

The HTML5 Revolution in Online Learning: *Link-Systems' WorldWideWhiteboard® v.5.0*

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About the Author

Link-Systems International, Inc. (LSI) provides a full suite of online education tools. The WorldWideWhiteboard was developed by LSI educators from the University of South Florida in Tampa, Florida, where LSI is still based.

David Kephart, former Director of Online Tutoring at LSI, has taught mathematics at the University of South Florida for a decade. Currently the Director of Academic Research at LSI, Dr. Kephart facilitates research studies and academic collaboration with universities, community colleges, K-12 schools and other educational programs.

As both an adjunct professor of mathematics and an active researcher in learning theory and practice, Dr. Kephart has published articles in peer-reviewed journals about online education, learning mathematics, and discrete mathematics.

The HTML5 Revolution in Online Learning:

Link-Systems' WorldWideWhiteboard® v.5.0

Introduction

A second online transformation of education is in the wind, one in which the adoption of HTML5 puts the power of the recent technology at the disposal of learners and schools everywhere. The advent of online learning can be traced from programmed learning efforts of a half-century ago to the arrival of the Internet and the facilitation of online repositories of knowledge and research in the eighties, but especially to the arrival of Web-based technologies in the nineties. A new wave of innovation is sweeping the world of telecommunications and transforming the approaches of educators. Students today need education software capable of using the full power of iPads, iPhones, and Android devices. The WorldWideWhiteboard of Link-Systems International, Inc. (LSI) already prominent in online collaboration and learning, is updating that technology to take full advantage of the developing possibilities opened up by HTML5 and mobile technology. As this paper explains, this puts LSI at the leading edge of a revolution in online learning.

The best-known aspect of HTML5 is its connection to mobile technology. HTML5 is an international, cross-platform standard enabling educators to make use of the full potential of the iPad (currently in its third generation), the iPhone and its seminal use of a high-resolution capacitive touch screen, and the unfolding sweep of Google's Android mobile operating system (currently shipping its fourth major "Ice Cream Sandwich" version, with a fifth on the horizon).

These devices have captured the imagination of learners everywhere from Africa and the heart of India, all across China and throughout Europe as well as the US. HTML learning software makes the popular activities associated with mobile technology within the reach of the educator. LSI's WorldWideWhiteboard is the one effective way of bringing the many benefits of online collaborative learning to this massive new audience of learners and in a way that is easy to understand, provides educators with the information they need, and supports green initiatives and financial aims of public and private educational institutions.

Brandon Satron, writing in the *MSDN Magazine*, sums up the technical aspects this way: "HTML5 is an umbrella term describing a set of HTML, CSS and JavaScript specifications designed to enable developers to build the next generation of Web sites and application." We will consider what it means to make this advanced standard available to educators. We will look at what it means for the WorldWideWhiteboard to support HTML5. We will also show how this fits into modern learning theory and how it concerns everyday goals of educators and administrators at every level from K-12 to higher education and adult learning.

What is the Point of HTML5?

Many have heard of HTML5 already. The "nearly militant" stand of Steve Jobs in 2009 for "HTML5, CSS, and JavaScript" as modern Web-development tools made HTML5 a well-known term among users of Apple products and the programmers and users of mobile applications. In 2011, headlines read that Adobe, the owner of the number one browser plug-in application Flash, was halting development of Flash for mobile devices at a time when Web-access from mobile phones and tablets was outstripping access from laptops and desktops. From this, many understood that HTML5 must be an important and effective alternate way to convey audio and video content on Web pages.

It turns out HTML5 is this and much more; it has profound implications for educators and the attainment of successful learning outcomes. Here we take a look at what HTML and HTML5 really are, why this change, in tandem with the popularity of smartphones and tablet computers, improves matters for mobile technology, and why HTML5 support is so important for the classrooms.

History of HTML

HTML, short for **H**ypertext **M**arkup **L**anguage, is the language of the Web. In brief, HTML5 is the fifth version of that language. The table below outlines the significant changes associated with successive generations of HTML. It is important to realize that development of the definition of HTML is in the hands of the World Wide Web Consortium (W3C) and that, since 2004, a particular committee of the W3C, the Web Hypertext Application Technology Working Group (WHATWG), has been delegated the task of HTML standards development. During the subsequent eight years this committee has been involved in proving the need for, defining, and setting forth the outlines of HTML5; this should give an initial idea of the importance as well as the complexity of this task, as contrasted with the development times of earlier versions. These are listed in **Table 1** - HTML Versions.

This long gestation period of HTML5 is due to the fact that it no longer simply covers a few additional browser capabilities left untouched by earlier HTML versions. The WHATWG aims to encompass next-generation Web content presentation and consumption capabilities—things undergoing constant change—within the definition of Web page layout. The W3C wants to be able to open all possibilities for Web expression under the HTML5 umbrella. Flash, mentioned above, was external to page layout, a proprietary program that had to be downloaded by each user to function, which ran in memory separate from the Web browser. Audio, video, and interaction between viewer and server were supplied under a non-standardized, closed license and served to the Web page.

What is Different About HTML5?

