

MANAGED LEARNING SYSTEMS
DEFINING AND VALIDATING NEW MODELS OF DELIVERY AND
ACCOUNTABILITY



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Executive Summary

The call for educational reform in the United States is strong and loud, and as a nation, we tend to view technology as a way to facilitate change and re-engineer the educational process. We at JES & Co. believe that to use technology effectively, we need to ask how we can apply successful business models to education if we expect technology to do for education what it has done for business and the private sector. Key questions need to be answered before technology's role in education can be validated.

There are many differing opinions advocating what should happen in order to bring about needed evolution in education, but although there is not always agreement, we can see that there is a common set of concerns underlying the call for reform – among these are *quality* of content, *equality* of opportunity and *accountability* to the stakeholders. At this level, we begin to consider generally what we must address if our solutions are to add *value*.

In 1996, President Clinton issued his Technology Literacy Challenge and identified connectivity, hardware, training and staff development, and appropriate content as the four pillars supporting the Department of Education's first national technology plan. Since then, a number of organizations and committees have expanded on the plan and issued many calls for action on topics and policy issues ranging from increased bandwidth to electronic content to teacher training. The foundation for change is well conceived and adequately documented, but we are still not in a position to say with assurance that the roles technology is playing in education are effective and cost efficient.

The trend towards clearly stating academic standards and testing students to determine how well they meet our expectations is part of the answer, but we find that students generally are not achieving the goals we have set for them, and they rank fairly to poorly compared with students in other nations. We cannot say confidently which programs and methods are of proven value. We believe, as do many others, that so called “e-Learning” can deliver any time, any place, any pace learning in ways that are individually adaptable to a variety of students’ learning abilities, but we do not believe that the accountability necessary to manage workable solutions is currently built into our educational systems.

We believe that schools need to begin to adapt value based management methods to the business of education. Value is established when we are able to measure and quantify how things are better. It is not enough to produce new content and introduce new processes; measurement and accountability must be integral to the system, and technology provides the means to that end.

If we expect technology to fulfill this promise to education, three questions must be addressed:

- ***What new business processes will be needed to fully support and enhance new educational models, and who will provide them?***
- ***What standards will assure the necessary quality of service, reliability and security demanded by new educational models, and who will set them?***
- ***What economic models will sustain the coming changes in education, and who will benefit from them?***

We believe that there is a clear and inevitable trend toward moving content and applications from the individual desktop and local computers to the Internet and to Wide Area Network servers. As this trend evolves, the business model is migrating in lockstep from purchasing and maintaining hardware and applications locally to software and content as a service supplied by Applications Service Providers.

The impact on education is that this trend enables, for the first time, the integration of the academic with the administrative in ways not otherwise possible. This is a prerequisite to applying technology to educational challenges. We believe that adoption of the software as service / e-Learning / e-Business model has the potential to create a holistically integrated set of processes that truly drive value in education. We call that integrated set of processes a *Managed Learning System*.

For the Managed Learning System to live up to its promise, stakeholders must develop and agree on standards that promote uniform and transparent access to and delivery of both academic and administrative information. In our opinion, the Internet is clearly the standard for the transport and delivery of information. The adoption of standards for data interchange, such as the School Interoperability Framework (SIF), must become widespread, and agreement must be reached on how to describe State academic standards in ways that are both meaningful and conducive to electronic storage and manipulation.

As technology begins to embrace the academic side of education through e-Content and e-Learning, business decision tools such as Total Cost of Ownership and Return on Investment yield to an emphasis on managing

the education process for value. Here, we see value as the degree to which we meet our goals (“Social Return on Investment”), and our yardstick is how well students perform according to the academic standards we have set.

We believe that the economic model sustaining the Managed Learning System within the software and content as a service standard will be a partnership among technology vendors, application and content developers, educators, and government at the State level. Private enterprise stands to gain through delivery and tracking of the service, which enables content and applications developers to build a workable financial model. The State must control the process in order to assure that the process is aligned with State goals, and the process needs to be structured in a way that preserves local autonomy. Therefore, we call upon all the stakeholders to cooperate in beginning to build the elements of the Managed Learning System. In particular we believe that the highest level of encouragement and financial support should be given to establishing projects that:

- *Bring vendors, developers, government, and educators together*
- *Start to build working, validated frameworks through sound academic and technical architectures*
- *Begin to model content and test delivery, adhering to and building on currently accepted standards*
- *Prove and validate the processes for measurement and accountability*
- *Provide the links to integration of the administrative with the academic*
- *Work iteratively using a phased approach to build upon successes and allow the managed learning system to evolve.*

Introduction

Is anyone satisfied with the current state of education? In the United States, it would certainly appear not. Hardly a day goes by without an article in the paper or on the nightly news reporting on or analyzing some crisis in education. In the United States, we are rapidly approaching the point where we will be spending a trillion dollars a year, and it sometimes seems that the more we spend, the worse it gets.

As pressure mounts for educational reform, it is inevitable that new and emerging technologies will be called upon to help manage the process and in many cases serve as a primary platform for content delivery. True, there are a few among us who are leery of integrating technology in the classroom, and there are occasional calls for a reversal of the role technology is currently playing. But the die is cast. There is considerable momentum feeding expectations that technology will do for education what it has done for business and the private sector. It is indisputable that technology is the engine fueling unparalleled economic growth even as it drives advances in the quality of our products and the efficiency of our processes.

But what does it mean to apply business models to education? How will technology do for education what it has done for business and how will we measure it? How can we validate our assumptions in the educational arena? Perhaps even more basically, what are we trying to accomplish, and what constitutes a successful result?

There is not, of course, unanimity of purpose among education's major stakeholders. Not surprisingly, then, there is a surfeit of answers and opinions -- answers oftentimes responding to questions no one has even

asked! If there is not consensus on what the questions are, we can hardly expect answers that will be meaningful across a broad spectrum of interests and objectives.

We believe there are key questions that any proposed technology solution must answer in order to validate its benefit to education. In this treatise we will review briefly some of the major issues challenging our education systems today, explore what core questions we believe need to be addressed that are common to those issues, and begin to describe the elements of a framework that can help us answer them.

