# Doc Says Goodbye

**by Irwin J. Hoffman, PhD**

As one of two teachers left on the faculty that opened GWHS in 1960 I want to share my thoughts with the faculty and student body. I have been privileged to work with wonderful students and colleagues over the years. For me the teaching profession was rewarding, fulfilling, and exciting. During this time I have seen our school rise into prominence as the national exemplar in computer education. The capstone to my career was the designation of GWHS as a computer magnet so all students in Denver could benefit from the creative ideas and curriculum available in our computer education department.

Working with young people like you stimulated my life and gave it a zest most people never see. Your exhuberance and excitement for learning was infectious. If I could do it all over again I woudln't change a thing. Take advantage of the remarkable education available at George and as you consider a career remember how exciting teaching can be. Thank you for the privilege of sharing in your life.

I thought it would be appropriate to say goodbye with an essay on my views of education.

# Beyond Literacy Towards Fluency: An Education Appropriate For The Information Age

**by Irwin J. Hoffman**

It defies common sense that contemporary issues do not pervade the education of America's youngsters. An understanding of the controversial and often life threatening dilemmas of our society is essential for our students to become informed citizens and, as a consequence, a knowledgeable electorate. These current problems are of pervasive concern, and most of them are imbedded in controversy. The diverse subjects taught in a comprehensive high school could individually make their own contribution to an intelligent understanding of life in our complex society. The controversies can be presented within the context of each discipline so that the rubric of the subject matter can be presented while the course contributes to the "warp and woof" of an overall understanding of modern society. The "glue," holding together this integrated curriculum, is the computer.

There will be a paradigm shift in the framework used to deliver education. Goals will change from regurgitative knowledge to generative knowledge. Educators will be concerned with how students learn rather than what they learn. Methods will change. Naisbeitt, in his book **Megatrends** pointed out that ownership, teamwork and networking constitute a new methodology that produces results in successful Information Age enterprises. Educators will have to utilize these new techniques as they modify and update the curriculum.

Networking will extend learning experiences beyond local sites. Already Robert Tinker of Cambridge has established an activity-oriented large scale science activity. Geographically separated groups of students are collecting acid rain for analysis. It is not hard to see the value of a computer network as a catalyst to this activity. Foreign language students at George Washington High School in Denver are using the Source (a public information utility) to send letters to pen pals in foreign countries using their Spanish, German and French word processors. Telecommunications and satellites facilitate this activity in our "increasingly shrinking" world.

The six headings presented below are suggested as typical guidelines under which the pressing issues of contemporary society could be studied and for which a new educational framework could be designed. They are designed to provoke a discussion regarding alternatives to our current educational delivery system. Technology has made it possible to seriously consider such modifications. Horizontal and vertical integrated articulation of learning is now possible and the education establishment should "plumb" the depths of this potential.

**The Shrinking World** — Travel, Communication, Terrorism, Other Languages, Other Cultures

**Environmental Issues** — Pollution, Erosion, Decline of Natural Resources, Institutional Responsibilities, Infrastructure, Ozone Depletion

**Moral Issues** - Genetic Engineering, Drug Ingestion, Impact of Religions, Hunger, Prejudice, Aging, Politics, Medical Care, Family Structure Changes, AIDS

**Technological Issuesd** — Micro Chip, Laser Beams, Fiber Optics, Space Exploration, Changing Work Place, Consumerism, Information Age, SDI, Technical Reading and Writing

**Recreation** — Leisure Times, Appreciation of Art and Music, Fitness

**Futurism — Change in Velocity:** Past History — Present World — Imminent Future

A creative K-12 curriculum developed around these issues would provide a strong basic education for children. Reading, writing, arithmetic and technological skills could be mastered in any context. Students should be prepared for modern society by studying the basic tenants of each discipline contextually within an infrastructure of modular curricular offerings that offers a total treatment of each issue.

