eSATS Statewide K-12 eLearning System Design Delivers the Means to Effectively and Efficiently Implement Many Current and Emerging Policy Initiatives

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Executive Summary

Arizona has a rich set of K-12 education policies that address significant improvement in academic performance and graduation rates. The cumulative goal is graduate success over a life span of higher education and competing in the globally competitive 21st Century work place. The effect of eLearning system adoption was analyzed for sixteen of these policies. The transformative effect of eLearning played a critical role whether it was teacher capacity and availability, 21st Century work skills, math and science, high school renewal, or finance. The innovative effects of eLearning play out in the classroom, community and online; merge with legacy book work; focus on the teacher-student interrelationship, and integrate a life span of self-paced learning for our students.

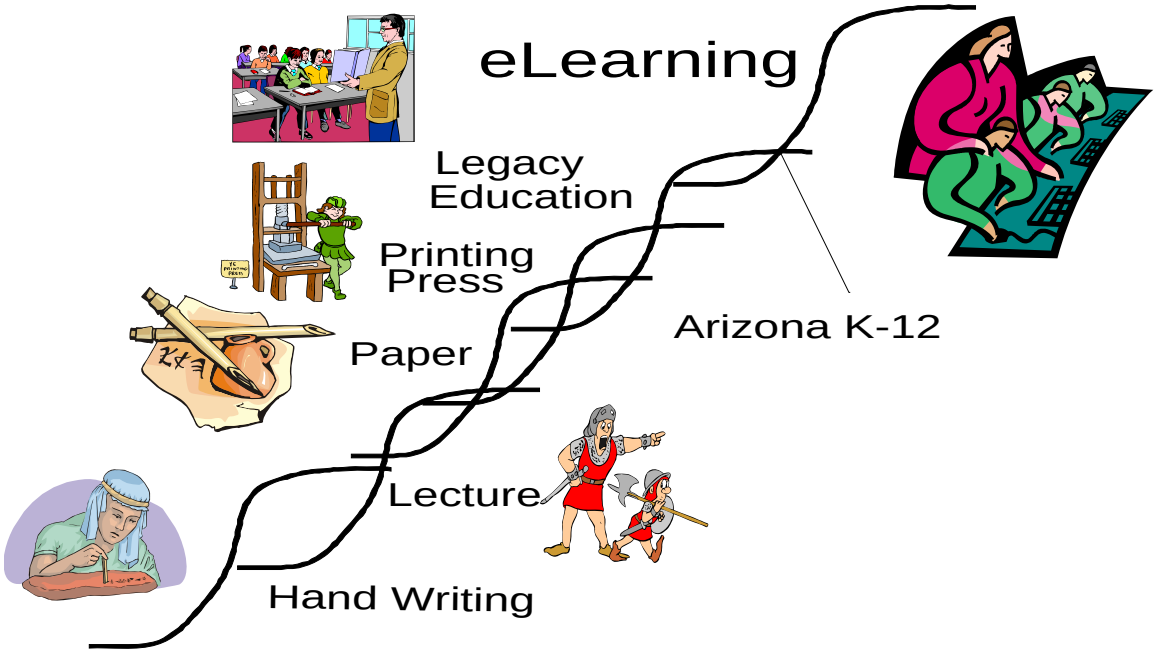
Introduction:

Arizona is rich with K-12 educational vision. It comes from a broad array of sources. Some of these sources include: Governor Janet Napolitano; Arizona Department of Education; Arizona Legislature; Arizona Board of Education, Arizona Regents, the educational organizations AEA, ASA, ASBA, AZBO; advocacy groups Arizona Business Education Coalition, Greater Phoenix Leadership, Pima County Business Education Roundtable; Councils and Commissions such as P-20, GCIT, CIAC; institutes from Morrison to Goldwater; foundations from Rodell to Flinn; business, technology and enterprise cluster groups like TRIO, ATC, eSATS, ATIC, GAZEL, SATC, AzTEA, G"X"EC's of AZ; Arizona Department of Commerce; many Chambers of Commerce; Universities and Colleges; Boards and Commissions; and National entities such as US Dept. of Education, NEA, NASBE, SIIA, Partnership for 21st Century Skills; National Governors Association, and Arizona superintendents and boards of governors of local educational agencies.

