Effective Access

Teachers' use of digital resources in STEM teaching

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Teachers' use of digital resources in STEM teaching

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Effective Access

Digital resources, including digital libraries, have the potential to transform STEM education by providing access to innovative curricula, stimulating applets and simulations, and other hands-on resources. These resources hold the promise of providing teachers with new ways to engage students; of introducing students to STEM inquiry and work; and of infusing STEM education with student-focused equitable pedagogy and practice. Such engaged teaching would bring the students—in all their diversity and needs—into the center of the curriculum as teachers would focus on the individual student and her or his social context and needs.

The Gender, Diversities, and Technology Institute at Education Development Center, Inc. (EDC) was one of the founding collections for the National Science Digital Library (NSDL). EDC, together with colleagues around the country, had the opportunity to fashion what has the potential to become one of the foremost resources for American science, technology, engineering, and mathematics education. In an effort to better meet the needs of K–12 teachers, EDC developed the Effective Access research project, supported by a grant from the National Science Foundation (DUE 60226483), which focused on the technology needs and experiences of high school STEM educators.

The Effective Access team's findings are not generalizable to all STEM teachers because of the nature of the study's research design and sample size. However, the study's surveys and interviews produced important insights for all of those who care about the intersection of technology, teaching, and learning, including the leaders of the NSDL. The results of the study also align with much of the current literature and with the Effective Access team's experience in developing digital resources for teachers. Based on this, the team has framed a set of suggestions for both future research and the development of technology-based resources. These preliminary ideas can help stimulate discussion among policymakers and practitioners, further the development of effective resources for STEM educators in high school, and encourage others to continue and deepen this initial research.

EDC looks forward to continuing to work with the National Science Foundation (NSF), the NSDL community, and others to move this important work ahead.

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Appendix

INTRODUCTION

Digital resources, including digital libraries, have the potential to transform science, technology, engineering, and mathematics (STEM) education by providing access to innovative curricula, stimulating applets and simulations, and other hands-on resources. These resources can offer teachers new ways to engage students; introduce students to STEM inquiry and work in new and exciting ways; and infuse STEM education with student-focused, equitable pedagogy and practice. Such engaged teaching would bring the students—in all their diversity and needs—into the center of the curriculum as teachers would focus on the individual student and her or his social context and needs.

Educators could use digital libraries to develop highly tailored experiences for students that introduce new materials and resources, ultimately improving students' understanding of STEM and increasing academic outcomes. Rather than relying on aging textbooks, teachers could find the latest information and resources on a specific topic and introduce these into their classrooms through a variety of means: students going to the Web to find information to solve critical math or science problems; students and teachers developing simulations or models of science phenomena and comparing those to ones created by scientists; examining different perspectives or theories about mathematics or science; learning more about STEM professionals and professions; and discovering the ethnic, racial, and gender diversity within the STEM world.

The overwhelming volume of resources, the vast array of Web sites, the complexity of Internet searches, the questions of validity, and ease of use can make finding high-quality resources for K–12 users a daunting, if not sometimes impossible, task. Digital libraries are one possible venue for the collection and organization of digital resources. However, developers do not create most digital libraries and search mechanisms for K–12 education users, and this presents a number of challenges for educators in both formal and informal settings. These challenges include the variety and scope of the collections; the fragmentary nature of material; lack of teacher guides; search engines not designed for the average user; teachers' lack of experience in using non-text resources; as well as challenges related to alignment of standards and the struggle between in-depth inquiry and curriculum breadth.

An additional set of challenges includes technology access; professional development (PD) in the use and integration of digital resources; time and opportunity to find and adapt digital resources; and conventional teaching practices that often do not focus on equitable instruction or supporting diverse learners. Despite the massive movement toward "wiring" schools, many teachers do not have easy or low-cost access to technology in the classroom. When access is not an issue, some teachers fully integrate digital resources into their teaching, yet others are stymied by a lack of time or PD that adequately addresses their particular technology environments. Furthermore, teachers are most accustomed to using textbooks and other print media; they often do not have models for using digital resources to meet the instructional needs of diverse students.

There is little connection between those who develop digital resources and educators. Consequently, the design and organization of resources may reflect the designers' paradigms, rather than respond to the needs of the teachers or students who are the ultimate end-users. This may be due, in part, to designers' focus on technology capacity and their interest in pushing technology further. Often, developers are engaged by innovations in the technology, while teachers and other end-users continue to want systems that are consistently easy to access and use. Complicated search engines or site designs are exciting to develop, but often do not benefit the end-user. For example, Google remains the most popular search engine because of its simplicity, while many digital library search engines and other technology make it difficult for users to move among and between sites and resources. Technology developers, trained in one disciplinary model, may not be able to understand the paradigm and practices of educators, who are trained in another disciplinary model. Thus, they may make assumptions about use and interest that might not hold up. Human-centered design is now beginning to evolve, with the framing question, “What does the person need and want?” guiding the development of the technology design, but developers seldom use this approach when designing digital libraries and digital environments.

While these issues apply across the education spectrum, the Effective Access research project, funded as a part of the National Science Foundation’s (NSF) National Science Digital Library (NSDL) program[1], focused on high school STEM educators as an important and broad subset, as high school STEM remains a priority of education reform in the United States. As a multi-layered project, Effective Access research is organized into several areas: the technology itself (technology access and capacity; the technology environment); the content and design of the digital resources; and the perceptions, assumptions, experiences, and practices of the teachers. Important lenses for the examination of these research areas are the social-cultural contexts and demographics of the educators, students, and technology designers. These aspects are often overlooked in research on technology. As the digital environment is still young, but growing increasingly more complex, it is important to address these social-cultural issues so that we can develop appropriate digital resources, environments, systems, and PD opportunities that help educators fully integrate digital resources into teaching and learning for all students.

The Effective Access (EA) team conducted a limited, multi-level investigation of high school STEM educators and their use of digital objects. The team attempted to answer the following questions to identify teachers’ unique needs in the digital library environment, to provide a better understanding of the possible impact of electronic resources on teaching and learning, and to develop a framework for future development of digital resources and technology supports.

What are STEM educators doing with digital resources, what would they like to do, and what could they do? How do they use various educational resources for curriculum planning and instruction, and specifically, how do they use Web-based resources?

What are the barriers or supports for teachers’ use of digital resources? What kind of access and capacity exists? How comfortable are they searching for and using digital resources? What training or other support do they receive? What kind of training and/or navigation/tutorial systems do they need/want to support the integration of Web-based resources?

What role does diversity play in the development and use of effective digital resources? What is the relationship of gender/race/ethnicity/disability/language to educators’ perceptions and use of digital resources? How does the diversity of their students impact their use of such resources? How does educator diversity influence experience with technology?

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[1]Effective Access is a project of Education Development Center, Inc., funded by the National Science Foundation (DUE grant #60226483). The perspectives and opinions expressed here do not necessarily reflect those of the National Science Foundation.

