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Is the Internet high performance technology?

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Abstract

The intent of this review is to show that the Internet is high performance technology. The review will define indicators of high performance technology that were developed by experts in the field. These indicators can be used to assess the effectiveness of various technologies that are available in schools. The review will then show that the Internet achieves high performance in each area. A technology that meets high performance in all twenty indicators should be considered high performance technology.

Is The Internet High Performance Technology?

A Graduate Review

Submitted to the

Division of Educational Technology

Department of Curriculum and Instruction

in Partial Fulfillment

of the Requirements for the Degree

Master of Arts in Education

UNIVERSITY OF NORTHERN IOWA

by

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Chapter One

Introduction

The Internet is an informal name given to a vast, worldwide system of interconnected computer networks (Idaho State University 1996). The Internet has gained tremendous popularity in the last few years. Many people have their own home pages on the World Wide Web (graphically browsed part of the Internet). The Internet has grown to be an astonishingly huge, varied, and useful collection of communication pathways, information providers, and avid consumers of information (Idaho State University 1996). The Internet is considered a valuable resource by many educators. Students and teachers have access to text, graphics, simulations, sound clips, and video from computers all over the world covering many educational topics. They can also communicate with other users from around the world. However, the Internet is not without its critics (Snow, 1996). These critics believe the questionable material such as pornography that can be accessed over the Internet makes it technology that should not be in the schools. Although there are computer programs and methods to help prevent access of this kind of material, they are not foolproof, and to the critics it is not worth the risk. Other critics believe that much of the material on the Internet is worthless and that there is not enough good material to make it worthwhile (Idaho State University, 1996). There is also a cost factor involved. It is expensive to give the students and teachers in a school district fast

internet access.

A review of what makes the Internet high performance technology is important because it can help schools and educators make decisions on what type of Internet access to provide. Should the schools provide Internet access for the students and teachers? Should they provide fast access? Should students have access from any room in the school? There are many types of technology in the schools today and educators can use help sorting out which types of technology to spend their limited dollars on. Some types of technology handle school objectives better than others.

The North Central Regional Educational Laboratory (Jones, Valdez, Nowakowski, & Rasmussen, 1995)) provides communities with the latest information on learning. They are now examining how various educational technologies can increase teacher effectiveness and student learning. NCREL has developed indicators for identifying high technology performance. Each indicator (Jones, et. al., 1995) presents features of technology that are important to learning. If a technology can effectively meet the criteria of many of the high performance technology indicators it should be considered high performance technology. It then must be considered for use in the schools. If the Internet is high performance technology then schools should provide fast Internet access for their students and teachers.

Research Question

Does the Internet effectively meet the criteria of enough high performance technology indicators to be considered high performance technology?

Terms

Network- When two or more computers are connected to each other by cables or phone lines. One computer can access files from another computer connected to the same network. Phone lines provide the slowest access time. Fiberoptic cables provide the fastest access time.

High Performance Technology- The technology meets the criteria for many of the high performance technology indicators. (Jones, et.al., 1995)

High Performance Technology Indicators- Features of technology that can be identified which are important to learning. The features promote engaged learning.

Engaged Learning- The students are responsible for their own learning. They make decisions about their learning. The students are energized by their learning. They collaborate with others to learn.

Hypertext- Interactive text that can be clicked by the pointer and the program will take you to another site. The text is usually a different color or style than the regular text.

The World Wide Web- A huge collection of documents containing text,

graphics, sound, simulations, and video. They can be searched, dialed up, read, printed, or downloaded. Most sites are linked to other sites. Hypertext Markup Language (HTML) is used to make the pages. They can be accessed by any format of computer. This is the fastest growing and most popular part of the internet. Web browsers like Netscape are programs that read the HTML pages.

E-mail- Electronic Mail. A way to send messages between 2 or more people on the internet.

Listserv- A party line for people who are interested in a given topic. A mailing list is created. People subscribe to the mailing list. Any E-mail that is sent to the mailing list is automatically sent to all subscribers.

Newsgroup- A specialized electronic bulletin board. A person can join a newsgroup that interests them. Then they can search information on the bulletin board and only download what they want. They can post a message, respond to a message, or just read what messages they want. They can be text or graphics.

