education but give them the tools to access information throughout their life. It would allow teachers to continue their studies, update their knowledge in their special field and broaden their views and knowledge in general. Students could also be engaged in discussion with other children across the country and around the world. They would undertake collaborative projects in all fields. The school would become a window to the whole world, where they would learn to understand students from different parts of the country and the world. Networks cut through cultural and ethnic biases, participants on networks are only judged by ideas.

All the technical equipment would lend itself to many innovative teaching approaches. The students could organize in groups to make movies acting out everyday situations of concern to them as well as enacting course material like historical plays or as help in language studies. They could write their own screenplays (in language studies in the foreign language) and act it out. As they would need actors, cameramen, sound, lighting, editing etc. students would have different assignments depending on their interests and skills.

An important part of the educational process will be guidance in the scheduling and choosing of the students courses. Mentor teachers and or counselors will ensure that courses which will be necessary for a college or university admission will be taken when appropriate. Students will have a choice in the selection of courses.

For all students, and starting early on, there will be emphasis in the desirability and the need for continued learning throughout their lives. Students will be given the skills to find helpful resources after leaving school and the motivation to keep abreast of new ideas, research and innovation.

ELECTRONIC EDUCATION DEVELOPMENT

From a national viewpoint there are three kinds of needs which have to be confronted to enable the full development of electronic education. First there needs to be a networking of schools. This network should be by computer networks through existing telephone systems and by fiber optic networks in which present telephone lines are replaced by fiber optic cable systems. The telephone companies of this nation are proceeding to install fiber optic networks but at a pace which they can afford rather than the pace required by the need. The Japanese government already has committed \$250 billion to achieving networking of every school, business and home with a high speed fiber optic network. This goal is admittedly more readily achieved in Japan than in our country but we also need more commitment to achieving this goal.

The second need is to inventory and rate the presently available software and courseware which can be used in classrooms or by teachers to supplement their instruction. There are presently surveys which provide some of this data but none are comprehensive enough to meet the growing need for computer and video courseware.

The third need is for the creation of a delivery system in which the courseware required by a particular school can be provided overnight and be ready for teachers when they come to school.

Fortunately there is activity in progress in all of these areas which will be detailed shortly. Also there is much activity in schools at all levels to suggest their increased involvement in the use of communications technology in their on-going teaching programs. This chapter will provide a number of examples of this increased use which suggests that, despite a teacher resistance to incorporating such technologies in their classrooms, more and more are being converted to the wisdom of becoming personally and directly involved. The School 2000 project would seek to involve teachers who have had beneficial experiences with the application of technology and to provide training for those not yet committed.

There is in the process of creation a Consortium of School Networking (CoSN) which ultimately hopes to bring every school into a network so that teachers, students and administrators can exchange ideas and data and create new relationships by use of computer messages. Already over 650 universities and colleges in the United States are on line with the Bitnet network through EDUCOM which now is moving towards extending the network to public and private schools. Existing state networks in several states will enable CoSN to move more quickly in reaching out to all schools. CoSN also is seeking funding for a New Alexandria Library which would provide resources for educational users in schools and colleges. Another project would update an existing survey of educational resources. These two projects address the need described above.

To provide for the third need a massive venture is about to be launched with federal and private funding known as the Community Learning Network (CLN). This ambitious undertaking will provide a national education technology and information delivery system to cooperating schools and school districts. The parent entity of the School 2000, the University of the World, is an active participant in the Community Learning Network and plans to extend these networks overseas. The availability of the information provided by CLN will enable schools of the type of School 2000 to function

effectively throughout the United States when the CLN network is in place commencing later this year.

The Community Learning Network will be a delivery system that manages a flow of information to and from a National Resource Center by satellite or fiber optic cable to regional repositories, called Community Resource Centers.

These regional repositories will capture and send a flow of data, voice and video images, to school classrooms and remote sites such as home bound students, business offices, health care centers, etc. Each community user will pay an hourly fee to use the system while the nations' schools will have access for little or no cost. This system will enable teachers to order the resources they need for overnight delivery and immediate use on the following day. Computers and other equipment in schools will store the information until called for by the teacher.

This system will also enable video conferences between schools so that classes may be viewed, seminars held, and teams of students can interact with teams in other schools throughout the nation.

Another delivery system to schools, the Channel one news program provided to high schools by Whittle Communications will be expanded to an additional 12,500 schools. Currently almost 10,000 middle and high schools in 47 states receive these programs.