How do the above align with the experiences, expectations, and practices of those who develop digital resources and digital libraries? This report summarizes the Effective Access team's findings and presents recommendations that emerge from this work. The report is organized in four major sections:

- A brief literature review that highlights what teachers say they value and want in accessing technology; how contemporary students view technology; and challenges for teachers in making use of technology to support student learning.
- A methods section which describes the design, time period, data collection, interview and survey participants, and methods of data analysis.
- Findings organized around seven major themes: Benefits and Changes in Practice, Time, School/District Infrastructure, Search Strategies, Technology Environment, Content for Planning and Instruction, and Professional Development, along with observations from technology designers.
- Recommendations.

LITERATURE REVIEW

Digital libraries offer a way to bring scattered digital resources together in a coherent and accessible framework and have the potential to be extremely useful to high school STEM teachers. In particular, the National Science Digital Library (NSDL) collections exhibit many features of educational value: they present sound content, offered free, by reputable sources and organized under the broader NSDL umbrella (Sumner et al. 2000), the very qualities teachers repeatedly cite as useful in teaching.

In this literature review, we highlight what teachers say they value and want in accessing and using technology in the classroom; how contemporary students view technology and learning; and the challenges that face teachers in making effective use of technology to support learning for diverse students.

Teacher Perspectives

Teachers use technology in a variety of ways; for example, to prepare lessons, communicate with colleagues and students' parents, and to keep track of grades (Bebell, Russell, and O'Dwyer 2004). The National Center for Education Statistics (NCES) 2000–01 Teacher Follow-up Survey reveals that teachers consider a computer with e-mail capability and classroom access to the Web as the top two technologies essential for teaching. Teachers ranked a classroom telephone, reference materials on CD-ROM, and at least one computer for every four students as their 3rd, 4th, and 5th choices respectively (Lanahan and Boysen 2005).

The type and degree of use is often rooted in teacher attitudes. For example, a study of teacher technology use in rural Texas highlighted the importance of teacher attitude towards innovation and change: "higher users of technology had a more favorable attitude toward change, were more able to cope with uncertainty and risk, less fatalistic, and had higher levels of motivation, more social participation, and greater exposure to communication channels" (Dooley, Metcalf, and Martinez 1999 p. 10). When expressing their concerns about technology, high users were most likely to consider the instructional impacts of the technology use and classroom management issues. Teachers who used technology less were more concerned with gaining information and with how the technology would affect them personally. Research continues to examine the effectiveness of technology in schools and has generally found that the impact of technology on student learning is dependent on how it is used in the classroom (Cuban 2001).

Technology is only one element of improving practice, not a stand-alone panacea. A 2002 WestEd study (Ringstaff and Kelley 2002) indicates that to be successful in the classroom, technology is only one component of an overall reform effort. Teachers must be adequately trained in the technology, but they must also understand how to use the technology appropriately in support of students and the curriculum. This process may require some teachers to change their beliefs about teaching and learning. Also, long-term planning and support is necessary. In short, to effectively use Web resources, teachers need time, technical professional development, a feeling of self-efficacy with regard to technology integration, and an openness to change (Dooley et al. 1999; Vannatta and Fordham 2004; Kadel 2005).

Student Perspectives

Students often have high expectations for technology as well as different modes of learning. Howe and Strauss (2000) find that contemporary students are group-oriented, value intelligence, are fascinated by new technologies, and are racially and ethnically diverse. They expect technology to mediate learning and view the Web as essential to their lives (Savage 2003 as cited in Oblinger 2004). Students also react favorably to culturally responsive software and are aware of its absence (Pinkard 1999).

It has been postulated that technically savvy students have different learning styles than previous generations of students and may develop differentially because of their interaction with technology. Oblinger (2004) posits that today's students' marked preference for experiential learning is because they have grown up playing video and computer games, and notes that, by college, students on average have had more years of gaming than of reading. If such speculations are true, then today's students are the cutting-edge, the precursors of a sea-change in student learning characteristics and attitudes (Atkinson et al. 2001). Educators have an obligation to learn from them, both to provide richer learning environments for them, and to extend emerging pedagogies to all learners. Using digital resources strategically in the classroom may be key to reaching these new students.

Challenges

Despite these indicators of the general importance of technology to both teachers and students, technology remains infrequently and/or inadequately employed as an instructional tool. While teachers use technology in multiple areas of their work and believe in technology's potential to positively impact teaching and learning, instructional use (e.g., student projects, accommodations, lesson presentation) is one of the least frequent ways teachers employ technology (NetDay 2001; Bebell et al. 2004).

Why do teachers see the Web as a resource, but not as a significant catalyst for change in their teaching? The answer to this question is important for digital library developers because it represents the key to transforming a collection from one that is of passing topical interest to teachers to one which is a rich source of information and pedagogical support that teachers can incorporate into their instruction.

Several key challenges revolve around characteristics of the users, characteristics of the content, and characteristics of the environment. All of these challenges interact to create the context in which technology and learning can be marginalized or thrive.

Characteristics of the Student Users

Despite the overall reputation of their generation, there are still significant gaps among today's students with regard to computer use. As of 2001, 70.7% of public high school students used a computer at home (NCES 2003). When breaking that figure down by student race, however, the gap emerges: 81.4% of white students used computers at home, but only 44.2% of black students and 49.1% Hispanic high school students reported the same. When it comes to computer use in school, public schools have successfully closed or narrowed that gap. A high percentage (88%) of public high school students aged 15 years and older reported using computers at school. This figure included 89.2% of white 89.0% of black students, and 83.8% of Hispanic students. In both categories—home and school—computer use varied with the students' race and increased directly with household income. The high percentage of students using computers at school is outstanding news. However, gaps in home computer access affect students' experience levels with the technology that teachers use in class, as well as the ability of teachers to include Web resources in homework assignments and on-going projects.

Diversity of the student body also plays an important role in the effective use of technology and goes far beyond issues of access. According to Haugland and Shade (1994 as cited in Williams, Boone, and Kingsley 2004, 215), educational resources "must be designed not only to actively engage learners in reflection and inquiry, but must also be cognitively, socially, and pedagogically appropriate for students." The on-line learning community has demonstrated the importance of designing digital tools to accommodate multiple learning and cultural styles (Gabbard et al. 2002; Yong and Parrella 2004). Even on-line group participants can be aware that there are cultural differences in race, ethnicity and gender (Shumar and Nair 2004).

Though the literature reveals much about technology and its use in classrooms (both positive and negative), there is little documentation about how digital resources are or are not appropriate, effective learning tools for different learners. Additionally, while recent surveys indicate that teachers believe that using the Web allows them to tailor instruction to student needs, there are no data indicating what characteristics of Web resources enable this customization (NetDay, 2004).

While the student population is more racially and ethnically diverse than ever before, the pool of classroom teachers is still predominantly white (NCES 2002). Furthermore, the majority of developers behind the technological resources being used in classrooms are white and male (Information Technology Association of America n.d.). Given this racial and cultural mismatch, there are important questions about whether the digital resources being produced are capable of accommodating students' learning and cultural styles.