Where Are We Now? – A Review

There are any number of white papers, commentaries, articles and reports detailing critical issues in education from a variety of different perspectives. It is not our purpose here to attempt to contribute to that existing body of literature, or to endeavor to arbitrate among differing viewpoints. It is our view, however, that to begin to address the role technology may or may not play in resolving particular challenges to effective delivery of education and educational content, it is useful to view problems and resolutions as having many elements in common. If we can arrive at a point of commonality at some certain level, we can begin to formulate questions and strategies that will be common to the answers.

There are *Quality* issues, for example. We see that there is concern over the quality of our educational materials – the textbooks, software, and other basic resources that comprise the foundation of knowledge transfer. We see concern over the quality of our teachers and administrators, over the quality of our facilities, and over the quality of our students. So what do we want? The best -- nothing else is good enough.

Not only do we want the best, we want the best for everyone. We want *Equality*. The digital divide threatens equality of access even as technology promises to level the playing field. We want equality of opportunity for all students. We want equality of standards, content and delivery.

And we want *Accountability*. We are concerned that our schools are not accountable to parents and government, that our teachers are not accountable to school boards and administrators, and that our students are not accountable to their teachers.

Viewed this way, we can begin to see a patchwork of problems, resolutions, solutions and fixes coalescing around common and oft-repeated themes. And now, technology has been flung into the mix, sometimes logically and sometimes haphazardly.

What We've Done About It So Far

We have come so far so fast that it is easy to forget that the World Wide Web was invented only ten short years ago. The Internet is more than just the World Wide Web, of course, but the Web stands as the bellwether for the connected community. Ten years is certainly not enough time to have developed mature models, especially when the rate of technology change is so accelerated.

Nevertheless, our first ten years of experience has taught us much, and it is useful to review our progress so far in identifying problems and proposing solutions. The numbers of writings in this field are again voluminous, and sifting through all of them is not our objective. Others have already assumed that task, and a review of their work will suffice.

In 1996, President Clinton issued his Technology Literacy Challenge and identified four areas critical to the integration of technology into our education system. This began the drive to assure that all schools were connected to the Internet by the year 2000 and resulted in the nation's first Educational Technology Plan, "Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge."¹

¹ <http://www.ed.gov/Technology/Plan/>

Sometimes referred to as the “four pillars,” Clinton’s foundation, as elucidated and expanded in the Department of Education’s technology plan, consisted of:

- Connectivity
- Access to Hardware
- Training and Staff Development
- Appropriate Educational Content

In response to this challenge, a group of education leaders and concerned executives from major corporations formed a unique partnership in the fall of 1996. The CEO Forum, as it came to be known, took upon itself the four-year task of researching issues impacting the marriage of technology and education and issued the third of four annual reports in June of 2000. The report, titled “The Power of Digital Learning: Integrating Digital Content,”² begins to address a definition of digital learning that incorporates the seamless integration of technology, connectivity, content and people throughout the curriculum.

Key recommendations of the CEO Forum report include performing a digital content inventory to see what is available, and increasing our investment in digital content. It suggests that in order to increase digital content:

- Schools must consider investing in the purchase of digital content rather than expecting it to be free
- Companies creating digital content must collaborate more effectively with teachers to determine what works for different types of learners

² <http://www.ceoforum.org/>

- Companies that provide content should strive to make their content available in digital format
- States and schools must provide curriculum specialists and other resources dedicated to assisting teachers integrate digital content into the curriculum
- Government must continue to make available in digital format the vast quantities of available public domain information
- Businesses, communities and parents must support educators and students in educating the public on the crucial nature of digital content and the need to reevaluate entrenched opinions on textbooks as the only legitimate source of educational content

The Software and Information Industry Association (SIIA) is a trade organization of several leading technology companies, and among its mission objectives is the education of its members and the public in keeping abreast of trends in technology development and public policy underpinning the digital economy. In July of 2000, the SIIA released its report “Building the Net: Trends Report 2000.”³ This report identifies and examines six broad trends that the SIIA believes are shaping our economy and changing the way people learn, shop, conduct business, interact with computers, and access reliable information.

While not geared specifically toward education, these trends nevertheless are universal, and there is no reason to believe that technology in education will follow a different path. For as education continues its inevitable transition to technology based educational content and delivery, it too will require what businesses have found is more

³ <http://www.trendsreport.net/>

economical to outsource or consolidate than to support – the transaction processing and data storage, the complex systems integration, the development of new breeds of application interoperability interfaces, and the required support, all washing out of a flood of new activity generated by a deep shift in the way education is delivered and financed.

To the point, the SIIA report first considers the implications of software as a service. In this model, software continues its migration from the desktop to the network server and finally to online application service providers (ASPs) who assume the responsibility of software maintenance, delivery, and licensing. For businesses, the theoretical advantages of control, supportability and manageability in the ASP software service model are overwhelming. The SIIA correctly notes that concerns about accessibility, privacy and security are slowing the adoption of the ASP model, but these impediments are surrendering to resolution as businesses quickly adopt new technologies in order to drive the ASP model forward.

A second trend noted by the SIIA is the recognition of the value of information. The Internet heretofore has seemed a vast repository of free information and content, but information is not free to collect or produce. We must and will develop valid models of tracking the interchange of information and generating revenue to support the quality of content and information we will require.

Other movements noted by the SIIA in Trends Report 2000 are the emergence of technology in education and e-Learning as a tool for lifelong education, the empowerment of the customer, the expansion and digitization of business to include digital transaction processes

ubiquitously, and the coming policy changes at every level of government that will impact how the business of technology is conducted.

Policy changes were among the topics targeted for public input and analysis by the Web Based Education Commission. Established by Federal legislation as part of the Higher Education Amendments Act of 1998, the Commission was "... established for the purpose of conducting a thorough study to assess the educational software available in retail markets for secondary and postsecondary students who choose to use such software." Further, the Commission was charged with conducting, "...public hearings in each region of the United States and prepar[ing] a report to the President and the Congress that contains recommendations regarding legislation and administrative actions, including those regarding the appropriate Federal role in determining quality educational software products."