The fundamental and remarkable distinction of HTML5 from previous versions of HTML is that it enables developers to harness the entire power of existing hardware to online communication. In this way, it provides a usable starting point for the presentation of content at the rate demanded by mobile technologies.

Specifically, HTML5 defines tags—document structure markers like in previous HTML versions—but these new tags describe the delivery of multimedia embedded within the Web browser interface. Entities such as `<video>` and `<canvas>` have extensively defined properties allowing for video to run, pause, resume, and so on and allow for complex user interactions with JavaScript and detailed Cascading Style Sheets (CSS) that live on the Web page and occupy storage only while the browser runs them. The initiation and termination of these structures are up to the browser and do not require extra applications on the client side. Ultimately, the developer will be free to add new entities, provided the functionality is defined on the server (web-site Internet provider) side. To be HTML5 compliant, Web browsers must “know” how to deal with video and elicit the system capabilities for live input and output. Memory-friendly Web applications use hardware resources in a conveniently programmable format, according to guidelines shared with all HTML5 clients. The rendering of the Web page becomes literally, not just metaphorically, part of dynamic inter-human communication.

HTML5 is far more than simply adding video and interactive Web elements to an already-existing standard. It defines a common set of Web-capabilities and error-handling methods necessary for the support of such content on all HTML5-compliant browsers and on every computer operating system running such a browser. In this way, the HTML5 standard makes the delivery of Web content user-friendly. How this works is the concern of the browser developer, and not the content author or the Web designer. For example, on mobile devices, the browser itself provides the hooks into gesture-and touch-based interaction for the designer and content author. Since HTML5 focuses on the functionality delivered rather than how external applications work, HTML5 compliance means that running Web apps based in JavaScript and CSS consume less memory and consequently uses less battery life.

The HTML5 standard, although many pages long, is not a complete description of everything that can be put on Web pages. Instead, it opens the way for new APIs and for the presentation of new and unimagined forms of media on the Web-media. On laptops and desktops, HTML5 is a smarter, more resource-friendly use of hardware. Adobe has withdrawn support for Flash on mobile devices, acknowledging that HTML5 is a more efficient way to make content directly usable and directly

interactive. The incorporation in HTML5 of CSS and JavaScript will eventually simplify the development of Web software.

Draft Version	Draft Published	Standard	Standard Published	Contents
HTML Tags	October 1991 (publicized)	HTML Tags	1989 (internal CERN publication)	Eighteen document structuring and formatting tags for graphic user interface display of Web pages. (HTML Tags, 1992)
HTML DTD (v.1.0)	June 1992			HTML is identified as a specialized SGML, the general document markup language used by CERN.
HTML DTD 1.1	November 1992			Informal draft (Connolly, document type declaration subset for HyperText Markup Language as defined by the World Wide Web project., 1992)
Hypertext Markup Language	June 1993	Hypertext Markup Language (HTML)	June 1993	An Internet draft, followed by seven revisions and leading to HTML 2.0 (Connolly, HTML DTD enclosed, 1992) (Berners-Lee & Connolly, Hypertext Markup Language (HTML), 1993) (Berners-Lee & Connolly, Hypertext Markup Language (HTML)Hypertext Markup Language (HTML), 1993)
HTML+	November 1993			Document competing with "Hypertext Markup Language"
HTML 3.0	April 1995 (authored March 1995)			Considered lengthy, included tables, flow-around text, and complex mathematical formulas (Connolly, HTML 3.0 Draft (Expired!) Materials, 1995)
		HTML 2.0	November 24, 1995	Form-based file upload, tables, client-side image maps, internationalization (Berners-Lee & Connolly, HyperText Markup Language Specification - 2.0, 1994)
		HTML 3.2	January 1997	Dropped math formulas, reconciled most proprietary extensions, adopted most Netscape tags (Raggett, HTML 3.2 Reference Specification, 1997) (WG, 1996)
		HTML 4.0	December 1997	Three variations adopted: strict, transitional, and frameset; adopted browser-specific attributes but deprecated Netscape's visual markup in favor of style sheets (Raggett, LeHors, & Jacobs, HTML 4.0 Specification, 1997)

Draft Version	Draft Published	Standard	Standard Published	Contents
		HTML 4.0	April 1998	Minor alterations (Raggett, LeHors, & Jacobs, HTML 4.0 Specification, W3C Recommendation Revised, 1998)
		HTML 4.01	December 1999	A W3C Recommendation (Raggett, LeHors, & Jacobs, HTML 4.01 Specification - 4 Conformance: requirements and recommendations, 1999)
		HTML 4.01	May 2000	ISO/IEC 15445:2000 version based on HTML 4.01 Strict (ISO/IEC 15445:2000 Information technology -- Document description and processing languages -- HyperText Markup Language (HTML), 2011) (ISO/IEC 15445:2000(E) Information technology -- Document description and processing languages -- HyperText Markup Language (HTML) Corrected version, 2003)
HTML5	January 2008			Published as a working draft includes "html" serialization and the XML-based XHTML5 serialization. (Hickson, HTML5: A vocabulary and associated APIs for HTML and XHTML, 2011)
		HTML5 (projected)	2022	Includes XHTML5, cooperates with CSS3. Extensive APIs forecast and HTML to continue in parallel with XHTML (Hickson, HTML5: A vocabulary and associated APIs for HTML and XHTML, 2012)