Characteristics of the Teachers

One reason for infrequent classroom technology use may be teachers' lack of familiarity with the use of technology in general and digital resources in particular and their need for training and professional development. In 1995, the Office of Technology Assessment (OTA) reported that schools and school districts spend most technology money on hardware and software, and spend relatively little on training, averaging no more than 15% of technology funds (OTA 1995 as cited in Dooley et al. 1999). This may explain why teachers indicated that they felt unprepared to integrate technology into their lessons in a National Foundation for the Improvement of Education Survey (NIFE) (NIFE 2000). Additionally, like the library media specialists in Tallman and Henderson's study (1999), teachers may be approaching the Web with text-based mental models and not taking full advantage of the new types of technology-enriched resources. As Cuban (2001) points out, teachers tend to use technology in the same ways they use traditional, text-based materials.

Teachers also have a concern that Web resources may not meet their pedagogical needs. Many commercial educational software publishers do not have a set of procedures for checking appropriateness with members of their target audience; few have teachers or students evaluate their software prior to marketing (Higgins, Boone, and Williams 2000; Mills 2001). If existing digital resources don't meet teachers' criteria for instructional tools, other positive factors about the resources may be moot.

Characteristics of the Content

Producing culturally relevant content for teachers and students is important, but not sufficient. The manner in which digital resources are organized and presented can have a great impact on their usability in classrooms. Developers created many digital collections and search mechanisms for university-level students and professors, and the complexity of the material can challenge K–12 educators who are looking for content for younger students. Teachers cite inappropriate materials and a lack of knowledge about using the Web effectively as obstacles to finding and using digital resources (Hawkins, Panush, and Spielvogel 1999).

Further challenges include the overwhelming variety and scope of the collections, the fragmentary nature of material, teachers' lack of experience in using non-textual resources, and the ongoing struggle between in-depth inquiry and curriculum breadth (ibid.).

Characteristics of the Environment

Having an adequate amount of equipment is vital. For example, the NCES survey found that teachers with a greater number of classroom computers were more likely to agree that available technology was sufficient, than were teachers with fewer or no computers in their classrooms (Lanahan and Boysen 2005).

Technological resources must be sufficient and accessible (Ringstaff and Kelley 2002). There must be an adequate computer-to-student ratio, and computers must be appropriately placed in a classroom or technical lab. Equipment and Internet connectivity are necessary, which makes cost an inescapable factor (Williams et al. 2004).

Web connectivity is also essential. During NetDay's 2004 Teacher Speak Up Day, 98% of the participating teachers reported having at least one computer connected to the Internet in their classrooms, but cited "not enough computers, computers that don't work, slow access to the Internet, and school filters and firewalls" as major barriers to integrating Web resources into their daily instruction. Teachers felt stymied by these equipment issues and an overall lack of time (NetDay 2004, 12).

The literature review raised a number of questions with respect to real and perceived barriers to the classroom use of digital resources. Ultimately, the questions could be synthesized into a single overarching query: "What do teachers need to more effectively use Web resources in their own planning and to meet student needs during instruction?"

In this study, the Effective Access team sought to understand teachers' preferences and challenges in using technology in their classrooms. The team's goal was not to find a unanimous—or even generalizable— answer to the study question, but rather to uncover the factors that interact and create multiple pictures of teachers' technology use. Therefore, the study explored ways that teachers pursued the discovery and integration of digital resources and examined how these resources are influencing their teaching. The project also began to investigate the ways that technology designers interact with teachers in the development process. The following sections detail the methodology and the findings from that work.

METHODS

Central Questions

The Effective Access team examined the following overarching questions:

- What are STEM educators doing with digital resources, what would they like to do, and what could they do?
- What are the barriers or supports for teachers’ use of digital resources?
- What role does diversity play in the development and use of effective digital resources?
- How can educators’ answers to the first two questions inform the expectations and practices of those who develop digital resources and digital libraries?

Study Design

The Effective Access team selected three methods to study STEM teachers’ use of Web resources and their preferences, ideas, and hopes for future resources: surveys, focus groups, and telephone interviews. The team chose these methods to generate nuanced pictures of teacher technology use, teacher perceptions of resources, resource availability and applicability, and the resulting implications for resource developers.

Using a preliminary literature review as a base, the Effective Access team generated survey questions. The questions probed teachers’ current use of and attitudes toward various educational resources, and Web resources in particular. The goal of the survey was to gather responses from as broad a range of STEM teachers around the country as possible in terms of their geographic location, high school setting (urban, suburban, or rural), personal demographics, and student demographics. The team created the survey on-line using a commercial Web-based survey tool. (See Appendix A for a text-only list of survey questions.) The teachers surveyed were a convenience sample. Thus, it is not possible to generalize the results to high school STEM teachers as a whole. Teachers volunteered to be a part of the Effective Access study after researchers contacted them via listservs, Web site announcements, e-mail, and direct mail.

The Effective Access team designed the focus group protocol to delve deeper into teachers’ current practice and ideas for the future. The protocol asked teachers many of the same questions that comprised the survey, but in an open-ended manner. Researchers could, therefore, compare the ideas elicited during focus groups to the multiple-choice options presented by the survey questions, thereby providing a check for the accuracy and thoroughness of the survey questions. (See Appendix A for the focus group protocol.)

After completing the focus groups and collecting the first two batches of survey responses, the Effective Access team created the interview questions for teachers and Web resource developers. The team designed the teacher interview questions to provide a deeper, more contextual picture of STEM teachers’ use of digital resources than responses to the broad survey questions could impart. (See Appendix A for teacher interview questions.) The team created the Web resource developer interview questions to elicit how developers perceive and respond to teachers' Web needs. (See Appendix A for Web resource developer interview questions.)

Time Period

The Effective Access team conducted the surveys between January 2003 and December 2004. Each survey was active for approximately three months. The team held focus groups during the summer of 2003 and conducted interviews in the fall of 2004.

Methods of Data Collection

By the end of the project, four separate waves of surveys had occurred. Each successive survey was an attempt to reach greater numbers of more and diverse STEM teachers. It was difficult to attract survey participants, most probably due to educators' hectic schedules.

The Effective Access team publicized the first survey through education and equity listservs, links on the Gender, Diversities, and Technology Institute (GDTI) at EDC and Eisenhower National Clearinghouse (ENC) Web sites, and announcements on Internet bulletin boards, such as the National Science Teachers Association (NSTA) on-line community. The team publicized the second survey though direct mail, sending postcard announcements to science and math department heads and technology coordinators at high schools across the country. For the third survey, the team contacted participants via e-mail, culling e-mail addresses for current STEM teachers from school district and high school homepages. The team selected the homepages from which it drew the addresses based on geography, targeting locations around the country from which there were few or no responses in surveys one and two. Participants in the fourth survey learned of its existence through two postings to the MathTools discussion boards, a section of the MathForum at Drexel. The team made this survey separate because staff at the MathForum wanted to examine the data that was generated by MathTools frequenters. The posted survey announcement alerted participants that MathForum staff would review their responses. (See Appendix B for detailed charts of sampling techniques, response rates, and geographic distribution of participants.)