The Commission submitted its final report to the President and Congress in December of 2000. Entitled "The Power of the Internet for Learning: Moving from Promise to Practice,"⁴ the report distills testimony and analysis from hundreds of education, business, policy, and technology experts. After reviewing the testimony and evidence submitted, the Commission formulated a call to action revolving around seven key policy areas:

- Enabling and providing widespread high bandwidth access including broadband and wireless technologies
- Training and supporting educators and administrators

⁴ <http://www.hpcnet.org/>

- Enabling frameworks that encourage educational research, development and innovation
- Developing high quality online content
- Revising or eliminating regulations that impede innovation and promoting approaches that advance any time, any place and any pace learning
- Developing policies and regulations that protect online learners and assure their privacy
- Expanding funding initiatives to sustain current models and develop new models of financial support

Now, we come full circle with December 2000 release of “e-Learning: Putting a World-Class Education at the Fingertips of All Children,”⁵ the Department of Education’s follow-up to its national technology plan of 1996. Building on the original work and drawing on the knowledge and experience of educators nationwide, Secretary of Education Dick Riley outlines five National Educational Technology Goals:

- All students and teachers will have access to information technology in their classrooms, schools, communities and homes
- All teachers will use technology effectively to help students achieve high academic standards
- All students will have technology and information literacy skills.
- Research and evaluation will improve the next generation of technology applications for teaching and learning
- Digital content and networked applications will transform teaching and learning

⁵ <http://www.ed.gov/Technology/>

The words and thoughts of perhaps thousands of individuals with interests and considerable expertise in education are distilled in the reports we have referenced. There are other studies and reports, of course, but these suffice to demonstrate the basic elements modeling a holistic approach to the evaluation of our current practices and to examine the elements that must comprise the framework of tomorrow's systems.

We've looked at what we have to work with (the "Four Pillars"), thought about how we can improve on what we've done with them so far (the CEO Forum's recommendations), reviewed where we think things are going generally (SIIA's trends), analyzed what policies we need to change or implement to smooth the way (the Web Based Commission report), and established some overarching goals that will serve to guide our direction as we move forward (The Department of Education's revised National Technology Plan). What more could we need? Well, we need to know what, if anything, actually works – what is made better for our efforts and not inconsiderable expense.

What We Need To Do About It Now

Is “it” working? Are things getting better because of it? The short answer is yes. Or, depending on who you talk to, the short answer is no. The problem is, whenever we try to take a close analytical look at whether some method, mechanism, theory, or idea is working, we only seem to be able to find short answers.

The question is addressed by the Web Based Commission, which responded positively to the question of the effectiveness of on-line learning compared with other methods by citing one study with the caveat that, “the research base is limited and has shortcomings both in scope and methodology.”⁶ An important side-note – the report comments that their caveat applies to “much educational research.” In other words, technology is not the only issue for which we lack, in many cases, rigorous generally accepted proof of benefit.

Others have a less charitable view of the benefits of on-line learning and technology in education in general. In September of 2000, the non-profit group Alliance for Childhood released its report decrying the use of computers in early education. With much fanfare in the popular media and the support of a roster of early childhood educators, pediatricians, technology experts, and others, the report “Fools Gold: A Critical Look at Computers in Childhood”⁷ quotes Larry Cuban, former president of the American Educational Research Association, as saying that despite 30 years of research on educational technology, “there is no clear,

⁶ Web Based Commission Report to the President and Congress, pg. 95

⁷ <http://www.allianceforchildhood.net/>

commanding body of evidence that students' sustained use of multimedia machines, the Internet, word processing, spreadsheets, and other popular applications has any impact on academic achievement."

The report has been criticized on several grounds by many experts in the field. We would digress were we to attempt an analysis or rebuttal, save to note that although we disagree generally with many of the arguments including the one just quoted, the point that there is a paucity of hard data backing enthusiastic claims of technology's benefits is difficult to argue.

Nevertheless, schools, government at all levels and corporate leaders are asking parents, taxpayers and students to invest in highly accelerated evolutionary change. Not all of the elements relate to computers or technology – changes in the traditional classroom and our basic pedagogical approach to education are also significant and far-reaching – but viewed as a whole, it is virtually impossible to conclude that technology is not already a principal enabling force.

This evolution is prompted in no small part by the belief that our students are not measuring up to their potential, and that as a nation we are at risk if our educational systems do not produce literate, capable citizens empowered with the skills and critical thinking abilities necessary to survive and prosper in the world community.

We are concerned enough that we are starting to test high school seniors for minimum competency in basic subjects such as math and reading comprehension as a prerequisite to graduation. One such program,

Arizona's AIMS (Arizona Instrument to Measure Standards⁸), has been in development since 1996 when revised academic standards were adopted by the State Department of Education. The program is designed to test students' abilities as compared to the adopted standards and serve as a basic requirement for graduation starting with the class of 2002. Perhaps to no one's surprise, students are recording generally dismal scores during the initial phases of program evaluation.

This is frustrating. Here is a program designed to identify unambiguously our expectations of the students and to account to the public that our educational processes are sufficient to assure that students can meet those objectives. If we knew which of our programs and systems were effective and which were not, the path forward would be clear. What is missing?

Arizona is not alone in its attempt to implement Standards-Based reform. Efforts to define and categorize academic standards in detail and to compare standards among states and the federal education agencies certainly predate our current technology evolution. McRel, a private, non-profit organization whose purpose is to improve education through applied research and development has worked extensively to study and catalog detailed academic standards⁹. McRel, in cooperation with Achieve¹⁰, another nationally based non-profit organization promoting standards-based reform, have developed a searchable database of national and international standards by subject and grade level.

⁸ <http://www.ade.state.az.us/standards>

⁹ <http://www.mcrel.org>, "Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education"

¹⁰ <http://www.achieve.org>, "High Standards: Giving All Students a Fair Shot"

Still, educators' efforts to implement standards-based reform have yet to realize their potential. Other reforms often fall short as well. There are many reasons, but at the top of the list, we believe that the accountability necessary to manage workable solutions, *technical and otherwise*, is not currently built into our educational systems and models in a way that is sufficiently expansive in scope and magnitude to provide the justification we need. But we also believe that the solution is not to shun forward progress or eschew technological advances, but to begin now to assure that mechanisms enabling manageability and accountability are an intrinsic part of the solutions we build!