Most enhancement policies focus on legacy education (lecture, recitation, and seat work). A few include technology as a component supporting legacy education such as high-tech high schools. A few have comprehensive policies for educational technology such as eSATS design, the Arizona Department of Education's technology plan and US Department of Education ("Toward a New Golden Age in American Education"). Others focus on a specific element such as teacher training within ASSET and support from IDEAL.

eSATS-GAZEL and predecessor organizations have addressed eLearning as a transformational policy based on a system design. The transformation is from content, tools and pedagogy of legacy education to content, tools and pedagogy of eLearning. eLearning design focuses on the teacher-student interrelationship as the critical design element. This element requires (at the school, district and state level) a system approach to support leadership, teacher education and professional development, digital curriculum, automated formative and summative assessment, data and decision support, much more individual student-teacher contact, individually paced learning, personal learning plans, funding for mastery learning, and access to computer interfaces and the Internet when individually needed.

The rational for eLearning transformation is that in the 300 years since its Prussian innovation, legacy education has reached maturity and a point of diminishing returns. Our current enhancement policies and funding will produce incremental improvements using legacy education. A recent study highlighted the massive investment of dollars and human effort required with legacy education (Rodel Foundation's "Lead by Five"). Industry maturity theory tells us that this state is normal for any industry. But large improvements are required if we are to maintain our global competitive advantage in the Information Age. Transformation onto a new innovation cycle is possible if content and processes change; employees retrained and educated; and technologies adopted. For K-12 education this transformation is delivered by what we define as eLearning.



The rapidly growing demands of global competition require both learning of core knowledge and new 21st century skills that have rapidly outpaced the capability of legacy education's incremental enhancements.

Our emerging generation of children (now labeled the Millennium Generation) is being raised in media rich, high tech, information and communication centered homes of play, learning and work. Their education environment needs to rapidly embrace these same dynamics if there is to be a significant increase in academic performance and graduation into 21st Century higher education, and related societal and work experiences.

Integrating eSATS eLearning Design with Education Policy Initiatives

The following analysis addresses a continually developing set of Arizona K-12 educational policy initiatives. We cast a wide net. We welcome any corrections and additions. We then used the eSATS system design to address our understanding on how eLearning could deliver a cost effective means to implement these policies.

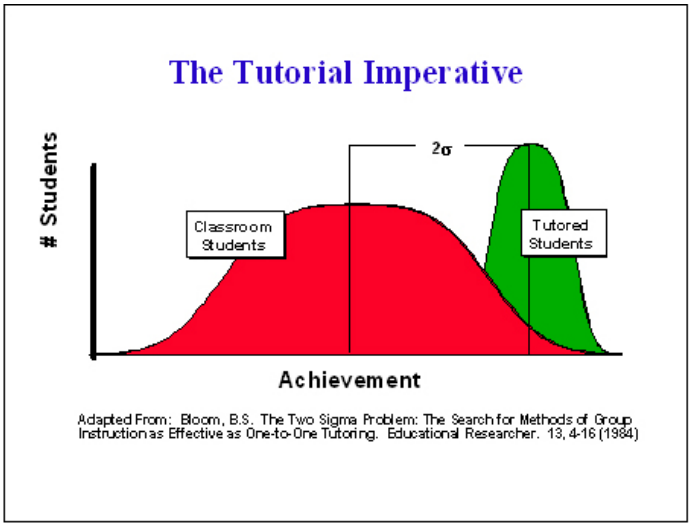
This set of 16 initiatives focus mostly on policies from Governor's Council on Innovation and Technology, P-20 Council, National Governors Association and Arizona Board of Education – Arizona Department of Education with others from a wide range of sources.

P-20 Vision **(draft-to be finalized on 12/12/06)**:

Every graduating student from the freshman class of 2012 will be prepared for work and post-secondary education in the 21st Century.

1. Improve from the current 70% four year secondary school graduation rate to 86% in 2012, and 93% in 2020. The required age to remain in school will be raised from 16 to 18 year, unless graduation takes place earlier. No Child is Left Behind.

eLearning addresses the inertia of social promotion with the more effective promotion based on mastery learning. Students learn at their own pace with automated personal learning plans and formative (immediate) assessment. Passage to the next academic grade level is based on mastery of required academic subjects and skills, verified by summative assessment. This means that every student can learn at their most effective pace and will graduate with a C or higher grade level (not grade inflation – superior learning). No Child Left Behind criteria is satisfied at every grade level. eLearning redraws the bell shaped curve, reducing its left side volume because of increased motivation and self-paced success for the struggling student.



eLearning emulates a tutor with much higher individual teacher-student contact time and a high level of interaction.

