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Information Technology
A Core Subject: Is it Time?

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Introduction

Children have incredible imaginations. At the kindergarten age they can be observed at school cutting and pasting, coloring and learning the letters of the alphabet. Their fine motor skills are obtained and concentration develops. In grades 1 through 6 they learn about the world around them with history, social studies, reading, writing and arithmetic. Projects are sent home and research skills are challenged. In grades 7 through 12, children now at the age of reason have developed some higher order thinking skills allowing them to explore some abstract concepts, which abound in their environment. Communication takes on a whole new meaning. Now granted, these students have developed varied learning styles. Some develop as visual learners. Others are audio learners, while yet others seem to find stimulation in hands on demonstration. How these learners are characterized creates a variety of concerns for educators. One major concern is the emphasis education places on achievements measured by functional testing in core subject areas and promotion utilizing senior exit exams. These conceptual and sophisticated recordings of the results from 12 years of public education foster curriculum development, and ideas inherent in the educational design of the modern public school educational system, as it is known.

Let us for a moment, address maladjustments in the learning process. As an institution, education has been reformed throughout history as a means to incorporate and lessen the impact of such cultural-lags as: the belief in the dualism between supernatural and natural affairs as opposed to the belief in the continuity of humans and nature; the conflicting beliefs of how human nature and personality have their origin and are developed; conflicting theories of human intelligence, reason, intellect, and the learning process; and the social role that a culture assigns to organized bodies of knowledge (i.e., the liberal arts, and the practical arts) (Butts, 1947; Mulhern, 1946). In the last century, a project team, led by Anthony F. Gilberti, an educator from Indiana State University, ahead of his time and known for his radical visions, described Technology as a Core Subject (n/d.), in the following:

> In the twentieth century, the institution of education is again being reformed to meet the needs of the evolving technological society, and lessen the impacts of the cultural-lags being created as a result of the use of organized bodies of knowledge (i.e., science and technology) (p. 3).

This vision manifested into the maladjustments known as the integration of technology in education. In this century there are three identifiable forms of technology integration used in education as described by Heather Kirkpatrick and Larry Cuban in Techonos Quarterly Summer 1998 Vol. 7 No. 2, Computers Make Kids Smarter—Right? Cuban (1998) wrote:

> "Are teachers both the problem and the solution? This is not a playful question. We stress that policymakers, practitioners, and parents need to know what they want to achieve with technologies, be familiar with research findings on CAI, CMI, and CEI, and connect their aims to what is known".

CAI, CMI, CEI

> CAI (computer-assisted instruction) refers to computer programs that provide students with drill-and-practice exercises or tutorial programs.
>
> CMI (computer-managed instruction) refers to programs that evaluate and diagnose students' needs, guide them through the next step in their learning, and record their progress for teacher use. Both CAI and CMI de-emphasize the role of the teacher in tending to student learning.
>
> CEI (computer-enhanced instruction) differs from CAI and CMI most noticeably in that its programs provide less structured, more open-ended opportunities that support a particular lesson or unit plan. Use of the Internet, word processing, and graphing and drawing programs are examples of CEI. Teachers in CEI are viewed as essential to the learning process, because simply seating students in front of their computers to surf the Net will not result in the same learning curve as when teachers assign well-designed projects in which students use the Net to gather information (See H. Levin et al., "Is CAI Cost Effective?" in Phi Delta Kappan 67 [1986], no. 10.).

In CAI the role of the teacher is partly based on fascinator and administrator of the program method, which relies on assistance to the student to follow the program. The instructor does take part in the evaluation component. With CMI, on the other hand, the role of the teacher is even less influential as the designed program is based on mastery and dependency is shifted more to the software instruction instead of the teacher involvement. For example, Jostens is a manufacturer of educational and instructional software that allows students to learn and develop in core subjects at their own pace and restricts movement to the next level until mastery is proven. It even provides diagnosis of responses to identify the student's weak areas of the subject matter presented. The instructor does not take part in the evaluation component. CEI is completely different form Computer Managed Instruction and Computer Assisted Instruction in that the program provides far less structure and more differentiated opportunities that support a teacher designed lesson or unit of subject. It is an Internet supported, project based form of technology integration for project designed individual and team student learning. Use of the Internet, word processing, graphics, animation, and drawing programs are essential to the lesson process. Simply seating students in front of their computers to surf the net will not result in the same learning curves as when teachers assign well-designed projects in which students use all the tools available to them to learn. Note: This would be for advanced students possessing the basic skill sets and somewhat advanced technological skills to survive in a Computer Enhanced Instruction environment. Two examples would be a Web Design class where a variety of software applications would be essential or a Computer Installation class where technology skills and knowledge such as locating and downloading device drivers would be critical. The American Association for the Advancement of Science (1993) noted:

> The task ahead is to build technology education into the curriculum, as well as use technology to promote learning, so that all students become well informed about the nature, powers, and limitations of technology. As a human enterprise, technology has its own history and identity, quite apart from those of science and mathematics. In history, it preceded science and only gradually has come to draw on science-knowledge of how the natural world works-to help in controlling what happens in the world (p. 42).