Other examples of use of telecommunications technology in school classrooms:

- (1) A recent survey by the Public Broadcasting System shows that television is used in the K-12 classrooms of public schools enrolling 23 million students or 61% of all children in K-12 schools. There is now one TV set for every four classrooms nationally.

- (2) A Kentucky educational television project which provides remote schools with access to quality learning in math, science and foreign languages received a Ford Foundation award for innovations in local government. The Kentucky Star Channels have been outstanding examples of the use of educational technology in the classroom.
- (3) The Cable TV industry is becoming increasingly interested in school use of its programs. It now provides free cable service to 12,400 public secondary schools, some 40% of the total. By December of this year all public high schools will be receiving such service. Consideration is being given to extending cable hook-ups and services to elementary schools.
- (4) The Public Broadcasting Corporations Adult Learning Service has provided courses to 1.7 million students over the past 10 years. These courses have been available to high school students both in their homes and in their schools.

Meanwhile there are numbers of examples of new courseware being introduced:

- (1) The fiscal 92 appropriations bill of the US Congress includes two million dollars for the establishment of a National Endowment for Children's Television which will receive funding to be reallocated to producers of children's educational programming.
- (2) The Annenberg Foundation has promised the Corporation of Public Broadcasting five million dollars a year for 12 years to award for projects that will accelerate the reform of math and science education.
- (3) TV Ontario's high school courses called Concepts in Science and Concepts in Mathematics are now available on video discs. Bar code laser scanners provide instant access to program seg-

ments. Bar codes are being used increasingly to enable teachers to quickly locate segments of programs.

- (4) Computer based courses produced by the Josten's Learning Corporation are reaching age groups from 3rd to 12th graders. They are now being used in 6,000 schools nationwide. Other major suppliers of computer courses for schools are the Computer Curriculum Corporation of Sunnyvale, California, and the Wicat Systems of Orem, Utah. Computer Courses reach a wide variety of students from the gifted to the troubled and everything between. It enables self paced instruction which is so vital in meeting the needs of a wide variety of student skills and ability. In this age there are computers in almost every home where parents value education and can afford computers. Their children come to the first grade already computer literate and with many reading and writing skills which poorer families have not been able to provide to their children. This poses immediate problems for teachers who are confronted with such a wide range of preparatory skills. Teachers typically solve this problem by grouping their students by ability but this means only one of the groups has the teacher's attention at any one time. With computers in the classroom, the other groups can advance at their own pace through computer aided studies. It is a substantial help to the teacher to have these resources to turn to knowing that both fast and slow learners will be receiving the help that they need while the teacher's attention is directed to a particular group.
- (5) Project Gutenberg is a 10 year effort of Illinois Benedictine College to establish a library of electronic books. Such books will be read from a computer screen from computers equipped for CD ROM disks. Such disks are purchasable for \$2 a copy, though Project Gutenberg hopes to include 10,000 of the most widely read books on its disks at a price of one cent per book, plus the cost of shipping and handling. Titles such as Alice in Wonderland, Moby Dick, Peter Pan, Aesop's Fables and Roget's Thesaurus are currently available.

And finally new hardware emerges almost daily to make dreams become reality. This process of development and obsolescence creates problems for administrators who, because of the involved expense, cannot hope to remain for long at the state of the art, but wide acceptance brings about reductions in price and secondary markets provide opportunity to trade in so that even with limited budgets some new acquisition is possible. An example of an emerging technology which could help future schools is in the merging of television and computers said to be achieved in a product of Frox Inc. With the Frox system everything is controlled through the TV screen with a one-button remote control. This is called a wand and sends a white gloved hand across on-screen displays that resemble the control panels of a TV set, video-cassette or recorder. Viewers can display TV schedule grids on screen, call up details on any single program and order their VCR to tape a selection at the push of a button. Sports scores or stock quotations can be received. All of this comes with an enhanced video image that Frox claims "virtually matches HDTV".

**RESEARCH AND EXPERIENCE
SUPPORTING THE CONCEPT OF SCHOOL 2000**

There exists a large body of literature describing various aspects of learning with computers in the classroom and a small but representative sample of literature is cited in Appendix A.