Interactivity: Classrooms, Tutorials, Computer-Based Instruction (CBI)

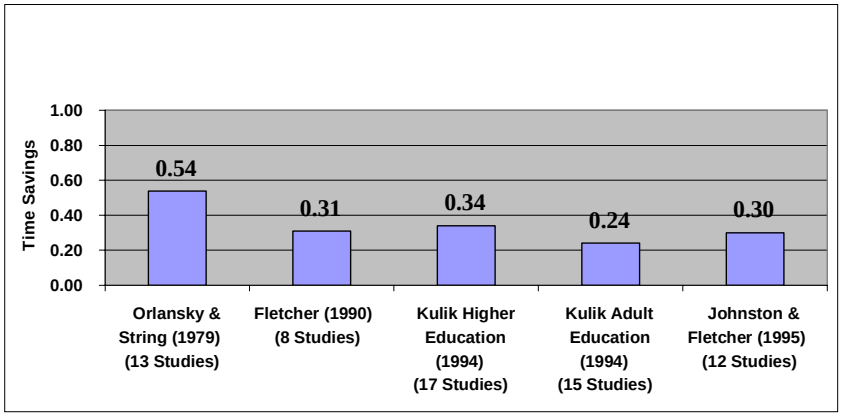
Number of Questions Asked Per Hour

	Traditional Classroom/Hr	Tutored Session/Hr	CBI/Hr
Student	.1	20-30	??
Instructor	3	120-150	180-600

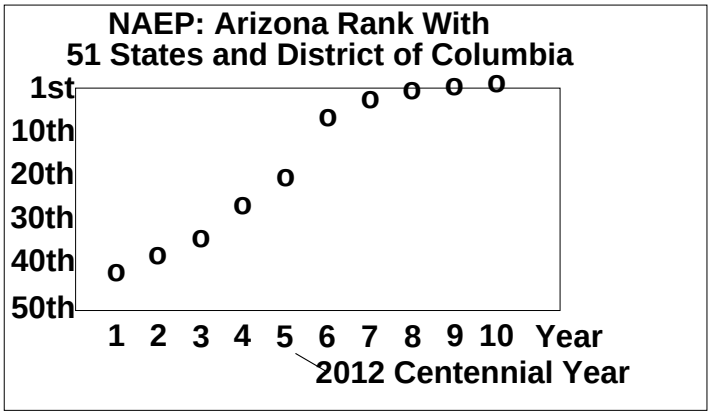
eLearning adaptations can be unique for each course, but generalities can also be made. In the early grades where memorization is needed to learn to read, spell, and write, to do mathematics and to capture the basics of science and the world – the drill and practice process of computer aided instruction, with its continuous formative assessment capability for each student, provides much needed motivation and decrease in time to learn.

Time to Learn

Proportion Time Savings from Technology-based Instruction



The middle and upper grades shift students from the basics toward more critical thinking and problem solving, of understanding complex issues, of seeking 21st Century content and knowledge, collaboration and creativity. eLearning then empowers students with the resources of the Internet, including a wide range of productivity applications (example: artificial intelligence assessment application that provides student immediate critical feedback on their essays) and simulations for history, science and math.



Current data indicates that a full implementation of today's eLearning would vault Arizona student cadre well above Massachusetts in the National Assessment of Educational Progress (NEAP) test score comparison.

The most recent study (11/05) from North Central Regional Educational Laboratory on middle school reading discovered close to 50% increase in assessed academic performance. http://www.ncrel.org/tech/reading/index.html They only studied classrooms where: "digital technologies were a seamless and routine part of learning environments and used by routinely by students and teachers to supports lots of different learning activities."