The Effective Access team did not modify the original survey questions from one survey to the next. However, the team added two questions after the first survey and included two additional questions after the second survey. The first two additions asked participants to identify their state of residence and years of teaching experience, while the third and fourth additions probed teachers' school context further, asking about the percentage of students in their classrooms with Individualized Education Plans (IEPs) and about the logistics of student computer access at their schools. The team added the state of residence and experience questions to facilitate data analysis and included the school context questions in response to issues that surfaced during the focus group.

Effective Access researchers asked survey participants whether they would be willing to take part in a telephone interview. The team offered phone interviews to all teachers taking the third and fourth surveys that responded in the affirmative and awarded a token gift certificate to each teacher who completed an interview. Fifty-five people said they were willing to be interviewed and provided contact information. The team contacted all 55 via e-mail in an attempt to schedule interviews. Of this group, 26 responded and were interviewed. Once an interview was scheduled, participants received a copy of the interview questions. Therefore, interviewees had the opportunity to see all of the questions beforehand except the one asking what the term “digital library” meant to them.

The Effective Access team identified potential technical developer interviewees based on teachers’ survey responses: teachers listed their favorite sites and sites that they found difficult, and the developers of these sites were targeted for interviews.

Methods of Analysis

In 2003, the Effective Access team completed a preliminary analysis of the responses to the first two surveys that was published in Online Computer Library Center (OCLC) Systems & Services, an on-line journal (Carlson and Reidy 2004). This analysis consisted of summarizing teacher responses to key questions and comparing these responses with the focus group data; this analysis was used to inform the interview questions.

When data collection ended, the survey sampling techniques had yielded four separate groups of data. First, the Effective Access team conducted a broad, within-group analysis. Next, the team examined the responses of each group of teachers and performed analysis of variance tests to ascertain how much of the variation in responses was due to teachers’ presence in particular survey groups. The team determined that the variation between groups was much smaller than the variation among the participants within a group and proceeded to combine responses from all four surveys for the final analysis. (See Appendix B for ANOVA calculations.)

After combining the data from the four surveys, the team analyzed responses to questions multiple times based on specific categories of teachers. Categories included teacher gender, school location (urban, suburban, or rural), teacher practice (percent of instruction time incorporating Web resources) and student demographics (race/ethnicity, percent eligible for free/reduced price lunch, and percent having IEPs). (See Appendix C for tables of full results by category.)

The Effective Access team analyzed Educator Interviews first by making frequency charts of recurring topics and ideas that the teachers mentioned on a question-by-question basis. Next, the team categorized and combined these topics and ideas into seven key themes: benefits and changes in practice, school/district infrastructure, time, search strategies, technology environment, content for planning and instruction, and professional development. The team then coded survey comments based on these themes.

Interview Participants

The 26 teachers are in many ways reflective of those who have participated in other larger scale national surveys (NetDay 2001; NetDay 2004). All high school STEM teachers, they are primarily Caucasian (20), and almost equally divided between females (15) and males (11). They are experienced educators with almost half having 15–37 years teaching. They teach in all geographic regions of the nation. The majority (21) of the teachers described themselves on the survey as highly comfortable or very highly comfortable using technology and this was true across years of teaching, gender, and school site. Two teachers rated their comfort level as low.

The interviewees are evenly distributed among rural, suburban, and urban settings. As might be expected, teachers in urban and rural schools report higher rates of poverty among their students than do teachers in suburban schools. Also, urban teachers taught more classes that were predominantly Hispanic or African American than did their suburban and rural colleagues.

Specifically, urban teachers reported their student population as majority minority, with four school predominantly African American, two predominantly Hispanic, and only one predominantly Caucasian. Teachers in two schools estimated that less than 25% of students are eligible for free and reduced price lunches, one estimated 25–50% and four estimated that one-half to all of their students are eligible. In three schools, 25–50% of students were estimated to have individual education plans (IEPs). The urban teachers in the study are diverse: three are women of color (two African American and one Asian), a Hispanic man, two Caucasian women, and one Caucasian man. Four of our respondents are highly experienced, with 18–37 years of teaching experience, three respondents have 1–5 years of experience, and none of the respondents have 5–18 years of experience.

Five of the eight rural schools represented have predominantly Caucasian student populations, two schools have equally mixed student populations, and one school has predominantly Hispanic students. Like the urban schools, there are economic disparities; teachers in two schools estimated that 25–50% students are eligible for free and reduced lunch and another two estimated 75–100%, rates that seem to mirror those of the urban schools in the study. Four teachers estimated that 25–50% of their students had IEPs. All eight rural teachers are Caucasian (five males and three females). Two of the rural teachers have up to five years of experience, and the other six have 15–25 years experience.

Of the seven suburban schools represented, six were reported to have predominantly Caucasian students. Teachers also reported fewer students eligible for free or reduced price lunches: only one teacher estimated that more than 50% of students are eligible for free/reduced lunch; the rest estimated that less than 25% of students are eligible. One teacher estimated that between 25–50% of students had IEPs and another estimated 25-50% had either ESOL or IEPs. Of the nine respondents (three were at the same school), two are women of color, five are Caucasian females, and two are Caucasian males. This group of teachers represents a younger teaching cohort; five have taught between one and four years, while the other four have taught between 15 and 28 years. This gap in the mid-career group is similar to that seen in both urban and rural groups.

Survey Participants

In total, 236 participants responded to the four Effective Access surveys. After filtering out responses from people who had not taught high school-level STEM topics within the past three years, survey responses from 197 teachers remained. It should be noted when considering the following summary of teacher backgrounds that not all teachers answered all survey questions.

A majority of the teachers were female, yielding a participant pool that was 62.2% female and 37.8% male (n=172). As shown in Table 1, most of the teachers identified themselves as Caucasian. 95% indicated that English was their native language.

Table 1: Survey Participants by Race/Ethnicity

Race/Ethnicity	Percent of Survey Respondents (n = 175)
Caucasian	85.7%
Asian	4.6%
Hispanic	3.4%
African American	2.9%
Native American	2.3%
Filipino	0.6%
Pacific Islander	0.6%

89.5% said their primary job title was "Teacher/Instructor," while a relatively small group (5.8%) selected "Technology Coordinator" or "Professional Development Provider." Lastly, a few respondents identified themselves as engineering and/or technology professionals working within schools.

Over 95% of respondents taught in formal (i.e., school classroom) settings. More mathematics and science teachers than technology or engineering teachers responded to the survey (see Table 2). The sum of the percents exceeds 100 because several teachers taught more than one STEM discipline.

Table 2: Survey Participants by Subject Taught

STEM Discipline	Percent of Respondents who Taught This Topic Within the Last 3 Years (n = 164)
Mathematics, including Statistics	55.5%
Science	43.3%
Technology, including Computer Science and Media	17.7%
Engineering	4.9%

The teachers represented a wide range of teaching experience. Five respondents answered the survey during their first year in the classroom, while two teachers reported 37 years of experience. For a summary of participants' years of experience, see Table 3. As a group, they averaged 13.3 years of experience; the median was 12 years.