Books and papers have been published that describe computers in education (1-10), educational software and guides through the maze of available programs (11-17), publications that evaluate software (18-22) and others that give directions on how to create courseware (23) and guide parents through teacher-tested educational software (24). Publications have been written about computer-aided education for children with learning disabilities and other special education situations (25-29). The changing role of the teacher in this new teaching environment has been described and

also the education that teachers need to function effectively in it (30-32). There are many articles about computer-aided instructions in the different subjects taught at school (33-38) and about teaching of English as a second language (39). There is a large body of literature about computer networks in education (40-44) and about computer-aided teaching in other parts of the world (45-47). Congress and the state legislatures held lengthy hearings on most of these subjects (48-49).

There are many innovative ways of computer use instituted in different school and for different age levels, in different subjects and with different software. How well the teacher chooses and introduces the software and conducts these courses is a large factor for the success rate of these programs. Since there are so many variables, even well thought-out and executed studies to measure the success of computer-aided instruction against teaching without computers can only give the answer for this special situation and can not be generalized.

Many teachers are enthusiastic about computer-aided teaching and convinced that their students learn far better and more successfully this way. One teacher says: "The kids don't pay attention when I lecture, but when they are at the computer they are working all the time. They are definitely less inhibited in asking questions." A math teacher points out: "Instead of me telling them the theorem, they are discovering it themselves and applying it." Teachers also stress as benefits that students are able to work at their own pace and teachers have the time to pay more attention to struggling students.

James Kulik, a researcher at the University of Michigan's Center for Research on Learning and Teaching (50), has examined 250 studies of classrooms where computers are used merely as electronic workbooks. Even in this limited capacity he found that the computers clearly helped students master basic skills better.

The Congress's Office of Technology Assessment reports: "There is a general consensus (based on anecdotal evidence) that the appropriate assignment of new technologies within effectively organized schools could make a big difference in academic performance."

But despite of these clear indications of the benefits of computer-aided teaching and the increasing numbers of computers in schools, a 1989 survey by John Hopkins University researchers revealed that, at that time, more than half the teachers in high school still did not use computers at all in their teaching. In schools where computers were available, students used them only one or two hours a week, and half of that time involved how-to instructions in computer use rather than on subject study.

There is clear evidence that computers in most schools are not an integral part of subject-matter instruction. The reason seems to be that most technology enters schools not with any thoughtful plan, but computer use appears sporadic, donated by PTA or computer companies. And only very few schools prepare new teachers to take full advantage of the new technologies in their classrooms. Teachers already on staff very seldom get systematic training in computer technology and in the new classroom strategies they will need to adopt.

With all the experimentation directed at improving our schools, there are now quite a number of schools that have large successful programs that adapt computer-aided instructions into their curricula.

We cite as an example a school in the State of Washington, called Cougar Valley Elementary School, which is in the Central Kitsap School District. This school already uses at the elementary level many of the elements that the School 2000 envisions for all grade levels. The district needed to expand and built two new schools. Teachers, administrators and parents were involved in rethinking the education process and outlining the new goals.

Cougar Valley Elementary School was the first of the two schools built. The building has 22 classrooms arranged in a cloverleaf design with movable walls and curving hallways, to keep the school as flexible as possible. Some of the nontraditional approaches that were adapted by the school are: teachers often work in teams, teaching several grade levels at once; each class has a partner class at a different grade level with which they regularly meet for activities; handicapped children and children with learning disabilities are blended into regular classes for the entire day and found to become more capable as they thought they could be by this approach. Instead of emphasizing work sheets and textbooks, teachers focus on group work and individual practice on the computer.

Teachers find that their role is totally different from traditional teaching. They are facilitating and directing learning instead of lecturing. The students mostly ask each other instead of asking the teacher. For math, for example, teachers can divide the students and let the advanced students work on the computer, while they give their attention to the slower learners. At the end of the day, the teacher can read the computer printout on the students that did their assignment independently. The printout outlines the success rate, length of time spent on each problem and other details and helps the teacher to determine the content of the next lesson.

The new technology also relieves the teachers of many time-consuming chores and increases communication among the staff. Teachers keep track of attendance, place lunch orders, schedule meetings and communicate with their colleagues and the principal through electronic mail. By extending the student's school day by half an hour, teachers have one afternoon a week for group planning. There is also emphasis on communication between parents and the school. An on-going challenge for the school is training teacher on the new technology and the teaching techniques. The school has 250 computers for 570 students. There is also a telephone in each classroom. If teachers don't want to get inter-

rupted, they can have their calls go to voice-mail and answer at a convenient time. The computerized phone system provides updates on school activities, scheduling and lunch menus. Parents can call at any time to hear a recording of this information. Some teachers are leaving homework messages for parents. In the evening, the parents can call the school, enter the room number of their child's class and get a recorded message from the teacher about what the class did that day and what homework was assigned.