Gopher- Menu system that gathers information on the internet. Text, graphics, and sounds can be searched, dialed up, read, printed, or downloaded.

FTP- People who have large computers set aside software that can be accessed by the general public. File Transfer Protocol is one of the standard methods to move these files from computer to computer (can be different format).

Telnet- Software that allows you to access files on a remote computer.

Baud- Speed at which Internet data travels. Most users have at least a 14400 baud speed modem now for use over telephone lines. In past years 2400 baud speed was common. The low price of 28800 (twice as fast as 14400) modems have allowed many users to get faster Internet access. Schools with direct connections to the Internet have access speed many times that of a 14400 baud speed modem.

Search engine- Software on the Internet that allows the user to type in key words and then be provided sites on the Internet that have information about that particular subject .

Chapter Two

Review of the Literature

Most of the literature search done for this Internet review was done over the Internet itself. The Internet is an excellent source to learn about the Internet. Databases can be searched worldwide for updated information. Users can find information from almost any subject provided by experts in the field.

The literature in this review focuses on showing how the Internet meets criteria for high performance technology.

With the help of the North Central Regional Educational Laboratory (Jones, et.al., 1995), twenty indicators of high performance technology were identified. This review will define and explain each indicator. This review will then discuss how well the Internet achieves high performance based on each indicator and provide examples of Internet use where applicable. These indicators of high technology performance were developed by technology experts at NCREL to help schools evaluate their technology programs.

The indicators can be grouped into six categories. They are Access, Operability, Organization, Engagability, Ease of Use, and Functionality. The technology provides the school with access to resources from its own classroom and beyond. Operation of the technology does not get in the way of learning. The technology's organization is distributed (across many people or places) and provides for learner contributions and

communication. The technology should promote engaged learning. The technology should be easy to use. Functionality of the technology provides learning tools and promotes incorporation with other media.

In a series of articles published on the Internet with permission from The Computing Teacher Journal, technology expert Judi Harris talks about the power of the Internet (Harris, 1994). She shows teachers and students how and why to use the Internet to enhance learning. Judi Harris uses actual Internet projects to help the teachers incorporate the techniques into their lessons (Harris, 1995) . The main theme of the articles was getting students and people connected so they can learn from each other.

Educational Technology at Far West Laboratory has published a series of articles on the Internet (Far West Laboratory, 1996). These articles discussed the benefits of using the Internet to help students become producers of information. Student newsletters or newspapers can reach a broader audience. The articles give up to date examples of each use. The main theme of all the articles was that the Internet's real power is facilitating collaborative interactions and projects.

Educational Technology at Far West Laboratory also has articles on the Internet on how to use virtual field trips to enhance learning in students (Far West Laboratory 2, 1996). They give addresses for virtual field trips on the Internet and explain some about each. The articles show how virtual field trips can make learning authentic and real.

Teaching Affectively with Telecommunications (Dyrli, & Kinnaman, 1996) is an article designed to help educators use the Internet to enhance the learning of their students. It talks about the power of the World Wide Web to engage learners because of its graphical interface and interactive ability. But they say this is not enough, students need to have a specific educational purpose related to curricular goals when using the Internet. The article talks about the benefits of the internet and how educators can use traditional teaching techniques to ensure learning quality.

Connecting with the World Through Successful Telecommunications Projects (Dyrli, & Kinnaman, 1995) is an article that shows how teachers can effectively use the Internet to enhance learning. This article discusses how teachers can give students learning experiences with online projects that they can not get through any other medium. It discusses the many valuable experiences that students can have over the internet like simulations, field trips, interactive experiments, and research related projects. But like many other sources, they feel the real value of online projects are those that require collaboration among students in various locations. The benefits to students are they learn how to plan, collect data, organize, work as a team, analyze data, meet deadlines, and make conclusions. The students are motivated to learn. They increase their communication skills and develop a cultural understanding. The article gives common pitfalls to avoid when

developing online projects, gives examples of successful projects, gives sources that teachers can use to help get them started, and gives keys for launching successful online projects.