Table 3: Survey Participants by Years of Teaching Experience

Years of Teaching Experience	Percent of Survey Respondents (n = 91)
1 – 5 years	28.6%
6 – 10 years	18.7%
11 – 15 years	17.6%
16 – 20 years	13.2%
21 – 25 years	7.7%
26 – 30 years	7.7%
Over 30 years	6.6%

Participants were from 35 states, plus the District of Columbia. Their states of residence represented every region of the contiguous United States. There were no participants from Alaska, but one lived in Hawaii. (See Appendix B for a complete list of teachers' states.) As Table 4 shows, in terms of the location of their schools or programs, participants were divided relatively evenly among rural, suburban, and urban settings.

Table 4: Participants by Setting

School/Program Setting	Percent of Survey Respondents (n = 177)
Rural	35.0%
Suburban	33.9%
Urban	31.1%

Most (70%) of the respondents taught classes in which the majority of the students were white. However, as Table 5 shows, almost a quarter of the teachers taught classes in which the majority of students were either African American or Hispanic. Teachers who chose Other explained that their classes contained even mixes of students. For example, a teacher in North Carolina said his classes contained equal numbers of black and white students.

Table 5: Students by Race/Ethnicity

Race/Ethnicity of the Majority of Teachers' Students	Percent of Survey Respondents (n = 174)
Caucasian	70.1%
African American	13.8%
Hispanic	10.9%
Asian	1.1%
Native American	0.6%
Other	3.4%

Most of the respondents' students were native English speakers. 84.0% said that less than 25% of their students were not native English speakers, while 9.1% said between 25 and 50% of their students were not native English speakers. 5.2% said the percentage of non-native English speakers in their classrooms was over 50%. (See Table 6.)

Table 6: Student English Language Background

Percent of Students Who are NOT Native English Speakers	**Percent of Survey Respondents (n = 175)**
0 – 25%	84.0%
25 – 50%	9.1%
50 – 75%	2.9%
75 – 100%	2.3%
Unsure	1.7%

Survey respondents taught in a range of economic settings as well. As shown in Table 7, approximately the same percentage of teachers fell into each one of the following categories: teachers teaching classes within which less than 25% of students were eligible for free/reduced-price lunch, 25–50% were eligible, and more than 50% were eligible.

Table 7: Student Eligibility for Free/Reduced-Price Lunch

Percent of Students Eligible for Free or Reduced Price Lunch	**Percent of Survey Respondents (n = 174)**
0 – 25%	29.3%
25 – 50%	29.9%
50 – 75%	15.5%
75 – 100%	13.2%
Unsure	12.1%

A majority of the educators reported that less than 25% of their students had Individual Education Plans (IEPs). Of this group, one-third said that between one-quarter and one-half of their students had IEPs; less than 5% indicated that more than half of their students had IEPs. (See Table 8.)

Table 8: Students with IEPs

Percent of Students with IEPs	**Percent of Survey Respondents (n = 93)**
0 – 25%	59.1%
25 – 50%	32.3%
50 – 75%	2.2%
75 – 100%	2.2%
Unsure	4.3%

FINDINGS

This section will present seven themes that emerged from the interviews and link these to the survey findings, where appropriate. Also included is a summary of relevant comments from interviews with developers of digital resources.

The findings have implications for a number of audiences, ranging from technology developers to those who develop digital content to the schools and administrators. The Effective Access study sample is relatively small and not randomly selected, and therefore cannot be generalized to the entire high school STEM teaching population. However, the project's beginning research has the potential to offer guidance to these important groups, as well as pointing to possible areas of future research. The next section includes a discussion of these suggestions.

Findings are organized around the following themes:

1. Teachers see benefits from digital resources. They are positive about digital resources and technology, both for their students and for themselves as educators. Furthermore, use of digital resources can result in changes in practice.

2. Time—and the lack of it—is an important consideration for teachers. The concept of time reflects a constellation of issues.

3. The school/district infrastructure is critical to integrating technology-based resources and instruction, yet it often does not provide the necessary tools or support, leading to frustration and reducing the positive impacts in the classroom.

4. Teachers often use simple search strategies, and they are often not satisfied with their results.

5. The technology environment does not reflect high school STEM teachers' or students' needs or use patterns.

6. Content is the primary motivator for teacher searches. Content includes both materials for planning and instruction and is linked to standards and to their students' interests and needs.

7. Professional development is critical to the successful integration of digital resources, yet teachers express frustration about the lack of quality on-time training.

Theme 1: Teachers See Benefits from Digital Resources

The teachers interviewed in this study were positive about the use of digital resources in the classroom, were generally positive about the potential of technology resources to improve teaching and learning, and they were willing to spend time using the technology. While this sample of teachers is similar to the participants in NetDay's 2004 SpeakUp Day (teachers from urban, suburban, and rural settings across the country who volunteered to share their views on technology in the classroom), respondents' attitudes differed in some interesting ways. For example, regardless of the number of years teaching, or where they taught, all 26 respondents easily defined the benefits of using digital resources and technology in the classroom for their students and for their own professional development. This group spends considerable time searching for resources for their classrooms, with about half (12) spending between 10 to more than 20 hours a month using the Web for planning and instruction searches. Again, years of experience does not seem to be a factor in the amount of time the teachers reported they spent searching. Of the 12 who used the Internet the most, six had 15–37 years of teaching experience.

The teachers perceived that technology enhances STEM instruction, providing resources for individual students as well as for the whole class, and serves as a means to address individual learning needs. The most common examples of benefits teachers mentioned include: real-world relevance and other ways to engage student interest with the topic (15); up-to-date and current information (10); accessibility, ease of use, convenience, or opportunities to do activities they couldn't do in class (8); and help in planning, preparation, and extending their own learning (8).

Real-world examples and alternative perspectives are seen as ways to increase student interest and to energize the classroom activities and curriculum. One teacher, in the smallest rural school in his southern state, saw the benefit of the Internet in terms of opening up opportunities and perspectives for students: "We are isolated, resource-shy. The kids have a myopic view of the world here. There's not a lot of impact from the outside. The Web opens doors for kids to see applications of what I teach—fuel cell, power plants, wastewater treatment. It's a resource for visual learners. It enhances my ability to hook them in…it serves to increase their interest so I can deal with the concept being taught." Similarly, an urban teacher saw benefits for his students saying that for the students, "The Web opens up the world to them, gives them a wealth of information. Our charge is to channel that." To a teacher in the suburban Northwest, the benefit of technology is, "You can bring in such a variety of REAL information [that is] more engaging for students than made up examples in books."

Other teachers reflected on the changes in the ways their students process information when using the Web and discussed how digital resources help them align their teaching to how students learn. Several mentioned that their students are part of the "computer generation." "Kids are more hands-on. They are used to PlayStation and Nintendo. They don't want lectures or to take notes. They see to remember and technology helps me demonstrate concepts to PlayStation Nation," explained a teacher in a large southern urban school. Similarly, a teacher in the suburban northeast felt that digital resources increased student interest, making her classes less teacher-directed and offering them more student-directed learning so that, "My students are actually reading. My goal is getting them to search and find the answers."