The remarkable thing about technology in education is that technology, as we have found in the business and private sectors, can potentially provide the means to prove or disprove its own validity as a mechanism for positive change! We *can* make it better – if first we have a handle on what *better* is. If we believe that there is more *value* in making things better, we can borrow concepts from Value Based Management methods to begin to quantify and qualify the consequences of selecting one from a number of solution pathways.

Here, we acknowledge that if things are better, they must be different. If things are different, they must be observable. If things are observable, they must be measurable. Therefore, in order to determine value, we must begin with valid measurement. And technology is the tool we can use to organize our measurements.

In many ways, current efforts to introduce technology as a teaching platform put the cart before the horse. For several years now, teachers

and academic publishers have worked on moving content from the blackboard and the printed page to digital storage and electronic presentation. Classrooms are wired to the Internet, and a great deal of content is moving through the wires. As yet, however, the systems are not in place that provide the means to capture meaningful information about what is flowing through the wires to our schools, teachers and students, how successfully it meets its intended purpose, how well it tracks to accepted educational standards, and how it results in improved performance. Such information can be collected of course; we believe, however, that the means to achieve it must be systemic – that is, built into the structure of our educational processes.

Three Questions

We must identify those who are currently building and managing educational systems, determine what other stakeholders need to be involved in order to build the systems we envision, agree on methods and standards of building systems so that the information we collect can be shared among the widest range of interests and put to the greatest use, and figure out how to fund the system design and sustain it going forward. We believe that these concerns lead to three questions that any proposed solution pathway must address:

- ***What new business processes will be needed to fully support and enhance new educational models, and who will provide them?***
- ***What standards will assure the necessary quality of service, reliability and security demanded by new educational models, and who will set them?***
- ***What economic models will sustain the coming changes in education, and who will benefit from them?***

The price of evolutionary change in education is high. We believe it is an imperative of the highest order that we clearly identify and promote strategies that will move us in the right direction and that have the greatest chance of assuring that we meet our goals.

We speak of new educational models, and are aware that for most, the term e-Learning is what will come to mind. Certainly, the content delivery potential of technology garners the most attention, and perhaps in far too many cases, the most controversy. As with other industries and market sectors, education has not escaped the proliferation of the dot-

coms, and discussions of business models often revolve around marketing and competition.

But while it is understandable that there is a magnifying glass trained on e-Learning, we must direct an equal amount of attention to e-Teaching, e-Administration and e-Management. We believe that technology is the means to integrate the academic with the administrative in ways not otherwise possible. Traditionally distinct and in many cases intentionally isolated from each other, the intersection of pedagogical and management goals underscores the idea that the business of education *is* education and that the key to placing value in education is measurement and accountability.

Viewed this way, we can begin to see a *Managed Learning System* holistically as the integrated set of processes driving value, and we can identify some additional stakeholders we may not have been considering. In order to manage the delivery of e-Learning content, we need to look seriously at how we will integrate the necessary data center and transport, systems integration, applications development and infrastructure support services, to mention just a few. We need to develop the content, but we must also store it, deliver it, track it and analyze it. As we begin to integrate these components a picture of the processes that need to interact begins to emerge (fig. 1).

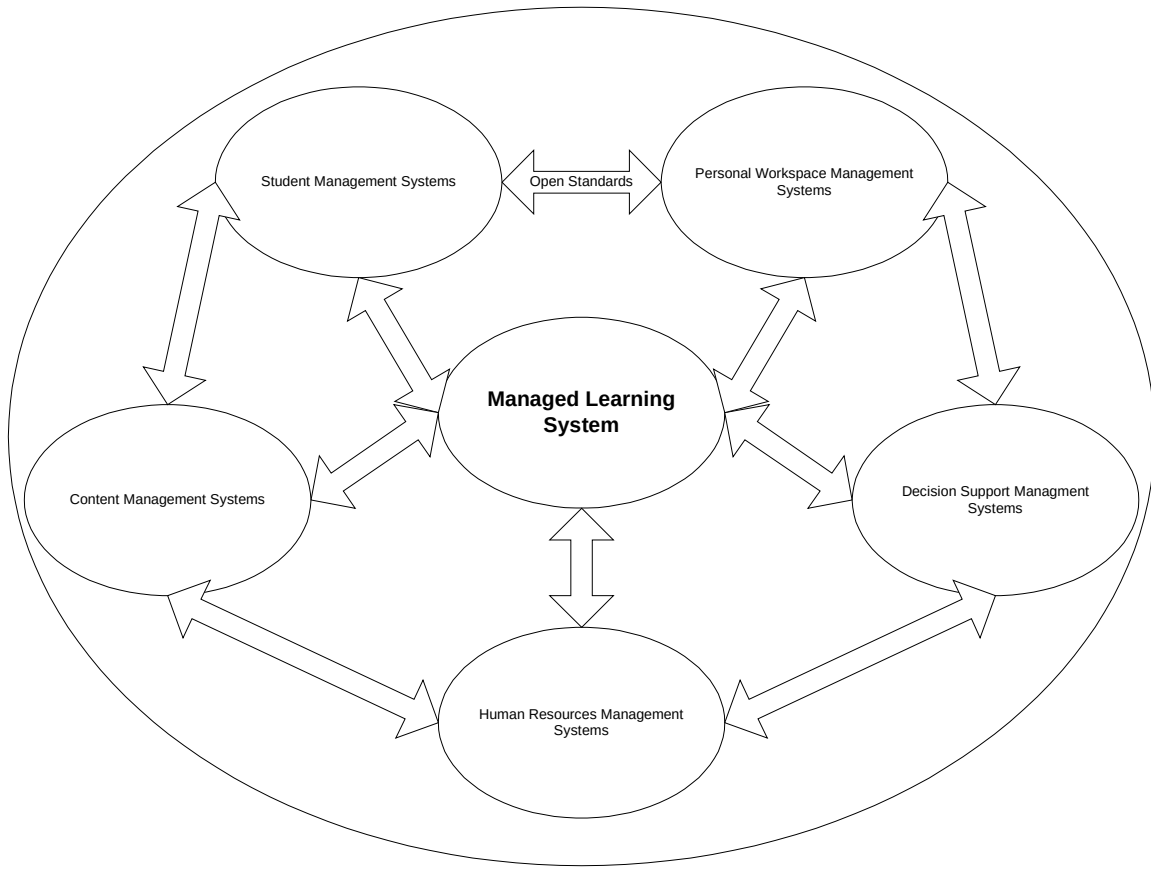


Fig. 1 – The Managed Learning System as the integrated set of processes driving value