NASA's K-12 Internet Initiative has published many articles on the Internet that can help educators enhance learning with the Internet. Some articles talk about the power of the Internet as a collaborative tool for educators (Nasa, 1996). They are called "Sharing NASA." This program allows students to share in some of the excitement of authentic scientific and engineering pursuits like high-altitude astronomy, Antarctic biology, and robotics. Other articles talk about Nasa's On-line Projects that students can become involved in (Nasa 2, 1996). Users can read about past projects, current projects, and future projects. The articles show teachers how to get your students involved.

The Global SchoolNet Foundation helps educators involve students in telecommunication activities (Global SchoolNet Foundation, 1995). They list collaborative projects where students can benefit by being a publisher and a receiver of information.

The Global SchoolNet Foundation sponsors a fieldtrip project to help students become producers of information (Global SchoolNet Foundation, 1994). Students publish information using Listservs. The format of the project can be used in many curricular areas.

The Last Frontier is an article about how to use the Internet to help your students become producers of information (Milone and Michail,

1995). Students conduct research and publish the results on the internet. They put more into their work because of the potentially large audience.

In a report prepared at Idaho State University (1996), the Internet was explained and some of the problems that Internet users were experiencing were identified. They talk about how a lack of central control can cause administration problems. ISU discusses the high cost of fast Internet access, useless pages taking up bandwidth, and lack of reliability of some sources on the Internet.

FYI on Questions and Answers is a booklet designed to provide support for Internet users (Sellers, 1994). It demonstrates how the Internet is an excellent source for providing technical support and training for Internet users.

High Performance Technology Indicators

Access. The first type of access is connectivity. The students and teachers are connected to a wide range of resources.

The Internet provides the learner with a vast amount of resources. The learner can browse and download information on thousands of educational topics from around the world. They have access to on-line magazines, on-line newspapers, and on-line books. They can download many types of educational software. The learner can go on virtual field trips of many different varieties. Much of the Internet's information resources can not be accessed without the Internet.

For example Dinosaur Hall (Far West Laboratory 2, 1996) provides Dinosaur information for all ages. It Includes text and pictures of the history of dinosaur discoveries in North America, types and classes of dinosaurs, links to diagrams and information on Phylogeny, Geology and Evolution.

The Exploratorium (Far West Laboratory 2, 1996) features programs, events and schedules for this hands-on science museum. It includes gifts and learning tools, publications, online exhibits and software.

The second type of access is interconnectivity. The students and teachers can communicate and collaborate in diverse ways. The learner can communicate and collaborate with other users (students, teachers, experts) on the Internet by using E-mail, listservs, newsgroups and world wide web pages.

The fieldtrips project sponsored by the Global SchoolNet Foundation (Global SchoolNet Foundation, 1994), is a collaborative project published on the Internet, where a class can join a Listserv and share fieldtrip information with other students from anywhere in the world. The students publish a report about their field trip for the other students to read about. They find out information that the other students in the listserv project ask them to find out about. Students learning from each other. One big positive of the project is that when the students are preparing their reports for their peers to read, their reports are more fluent, better organized, more substantive, and more informative. They are more

willing to write, proofread, revise, and edit their work. They will be more careful about their spelling, punctuation, grammar, and vocabularies. The students will enjoy it more when they know their audience is not only interested in what they have to say, but are in fact counting on their accurate and factual reporting.

Internet Initiative (Nasa 2, 1996) provided Online From Jupiter to help students track the progress of the Galileo spacecraft as it encountered Jupiter in December of 1995. This project ran from November '95 to January '96. Classrooms had an opportunity to connect with the men and women of the Galileo team. To join this project, students sent an Email message to a listserv address.

Keypal Projects (Harris, 1995) were the first educational telecomputing activities to be tested online. When an online activity is organized according to this structure, individual students in two or more locations are matched with each other so that they can communicate using E-mail. For example, students at Burleson High School in Texas communicated with students from South Africa, Norway, Finland, Denmark, Peru, Russia, Estonia, Chile, Mexico, England, Iceland, Germany and Canada, exchanging information about their experiences living in the 14 different countries as part of a project called, "The World at Our Fingertips."