Table 1 - HTML Versions

A caveat must be issued, however. Because HTML5 is still in development itself, the major Web browsers are themselves at different stages of compliance with the HTML5 standard. For some time, Web application developers must take these differences into account to make their applications run in the expected manner. Even this in-between state is a vast improvement over the period of the "Browser Wars" of the late nineties. Today, each new browser strives to prove itself more *like* the HTML5 ideal, instead of attempting to prove how it is *different and unique*. The W3C already refers to up to 100 APIs (elaborated rules) in preparation. The major Web browsers vie to support these features, even while the standards are still in draft form. Anyone with Web connectivity can log into a site that will immediately evaluate the Web browser in use for HTML5 compliance (<http://www.html5test.com>). As to CSS, HTML5 as a standard remains technically distinct from the new and powerful CSS3 standard for Web

presentation even as it includes it. Users may test their browsers for CSS3 compliance at a similar site (<http://www.css3test.com>).

How Does HTML5 Ally with Mobile Computing to Change the World of Communication?

Notice that no aspect of the HTML5 standard explicitly refers to mobile devices. All the same, the primary impetus to the rapid move towards HTML5 is surely due to the endorsement of the mobile device manufacturers, in particular, the open letter of Apple founder Steven Jobs, who declared that the iPhone and iPad would never use Flash—at the time the most popular browser plug-in. This stance, as suggested above, flowed from practical considerations of developing mobile hardware and running software on mobile devices (Jobs, 2010). Allowing the browser to proctor Web activity meant less consumption of battery and memory power. It also meant content that enables user interactivity—the defining feature of popular mobile applications—will be simple to monitor and evaluate and will run without undue user burden. In some sense, the age of the computer geek is over and the age of computer literacy is at hand.

Rather than HTML5 being *for mobile devices*, it is more accurate to describe mobile communications, via tablet or smartphone, as being ready-made *for HTML5 implementation*. The leading browsers vie with each other to support the standard, rather than to spin off distinct “better” versions and violate the standard. The end result is that, more and more, users leave their desktops behind with confidence, communicating with handless kits through their smartphones in the car, keeping up with the latest news and weather alerts, and staying in tune with what is trending on social networks.

Okay: How About the Technical Details?

Thankfully, the end-user need not worry about technical details with HTML5. Things work the way they are supposed to in a browser supporting HTML5. Beginning in 2004, the WHATWG committee of the W3C set this as a priority, with the concept being to merge the passive presentation for which HTML was already prized with the dynamic object model (DOM) that had brought Web pages to life. All of the WHATWG discussions involved industry leaders, so that Microsoft, Google, and Apple gradually acclimated themselves to the idea that needless duplication of browser and plug-in effort would be done away with.

The WHATWG recognized that the full outline of such a unifying standard would take a number of years—it will be complete, reportedly, in 2022. These developers saw the upsurge in mobile computing as an expression of the need to implement support while the standard was being written. In short, the software community came together in a manner that is as typical of the development of digital communication as it is astonishing. As with the IP standards that define Internet connectivity, browser and mobile hardware developers occupied themselves with more uniformly supporting HTML5. The result is that educators eager to reach diverse students now have the tool to do so.

The `<video>` tag that inserts a video source and the `<canvas>` tag that enables some type of live user interaction do not run either kind of content; it is up to the browser to link the page to the available

hardware to make that happen. What these and the scores of HTML5 entities yet to come do accomplish is the structuring of the page content and the consistent, well-defined communication to the browser of expected functionality.

As additional components of HTML5 are implemented, the users of mobile devices can count on having increasingly engaging online interactions at their fingertips. Educators can count on improvising at will in the online environment; HTML5 support will mean that educators using HTML5-based tools will get what they expect. Unlike Flash, there is no additional plug-in or download and no surprising instability or lack of security. Whether more at home on iPads, smartphones or Androids, the educator will find in HTML5 tools a natural extension of his or her teaching capabilities. Moreover, a wealth of new capability comes to the desktop and laptop.

Precisely What Does This Do for Schools Systems, Educators, and Learners?

Education, fundamentally, is a special type of human communication. Educators today recognize that the engagement of students as active participants in learning secures an investment by the learner in cognitive development and provides a way for the educator to contextualize learning objectives to individual experience and background. For two decades, online technology has supplied a vital example of providing engaging and even personalized educational experience.

If the vast majority of educators today feel that the “old way” is not simply out of touch but actually hampers student success, then online experiences have reinforced this conclusion. There are two main ideas of constructivist learning theory that have been at least partially confirmed:

- Concrete measurement of cognitive achievement is not only possible but is a vital part of education. Teachers, tutors, and mentors must make their expectations known so that students can take responsibility for their own results. This encourages creative approaches as well as superior exam results.
- Learning occurs in the context of the learner and must be a made part of that context. This includes three main approaches, recognized widely for their effective encouragement of learner engagement:
 - Embed learning in a problem that is recognizably part of the students' social context, such as learning to buy a car. Mathematics and personal finance become real issues.
 - Recognize that the learning environment is a context in and of itself. Offering an unthreatening focus for discussion and exploration can catalyze learner interests.
 - Speak to students through their authentic experience. Offering online communication tools in the technological context of social networking allows students to see learning as a continuation of life activity.

