Prospect of a Technology-based Learner Interface for Schools

Arthur Recesso
Curr & Instr Tech, COE
Valdosta State University
1500 N Patterson Street
Valdosta, GA 31698 USA
amrecess@valdosta.edu

ABSTRACT
The International Forum of Educational Technology and Society (IFETS) hosted an online discussion about the potential for the development and widespread implementation of a technology-based learner interface. The following is a summary of the discussion, which took place from October 23 to November 9, 2000 on the IFETS listserv. This was an open forum with participants' backgrounds ranging from private industry to public education academia. In the context of a K-12 school implementation there were several issues raised. A technology-based learner interface to be used successfully in a classroom would have to overcome barriers presented by teacher training, costs, and providing a system conducive to facilitating effective instruction.

Introduction

Our discussion centered on the potential for broad diffusion of a technology-based learner interface. Much of the literature on intelligent tutoring systems, computer-based instruction, embedded computer-based teaching, intelligent computer assisted learning is appropriately concerned with student achievement (See Papert, Brusilovsky, Specht, Weber, and Kommers). Within this IFETS context we consider three critical issues being faced by schools that are global in perspective, but remain focused on the learners' needs, and may help us to define new purposes for researching and deploying such technology.

1.) A shortage of teachers. Policy sources are saying up to two million teachers will be needed in the United States (Ingersoll, 1999, http://depts.washington.edu/ctpmail). In a recent meeting with a state education department official I was told, if the state’s teacher education program produced to its fullest capacity and each of those teachers entered education, they could only produce half of the teachers needed this year. If you add a factor of quality, whether all of these teachers are hirable or of the caliber that schools want, the situation becomes even more critical.

2.) The quality of teaching. The current approach to improving teaching is to raise standards for teacher preparation programs, increase degree attainment requirements of teachers, and increase the availability of in-service training related to classroom strategies. Are we misplacing our resources by continuing to address the quality of teaching in a teacher-lead classroom format that may be outdated? Are the expectations of the teacher too high? Is it realistic to expect a primary teacher to provide knowledge in all subject areas and secondary teacher such thorough knowledge in a subject area? Is there a means for making the role of the teacher more realistic and manageable?

3.) The capacity of schools. There are school districts that cannot attract better teachers because of their location, pay scale, competition from private industry, or just because the teachers they need are not available.

Each of these issues has a direct impact on student learning, but provides a broader lens through which to consider the potential impact if a critical mass of schools had access to such a technology enabling us to offset these issues.

Potential for Development

Technology-based learning environments, mostly in the form of web sites, online learning systems, and educational software, are growing in use. For the purposes of our discussion we define the technology-based learner interface to be much more than a static website, drill-and-practice learning system, or authored interactive multimedia program. A technology-based learner interface uses software, Internet, or other computer-related technology as the means for replicating effective instructional strategies to interactively deliver content, engage the learner, facilitate learning, and assess instruction. Silicon Valley style cutting-edge
developments in the realm of highly-interactive technology provide the foundation for opportunities beyond the attempts to improve the existing learning environment. Computers, Internet, and software are available to build new means for teaching and learning. Building on the work of Papert, Bork, Brusilovsky, and others, our discussion centers on the idea of a system that could apply existing technologies to provide an interface between the teacher, using appropriate and effective instructional strategies, and the learner, engaged by the system to attain and improve knowledge (See Figure 1).

![Figure 1. Learner Interface Framework](image)

**Background**

The idea of a technology-based learner interface was notably brought to fruition through the work of Seymour Papert at MIT. Papert's LOGO has long been the quintessential prototype for designing learning activities using a computer, software, and a constructivist approach. There are many others pioneering work in this field (See Bork, Brusilovsky, Kommers, Papert, Streitz, Weber).

Through this discussion we address efforts to plan, design, create, and implement a learner-interface that enables schools to overcome the issues of teacher shortages, improves the effectiveness of existing and future teachers, and increases the capacity of the school to provide an equitable and quality learning environment.