Mad Scientist Network (Global SchoolNet Foundation, 1994) as the collective crania of scientists world wide, answers the science questions of students of all ages every day over the Web. Scientist-on-

Tap (Global SchoolNet Foundation, 1994) links scientists from the Jet Propulsion Laboratory to students to demonstrate the power of distance learning. Students around world connect with scientists while they are working from the comfort of their own offices. History listservs (Harris, 1994) provide access to a variety of discussions covering a wide range of topics. Not only will 6th and 7th graders see that ancient history is alive and well, but that historical fact is open to interpretation based on evidence. History listservs provide an excellent opportunity for middle school students to observe the give and take of inquiry and to dialogue with the experts.

The third type of access is that the technology is designed for equitable use. All students have access to challenging, interactive learning resources. The Internet has the capability to be accessed any where, at any time, and by any student when schools place the hardware and software accordingly. Because the Internet can be costly for families to be connected at home there are some equity issues for schools to deal with. They can work with local establishments like libraries to help all students to have Internet access away from the school.

Operability. Interoperable means the technology is capable of exchanging data easily among different formats and technologies. The Internet can be accessed by Macintosh, IBM (and compatibles), or Unix users equally as well. With the right software and hardware any user can access the same text and graphics. On the World Wide Web (WWW),

Hypertext Markup Language (html) is the standard language for the WWW pages. Any WWW browser (like Netscape) can read any WWW page no matter what computer made the file. Similar principles apply when browsing Gopher files. Sound files, movie clips, animations, and software are usually presented in multiple computer formats.

The second type of operability is that the technology is transparent. Users do not need to be aware of how the hardware or software operates. The time that is saved can be used by the students being engaged in learning.

With the graphical nature of all the Internet tools today (Dyrli, & Kinnaman, 1996), the user can move from a gopher program to a web browser without making any adjustments. It is simply point and click to get around. World Wide Web users do not need to know Hypertext Markup Language to be able to click on the hypertext to move to another site.

Organization. The technology is distributed if it exists across any number of people, environments, and situations. The Internet resources exist across millions of users and millions of computers worldwide (Milone and Michail, 1995). Users can learn from people of different cultures, backgrounds, and environments. They can learn more about themselves and their environment by contrasting what they learn from people from all around the world.

The second indicator for organization is that the technology is designed for user contributions. The students and teachers can provide input or resources for the technology. A popular way for students to become producers of information on the Internet is by them making their own web pages. They can create pages that could be viewed by any other user in the world. Because of this concept, the producer will develop a better product. The producer can place text, sound, graphics, animations, and video clips in the pages to help get their message across. Students and teachers can also provide input for others to learn by using listservs. After joining a listserv that interests users, they can publish messages in the listserv that will be sent to all the other users in that listserv.

The Last Frontier (Milone and Michail, 1995) involves students in Devin Jones's eighth grade class from Juneau, Alaska in electronic publishing. They maintain a site on the Internet intended to keep those of us in the rest of the world informed about what Alaska is really like. They conduct research and publish the results on the internet. "It's easy to motivate the students to excel when the potential audience is in the millions" (Milone and Michail, 1995, 49). At the end of the year, the eighth grade trains the seventh grade on how to do the project the next year. Students as producers, students as teachers.

The next indicator for organization is that the technology is designed for collaborative projects. The technology is designed to facilitate

communication for students and teachers with other users with different systems or equipment.

This one combines the indicators of interconnective and interoperable. Teachers or students on one computer platform can E-mail to users on another.

Engagability. The first indicator for engagability is access to challenging tasks. Technology offers learning capabilities that promote thought and inquiry by the students.

The Internet can be used as a tool to promote learning at the high end of Bloom's Taxonomy (Educational Technology, 1996). When doing research on the Internet, the students are evaluating and collecting data that they will then synthesize into new messages. Evaluating what data to include and from what source, will become an important skill to develop for all students. The Internet allows for this skill to be developed.

Projects which we call "Sharing NASA", (Nasa, 1996) allow students to share in some of the excitement of authentic scientific and engineering pursuits like high-altitude astronomy, Antarctic biology, and robotics. These are full multimedia experiences, making use of television broadcasts and videotapes, printed workbooks, and online interaction over the Internet. Projects usually last from one to three months and are open to any teacher or student. In addition, teachers, students, and whole classrooms are used as volunteers on the projects, mainly helping with

moderating the interactions between other students and the online experts.