Online learning typically takes one of three forms. Courses may be conducted entirely online without a single face-to-face meeting. Courses may offer blended learning solutions by combining major online components with limited face-to-face interaction. Finally, online assistance or practice problems may be

offered as a complement to course work, in which case a separate arrangement may enforce guidelines (in the case of online tutoring) or may notify the instructor of results (in the case of online homework).With these and the ongoing test of in-class methods, we can conclude that the debate about constructivist learning is largely over. Today campuses more and more consciously seek out collaborative and specifically online collaborative learning techniques and methodologies. This is seen both as a way to meet cognitive learning standards and to fulfill the basic need for contextualization.

Enter the iPad, the iPhone, and other mobile devices. Starting with the introduction of the iPhone in 2008, we have witnessed the growing possibility for a universal form of online courses and a different, more powerful form of support outside the classroom. With HTML5, these become a reality in the sense that educators can now rely on conveying expectations, conducting discussion, and admitting creative student contributions whenever and wherever they may be. All that may be missing is an effective implementation of HTML5 learning tools. Now that is supplied by the WorldWideWhiteboard.

To restate the situation: educators instinctively, or on the basis of strong scientific evidence, acknowledge the powerful impetus that online tools and their popularity among students can give to learning outcomes. A quantum leap in the universality of access of online tools is currently underway, in the form of less expensive, touchscreen-equipped, eminently portable devices. Distance education software has not caught up with the hardware boom until now. The remainder of this paper explains how LSI has rewritten a proven, Web-based tool for online collaboration in HTML5 to provide precisely the missing ingredient to complement the new technology.

WorldWideWhiteboard V.5.0, HTML5, and the Support of Online Learning with Mobile Technology

Link-Systems and Online Collaborative Learning

Link-Systems International, Inc. (LSI) was incorporated in 1995. The company's first product was the WorldWideWhiteboard (originally named for its online tutoring service, NetTutor). The WorldWideWhiteboard was Java software and generated a whiteboard-like interface on which either an instructor and student or a tutor and learner could discuss the issues in a course or those raised by students. Numerous studies made use of this interface, establishing its pre-eminence in facilitating discussion of math topics in online courses (Smith & Klein, 2004), its utility in campus-based online tutoring, and its feasibility as a medium for conducting online office hours.

Theories of How Learning Takes Place and Online Learning Tools

In the development and marketing of this product and in conducting the NetTutor online tutoring service, LSI found natural allies among educators determined to implement best-practices of online education. Such collaborators helped show, for instance, that the WorldWideWhiteboard encouraged the development of successful communities of learning within math courses (Thomas, Li, Knott, & Li, 2006). This alliance was based on agreement with the constructivist philosophy of education, the

outlook which, by the end of the twentieth century, had become a leading model of how learning occurs in the classroom.

Two aspects of online collaboration connect the use of the WorldWideWhiteboard to constructivist ideas. On the one hand, being present anywhere and anytime, like the Internet itself, enables the fully contextualized presentation and scaffolding of learning interactions. On the other hand, the WorldWideWhiteboard offers live interaction to ensure that specific cognitive learning objectives are reached by individuals and the classroom as a whole. It is the embodiment of the extension of constructivist learning into online collaborative learning.

The WorldWideWhiteboard offers tools for subject-specific aspects of online collaboration, such as math symbols and operators. It offers video and audio communication as optional and discussion leader-controlled features. Records of all online sessions are preserved for convenient access by the participants. These features have been shown to support learning assistance supplied by institutions (Turrentine & MacDonald, 2006).

Over the past decade, online tools have become a vital part of every educational institution. Online Collaborative Learning can easily be seen today as an important component of higher education; indeed, this is now penetrating the K12 sphere. Moreover, online tools reach those in greatest need of encouragement and assistance most effectively (Kersaint, Barber, Dogbey, & Kephart, 2011). The WorldWideWhiteboard has, correspondingly, transformed itself from an interesting add-on for the classroom experience to an essential supporting component, even when the course itself is not online. Students today expect and respond to the opportunity to communicate with a source of online assistance and discussion.

LSI describes its approach today as Integrated Cognitive-Contextualized learning, meaning the combination of Internet use and live educator interaction. The WorldWideWhiteboard continues to exemplify this approach.

The WorldWideWhiteboard and HTML5

At the expense of a significant development effort, many hours of testing, and a re-education of its marketing team, LSI has entirely rewritten its already successful WorldWideWhiteboard product in HTML5. This firmly places LSI in the vanguard of a new wave of learning technology. As emphasized above, this marks the resumption of the revolution in learning made possible by the Web.