E-Learning, by design and intention, enables any time, any place, any pace learning. How will we know if a student retrieves and completes satisfactorily a lesson from a remote connection at home, or perhaps from a hospital or library? Here, we begin to see the intersection of our student record systems with the academic. Was the student in school that day? School funding is often based in part on attendance, so we see the intersection of the academic with state and federal reporting requirements. Is the school compensating the publisher of the curriculum on a royalty per use scenario? The list goes on.

Now, we must ask a very hard question – Do schools have the resources needed to build and support the kind of systems that will enable this level of integration and functionality? Our answer is no. Schools are unable to compete with the private sector when it comes to attracting and retaining high-end technical expertise in-house. Then again, many in the private sector are also coming to the conclusion that complex systems supporting business process re-engineering and management are best hosted rather than internally supported.

The obvious solution to the challenge of infrastructure acquisition and support is for schools to follow the private sector into the software as a service model. Recall that we have already reviewed this model in the context of trends shaping our economy. In addition, we also believe that a new interrelated model, *content* as a service, will emerge as a necessary adjunct! For the Managed Learning System to build value, content must flow through the system, not around or under it. The content itself must integrate with the entire system. Administrative and management processes must be able to determine what the content is, where it came from, who used it, and perhaps most importantly, what educational standards it envelops.

A number of stakeholders, and a second layer of the Managed Learning System, are beginning to emerge. As represented in Figure 2, each partner is dependent on the other to provide the connecting threads and interfaces that enable all of the processes to work together. This is accomplished only through agreement on, and adherence to, standards.

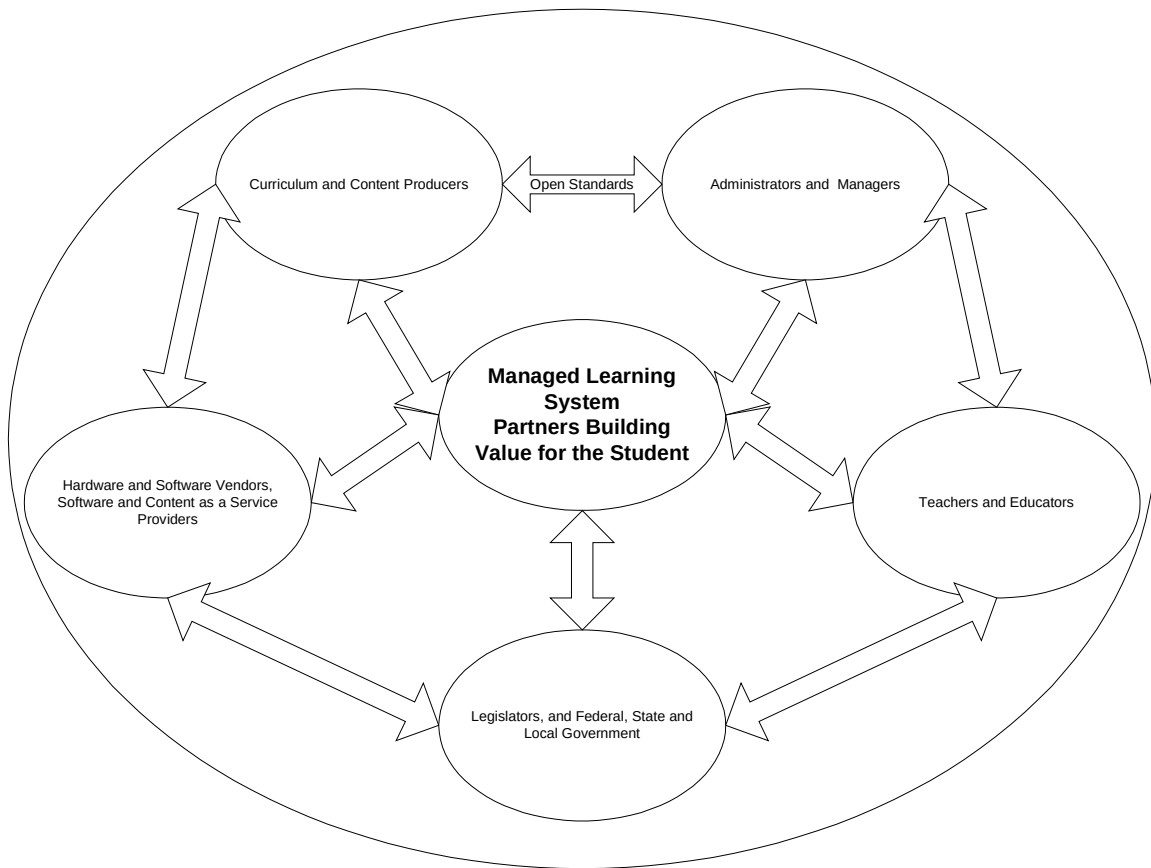


Fig. 2 – Dependencies exist among the Managed Learning System Stakeholders

By definition, standards are not proprietary and are not owned by one vendor or group or agency at the expense of another. To the contrary, standards are elements, procedures and specifications mutually adopted by competing interests so that everyone's common goals can be attained. Although adoption of standards allows products and processes to interoperate, premature adoption of standards can impede progress by locking down specifications that are not yet mature or adequately evolved. Competition drives innovation, and the field of computers and high technology is still in its infancy.

This appears to present us with a bit of a quandary. Our Managed Learning System depends on interoperability and cooperation among a

wide spectrum of interests. What can we do in the face of competing and sometimes contradictory standards?