Geogame (Global SchoolNet Foundation, 1994) is a perennially favorite project that will excite your students as they immerse themselves in atlases, maps, almanacs, and other references in order to solve a geography puzzle. Students answer 8 questions about their community: latitude, typical weather, land formations, time zone, points of interest, etc. They combine their responses with other classes to create a geography puzzle all students will love to solve. A simple first project for beginning telecommunicators.

The Jason Project (Global SchoolNet Foundation, 1995) brings the thrill of exploration and discovery live to students around the world as they participate in an amazing electronic field trip. In 1995 they trekked to Hawaii to study volcanoes. The Global SchoolNet Foundation manages the Jason Project.

The second engagability indicator enables learning by doing. The students use the technology for simulations, real world problems, goal based learning, and hands on activities.

The Internet allows students to follow current world problems as they are happening. The Internet's ability to update information at a moments notice is a big advantage over other technologies in schools today. Students can track a satellite picture of a hurricane as it nears a U.S coast. They can follow the events after an earthquake or flood as they are

updated on a web page. They just push the reload button on the top of the WWW browser to have current information loaded on their computer. Teachers can find resources on the Internet to enhance almost all learning goals in the classroom. This can make the messages more real and interesting to the student.

The Internet allows for hands on learning to take place with its interactive hypertext and buttons that the students control (Dyrli, & Kinnaman, 1996).

San Francisco Bay Area Earthquake Teachers Guide (Far West Laboratory 2, 1996) includes maps and information on Northern California earthquake activity, geology and predictions. Interactive Frog Dissection (Far West Laboratory 2, 1996) is designed for use in high school Biology classes and features step-by-step demonstration with opportunities for student practice of various steps and feedback on performance.

The last indicator of engagability is that the technology provides guided participation. Students can customize the content to suit their interests and learning styles.

The interactive ability of the Internet lets the user guide the learning (Dyrli, & Kinnaman, 1996). It assumes notions of active and participatory learning. Interactive activities focus attention on learning rather than teaching. Activities are designed to help students use and apply new information in meaningful or relevant situations. They can choose the

links (hypertext or buttons) that they are interested in and do it at their own learning pace. The multimedia capability of the Internet's World Wide Web allows learning across many different styles. The student can read about it, listen to it, or look at a graphic or video.

Ease of Use. To have ease of use, a technology needs to have effective helps. Help is provided like procedures and routines to assist in using the technology.

Most Internet sites that require help supply it to the user by letting them access frequently asked questions (FAQ's) or help guides. The Internet is also an excellent source for help in use of many other types of technology (Sellers, 1994). Internet sites like the John Muir Exhibit (Far West Laboratory 2, 1996) provide study guides and FAQ's to assist users.

Technology should be user friendly. Students and teachers can easily learn how to use the technology. Once set up by the teacher or technology coordinator, the Internet is easy to learn and use by the student. The graphical interface of the World Wide Web makes it the most popular and easy to use part of the Internet. The student double clicks on the web browser and it connects to the network on its own by telephone or direct connection. The student can then click on hypertext, select bookmarks, type in an address, or do a word search. Now the web browser can select or use Gopher sites, Telnet, Newsgroups, Ftp, and E-mail. So the need to learn the other programs are less significant.

The third indicator of ease of use is that the technology is fast. The technology has fast processing speed and is not "down" for long periods of time. A technology that is down can not be accessed by the students.

Access speed is an area where the Internet has made great strides the last few years. With the availability of fiberoptics in schools now, students and teachers can have high speed Internet access. But until most sources are on high speed fiber and the Internet's backbone is upgraded, there will wait times for some types of downloads, such as software, videos, sound clips, and some graphics. But there are still many great resources on the internet that a 14400 baud speed modem can handle with quick downloads.

The next indicator for ease of use is available support for the technology. There is support available for the technology.

Much technical support and training for the Internet can be found on the Internet itself (Sellers, 1994). Users can send questions to experts by E-mail, listservs, or newsgroups. They can use search engines and plug in keywords that can send them to sites where they can receive support. Most software and hardware companies have their own sites on the Internet that have support pages for users to receive help.

U.S. Geological Survey (Far West Laboratory 2, 1996) is a scientific research organization that has information about public issues, education, environment research and geographic information. This site supports its users by supplying teacher lesson plans and fact sheets.