Most students have moved beyond what is offered by smart classrooms that merely integrate digital technology into the traditional learning environment. Clickers and other devices represent the move toward the *engaged smart classroom*. In the WorldWideWhiteboard v.5.0, LSI enables instructors in classrooms to reach out to and involve students in a very dynamic exchange. For schools that have already made an investment in mobile learning through, for instance, providing students with tablet computers, the WorldWideWhiteboard v.5.0 provides an out-of-the-box learning application that can support today's curricula on either the iPad or Android devices.

In the blended learning environment, the WorldWideWhiteboard even reaches students on their cell phones. It can bring learners and even instructors into the virtual classroom anywhere they may be. But, even more important, through implementing the entire interface in HTML5, the new WorldWideWhiteboard offers and will continue to offer the very latest in Web media all the time on all of these devices.

What WorldWideWhiteboard v.5.0 Looks Like and How It Helps the Educator

With an understanding of the potential and actuality of HTML5, the first inquiry is: what does an HTML5 implementation *look like*? LSI has answered that question by providing a whiteboard-like interface that exhibits the full power of HTML5. In addition, the same behavior observed on the desktop for this software is also enjoyed on the iPad. But, most importantly, the WorldWideWhiteboard, in a complete rewrite from the ground up, will continue to exhibit the most advanced capabilities under the most advanced HTML5 browsers available.

The Setup

It is important to understand that the WorldWideWhiteboard originated in 1995. It began as a Java application serving educators and their students a virtual online classroom environment. It uses the model of a classroom session in space shared by participants, one of whom is the session leader or facilitator. Each participant could be situated anywhere in the world, as long as he or she had Web access. Extremely economical with bandwidth, this represented the first commercially-available collaborative learning solution that offered both synchronous and asynchronous modes of interaction. That is, all participants could naturalistically converse in real time or the facilitator could review individual participants' contributions and return responses when one or more were offline. The WorldWideWhiteboard, from its beginning, contributed to revolutionizing education by putting the shared environment of the Web at the disposal of educators.

Completely re-written in HTML5, the WorldWideWhiteboard v.5.0 further leverages the engagement and authenticity implicit in Web interactions. It extends accessibility to mobile devices and allows the educator and learning to use all of the tools of Web communication. The WorldWideWhiteboard now brings together users on the go: a teacher riding home on the bus can assist a struggling student who is on another continent. Moreover, the design of the WorldWideWhiteboard has been redesigned to accommodate greater ease of expression and the retention of ideas discussed, reflecting the power boost due to the way HTML5 takes advantage of available hardware. While accessibility is thus expanded, tedious details of its operation pass to the "cloud" so that system administrators can control enrollment and branding interactively. All participants can use new and innovative storage, replay, and printing features.

With WorldWideWhiteboard v.5.0, elements common to Web communication that the population has grown accustomed to—dynamic Web sites, instructional video, word processing, spreadsheet, PDF documents, video broadcasts and voice communication—can all be shared on the same interface

simultaneously and separately by all participants. Instructional designers can now adapt the medium and media of the Web to directly and realistically present contextualized cases, and course content. Pedagogy and andragogy can focus on subject-specific needs of the learner as the learner encounters them. In short, the WorldWideWhiteboard enriches and helps realize potential of the online collaborative learning experience.

These, admittedly, are very large claims. LSI has offered the best possible test of their validity, namely, a program offering direct experimentation with the software for oneself. We look at some views of the WorldWideWhiteboard as an introduction to its unique capabilities.

In **Figure 1**, we see a normal collaborative session in progress. Here formulas either dragged from another Web browser window or created on the WorldWideWhiteboard with its **math** tool are posted into the midst of a white board session. Explanatory text has been provided, either with the **text** tool or with the **insert text** paragraph insertion tool. Modeled after a typical online course review for an upcoming exam, note that the leader advises participants to prepare for an exam. All interactions are tracked. Users click the **playback** toolbar button to replay the entire session.

In **Figure 2**, more objects have been added, as from a session with discussion. Notice that, in addition to allowing a video to play on the whiteboard area, the screen may display up to four video streams from participants' locations. Every participant can provide audio input, as well. Mathematics is displayed as high quality text since it is an HTML5 object, as well. The entire interface is free of "jaggies" and the other visual imperfections of pre-HTML5 platforms. A chat line is conveniently displayed to the right of the whiteboard area – out of the way of the main action.

In **Figure 3**, pictures give some idea of the wide range of devices on which the WorldWideWhiteboard runs. Functionality, of course, is somewhat different on touch-screen devices than on laptops and PCs, but the ease of use remains the same. All objects may be individually edited, resized, and deleted. Text, font style and size may be controlled from the menu bar, while various subject-specific objects may be inserted from the tool bar.