Current information expands teachers' options and offers a way to expand student research and learning as captured in the statements: "I am completely confident that I can find relevant examples, raw data, and real-world situations to match any need I run into." And, "I'm more current in terms of events and real-life examples." One teacher linked currency of information, expanding beyond the textbook, and the important link to real- world examples saying, "Web resources are more up-to-date than textbook resources, and there's more stuff related to everyday life." Another pointed to the benefit to his teaching: "What I like is the Web has pretty up-to-date information that's hands-on. I can get them more involved in finding the information, rather than listening to me lecture." A suburban teacher added, "Information on the Web is available like air…accessibility is a big plus."

Teachers felt that digital resources had the added benefit of providing opportunities to supplement limited resources, such as labs. As one teacher explained, "In the past I've used a simulation of pig dissection. Now I need stuff on space—movement in space, Newton's laws and catastrophic events like volcanoes, earthquakes, tidal waves." Another talked about being able to do physics experiments or offering alternatives for students who can't do experiments because of allergies, and another described how he uses the Web as a resource, "If something doesn't go right and a kid or small group is confused, I can send them to the Web. For example, we were working with trapezoids and some kids couldn't visualize it, so now I have some kids using applets on the computer and others working with hands-on pattern blocks. They choose, but the important point is that I could offer options."

Finally, an important benefit to the teachers was improving their own teaching and expanding their knowledge base. The majority (18) said that technology had changed their teaching, while six said it had not and two did not indicate an answer. Of the six who said it had not changed their teaching, two were new teachers (1 year and 4 years of experience). The other four teachers who said it had no impact all had 15 –17 years of teaching experience. Interviews with those who said it had made no change show they are using technology in a number of ways that focus on student needs, as, for example, the teacher who consistently looked for resources to support the different learning styles in her class. A teacher for 17 years, she looks for "user-friendly materials to meet the needs of the wide range of academic functioning abilities in my class. . . My students are alike in that they are all Caucasian, but they vary greatly in terms of age and ability. I need to find a wide variety of information so I can tailor it." Another teacher talked about how he incorporates sites such as NASA into his instruction, while a teacher with 16 years of experience described the use of the Web for dissection and for understanding movement.

When asked about how teaching has changed due to technology, the teachers presented a wide range of examples, some of which related directly to instruction such as, "I rely less on the textbook and can add interactive labs and lessons through the Web. The kids love it…easier to do some activities than equipment, set up, risk with lab." Another senior teacher felt the Web helped him improve his classroom because he is able to find real data so lessons involve more inquiry and enable him to include more historical background.

For other teachers, the Web offers opportunities for guidance, consultation, and collaboration. For one teacher this meant that, for himself and his colleagues, it was bringing "the real world to them, it gets people thinking, shows applications, how colleagues have done things." Several commented on how the Web helped them save time and learn from others. A teacher noted that finding resources and a person on-line who had used the same textbook "saved me four to five hours…it was great to know someone else had done this and could help." An urban northeast teacher stated, "Mostly, I don't want to reinvent the wheel. Also, it has the most current information. It's easy and has so many resources." The Web offers opportunities for teachers who may be isolated, as the teacher in the rural west who feels the Web benefits collaboration "among everybody. I can have students talk with scientists, other students, instant messaging especially with my peers in real time." Two other teachers also saw digital resources as a way to improve their own teaching—and their students' success. There is a wealth of best practices out there and many of them are designated as such. "The Web provides me an instant opportunity to see and judge for myself whether this resource is one my students will benefit from." "I have written my own curriculum for several years. Without the on-line sources I used, I would not have had the successes in the classroom, including students winning awards."

Results from the Effective Access survey are similar to interview findings and add several insights about changes in teacher practice. As expected from NetDay's studies, teachers who took the Effective Access surveys overwhelmingly report that they use the Web during curriculum planning and/or instruction. In fact, 96.7% of all participating teachers answered affirmatively. Within the larger group, 100% of all teachers with five or fewer years of teaching experience say that they use the Web for professional purposes.

When asked how Web resources changed their curriculum planning or instruction, a majority of survey participants (62%), indicated that Web resources have impacted their teaching. (This is almost a complete reversal from the attitudes of the teachers in NetDay's 2001 survey, in which 67% of teachers surveyed identified the Web as a "moderately helpful" resource, while only 29% said that the Web had changed the way they teach.)

Table 9: How Have Web Resources Changed your Planning or Instruction?

My Curriculum Planning Has NOT Changed	My Instruction Has NOT Changed	My Curriculum Planning and/or Instruction Has Changed
25.3%	28.6%	62.3%

Within subgroups of survey participants, some variation did appear. For example, women were more likely than men to say that Web resources have changed their teaching (69% of female teachers vs. 53.4% of male teachers). Also, teachers of African American students and Hispanic students were more likely to report changes than were teachers of Caucasian students (75%, 80%, and 59.8%, respectively). Responses did not vary as widely when participants were examined by location (whether teachers' schools were urban, suburban, or rural) or by the percentage of students eligible to receive free or reduced-price lunches.

When participants explained the changes resulting from the use of Web resources, several key benefits emerged. In terms of curriculum planning, almost everyone mentioned the greater availability of resources to meet their particular needs. Many explained further that they no longer had to "reinvent the wheel," that they could borrow and tailor other colleagues' work. Some mentioned that they used Web research to strengthen their own grasp of topics. Figures 1 and 2 showcase educators' descriptions of the changes enabled by Web resources.

"Some of the techniques discussed on the Web and the motion videos on some of the topics help in giving me insights into handling a particular topic with greater depth."

"I feel better prepared, more creative when I can see what others have done and learn from them."

"I don't have to reinvent the wheel. I can stay up-to-date easily. No zillion trips to the library. [I] can collaborate with colleagues who aren't in my area…I can learn new topics easily without taking a class or going to a conference."

"I know so much more…I have researched topics more thoroughly."

"…Given me an additional place to brainstorm…"

"…I think we have a lot to learn from one another…The on-line collaboration is especially useful as it gives me an opportunity to communicate with like-minded teachers."

"I am trying to find ways of incorporating technology and the Web into meeting every State Standard."

Figure 1: How Web Resources Have Changed My Curriculum Planning

In terms of instructional time, the survey participants feel they are running a more student-centered classroom. Web-based lessons are more interactive, more easily tailored to the individual student, and provide real-life examples that are engaging to students and allow the teacher to be more of a facilitator than lecturer. Also, some teachers reported that the Web had become their primary teaching tool, either because they lack textbooks or because their existing textbooks are outdated.

"Web-based resources provide more universal access for multiple audiences…it [the Web] also presents information that addresses audiences that do not learn from conventional classroom instructional strategies by presenting 'the picture' of an idea in a dynamic way. This facilitates abstraction for many learners (of all ages)."