2. Align education from preschool through post secondary to life long learning;

All forms of higher education and workforce training are rapidly adopting eLearning models for accessibility, flexibility and cost effectiveness. Over 50% of preschool children can use computers and the Internet. Systemic K-12 adaptation of eLearning will support alignment between K-12 schools and post-secondary education and training. For example, individual digital learning portfolios can follow the students through their life span starting in the early grades. These portfolios will not only support personalized learning plans and assessment, but formal and informal relearning of material whenever needed. The attendant increase in academic knowledge and 21st Century skills of a high school graduate will then provide extraordinary

freshman classes at our community colleges and universities. Arizona colleges and universities will likewise develop extraordinary eLearning savvy teachers for our K-12 classrooms. For years, eLearning – especially the online component – has been blurring the line and accelerating credits between upper level high school course work and entry level college work.

3. Alternative and non-traditional delivery systems for higher graduation rates, 21st Century skills and participation in Career Technical Education.

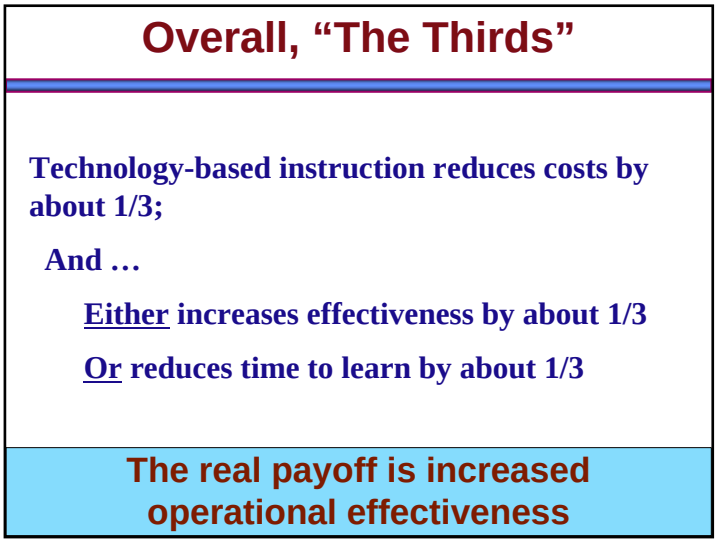
eLearning has become the defacto method for non-traditional and distance learning courses for K-12 from a variety of post-secondary sources, including community colleges. eLearning can embed academic content into the learning process for students in CTE so their subject mastery can count for college admission. Systemic eLearning adoption can support charter and virtual schools, as well as AP courses, special education, career exploration, English language learners, and home schooled students.

4. Students meet new graduation requirements with Algebra I in 8th grade and other vehicles such as individual learning programs;

The eSATS sponsored SB1512 (2006) has appropriated $3 million for a three year middle school math pilot of two year cadres (6th and 7th; 7th and 8th; or 8th and 9th) of middle grade students at 10 schools, engaging 10,000 students over three years. eLearning is the ideal way to extend Algebra I to all 8th grader and enhance all mathematics with digital curriculum. The basic change that eLearning delivers is individualized education.

5. Teachers Raises

Critical issue short term issue that needs to be addressed now. We must retain our high quality teachers who are expected to lead the eLearning savvy transformation for all Arizona teachers. A much longer range solution would be to apply part of the eLearning cost reductions (construction avoidance, books, early graduation, etc.) to teacher salaries. The eSATS econometric model has identified an opportunity for eLearning certified teachers to receive a one time – permanent salary increase of $10,000 (today's dollars) funded from cost savings.



6. Academic success through parent and student support with communications and involvement;

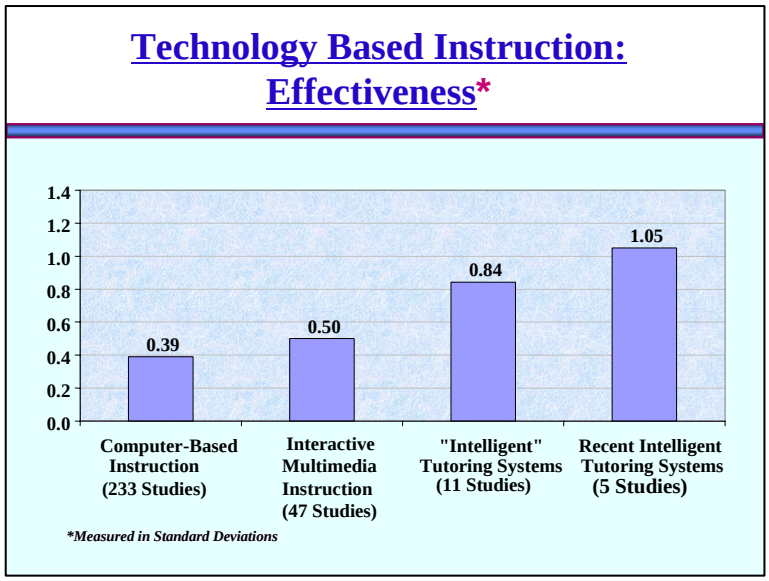
21st Century communication systems for the home can be enhanced with a complete implementation of eSATS including broadband internet at each school and 1 computer per student in the classroom. With a four year refresh rate, 4 year old high quality internet based computers can be recycled into student's homes at 250,000 per year – filling the digital divide. This will provide many opportunities for increased learning and parent involvement as the school's eLearning systems extend into the homes.