The HTML5 Revolution in Online Learning: Link-Systems' WorldWideWhiteboard® v.5.0

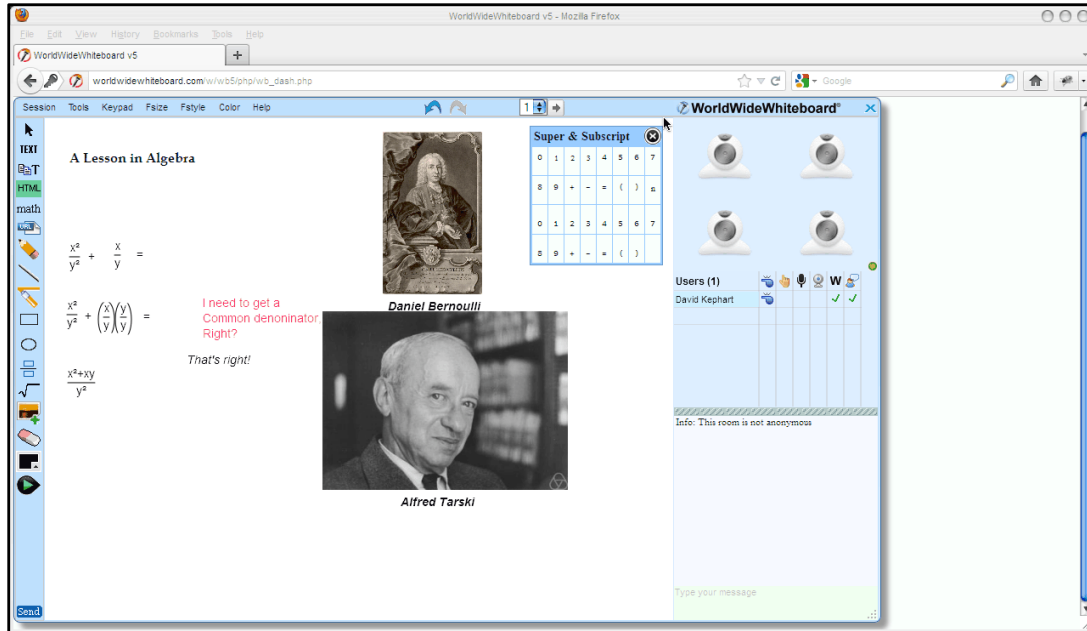


Figure 1. An Algebra Session Beginning on WorldWideWhiteboard v.5.0

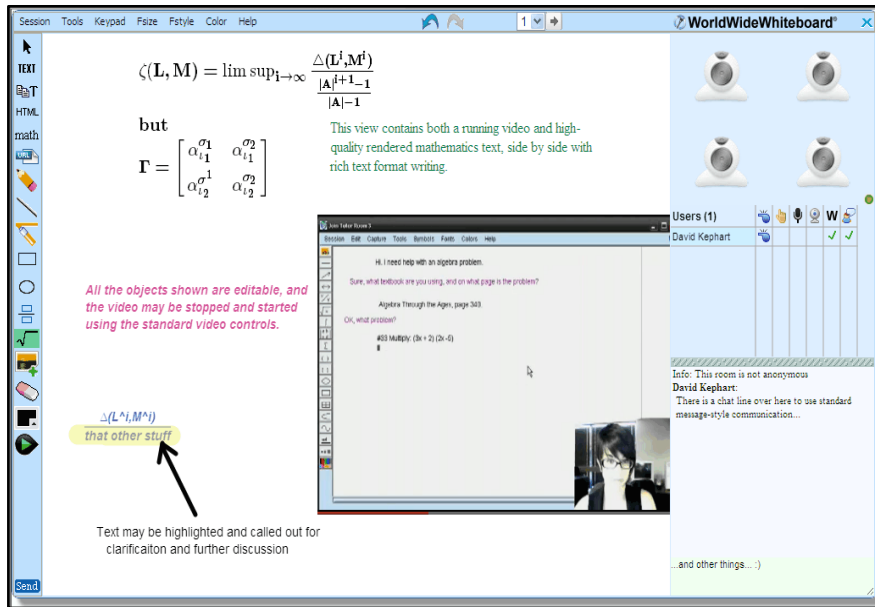


Figure 2. Video Running on WorldWideWhiteboard v.5.0

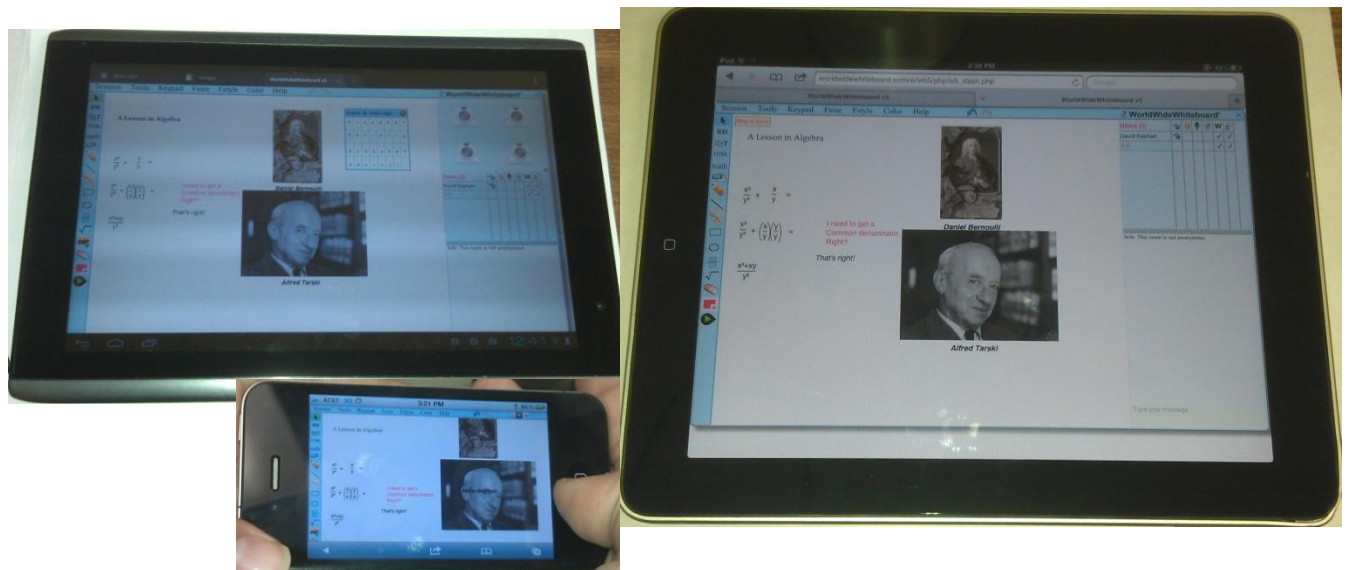


Figure 3. Android (Acer Iconia A500), iPad, and iPhone 4S Mobile Devices Connected Via WorldWideWhiteboard v.5.0

Educators can readily picture the same students who have grown into the habit of texting their friends (even in class) might eagerly take part in a class through the same interface.

Users and the Technology

A major consideration in the early days of Web programming for education was whether end-users—i.e., students and faculty—can handle a learning curve supposed to be associated with acquiring facility with the software. While the task of explaining how things work has since been embraced by help desks and other institutions' staff, it is different with personal devices. Can users make their way through the WorldWideWhiteboard on an iPad?

The initial studies into usability conducted by LSI show that the software skill necessary for the use of the WorldWideWhiteboard is rapidly acquired and easily retained. Volunteers trying out the interface “cold”—i.e., without access to help documents—were able to learn most of its functionality within the first thirty minutes of operation.

In addition, as with the earlier versions of the WorldWideWhiteboard, every installation of the software involves a selection of available tools; that is, math-centric tools such as the square root sign or fractions need not appear in a connection dedicated to composition classes. The long LSI tradition of customizing the interface and creating *additional* tools as required for particular courses and faculty member continues with the HTML5 version of the WorldWideWhiteboard.

The result of customization and readily acquired operational principles is that, in every case tested, the technology appears adapted to the class or interaction, rather than the other way around. This relationship, too, is inherent in the HTML5 approach; what the user needs for a given function the standard defines.

Technical Considerations

A major concern for some software is whether it is easy to install. In the case of the WorldWideWhiteboard, HTML5 support means that there is nothing to install; the HTML5 browser already present on the PC, iPad or other mobile device (and Internet connectivity) are all that are required.