As described above in "the task ahead," does technology needs to be recognized in education as a core subject? Has technology ineffectively been integrated in education? Data will be referenced on the national, state, district and local school levels. Technology, to be effectively administered, should be taught as a core subject from K-12 with a progressive skill set and functional assessments. Will true technology integration of instruction into other core subjects develop naturally as a demand? The thrust to learn with technology presents many variables and could be debated for years. Given some sense of rational in the traditional educational setting, in some form are we not describing a varied attempt, leading technology education to evolve into a core subject? Aforementioned, in this introduction are the descriptive elements from K-12 that allow children today to formalize their education with conventional tools. Humans have quantum leaped into the technological era. References indicate that our children are ready to make that commitment. But is the educational system willing to recognize the preparedness necessary to thrust students into higher education and the global workforce?

Literary Review

Accurate data is invaluable to assess the influences; growth and impact information technologies have on education. Studies into information technology and the effects of computers in classroom have varied over the past twenty years. Recognizing this, Smolin and Lawless, in their article, Becoming literate in the technological age: New responsibilities and tools for teachers, (03) quoted technology literacy as:

> "the ability to use computers and other technologies to improve learning, productivity and performance" (U.S. Department of Education 1997). Furthermore, "a technologically literate person is someone who understands what technology is and how it can be used is comfortable with its use. For students, "technological literacy goes beyond just knowing how to use technology tools such as word processing and the Internet. It is knowing how to use them in conjunction with school subjects to increase academic performance" U.S. Department of Education).

Other researchers, Cuban and Kleiman, examine "Myths and Realities about Technology in K-12 Schools" (01).

> "We are in the midst of an explosion of multimedia digital technology-computers and all that goes with them-in K-12 schools throughout the country. Propelled by federal, state and local incentives, schools spent an estimated $6.9 billion in 1999 on desktop computers, servers, routers, wiring, Internet access, software, and everything else involved in making modern technology available. Education funds are enhancing the bottom lines on Intel, Microsoft, Apple, Cisco, IBM, and other high-tech companies" (p 1).

Many other studies examine:

- The Impact of Information Technology on Teaching and Learning
- Using Technologies to Improve Student Achievement
- Adequate Training for Teachers
- Technology Integration
- Curriculum
- Higher test scores.

The National Center for Education Statistics is the primary federal entity for collecting and analyzing data that is related to education in the United States. Contained in this site are "Quick Links" that will provide hundreds of references related to information technology in schools.

This study is about information technology in Maryland public education, i.e., computers. To understand what has transpired over the past ten years, first look at the trend and ratios of computers users and the increased availability of computers in schools. The data that is about to be presented is available on the Internet to anyone willing to access it. Throughout the United States, each Department of Education is required to record a yearly inventory, listing the number of computers per student. Data is generally compiled by, administrators media specialists and technology department heads. This data is critical in planning technology growth on several levels. First, the state requires each school district and each individual school to submit data, which is compiled and used for future federal technology funding requests. Next, an additional questionnaire is submitted describing the level of teacher knowledge and skill. Additionally, the state records the percent of classroom computers with Internet access. In Maryland, the compiled report is called the Technology Inventory Summary/Digital Divide and can be found on the web at http://msde.aws.com/freq.asp. It is kept separate from any Maryland student assessment scores, which examines students' general knowledge in areas such as English, government, algebra, geometry and biology. Many other tests are administered, to measure even more student standards.

According to the Maryland State Department of Education, the ratio of "student-to-computer" has dramatically increased from 1995 to 2001. It is reported that in this span, the number of computers made available to students has increased from 16 students for every 1 computer to 5 students to every 1 computer in the State of Maryland alone. Is this trend alarming? How many dollars were spent? According to the Milken Exchange, a special report was published in Educational Weekly. "The State of the States," reported on Maryland and citied a five-year plan for Maryland schools. In 1995 they estimating $150 million dollars would be spent on technology. The report stated the following:

> "Maryland's technology funding is distributed among all districts for wiring, hardware, software, and professional development based on technology needs as ascertained by statewide data collection. Districts must prioritize schools with high needs (p. 1).

Teacher knowledge and skills have increased, as well. Maryland reported in 2001, that 89 percent of the teachers use computers, 88 percent use the Internet but only 70 percent use the computer for technology integration (p. 7).

Are Maryland teachers effectively using technology in the classroom? According to the data above Maryland teachers are utilizing technology in the classroom to a limited degree. If there are three forms of technology application, CAI, CMI and CEI and only 70 percent of teachers are reporting technology integration into instruction, than it raises a suspicion about technology integration in instruction and just how efficiently and effectively it is utilized. That poses another relative question. In Maryland does technology improve student achievement? As reported, billions of dollars have been spent since nation wide and $150 million was allotted in Maryland in 1995.