In reality, marketing objectives and fierce competition among vendors overly confuse the subject of standards, and there is a way through. We will address here four areas of standards impacting the Managed Learning System and present a solution pathway for each: hardware, operating system and transport standards; information interchange standards; content standards; and academic standards.

It may seem at first that hardware and operating system standards would be the most intractable, but the trend toward the software as service and hosted applications delivered by application solution providers mitigates the impact of a dearth of standards at the lowest levels of technical detail. We believe, as do most in the industry, that hardware and operating systems will continue to evolve and mature significantly in the foreseeable future, and that competition in the marketplace will fuel dramatic improvements before consensus is reached on low-level technical standards and processes. As management and delivery of information move from the purview of the individual schools and districts to the service providers, we will see that the key enabling standard becomes the transport. From the view of the Managed Learning System, the low level manipulation of information is a black box – the system really doesn't care about the mechanical details as long as something everyone can agree on comes out of the box. What is clear is that the Internet, as the conduit for the transfer of information, is now the de facto standard for transport, and that is what we need to come out of the box.

Insofar as hardware and the operating system are concerned, what is important to the Managed Learning System is that system vendors develop, and more importantly demonstrate and deliver, validated architectures that are flexible and resilient, and that comply with standards of transport and information interchange. The marketplace will eventually decide among competing technologies and innovations, but it does not need to do so before our Managed Learning Systems can be built.

Education is not the only industry that has grappled with the problems of standardizing formats for the exchange of information. In the Healthcare industry, for example, work has progressed for years on categorizing diseases, diagnoses and treatments in ways that lend themselves to electronic storage and manipulation. The process is ongoing and certainly not perfect, but there is general agreement on a variety of standards and the need for competing interests to continue to develop them. The case for standards in the field of healthcare is compelling – it drives insurance billing and payment of claims among other things! It is a more mature industry with respect to the pervasiveness of technology, and what lessons we could learn from that industry's experience is perhaps the subject of its own paper.

To continue, however, we see two related and overlapping areas in which current standards need to be further developed and then applied to the exchange of information in the Managed Learning System. The first of these areas, standards for the exchange of information among disparate systems, strikes primarily at proprietary categorization of the individual elements comprising a collection of information.

As a simple example, one system or process might store a student's name in a single container consisting of up to 30 spaces. Another might store a student's name in three containers – first name, middle and last – of 15 characters each. As long as the only process needing that information is the one that created it and stored it, there is no problem. Most of the administrative software programs running in the educational space today are proprietary in this manner. A programmer can, in each specific case, write custom software that will translate a piece of information from one system to another. In fact, so-called middleware is a multi-billion dollar a year cottage industry. The problem? This is an overwhelming impediment to the synthesis of useful conclusions from available but disparate and difficult to assimilate data elements. Resolution means either tedious, expensive duplication of effort, or yet more proprietary and expensive software and middleware. In order to support an efficient and cost effective decision process that is easily and practically usable, a Managed Learning System requires that processes have transparent access to data originating in other processes.

We are certainly not the first to suggest that information exchange standards need to move from theory to practice. In 1997, a consortium of education software companies, school district technology coordinators and administrators started to meet to discuss ways to answer the interoperability challenge. The result of their efforts was the germinal specification for a Schools Interoperability Framework (SIF). Work has continued since, and in June of 2000, the group announced the completion and release of the "SIF Implementation Specification v.1.0."¹¹ SIF addresses not only standard formats for shared data, but goes farther

¹¹ <http://www.sifinfo.org>

in starting to define common naming conventions and rules governing how individual processes should interact. SIF has been tentatively adopted as a working strategy by most of the major education applications and content developers, but is not yet fully implemented outside of some preliminary pilot programs.

Where standards relating to classification of the information needed by administrative systems (such as student records, libraries, transportation and scheduling) necessarily describe the size, shape and color of highly granular pieces of information, a set of standards that enables management of academic content must serve additional purposes. There is some overlap, but in addition to describing labels, naming conventions and general specification formats, our Managed Learning System needs to understand the academic purpose served by educational content.

The IMS (Instructional Management Systems) Global Learning Consortium, Inc. was incorporated in 1997 for the purpose of defining technical specifications for interoperability in distributed learning environments. A non-stock, not for profit Membership Corporation, IMS started releasing specifications for Question and Test Interoperability and Content Packaging in June of 2000¹². The first release of a Learner Information Packaging Specification was made available in December of 2000. Higher Education comprised the original focus of the IMS specifications, but much of the work is applicable to K-12.

Both SIF and the IMS specifications lay groundwork for incorporation of academic standards into the Managed Learning System, but without

¹² <http://www.imsproject.org>

general agreement on pedagogy and instructional design, a comprehensive approach to incorporating detailed instructional purpose as a set of data elements is still open for development. We noted earlier in our discussion the work of Achieve and McRel in categorizing standards.

We believe that for States to be successful in developing and adopting standards that meet State and Local objectives and assuring that content delivered to students is aligned with those standards, formal categorization of the elements comprising academic standards must be developed and incorporated as an integral part of the information and content contained in or handled through the Managed Learning System. Content and delivery must map not only to technical standards, but to educational standards as well.

We have discussed some of the business processes moving us toward our goals, and the standards that will assure manageability and accountability. Our third question is perhaps the most difficult to predict – What economic models will sustain the coming changes in education, and who will benefit from them?

We believe, though, that current trends will give shape to our answer, if not fill it in completely. The single most important change to the current implementations of technology in education is the inevitable shift to hosted applications and the Application Service Provider and e-Business models, both for delivery of content and administrative functionality. The consequences of this shift, and our view that content as a service is an intrinsic element, impact our economic models in several ways.

Historically, the decision to invest in technology, or for that matter many other business processes, has been based on a careful and sometimes exceedingly complex calculation of the so-called Total Cost Of Ownership (TCO) and the expected Return On Investment (ROI). While traditionally, this has led to cost reductions, savings, efficiencies, and product improvement, the private sector has found that this does not always translate into increased value for the shareholder. The parallel in education is dramatic – as technology becomes increasingly responsible for content and academic achievement, we must shift our focus from administrative efficiency to the business of education.