A second technical concern is whether the WorldWideWhiteboard can be readily modified as software and hardware advances occur. Numerous details of the whiteboard and access may be customized according to user needs. Altering these is ordinarily a matter of changing a few settings, since, as an HTML5 application, the WorldWideWhiteboard comes with its own API. It can likewise be easily embedded in a school's Course Management System (CMS). This makes the whiteboard, modifications, and records of using available to the appropriate users with a few clicks.

Internally, one additional characteristic of HTML5 is a vastly improved approach to reporting errors in software. This assists the user of the WorldWideWhiteboard v.5.0. LSI's customer service team is already known to handle reported issues within minimal delay. Note that a button is available for the user who notices unusual behavior, right on the main page of the interface.

LSI, as a firm with over fifteen years of research-proven educational software development experience, has made everything about HTML5 adaptable to the actual pedagogies educators use. While student-centered at its core, the WorldWideWhiteboard can implement the best-practices of anything from a purely situational to an instructor-guided approach. The WorldWideWhiteboard has proven to be the best method of discussing mathematics online (Smith & Klein, 2004). The “what-you-see-is-what-you-mean” philosophy of the HTML5 standard has increased the usability of the interface for both educator and learner.

HTML5 Tools to Transform Learning

The ultimate concern with any education software is that it must further the actual learning process. LSI has a strong record in this regard, having sought independent investigation and confirmation of the pedagogic value of all of its software for over thirteen years. A number of peer-reviewed studies have shown that the integration of cognitive learning aims with the contextualization potential realized in online presentation has given sometimes dramatic and at all times expertly acknowledged impetus to education.

In this regard, HTML5 is a newcomer on the educational scene. Because of its close association with mobile technology, the overwhelming popularity of mobile technology is closely linked to the user-friendliness and graphic appeal of HTML5 applications. In addition, LSI is actively seeking researchers who want to study the close relationship between student success and the popularity of technology. We already know that persistence, retention, and scholarly achievement are positively impacted by the availability of both synchronous and asynchronous techniques.

The Online and On-Device Learning Medium

The Internet is a medium that is more involving than television or radio broadcasts. A live Internet interaction demands the user's full attention. We know that this focuses cognitive activity on the event. Texting is a famously dangerous activity for the driver; textual communication with other learners and with faculty is far more demanding than the student's presence in a lecture.