"I've been able to find real data so that my lessons involve more inquiry and I've included more historical background into my lessons."

"[The Web] allows my students to arrive at conclusions on their own as opposed to listening to me 'lecture.'"

"It has become easier to differentiate my instruction and thus my planning."

"Knowing this is available has helped tremendously by giving me a resource that is motivating my students to use computers in a positive way."

"I like the animations and graphics that illustrate physical concepts."

"Students can use real-world raw data for mathematics applications."

"I have recently designed and put together a computer lab for my science department composed of 40 i-Macs and a G-4 computer all networked to each other and the Internet. However, it is taking me time to integrate the resources available online and on CD."

Figure 2: How Web Resources Have Changed Instruction

Theme 2: Time–and the Lack of It—is an Important Consideration for Teachers; The Concept of Time Reflects a Constellation of Issues

Time is a recurring theme when teachers describe their work and their lives. When referring to technology use in the classroom, “time” has multiple meanings: as a descriptor of use during instruction; as a barrier to the use of digital resources; and as a resource that can be invested in learning how to use digital resources.

First, time is a descriptive measure when examining the question of how much of teachers' instruction time incorporates digital resources. Most of the teachers that the Effective Access team surveyed reported that they use Web resources during less than 25% of their class time with students, as shown in Table 10.

Table 10: Use of Web Resources during Instruction

% of Instructional Time Incorporating Web Resources (Self-Reported)	% of Teachers Surveyed
0–25%	63.4%
25–50%	23.5%
>50%	13.1%

Teachers working in rural, suburban, and urban settings reported differing levels of digital resource use during class time. Over 75% of suburban teachers said they used Web resources during less than a quarter of their teaching time. In comparison, rural teachers were more likely to utilize materials from the Internet: 19% of rural teachers stated that more than 50% of their instructional time involves Web resources compared to 10.6% of urban teachers and 6.5% of suburban teachers.

Among frequent users of digital resources, gender of the teacher had no impact within our survey group. Male and female teachers were equally likely to report that they use Web resources during half or more of their classroom instruction. A gender split did emerge when focusing on teachers who use Web resources less frequently, however. Of the teachers who said they used digital materials during less than half of their instructional time, men were more likely (31% of men vs. 20% of women) to report that their use fell in the 25-50% category than were women, while women were more likely to choose the lowest category (67.8% of women vs. 55.2% of men).

Instructional use of digital resources also varied by the demographic composition of teachers' classes. Over one-quarter of teachers of majority Hispanic classrooms indicated that they were frequent users of Web resources during class time. In comparison, only 15.8% of teachers of African American students and 11.1% of teachers of Caucasian students reported the same high levels of use. (It should be noted, however, that only 15 teachers who answered this survey question indicated that a majority of their students were Hispanic, 19 indicated a majority of African American students, while 108 taught mostly Caucasian students.)

The Effective Access team identified another difference in instructional use of digital materials when comparing the years of teaching experience of the teachers surveyed. Of the group of teachers with 16 or more years of experience, 20% reported that they incorporate Web materials into their teaching more than half of the time, compared to only 7% of teachers with five or fewer years of experience. This indicates that for the survey participants, years of teaching experience did not mean teachers shied away from Web resources.

Time was also a barrier for the survey participants. When asked to choose from a list of challenges that impede their use of digital materials, two-thirds of the teachers chose "takes too long to locate resources." Their third choice, "resources are difficult to adapt to my needs" also relates to time, since adapting Web resources adds to preparation time. Teachers in our survey were in consistent agreement over their rankings of perceived challenges to seeking and using Web-based resources in their classrooms. Table 11 shows their choices, in order of popularity. Order did not vary appreciably by gender, location, or student demographics.

Table 11: Teachers' Top Challenges When Using the Internet in Support of Their Teaching

Challenge	**Percent of Survey Takers Who Cited This Challenge As One of Their "Top 3"**
Takes Too Long to Locate Resources	66.9%
Products/Web Sites are Too Expensive	39.7%
Resources are Difficult to Adapt to My Needs	32.5%
Resources Are Not Culturally or Developmentally Appropriate For My Students	27.8%
Unsure About the Validity of the Resources	22.5%
Resources Don't Align with State Standards	18.5%
Internet Connection Problems (e.g., Speed, Reliability)	11.9%
Limited Internet Access	11.3%
Printing Problems	10.6%
Problems with Computer Hardware	9.3%
No Support from Colleagues or Superiors	6.0%
I Am Not Comfortable Using the Web	2.6%

If a majority of surveyed teachers say that finding Web resources takes too long, how long is "too long?" The time spent searching the Web for education resources by the teachers fell across a broad range. Almost half of the participating teachers spend five hours or less *per month* searching the Web for their classes, while a full one-third of them spend 10 or more hours per month.

As might be expected, teachers who use Web resources frequently during class (50% or more of their instructional time) reported spending the most time each month searching for resources to use. 65% of these teachers spend 20 or more hours per month searching the Web, compared to only 5% of teachers whose instructional time incorporates Web resources less frequently. In fact, the majority of teachers who said that they use Web resources during less than 25% of their teaching time said that they spend five or fewer hours per month searching for digital resources.

The connection between high classroom use and high search times wasn't true for all subgroups of survey participants. Even though rural teachers use Web resources in more of their instructional time, urban teachers in the survey spent more time searching the Web. Over 40% of participating urban teachers said they spend more than 10 hours per month searching compared to 34% of rural teachers and 23% of suburban teachers.

Time could also be considered a resource that can be invested. On average, surveyed teachers said that they would be willing to devote between one and five hours to learning to use a new Web-based resource. However, fully 44% of the teachers said they would devote only one hour or less. Whether rural, urban, or suburban, teachers with 6–10 years of experience were even more likely to commit an hour or less.

Similar to the survey findings, the interviews revealed the multi-dimensional nature of time in the teaching environment. Several considerations converged when teachers discussed time, such as limitations or restrictions imposed by the classroom and the curriculum, the technology and technology infrastructure, and the resources of the school sites.

Teachers reported that time was a struggle when finding resources for immediate lessons, supplementing the textbook, or finding alternative ways to present the lesson. As the curriculum moves ahead at a regular pace, teachers often do not have the luxury of conducting extensive searches to find information. Teachers' daily preps have not expanded to give them more time for such tasks as searching and adapting digital resources. Thus, teachers often want immediately applicable lesson plans and activities.

Many of the teachers interviewed mentioned items related to time as challenges, such as: takes too long to locate resources; resources are difficult to adapt to my needs; and problems with connectivity and with computer hardware. Of the 24 teachers who mentioned time as a concern, most expressed frustration about the amount of time it took to locate resources (19). They linked this not only to the time it took to do the search but also to the time it took to download (10) and to connectivity issues (4). For example, one teacher described this constellation as, "…it takes too long to locate resources. [The site] is slow; kids can't get necessary information in a class period. And then we have Internet connection problems (e.g., speed, reliability), and problems with computer hardware. Another teacher, who has "to screen everything before I can send kids there" appreciates a site that enables her to use her time well as when the "information is readily available—I don't have to dig through ads to find material. That saves me time to search for and evaluate resources." For teachers whose students' technology access varies, the amount of time it takes to find materials that can be used later without technology can be frustrating. As one technology teacher said, "For my students who get sent to off-campus suspension program with no computer access, I have to find resources they can do on paper."