Teacher education will be changed as new teachers are prepared to teach within these infrastructures. The universities will eschew their customary (inherited) departmentalization of man's cognitive forays and develop new ways to "package" knowledge. For instance, a university might have a department of Environmental Issues. Within this department science, technology, mathematics, social science, art, music, etc. would be oriented to prepare all students, including prospective teachers, to intelligently analyze the issues that impact on the world's environment. The power of mathematics and science as an interpreter of phenomena will be given to everyone, while the abstract structure of these disciplines will only be offered to those who are capable of understanding it. No longer will mathematicians and scientists impoverish (intellectually) the non-scientifically inclined by postponing (withholding?) such analyses until a student has reached a specific level of expertise in their fields. Instruction will change so that the question so often asked, "What good will algebra do me?" will become "When do I get to study the rules of algebra? I see what it can do." The use of the power inherent in these subjects will motivate the study of the subjects. An example of extending this power downward is found in using spread sheets on the computer. A non-algebraically oriented student could study any application that requires exponentiation on the computerized spread sheet without an in-depth knowledge of algebra. Half-life, growth of bacteria, investments and many other applications of mathematics requiring a knowledge of exponents and logarithmns would be available to students who would never study these subjects.

The elementary school of the future would staff itself with a faculty whose college degrees might include majors in the topics listed above. The former Physical Education majors will become Recreation majors with an understanding of how recreation impacts the environment, an awareness of the values of art, literature and music as leisure time activities, and become part of the academic faculty instead of existing in the twilight zone of academia.

Naisbitt observed changes in the operation of the corporate world. The academic world will respond to the same forces. An exciting spirit in the education enterprise will develop as students and teachers network, material is developed by projects undertaken by students teams, and ownership of the curriculum develops at the grass roots level of practicing teachers. The authoritarian model of education will gradually disappear as the effectiveness of this new technology becomes apparent. Students who lag behind in required skills will find remediation available in sophisticated CAI programs, replete with adaptive testing and administartice procedures. The colleges will be forced to accommodate the changed demands for their "product."

Examples of erstwhile efforts in this direction are already taking place in isolated pockets around the country. The teacher developed "PIC" program in Jefferson County, Colorado, is producing an integrated curriculum for grades 1 and 2. Jefferson County's "Topics in Science," program integrates the sciences for grades 6 and 7. Teachers in the school district of Fort Collins, Colorado, are developing an integrated high school science program, called "Project Engineering." This program, also, could be redesigned to require parallel units in business, mathematics, English, social science, art and industrial art. All of the above programs encourage students to work in teams and provide networking opportunites for students and teachers alike. The outstanding curriculum in the Denver Public Schools magnet computer laboratory at George Washington High School uses the computer to integrate social science (questionnaire design and data collection), mathematics, English, and computer science in a popular class called Technical English. This course emphasizes networking, team-work and student ownership, undergirded by an integrated software package that includes a word processor, a spreadsheet; a data base, report generation, and a graphics package.

The University of Chicago is piloting a major new mathematics curriculum called UCSMP, "The University of Chicago School Mathematics Project." Dr. Usiskin, an author of this program, indicates that some of this new mathematics curriculum comes from the social studies and business communities. Except! The social studies and business departments are unaware that this curriculum is being tested in their school. Mathematics teachers are the sole owners of this curriculum modification, even with its purported applications to the real world. Interdisciplinary integration is not often a requirement of grant offering institutions or a priority of principal investigators.

In the late '70s the National Science Foundation (NSF) supported research called "Project Synthesis." The results of this study proposed an integrated science curriculum, still not a synthesis with the other humanities, but nevertheless a start. The Congressional mandate of the NSF only provides funds to support research that is totally related to the advancement of the science curriculum. Congress should mandate the Foundation to pursue research that develops an integration of science mathematics and technology across the entire curriculum. Scientists must not only compute, they must read and write critically and understand the social consequences of their work.