The principal reported to us they have no hard database yet on increase in achievement levels still they all are enthusiastic about the school. The students have better discipline, have fun learning and the teachers find that this translates into increased achievements.

SCHOOL 2000 TEAM MEMBERS

The persons who have met regularly over the past year to develop the concept of The Learning Center, described in this proposal, come from considerably different backgrounds and approached the task with widely differing experiences. The design team learned of the plan for "designs for a new generation of American Schools" about half way into this work year by attending one of the PBS broadcasts aimed at stimulating interest in the activities of the New American Schools Development Corporation. Thereafter our thinking has been restructured to meet the criteria contained in the RFP and with the intention of submitting a proposal incorporating our ideas. We have been pleased to find the considerable synergy between our original concepts and the ideas being proposed by the New American Schools Development Corporation.

The design team for School 2000 are a project group of the University of the World which had as its initial goal the design of a "student work station" that incorporated the use of educational

technology for individual students. The thinking about a single work station quickly led to thinking about its use in classrooms and eventually to the creation of new schools based upon the use of such technology as the basis for instruction. This effort continues to be a project of the University of the World and will be pursued in that milieu regardless of what transpires with NASDC.

We have been fortunate that two of our design team members have been educated in Europe and later have become familiar with education as it is practiced in the United States. We see it as a positive that none of the design team members has actually functioned as a teacher or administrator in our public schools though two of the team have had considerable experience in teaching, research and administration in good American universities. This lack of familiarity has led to frequent consultations with public school teachers and administrators who have contributed their criticisms and enthusiasms, all of which have been duly incorporated into the proposal.

The strengths of the design team are those of youth and wisdom, of experience in computer programming, video and film production, architectural design, research, and educational administration. All of these skills have been brought to bear on the evolution of the School 2000 concept. One team member has served on quality review panels in several San Diego schools over the past three years which has provided opportunity to see the present functioning of schools at several levels. As a team we believe that we have the necessary skills within the group--or accessible through consultation--to carry out this bold concept in reforming American public education.

Names, titles, addresses and phone numbers of all principals:

Martin Chamberlain, Ph.D.
Co-Director and Administrative
Coordinator
2468 Rue Denise
La Jolla, CA 92037
Home: (619) 459-0332
Office: (619) 456-0103

John Reisman, Co-Director
and Technology Coordinator
321 W. Kalmia Street
Fallbrook, CA 92028
Home: (619) 723-6221
Office: (818) 507-5657

Louise Schmidt, Ph.D.
Curriculum Coordinator
8281 Camino del Oro
La Jolla, CA 92037
Home: (619) 459-0367

Aurelia Provvedini
Facilities Design Coordinator
6353 Mercer Street
San Diego, CA 92122
Home: (619) 546-1137
Office: (619) 284-2523

The lead contractor is the University of the World and its' agent with responsibility for managing the team's work and executing its contract with NASDC is Martin Chamberlain, Executive Vice President. The accounting activities will be performed by Mary Ward, Administrative Assistant at the University of the World's Central Office in La Jolla, California.

Advisers who have contributed critiques and ideas to the proposal as submitted include:

Mr. John R. B. Clement
Director
K-12 Networking Project
EDUCOM
1112 16th Street, NW, Ste. 600
Washington, DC 20036
(202) 872-4200

Dr. Justin Lancaster
Executive Director,
Environmental Science and
Policy Institute
Harvard University
Pearce Hall 117
Cambridge, MA 02138
(617) 496-1457

Mrs. Ann Emanuels
Principal
Carmichael Elementary School
Carmichael, CA 95608
(Sacramento)
(916) 971-7667

Mr. James Meinke
Teacher, Lakewood High School
14100 Franklin Boulevard
Lakewood, OH 44107
(Cleveland)

Dr. Gloria McMillan
Teacher, La Jolla High School
750 Nautilus Street
La Jolla, CA 92037
(619) 454-3081, X-238

The resumes of past experience for the project team follow:

Martin N. Chamberlain, PhD

Educated in public schools in Washington state. Earned B.S. in Mining Engineering at the University of Washington and a PhD in the division of Social Sciences at the University of Chicago 1960.

Worked in private enterprise until WWII. Served as an officer in US Navy; commanded a destroyer 1944; retired as Captain, USNR. Employed at University of Washington as director of continuing Education and at the University of California, San Diego as Dean of University Extension, Assistant Chancellor for Community Relations and director of Summer Session. Served as director of U.S. Peace Corps in Tanzania 1963-65. Extensive list of publications.