The popularity of mobile devices elevates the characteristic of the medium established by the Internet to a still-higher, more involving level. Users of mobile technology acquire a kind of fierce loyalty to their devices; participation in class via these devices, if the full potential of Web communication is available, is comparable to direct study or even the discourse with classmates widely known to result in the best improvement—e.g., in study groups.

An important component of this is that communication is tactile as well as visual and possibly aural. The student who is active via iPad in a class is quite literally *in touch* with the class. When attention wanders, the features of the WorldWideWhiteboard enable the leader of a class to bring participants back to focus on what is going on.

HTML5 and Instructional Design

Enthusiastic teachers are as important to education as involved learners. Instructional designers will appreciate the flexibility of the HTML5-based WorldWideWhiteboard. Manipulatives, rather than simply being *linked to*, may *run within* the live classroom. Live HTML links of course-related content may be compiled into the session, for instance on dedicated pages, or placed on a final reference page for later consultation. In an online composition course, for instance, the instructor can select links to Google to explain what plagiarism is and how to avoid it.

The way that items are presented on the HTML5-enabled interface can be completely functional if the teacher wishes, or that functionality can be modified or restricted. With the wealth of podcast material,

dynamic presentations, and collaborative materials available, the instructional designer can build an altogether different style of learning environment.

With the WorldWideWhiteboard there is no longer a fixed boundary between experiment and presentation or between study and involvement. Webcams and microphones can support genuinely participative learning while maintaining the focus of the class on specific learning goals.

Conclusion

This paper has explored the depth of the transformation in communication represented by the HTML5 Web standard. We have discussed how these capabilities show up in educational software. At LSI, we are working to bring the experience of education up to a different standard, that of explicit and measurable learning goals. We urge all forward-thinking educators to take a look at the WorldWideWhiteboard and the considerable possibilities both for mobile device access to learning and for the transformation that each educator may make in his or her teaching.

HTML5 is a standard that puts the full power of the computer at the disposal of the Web communicator. Real time audio and video are its hallmarks at present, but even more exciting features lie ahead. It amounts to a standardized way of embedding every significant element of computer communication into the Web page.

For educators, this opens up a new world, a revolution in technique and immediacy of presentation, and it can do so on the most widely available and popular hardware around. With the introduction of the WorldWideWhiteboard v.5.0, Link-Systems International, a distance learning software vendor of long standing in the academic community, once again makes the very latest technology available to educators. The new WorldWideWhiteboard opens up new and unexpected horizons for learning. Designed from the ground up with HTML5, LSI offers this new version of a product that challenges and enables educators to help learners construct new knowledge in new ways through the shared online collaborative learning experience.

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About Link-Systems International, Inc.

LSI Mission Statement

Link-Systems International is the leader in providing integrated technology and service solutions to educators in order to improve the quality of education and training, ensure student success and retention, and provide affordable education to students, workers, and their families.

Our Company

LSI is a privately-held company that has been dedicated to student success and student retention in K-12 education, higher education, and workforce development education since 1995. We specialize in technology development, online tutoring services, and content services.

Our core technologies include a very flexible online tutoring/teaching platform, an online grade book, an online algorithm engine with metadata and workflow capabilities, and an online business intelligence/data mining technology designed to provide real-time alerts regarding student/school/teacher performance, attendance, and other metrics.

Our core services include content development, consulting, and online tutoring through our NetTutor® brand.

Our customers include K-12 publishers, higher education publishers, virtual high schools, higher education institutions, technology companies, and joint programs dedicated to providing online educational content to members of organized labor and their families.

We are located in Tampa, Florida, a few miles from the University of South Florida. Along with the Moffitt Cancer Center—one of the premier medical research institutions in the United States—USF has excellent engineering, computer science, and mathematics programs, providing LSI many of its employees.

Launched in 1995, LSI has created several unique and powerful technologies that facilitate the sharing of content over the Internet. We specialize in mathematics, technical, and scientific content—the most critical types of online content with respect to student success, and the most difficult to share online.

Today, LSI is recognized by a variety of publishers and educational institutions not only for its high-quality work and dedication to meeting commitments, but also for its unique ability to develop digital strategies that are custom tailored to the needs of its customers.

Our partners and customers have come to value and trust LSI because we are the only company that offers a complete suite of interoperable solutions that address the entire life cycle of the

student, with an overt focus on the bottom line: student success and student retention. That student life cycle includes:

- * Online Assessment and Placement
- * Content Authoring
- * Content Recovery, Content Management, and Metadata Management
- * Online Teaching, Collaborating, and Tutoring
- * Online Homework and Testing
- * Online Grade Book Technologies
- * Online Real-Time Performance Monitoring and Intervention

Through a relationship with LSI, educators acquire the ability to construct a complete, holistic approach to student success and student retention.

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About Academic Research at LSI

We are enthusiastic about the commitment of institutions and academics to the use of technology with proven benefits to their students. If you would like to write about the impact of Web-based technology, please let us know. We encourage educational research and will work with you and your staff to develop scientific studies into the relationship of the online learning experience to successful student outcomes. Please contact our Academic Research Department.

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