7. Increased teacher capacity and availability, especially in math, science and literacy; and in rural and disadvantaged areas. Teachers must be highly qualified and satisfied with their Arizona engagement and classroom;

The critical words are Attraction, retention, creation, and development. The eSATS eLearning system identifies and funds a ratio of one mentor-master per 50 teachers and $1250 per annum per teacher for professional development. The Current average amount is approximately $100. The certification levels "eLearning educator" would be set by Arizona Board of Education. Teachers will be supported by the Teacher Education and Professional Development Institute in determining the most personally effective path to choose of the many vetted professional development and education offerings, starting with the most rural and disadvantaged areas. Arizona colleges of education will be transformed to educate eLearning savvy pre-service teachers, creating a significant incentive for enrollment of best and brightest freshman. Also, the 20% raise in salary ($10,000) will assure that Arizona can attract and retain our eLearning savvy certified teachers and attract from national markets to anywhere in Arizona. Such teachers will be provided a teacher equipped classroom (computer, electronic white board, with a common suite of essential software and tools). The initial priority of this system will be teacher professional development and education to secure certification as an eLearning teacher of math, science, and/or literacy. The Arizona broadband initiative will focus on serving rural and urban underserved areas. The student computing will evolve to any-time access with automated formative and summative assessments, and full time Internet connected integrated with the most effective digital curriculum. With both colleges of education and schools transformed to eLearning, the required15 week student teaching experience will be highly integrated.

8. "Innovate American with Math, Science, Technology and Engineering" from the Nation Governors Association. Learning of Math and Science through K-12 is critical to 21st century success. High school exit with two years of algebra is a college success predictor. Math and Science pathway requires college grants;

Innovate Arizona to show the way to Innovate America. The transformation of Arizona K-12 education in ten years with an eLearning design is probably the biggest and best innovation by a state government in many decades. eLearning is rich with K-12 math and science digital curriculum, from drill and practice to high end simulations and intelligent tutors.