Aurelia Provvedini

Educated in French Schools until age 16, graduated from high school in the US. Studied dance, theater and music in Paris, London and Los Angeles. Enrolled in the New School of Architecture in San Diego and currently completing bachelor's thesis. Has begun apprenticeship-training with San Diego architectural firms and the San Diego City Planning Department.

John P. Reisman

Educated in California. Earned certificates in sound reinforcement, recording engineering & video production. Worked for the Armed Forces Radio and Television Service. Extensive experience in the fields of audio production, engineering, film production, production facility management, satellite broadcasting and computer applications in management. Special interest in computer networks.

Louise Schmidt, PhD

Educated in German Schools and earned the equivalent of an MA degree at the Freie Universitaet in Berlin. Took an MA and PhD degree from the Professional School of Psychological Studies in San Diego, 1981 Employed as a research associate at the University of California, San Diego. Did family and adolescent counseling in the

Old Town Counseling Center. Publications both in the U.S. and Germany.

Resource Persons: [To be used as consultants if the School 2000 project is funded.]

Dr. Rita M. King
University of the Pacific
3601 Pacific Avenue
Stockton, CA 95211
(209) 946-2670

[Curriculum & Teacher
School of Education]

Lt. Col. James S. Cary
2518 B North Fairfax Drive
Arlington, VA 22201
(703) 247-8315

[Networking and
Technological Applications]

Mrs. Ann Emanuels
Principal
Carmichael Elementary School
Carmichael (Sacramento), CA
95608
(916) 971-7667

[Elementary Teaching and
Elementary Educ. Admin.]

Mr. John R. B. Clement,
Director
K-12 Networking Project
EDUCOM
1112 16th Street, NW, Ste. 600
Washington, DC 20036
(202) 872-4200

[Networking]

Dr. Gloria McMillan
Teacher, La Jolla High School
750 Nautilus Street
La Jolla, CA 92037
(619) 454-3081, x-238

[High School Education] -

Dr. Dee Brock
3533 Piedmont
Plano, TX 75075

[Learning Resources]

BUDGET

The following budgets are detailed for years one, two, and three of the project and summarized for years four and five. The budget envisions the first year being spent on (1) perfecting the design of School 2000 Applications; (2) arranging its installation with school districts in representative areas; (3) designing a variety of models which school districts could use in modifying their facilities to enhance the use of technologies in the teach-

ing/learning transaction; (4) writing publications, supported by research to be investigated, which encourage teachers to use educational technology in their classrooms; (5) designing teacher seminars and workshops to help move teachers into the technological world and experimenting with such workshops to determine how to meet the teachers' needs as well as achieving the desired results with minimum disruption to school and personal activities; (6) reviewing and judging the quality and usefulness of educational technology resources and creating a resource catalogue. Year one will be used to set the stage for intensive applications of the School 2000 concept in the following years.

Year two will be the year that the concept becomes reality. Initially the project will be developed in remodeled classrooms in a variety of schools with differing student bodies. Efforts will be made to expose the concept to a wide range of student abilities and backgrounds and in different parts of the nation. Agreements to do this will have been negotiated during year one so that implementation can proceed when and if phase II funding is received.

Year three will see a continuation of the use of the concept in existing schools but will focus on the creation of a new school designed to provide full implementation to the School 2000 concept. Thus the year three budget contains funding for building and equipping a new school built to showcase the concept from designs created during the two previous years.

Years four and five will be devoted to publicizing the concept and developing ways of getting it widely implemented throughout the U.S. and abroad. Because the emphasis in phase III will be on public relations and selling the concept, no detailed budget is provided here. Such a budget will evolve during phase II as the acceptance of the concept begins to emerge.