The result? While Total Cost Of Ownership and Return On Investment are not rendered inconsequential as investment metrics, they become secondary considerations if our business goals are not met. Corporate shareholders vote and demand that their companies be managed to increase shareholder value. Taxpayers vote and are demanding that our educational processes be managed to produce value. Here, the value is not monetary benefit to the shareholder, but the degree to which we meet our goals. Increasingly, this means that our yardstick is how well students perform according to the academic standards we have set.

Once academic achievement becomes an integral part of technology processes, traditional calculation of the Total Cost Of Ownership loses meaning, and the concept of Return On Investment, ROI, mutates to the less tangible Social Return On Investment, SROI. How far are we willing to go in asking what a literate, employable and socially conscious graduate of our educational systems is worth? If no explicit value can be assigned to SROI, technology is perhaps no longer best viewed as a capital

investment, but rather as a recurring cost, much like utilities, salaries, and other budgeted items, at least from the perspective of the school.

Two other factors will drive the shift to the software as a service model in education. The first is that increasingly, management of the educational process is migrating from the local district to the state. This does not necessarily imply a loss of local autonomy, but does reflect that academic standards are set at the state level and that the state is principally responsible for measurement and accountability to those standards.

The second factor is that the infrastructure necessary to support the bi-directional flow of information extends well beyond the boundary of the school. It starts at the top with the State Educational Portal and extends through several physical layers – call them Education Hubs – providing bandwidth, traffic shaping, caching, storage and redundancy. Some collection of hardware remains at individual schools, validating and serving recipients in classes as well as remote sites such as the home, libraries or hospitals. In order to work, the entire system depends on a high level of integration. We believe that the only economic model capable of providing the level of support and maintenance such a system will require is software as a service. The cost of obtaining and maintaining the system is born by the service provider; schools will contract for the services they use. As figs. 3 and 4 demonstrate, the number of services and processes required, multiplied by the number of portals, hubs and destination delivery points deployed, comprises an architecture far surpassing what individual schools or districts typically support today.

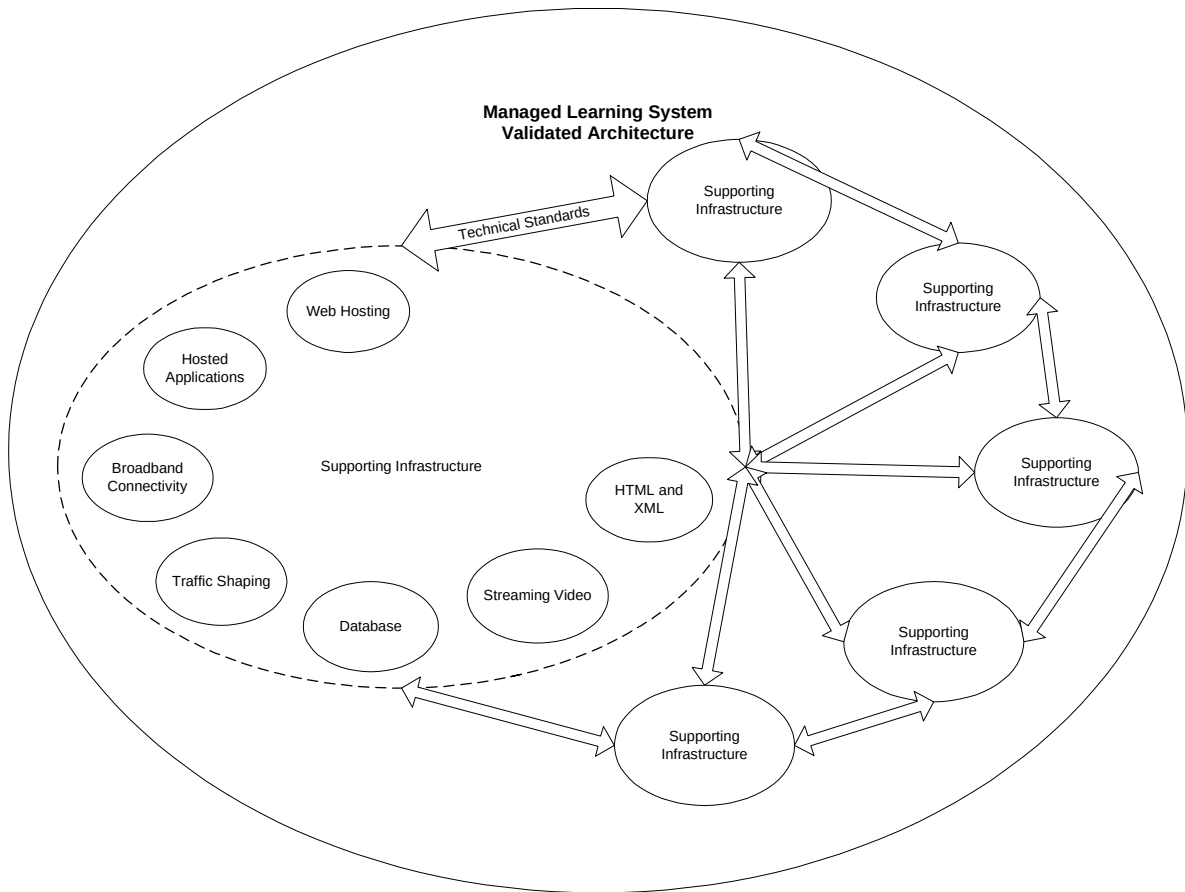


Fig. 3 -- The need to provide a number of redundant distributed systems delivering the required variety of services leads to a significant, although not necessarily complex, architecture