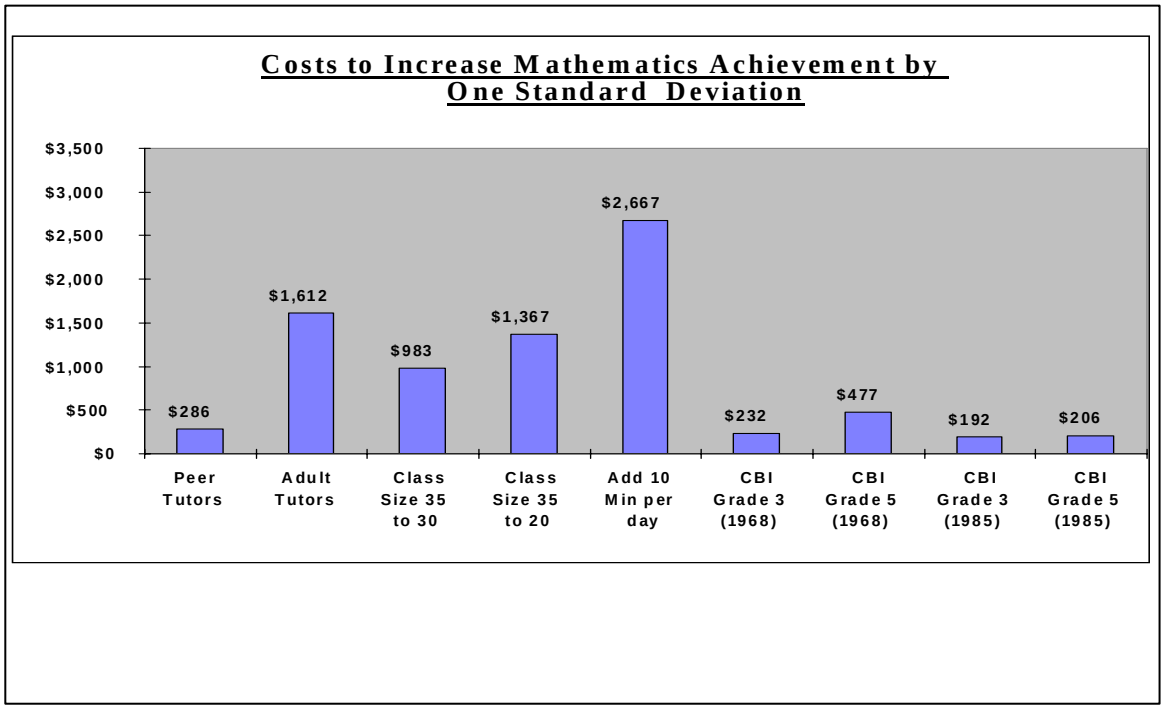


Engineering courses are moving down into secondary schools (JACMET – Joe Tidwell – ASU Polytechnic) and eLearning technology is built information technology. Any SMET student requires a computer, digital curriculum, the internet and an eLearning savvy teacher. (Again) SB1512 (2006) is investing $3million into an eLearning middle school math pilot system for 10,000 students that will address 8th grade Algebra I within the 6th through the 9th grade digital curriculum with online support.

The technology aspects of eLearning (remote probe, satellite data, video and web conferencing etc.) will motivate and enrich the pool of math and science researchers that can be brought into the teaching pool as individuals or teams, while remaining at their industry job. eLearning delivers the means to effectively and efficiently implement this proven idea to support many more students.

Over the next decade the rigor of the high school curriculum will increase toward the goal of four academic years of math and four academic years of science with a electives for engineering and technology. eLearning with its high degree of flexibility of access (classroom, hybrid, home, online, rural, college sourced …) will be a major access to assure a all Arizona students learn these courses and still enjoy electives.

A critical issue is cost effective means to deliver math and science to 1 million going on 1.4 million students in ten years. eLearning has the answer.



9. Robust data driven decision system with expand data capacity integrated with formative, summative, longitudinal and continuum assessment for students, teachers and parents.

The 2006 $2.5 budget funding of the data warehouse system at the Arizona Department of Education will be extended to a $30 per student range under eSATS ($30 million). This funding will support realization of a comprehensive portal based system (currently IDEAL) to support classroom, school, district and state. Not only for data but to access information, decision support, instructional and teacher education and professional development. The decision support data system will expand formative and summative assessments; longitudinal and granular aspects of research; and be accessible to all members of the student's ecological learning system, especially parents.

10. Redesign the financing system for Arizona schools

(note; this system was most recently revised in the mid 1970's lead by a then associate Senator David Kret Ph.D.)

The ten year eSATS financial model addresses the phased direct costs for effective adoption of eLearning for all Arizona teachers and students. The model addresses expenditures and cost savings but not revenue sources. Annual costs included $10,000 a year raise for eLearning certified teachers; $2,500 per teacher for 50:1 mentor teachers and professional development and education; one computer with broadband-Internet connection and technical support per student; appropriate digital curriculum for each course

and grade level; full data-assessment-instructional delivery system from classroom to community to state with financial rules and administrative system to manage funding schools for individual mastery learning. The model also includes the cost savings do to construction avoidance, accelerated calendar year graduation rates, reduced book purchases, etc. After a one time ten year investment of $2 to $2.5 billion to build out and maintain upgrades for a student system growing to 1.4 million in 2016 the net cost per student drops to approximately zero in year ten.

11. Unify and optimize size of school districts.

eSATS system design does not address this issue directly. eSATS focuses on the optimization of the classroom where learning takes place.