School 2000 Budget

YEAR ONE:

A. Staff		
1.	Design Team Personnel	
	John Reisman, Co-Director (3/4 time)	\$ 45,000
	Martin Chamberlain, Co-Director (1/4 time)	15,000
	Louise Schmidt, Curriculum Design (1/4 time)	15,000
	Aurelia Provvedini, Facilities Design (1/2 time)	30,000
2.	Other personnel	
	Secretarial/clerical	<u>40,000</u>
	Total Salaries	145,000
3.	Fringe benefits 15%	<u>21,750</u>
	Total Salary Expense	\$ 166,000
B. Travel Expense		
1.	Air: (San Francisco-300, Salt Lake-300, Chicago-450, New Orleans-450, Washing- ton DC (2)-1000, Texas-450, New York- 600, Atlanta-500, Seattle-350	4,400
2.	Ground	500
3.	Hotels	1,800
4.	Meals	<u>1,080</u>
	Total Travel Expense	\$ 7,780
C.	Computer Service Costs	3,000
D.	Subcontract Costs (Programming/Program Master)	60,000
E.	Consultant Services	5,000
F. Other Direct Costs		
1.	Materials and Supplies	2,000
2.	Equipment	15,000
3.	Instructional materials	20,000
4.	Software	<u>3,500</u>
	Total Other Direct Costs	\$ 40,500
G.	Payments to Schools	
	Staff Development (model teacher training program)	22,000
H.	Construction, Renovation	
	Create Model Learning Center	5,500
I.	Overhead 10%	30,553

J.	General and Administration	10,000
K.	Fee or Profit	<u> --0--</u>
	TOTAL YEAR ONE	\$ 351,083
YEAR TWO		
A.	Staff	
1.	Design team (as in first year)	\$ 105,000
2.	Other personnel	<u> 45,000</u>
	Total Salaries	150,000
3.	Fringe benefits 15%	<u> 22,500</u>
	Total Salary Expense	\$ 172,500
B.	Travel Expense	
1.	Air: (San Francisco—300, Dallas (2)—850, Washington DC (2)—1000, New York (2)— 1000, Atlanta (2)—1000, Seattle—450)	5,550
2.	Ground	650
3.	Hotels	2,300
4.	Meals	<u> 1,500</u>
	Total Travel Expense	\$ 10,000
C.	Computer Services Costs	4,000
D.	Subcontract Costs	7,500
E.	Consultant Services	8,000
F.	Other Direct Costs	
1.	Materials and Supplies	2,500
2.	Equipment	22,000
3.	Instructional materials	12,000
4.	Software	<u> 12,000</u>
	Total Other Direct Costs	\$ 48,500
G.	Payments to Schools	\$ 14,000
H.	Construction, Renovation	\$ 212,000
I.	Overhead 10%	\$ 47,650
J.	General and Administration	10,000

K. Fee or Profit

 --0--

TOTAL YEAR TWO

\$ 591,800

YEAR THREE

A. Staff

1.	Design team	
	John Reisman, Co-Director (100%)	60,000
	Martin Chamberlain, Co-Director (25%)	15,000
	Louise Schmidt, curriculum (33 1/3%)	20,000
	Aurelia Provvedini, design (75%)	45,000
2.	Other personnel	
	Secretarial\clerical	50,000
	Construction Supervisors	<u>55,000</u>
	Total Salaries	245,000
3.	Fringe benefits 15%	<u>36,750</u>
	Total Salary Expense	\$ 281,750

B. Travel Expense

1.	Air: (Dallas (2)—800, Washington DC (2) —1000, New York—500, Atlanta—500, Seattle—450)	2,800
2.	Ground (including local mileage)	4,800
3.	Hotels	1,200
4.	Meals	<u>840</u>
	Total Travel Expense	\$ 6,840

C. Computer Services Costs

3,000

D. Subcontract Costs

15,000

E. Consultant Services

5,500

F. Other Direct Costs

1.	Materials and Supplies	2,500
2.	Equipment	85,000
3.	Instructional materials	15,000
4.	Software	<u>1,900</u>
	Total Other Direct Costs	\$ 104,400

G. Payments to Schools

\$ 25,000

H. Construction, Renovation

\$1,875,000

I. Overhead 10% (less construction)	44,149
J. General and Administration	15,000
K. Fee or Profit	<u> --0--</u>
TOTAL YEAR THREE	\$2,375,639

YEARS FOUR AND FIVE

The budget for years four and five will be determined by the success of the projects created in years two and three. Attempts will be made to get stories of these successes in the news and in print. A campaign will be developed to publicize the results and to solicit interest in replications of School 2000. Publications will be developed to explain how to achieve similar results through local resources. The persons involved and the continuing effort will revolve around publications, publicity and travel to provide on the spot encouragement to school districts or communities which show interest in having School 2000 replications. Years four and five will focus primarily on public relations and sales activity.

The contractor for this project, the University of the World, is a non-profit organization with a 501(c)(3) status from the Internal Revenue Service.

APPENDIX A
SAMPLE OF RESEARCH LITERATURE

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