**Discussion**

Although this discussion primer suggests we review the research of computer-based instruction, adaptive hypermedia, and intelligent tutoring systems, discussions involving learning theory and instructional design should not be off limits. In order to launch the discussion the following questions were offered:

- Considering the critical issues discussed earlier, what is the potential for collaborative efforts using existing technology to design and deliver a widely diffused technology-based learner interface that could be used by teachers to design highly-interactive learning environments, engaging the learner, and assessing learning?
- What would the research and/or development framework be if we were to expect that this learner interface would: enable the teacher to easily (e.g. without high end programming knowledge) construct highly-
interactive learning environments using appropriate instructional and learning strategies; engage the learner through a computerized, but familiar world, where he/she uses inquiry, discovery, and self-directed learning; and enable the school to build a networked database of best-practices modules based in subject areas and specific learning topics, providing an opportunity to overcome issues of teaching quality?

Discussion of Development Costs

Cost and instructional strategies were the dominant strands of the discussion. The common thread of the element of cost was the high level of expenditures experienced by those involved in multimedia development. Development of video-formatted material for one class period can easily require funds over $75,000, not including the costs for equipment. From their existing body of work we can see that Bork and Papert acknowledge the initial costs are high, but if the $75,000 multimedia lesson is shared with hundreds of schools, thousands of classrooms, and many thousands of students over a period of years, the cost becomes negligible. The actual costs of present delivery of traditional classroom/non-multimedia instruction is still unclear, making the point difficult to compare on a cost-per student basis. In the U.S. the cost for student learning is calculated as the expenditure per pupil. The national average as of 1993-94 statistics is $5,700. The expenditure per pupil is $3,181 and $6,497 in Georgia and New York State respectively (NCES Data: Expenditure Per Pupil). Georgia is among the lower-third of states when comparing per-pupil expenditure. But is also reports over $165,000,000 in annual media expenditures for K-12 schools. If we consider the development costs of a highly-interactive multimedia lesson to be $75,000. Divide the costs among the 180 county-wide P-12 school systems in the state of Georgia. The cost would be $416 per school system, if only one classroom per system used the lesson. Applying Rogers innovation adoption curve we could estimate that actually 10% of the 1,200 elementary schools, or 120 schools, would adopt the innovation (Georgia State Education Department: School Totals). The cost per school would be $625. If 10% of the over 82,000 full-time teachers adopted the lesson (Total number of teachers accessed from http://accountability.doe.k12.ga.us/Report99/default.html), the cost per teacher is $.91 just for the state of Georgia. If the multimedia lesson was used once by only by 5th grade teachers, for a total of 117,973 students, the cost per student would be $1.50 (Georgia State Education Department: Enroll Grade Totals). Georgia is already supports a $122 per student media expenditure (1,346,623 students/$165,000,000 media expenditures). This example of one state in one country shows that if lessons are widely distributed and implemented in many states or countries, multimedia development costs may actually be negligible. We can assume the design, development, and implementation costs of a technology-based learner interface could be also be calculated in the same fashion. An accurate calculation of existing learning activity development and implementation would provide greater insight, providing a basis of comparison to the cumulative costs of many learning activities delivered through a common interface for each student and classroom. A more important issue may be depend more on "how much funding is devoted to designing new curricula that puts the burden of instruction on the right components. (We) can expand the effectiveness of teachers by getting them out of the roles that are more effectively handled by the computer..." (Myers #63).

Discussion of Instructional Strategies

Then common tenancy of the discussion participants was that teacher effectiveness would be an integral issue related to the development and implementation of an technology-based learner interface (Bergeron #77,78, Kahn #76,#79, and Kort #77,#81). "If there is a danger it is in the failure to recognize what computers can and cannot do effectively with or without human assistance" (Myers #62). "The drive to create this tool makes the assumption that teachers are also technologists, but some instructional technology is transparent, we should discriminate between content expertise, designing and developing the content for presentation, and facilitating the learning experience" (Bergeron #74). Betz likened this to a team-teaching role that has been unsuccessful because logistics tend to interfere with delivery of instruction (Betz #72). Bergeron responded by disagreeing with the team-teaching analogy and likening it more to a development team approach used in many successful companies (Bergeron #76). "Designing and developing high-quality educational interactive multimedia programs is hard to do and even harder to do well. We don't expect teachers to write their textbooks or create the pictures they need for class." (Begeron #78). Kahn (#79) responds, "Although we may not expect teachers to write their textbook...they should have the capability...we do want them to be producers and not just consumers". He added, "We all accept that a teacher or student should not only mater reading, but also writing...why not also accept that a teacher or student should not only master software but also develop it?" (Kahn #76) (I am assuming from the direction of the discussion at this time, Kahn was referring to "student" as pre-service student preparing to be a teacher.). The exchange typifies the polarity of discussant position on the topic of teacher-as-designer versus teacher-as-active user/consumer.
There was a common thread about teacher instructional strategies. "All good teachers start with goals, objectives, and outcomes, no matter the medium." (Bonnycastle #74). We are not discussing an interface model to replace what works, but for a teacher to exchange what does not work with something that does. Technology provides the capacity and interactivity to provide such a scenario. Computer Assisted Learning, for example, has the ability to deliver immersive learning environments, such as games and simulation, where the student is able to apply knowledge and perform skills (Kort #77). "So, an important skill for the innovative educator to learn is how to make use of such constructivist learning tools. Building and using models is a powerful way to gain mastery of a subject and to foster creativity, innovation, and diagnostic reasoning skills." (Kort #77).