The Maryland State Department of Education from 1993 until recently, measured student achievement with an instrument known as the MSPAP. According to the Department of Education, there has been some measurable progress reported in student performance. However, it was not considered overall and did suggest that minority students were not equally performing. Since there are hundreds of downloadable documents, formulating every conceivable outcome, it is suggested that interested individuals search this site. The results can be found at the Maryland State Department of Education. A brief summary of the MSPAP findings, are as follows:

> MSPAP results do not provide solutions for improvement, but highlight areas where schools are doing well and where they may need to improve.
>
> The tenth annual *Maryland School Performance Report*, released on December 1, 1999, shows that Maryland's schools are making steady and substantial progress toward meeting state standards. This year, 43.8 percent of Maryland students achieved a satisfactory score on MSPAP, compared with 31.7 percent when the first test results were released in 1993. Gains have occurred in rural, suburban, and urban school systems and in large and small schools alike. Seventy-seven schools across Maryland recorded a composite score of 70 percent or better — seven times the number in 1993. Eight of the twenty-four school systems achieved composite scores above 50 percent, with one school system reaching 60 percent. Just as MSPAP results allow schools and school systems to diagnose and resolve weaknesses, state-level data provide the impetus for many state-sponsored programs and legislation designed to counter discouraging performance trends. Among the continuing problems identified by the 1999 MSPAP results is slow progress in middle schools, particularly in reading. Despite strong gains in third- and fifth-grade reading (10.6 and 16.7 point increases respectively) over the course of testing, progress remains slow in the eighth grade, where only 25.3 percent of students met the satisfactory standard.

Since the MSPAP did not product the desired outcome to continue funding, the Maryland State Department of Education instituted the High School Assessments. The "HSA" are prescribed to measure students' progress in core subject areas, much like the MSPAP, and are described as follows:

> High school assessments are a test of a student's knowledge of **Core Learning Goals** contained in certain course content areas. The tests will be given after the student completes a course containing the Core Learning Goals. Students entering grade 9 in fall 2001 will be required to take tests in English I, government, algebra/data analysis, geometry, and biology.
>
> **Skills For Success** include learning, thinking, communication, technology, and interpersonal skills that students will need in the 21st century. These skills should be taught in every course and will contribute to student performance on all the tests.

Has technology and the infusion of hundreds of millions of dollars to equip Maryland schools, over the past ten years played a significant roll in education and student achievement? The measurable student outcomes, reported by the Maryland State Department of Education, in compiled data, indicates that Information Technology in Maryland schools is not effective in these areas. There are also numbers of offspring problems to contend with. Just some of these technology related problems are:

- The Total Cost of Ownership (TCO) of Technology
- The Technology Gap
- Teacher Shortages in Technology
- The Technology Divide
- Digital Classrooms

The Maryland State Department of Education has recognized these and other technology related problems. Presently, Maryland has "stepped up to the plate" while spending even more dollars in an attempt to remedy these and some other related technology issues.

Maladjustment, or something that can be described as poorly adjusted and not suited for particular use in ones' environment is representative, of technology described as a tool. Technology Tools in core subjects such as mathematics and science place an incredible amount of weight on technology alone, i.e. computers and the Internet. The dependences on information technology are described as so much more than a tool. A pencil is a tool. It can be used to create, formulate and replicate. A pencil can also be used to delete, erase or edit. A computer connected to the Internet has unlimited research abilities allowing knowledge as power to be accessible to every student. As reported by the Department of Education, information technology has flooded schools. Teachers are under utilizing this technology in core subjects. Therefore, information technology is maladjusted in education K-12. Is it time to adjust information technology and make the paradigm shift in this discipline as a core subject each year, with a progressive measurable skill set? Gilberti's article, Technology as a Core Subject as a Core Subject, referenced to the American Association for the Advancement of Science, back in (1993) and strongly noted:

> The task ahead is to build technology education into the curriculum, as well as use technology to promote learning, so that all students become well informed about the nature, powers, and limitations of technology. As a human enterprise, technology has its own history and identity, quite apart from those of science and mathematics. In history, it preceded science and only gradually has come to draw on science—knowledge of how the natural world works—to help in controlling what happens in the world (p 42).

Effective technology applications engage and stimulate learners. Students challenge, question and develop skills relative to societal needs Properly designed and assessable technology curricula can create learning environments conducive to the demands of higher education and workforce preparedness. Information technology has become perpetual in education.

Conclusion

I see education being held hostage by an old regime. Change is coming but with the speed of Vatican II. Radical change, immediate reform or a plain old step in the right direction will be the growth plate of information technology education in K-12. Students are entering college confused, unprepared and blind to technological skills and expectations.

Each state, every school district and furthermore, every individual school is reluctant to conform to a blank technology curriculum for K-12. They should not be blamed. There exists a decade long flood of as many types of hardware and software packages as DNA combinations. Evidence in Maryland provided by the Department of Education allows gathered data from individual school districts, individual schools and educators to indicate that conformity is a seed in unfertile soil.

School boards have changed guard unsynchronized three times in the past ten years during the technology flood. Principals conform to new corporate philosophies, changing budgets and the demand of functional assessment exams. Educators peer across the technology divide which separated them by tenure.

This research is not all about the ills of education even though the finger was pointed directly at several recognizable sicknesses. There can be a prognosis. For technology to improve student achievement, information technology should become a core subject in K-12 education. If technology is not being used effectively by teachers than students should be allowed to learn technology as a core subject. Are students not the teachers of the future?

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