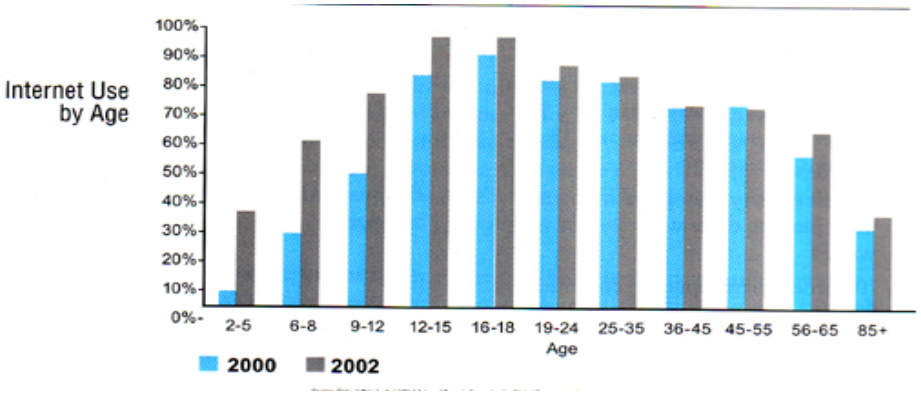
eLearning can be classified as a disruptive innovation. It could have a significant effect on unifying and resizing of districts but currently this The critical issue of broadband connectivity from the district to schools must be addressed as part of these deliberations. With the state specified and school level implemented eLearning data and information systems in place it would seem that eLearning would effect the administrative and instructional burden of unification.

12. Assure that 21st Century Skills training and education is integrated within current core academic subjects.

The need for students to learn life skills; 21st century content; learning and thinking skills; and information and communications literacy during their 12 academic years is critical. eLearning addresses this in two ways. eLearning adoption in the high school classroom models the information environment of work and post-secondary education. By learning with eLearning applications, instructional software, and systems for 13 academic years many but not all of 21st Century Skills will be learned. This learning will be much better than with legacy lectures, books and seat work. Because of the increase in pace of academic elearning (30 to 50 percent) and much high student-teacher contact time (from 1 minute to 3-5 minutes a day) there is time and means to integrate specific 21st Century skills into the curriculum.

13. Pre-K Assure that all Pre-K students are healthy, safe and ready for Kindergarten

In the readiness area, over half of entering Kindergarten students are computer savvy with experience in a wide range of media from television, computer games and computer-internet. The hybrid eLearning classroom with books and computers is a much better match for their skills . In fact they are more ready for an eLearning environment than a legacy classroom.



14: Arizona High School Renewal and Improvement Initiative. Breaking Ranks II (for 350,000 going on 420,000 students).

The core of Breaking Ranks II is collaborative leadership, personalization of curriculum/instruction and assessment. The 7 cornerstone strategies and 31 recommendations are valid pursuits, and the imperatives and goals are on mark. The challenge is to move to implementation from the summit and planning mode. A cost effective and accessible means for leadership to collaborate; students to have personalized curriculum and instruction; and both to have formative and summative assessment is eLearning. The 2007 legislature is expected to support 10 pilot eLearning pilot high schools with automated personal learning plans. Breaking Ranks II could grow within this pilot.

15. Creation of a statewide Education Technology Advisory Board

The newly created ten year eLearning Task Force from eSATS' SB1512 (2006) will assume this role.

16. Cost effective broad band connectivity to all schools, including rural and disadvantaged areas.

The GITA broad band initiative is closely aligned with eSATS eLearning implementation. eLearning centered schools broad band requirements will make them an anchor tenant for rural communities and underserved areas. Once the middle mile has been spanned, most schools will have the required access and reliability required. The bandwidth expectations in 10 years for eLearning implementation are large, in the range of 100 kbps per student or 70 mbps per typical school. With 2000 schools this is 140 gigabits per second by 2016. This is well above current usage and funding streams. To provide a comparison, the new ultra high-speed Internet2 that will be upgraded by 2007 to serve the United States research and higher education community will have 100-gigabit per second capacity. A statewide – district design approach will be needed to assure cost effective broadband connectedly as prices fall and compute usage increases.

Conclusion

Arizona must address the transformation of its K-12 education system to meet global competition and to assure every student is educated to lead a successful life. Standards and policy are now in place. It is time to implement the changes. The most accessible, effective, and efficient means of transformation is a ten year adoption of an eLearning system designed for Arizona's 1,000,000 going on 1.4 million students.