Teacher-training issues were raised in the context of instructional strategies. Myers (#62) added that most technology is added to the classroom after the fact, when design and planning has already been completed. "Young people already accept communication through a keyboard as being part of a community...the instructors need to also." (Myers #62). There was agreement that teacher needed to progress through stages of awareness, integration, and then contextualization in order to implement highly interactive uses of technology (Bonnycastle #74 and Original Discussion Paper). It is important to note a tone of caution that was present and typified by the exchange between two discussants: "...classrooms continue to be a static place where information is deliver in a one-way classroom". "this is a sweeping generalization...there are some boring lecture going on...but there are also some exciting teaching going on...". There was excitement and agreement that the work on designing a learner-interface should move forward, but that the solution should not involve discarding all that teachers are doing, as if there is nothing good happening in the classroom. Instead the work should involve identifying what works for teaching and learning and replicating these activities to be delivered through a common interface for use by teachers as they facilitate and determine the need.

Summary

The discussion about the potential for a technology-based learner interface focused on cost and instructional strategies. High initial development costs were addressed using a model of diffusion. Using Rogers' model and Bork's cost analysis, we find that widespread use of interface technology would result in low per-student costs.

Using a technology-based interface to support instructional strategies we must address teacher training, identifying what presently works in the classroom, and determine the approach for development. Teacher training is often non-existent when technology is introduced into the classroom. Successful integration of learner-interface technology would be dependent upon the teacher's ability to use the system and adapt their classroom teaching. Teachers would be trained in use of the interface and access to teaching and learning modules. The modules are representative of "what works" in the classroom. When preparing to teach on a topic, teachers "plug-in" the module to deliver instruction on a topic, one that may not be their area of strength or expertise. Discussion participants were split on their views. Some though teachers should be trained and have that capabilities to complete this integration. Others thought the teachers should be working with others, a team project similar to the private sector design model.

The discussion has set the tone for further research and development. The cost arguments may have been deflated for the time being, but further analysis is needed. Instructional delivery and student learning should be the focus, assuming economies of scale will come into play as a well-developed system is provided for the teachers. We have discovered from the discussion there is not consensus on how to proceed with planning or development, therefore, more efforts should be made to research "what works" in the classroom and how it can be replicated through an technology-based interface.

Resources/References

Bork, Alfred  
http://cui.unige.ch/eao/www/CBL_papers/ifip92.html

Brusilovsky, Peter  
http://www.pitt.edu/~al/aied/brusilov.html

Kommers, Piet  
http://users.edte.utwente.nl/kommers/artikel/home.htm

Georgia Department of Education: Total number of students per grade level  
http://db1.doe.k12.ga.us:8001/ows-bin/owa/fte_pack_enrollgrade.display_proc
Georgia Department of Education: School count  
http://db1.doe.k12.ga.us:8001/ows-bin/owa/school_main.fill_form

Georgia Department of Education: School report cards  

IFETS Discussion Archive (See #537-556)  
http://ifets.gmd.de/archiv/

Ingersoll  
http://depts.washington.edu/ctpmail

National Center for Education Statistics: National expenditure per pupil costs  
http://nces.ed.gov/pubsearch/

Papert, Seymour  
http://www.microworlds.com/company/logo.pdf


Streitz, Norbert  
http://www.informatik.uni-trier.de/~ley/db/indices/a-tree/s/Streitz:Norbert_A%3D.html

Weber, Gerhard  