The scientific literature abounds with schemes for a unified curriculum that promotes scientific and technological synthesis in the curriculum. Why does this literature ignore the necessity of bringing in the humanities? Roger Bybee of BSCS, located in Colorado Springs, Colorado has established a whole conceptual framework (Appendix A) under which a unified science program could be taught. One could easily envision an entire integrated curriculum under this framework.

Many scientific disciplines are suggesting modifications within their area of concern. The advocates of modernization within the mathematics curriculum are suggesting changes that recognize the value of the calculator and computer. Mathematicians point out that the division algorithm, except for single digits, is no longer necessary. The National Council of Teachers of Mathematics (NCTM) and the Mathematics Science Education Board (MSEB) suggest that calculators be part of instruction from early primary school. At least four states are including calculator items in their standardized tests for next year. The College Board has instructed the Educational Testing Service to develop a mathematics level 2 test that require the use of the calculator. The NCTM is advocating changes in geometry and the development of high school courses in finite mathematics. However, I like the science people, mathematicians are not suggesting that mathematics unify with the other humanities.

It seems to me that the suggestions for change in the mathematics and science curriculum have an implicit agenda for a totally integrated curriculum. Yet advocates of these changes are so entrenched in their own interests that these suggested modifications stop short of a truly appropriate, integrated education. Mathematics, science and the other humanities should be taught as servants of each other, not as masters of their own fiefdom. The curriculum for this education should stress the dependency each discipline has on the other. Learning activities should be correlated between disciplines.

Mathematicians and scientists are not solely to blame. Rarely do I see suggestions of curriculum modifications in English and social science that advocate a partnership with mathematics and science. Each discipline seems to exist in an isolated relationship, whereas in reality they are completely symbiotic. English teachers must teach technical reading and technical writing. Instructors who are involved in teaching students to write research papers must address the new methods of collecting data in bases and analyzing this data with application programs such as graph generation, spread sheets, and word processors. English teachers who restrict their instruction card catalogues, and do not include the library electronic search routines with modems and computers are doing their students a distinct disservice.

In my opinion the year 2000 will see a change in the K-12 curriculum, demonstratign the symbiotic relationship among all subjects. Students will no longer

(Continued on Page 5)

(Continued from Page 4)

study any field as a subject in its own right, but will study all disciplines as an application toward understanding contemporary issues in society. The K-12 curriculum will produce citizens who: (1) can comprehend the problems of their time; (2) participate in the dynamic vocational and avocational evolution; and (3) are able to read, write, compute and communicate effectively in the Information Age. Instruction in the next century will discard the outmoded remnants of a curriculum developed by the pressing needs of the Agricultural and Industrial Ages.

Twenty-first century instruction will be graduated to reflect the natural skills of the students. The subject matter studied at all levels will reflect the society students will join. For instance, all students might study problems related to retirement. In a mathematics application, those students who are capable of mastering algebra will examine investment issues with equations, logarithms, exponentiation and the rule of 70. Students who are not as capable, mathematically, will study the growth of investments with application computer programs, calculators, spreadsheets or the analysis of pre-printed tables. At the same time the social science classes will discuss the problems of retirement, social securtiy, IRAs and Keogh plans. Social Science classes might also discuss the history of FICA, the depression and other issues that bring investment growth into perspective for the students with research, reading and writing skills appropriate to this subject. A combined English, art and social science project might involve creating a brochure for a nursing home.

Higher education will have the responsibility of taking those students who are "turned on" by a discipline and making specialized scholars of them. Students will still enter college with the algebra, geometry and trigonometry necessary to study higher subjects; however, they will have studied these subjects within the context of societal issues. The training of teachers will be modified to reflect the changes in methods of instruction. Colleges must develop better writing skills in mathematics and science teachers. Teachers of English and social science will have to be taught the roles of mathematics and science as descriptors of their disciplines. The use of the computer will have to be taught in all areas of teacher preparation. Lip service to the use of this tool will have to be replaced with an effort to produce genuine competence in the use of application software. Universities will have to train administrators to work in a networking environment. There will be many changes. The Information Age will make its demands and we must respond!