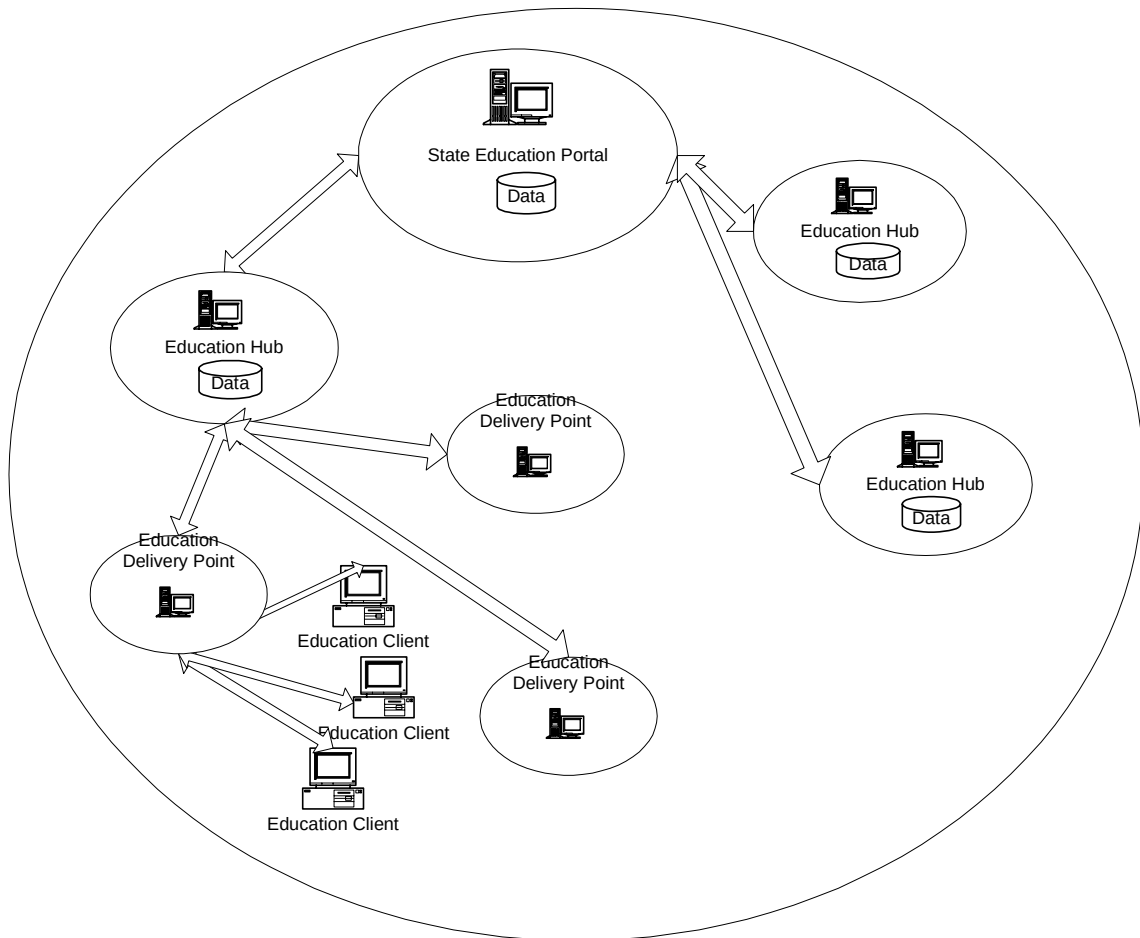


Fig. 4 – The supporting infrastructure scales all the way from the top state level down to the school and classroom

The implementation of significant new infrastructure at the state level, required as we see for a fully functional Managed Learning System, leads to some interesting possibilities. Once a data center is established, scaling it to provide increasing numbers of processes and client services

is a logical progression. Will the State Education Portal become, in fact, the State Government Portal? If so, who becomes the service provider?

In our opinion, the best answer lies in a partnership among technology vendors, content producers and the State itself. The State must own the process if it hopes to assure that the process is aligned with State goals, which are not necessarily the goals of the business partners. Yet, the business partners have much to gain from the coming changes in Education. Indeed, the degree to which transaction and processing activity will become intrinsic elements of the whole process of educational delivery is unanticipated and as yet undefined. It is, however, inevitable.

Conclusions and A Call for Action

We believe that a good foundation has been laid for the development of new systems that manage the educational process. Work by organizations such as the CEO Forum and SIIA, committees such as the Web Based Education Committee and agencies such as the Federal Department of Education spell out clearly the current state of technology in education and provide a vision for future direction.

We believe that systems and processes that provide measurement and accountability enable value in education and make decision support systems possible and meaningful. Standards-based reform is only fully realized when all aspects of the education system are measured and accounted.

We believe that technology provides the means to build these systems and processes, and that properly implemented, these systems and processes add value to traditional learning methods as well as new models of e-Learning.

We define the integrated collection of systems and processes driving value in education to be a Managed Learning System.

We believe that the appropriate technical model for deployment of the Managed Learning System is software as a service, hosted by Applications Service Providers.

We believe that for Managed Learning Systems to reach their potential, stakeholders must agree to and continue to develop standards that promote the transparent interchange of information among discrete elements of the system. Specifically, we believe that the Internet, SIF and the continuing work on defining descriptors for academic standards are key enabling initiatives.

We believe that the economic model sustaining the Managed Learning System within the software/content as a service standard will be a partnership among technology vendors, application and content developers and government at the State level. Private enterprise stands to gain through delivery and tracking of the service, which enables content and applications developers to build a workable financial model. The State must control the process in order to assure that the process is aligned with State goals, and the process needs to be structured in a way that preserves local autonomy.

Because private enterprise stands to gain considerably from the service model and because that model is neither fully anticipated nor defined, private enterprise, and in particular the technology vendors and the content and application developers, must put forth the initial effort and investment to provide validated architectures and demonstrated solutions before expecting unqualified buy-in from government and the taxpayer.

Therefore, we call upon all the stakeholders to cooperate in beginning to build the elements of the Managed Learning System. In particular we believe that the highest level of encouragement and financial support should be given to establishing projects that:

- ***Bring vendors, developers, government, and educators together***
- ***Start to build working, validated frameworks through sound academic and technical architectures***
- ***Begin to model content and test delivery, adhering to and building on currently accepted standards***
- ***Prove and validate the processes for measurement and accountability***
- ***Provide the links to integration of the administrative with the academic***
- ***Work iteratively using a phased approach to build upon successes and allow the managed learning system to evolve.***