The last ease of use indicator is that the technology provides just in time information. The students can access randomly, at multiple points of entry, and receive different levels or types of information.

The Internet puts tremendous power into the hands of teachers and students (Dyrli & Kinnaman, 1995). It allows them to learn anywhere and at any time. There are different ways to find the information. The user can select hypertext, buttons, or bookmarks to find information. The user can do keyword searches and find information at many sites about any particular subject. The students can type in an Internet address to access a site they had learned about. The Internet provides information for students at all levels and covers thousands of educational areas.

Functionality. Media use is the first indicator for functionality. The technology provides opportunities to use media technologies.

The Internet uses text, graphics, sound, simulations, and videos to get messages across. Students producing their own web pages can incorporate all of these types of media. They can use computer cameras or scanners to provide the graphics. They can use sound and video equipment coupled with editing software to create their sound and video clips.

Newsday (Global SchoolNet Foundation, 1994) lets your students write articles and then post them on the Newsday Newswire for the whole world to see. Then students can read and choose articles from other schools to download and to include in their own newspaper.

Finally, students can exchange their newspapers with others. Students' reading and writing skills will improve while they learn about current local, national, and global issues (Global SchoolNet Foundation, 1994).

Current information is the second indicator for functionality. Students or teachers can receive up to date information from the technology.

The learner can access current information on the Internet in many areas of the curriculum as well as late breaking events from around the world. Users can access online newspapers like USA Today that can update information throughout the day. They can receive updates to global events from many sites on the Internet. It is as if the students have their own wire service right at their finger tips. One example is Radar Images of Earth (Far West Laboratory 2, 1996). Students can receive current images from the Space Shuttle Endeavor including a 3-D image of Mammoth Mountain, California.

The next indicator asks if the technology promotes authoring. Students or teachers can use the technology to develop messages that can be received by others.

Students can produce messages using e-mail, listservs, newsgroups, or by making their own web pages. Many of these messages can be seen world wide by other students or users. Students will put more into their work if it will be seen by people from around the world (Milone and Michail, 1995).

Students as Producers (Far West Laboratory, 1996). gives students the opportunity to be consumers and producers of online information. Both teachers and students have used basic e-mail to exchange and share different kinds of information online for a long time. This has included posting school publications, project findings, book reviews, etc. The advent of Gopher and World Wide Web allowed easier access and viewing. The "point and click" hypertext environment of WWW adds context and allows graphics and other media to be shared.

The last indicator asks if the technology supports project design skills. The technology facilitates the development of skills related to design of projects or products.

When students are making their own web pages they can develop many design skills. They can use programs like PageMaker to make picture graphics and text graphics for their pages. They can utilize many design elements when laying out their pages for the best visual effect. They can decide where to place graphics, what size and style of text to use, etc. With the ability to see pages around the world, the students will put extra effort into the design (Milone and Michail, 1995).

Chapter Three

Conclusions and Recommendations

The North Central Regional Educational Laboratory (Jones, et. al., 1995) provides schools with information that will help them make decisions about future technological purchases and use. They have examined how various educational technologies can increase teacher effectiveness and student learning. NCREL has developed indicators for identifying high technology performance. The indicators are directly related to student learning and achievement.

With each indicator you can consistently identify why the Internet achieves high performance in that area. If a technology can effectively meet the criteria of many of the high performance technology indicators, it should then be considered high performance technology. The Internet meets the criteria in each of the twenty indicators identified. The Internet should then be considered high performance technology. The Internet is high performance technology that relates to student learning and achievement. A technology that achieves high performance in this many areas should then be considered for use by schools.

The schools need to provide for effective Internet use. They need to allow for equitable, fast Internet access for all students. Students should have access to the Internet from any room in the school (Jones, et. al., 1995). This can be done by connecting a local area network (LAN)

into the wide area network of the Internet. Many school officials are placing LANs into their schools so they can improve Internet access. Teachers need to be in-serviced on how to use the Internet for engaging the students in challenging learning experiences like collaborative research projects (Jones, et. al., 1995). It will be expensive for this to occur, but with all the benefits that the Internet has to offer, it will be very cost effective in the long run.

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