In the teachers' responses, the amount of time to download often related to the technology available in the schools, but also to how it put constraints on what the class could do. Teachers may not use sites with good materials that are slow to download. For example, like four or five others, one teacher said, "If it's slow at all, I'll go elsewhere." The technology-related time issues range from dial-up or slow access ("having equipment available is important. And if a classroom has only one computer with dial-up, that's really bad, because it takes too long") to lack of current computers (8). One teacher, making this point said, "My computers are old and have trouble accessing sites with newer capabilities" while another talked about the "clunky computers" and another about the "lack of applications and software." One teacher expressed it this way: "I test sites on my system at home (dial-up). If I get lots of messages like 'Hi, you're using an old version of Netscape,' then I don't use the site. The kids with faster machines get bored, so it would be good if there was an option of entering answers on the computer and printing out results." Another teacher explained that the school computers can't run Shockwave and "if I don't have Shockwave then the applications I find on the Web can't run." Another issue mentioned was the nonalignment of computers, as one teacher explained, "I do my research at home on my PC and find applications but that makes it difficult because the school has Macs." Similarly, another teacher noted that, "The cross-platform issue is important to me…and whether pictures download fast enough for teachers. When you are projecting something for your class, you need the image right away."

Download speed is a universal problem, but the interviews made it clear that speed has special resonance for teachers. When they are up in front of the class, things have to happen immediately.

If they are surfing the Web at home, downloading a resource just for themselves, they can and will wait if they think it will be a valuable item. However, as soon as students are involved as audience or participants, teachers' willingness to wait is gone. Resources that require long start-up times are not useful then. Because teachers are so aware of this speed issue, anyone designing for teachers should be aware of the issue's relative importance.

A significant factor in the time constellation, as pointed to by 16 teachers, is the integration of technology into planning and instruction. Teachers indicated that neither they nor their students had enough time, as one teacher said, "We need time—time enough for students to get comfortable with whatever resource you're using so they are comfortable with it too and settle down and get work done." Several teachers pointed to the link between the lack of school resources and time. For example, one teacher said, "I look for high tech applications, but not so high tech that it takes five hours to load or that they can't access on slower home connections...Also, reserving computer time for students. If I don't plan far enough ahead, I can't get computers for them."

Several other teachers were frustrated by the increased pressure to stay current with the technology, to learn new applications, and to integrate these into STEM teaching. For example, one teacher answered, "I need TIME. They want you to be everything and do everything. I don't have time to sit down and learn to use it. Right now I have to know three different systems."

Theme 3: School District Infrastructure is Critical to Integrating Technology-Based Resources and Instruction, Yet It Often Does Not Provide the Necessary Tools or Support

The school environment within which teachers operate can have a huge impact on how often and to what extent teachers make use of digital resources. Cost of equipment and resources, the availability of technical support, and the logistics of student computer access at a given school are all important. What kinds of school environments did survey participants describe, and how do these environments affect the teachers' use of digital resources?

For the teachers responding to the survey, textbooks and Web sites top their lists of resources used daily (see Tables 12 and 13). Colleagues also appear high on their list; teachers reported that they collaborate with other teachers frequently. Over 50% said that they collaborate with colleagues daily or at least once a week. Only 1.6% of surveyed teachers (n=183) said that they never collaborated with other teachers.

Tables 12 and 13: Resources Used Often By Teachers During Their Curriculum Planning and Instruction

Resources Used During Curriculum Planning	Use Frequently or Always (%)	n
Web Sites	71.3%	181
Textbooks	70.2%	178
Colleagues	52.8%	178
Books	52.2%	180
Other Print	39.8%	123
Professional Journals	37.1%	175
Applets	26.7%	120
CD-ROMs	24.4%	176
Magazines	23.3%	176
Specialists	20.5%	176
Newspapers	11.9%	176
Administrators	6.3%	176
Encyclopedias	1.7%	174

Resources Used During Instruction	Use Frequently or Always (%)	n
Textbooks	68.4%	177
Web Sites	58.5%	176
Other Print	43.7%	119
Colleagues	34.9%	175
Books	33.1%	172
Applets	30.4%	115
CD-ROMs	23.1%	169
Professional Journals	22.8%	167
Magazines	14.5%	166
Specialists	9.6%	167
Newspapers	8.4%	167
Encyclopedias	1.8%	166
Administrators	0.0%	166

Colleagues are also a frequent source of new educational resources for survey participants (see Table 14), although Professional Development sessions or conferences were their top source category. (In this survey question, "resources" referred to any educational resource, not simply Web-based ones.)

Table 14: How Teachers Find Out About New Resources

Source of Information	Percent of Teachers (n=181)
Professional Development sessions or conferences	68.5%
Colleagues	64.1%
On-line Sources	64.1%
Professional Journals/Readings	49.2%
Direct Mail	47.0%
Newsletters	36.5%
Print Ads	23.3%
On-line Ads	18.8%

The most common equipment configuration for teachers surveyed was a single computer in their classrooms that is hooked up to the Internet (see Table 15). Although teachers reported having several different set-ups (a single classroom computer, access to a lab, and several classroom computers were the most common), almost all teachers had some sort of classroom Internet access. Fewer than 8% described having one or more computers in their classrooms but no Internet; most of these teachers teach in rural schools.

Table 15: Computer and Internet Access for Teachers and Students

Computer Access at School	% of Teachers (n=92)
One Computer in Classroom, with Internet	47.8%
Computer Lab to Which My Class Often Has Access	41.3%
Several Computers (But Fewer than Number of Students), with Internet	38.0%
Computer Lab to Which My Class Rarely Has Access	25.0%
1-1 Student to Computer Ratio in Classroom	10.9%
Several Computers (But Fewer than Number of Students), No Internet	5.4%
One Computer in Classroom, No Internet	2.2%

Access to centralized computer labs sometimes presented problems. Over 40% of the STEM teachers surveyed said that their schools have labs that their students often may access. However, one-quarter of teachers don't have such access. A school with a computer lab of limited use to teachers was more common in suburban schools than in rural or urban schools.

Of the teachers surveyed, most of the teachers having a 1-1 student-computer ratio in their classrooms were technology teachers whose classrooms are computer labs. However, a few science and math teachers indicated that their schools have mobile carts of laptop computers.

For survey participants, having the equipment is one thing, but maintaining it in working order is quite another. Almost half of the teachers said that they themselves were their only source of technical support. The rest of the teachers said that they could turn to a technology coordinator and/or other teachers (Table 16).

Table 16: Teachers' Access to Tech Support

Source of Tech Support	Percent of Teachers (n=153)
No One (Other Than Myself)	49.0%
Technology Coordinator	48.4%
Teacher/Colleague	43.1%
Librarian	9.8%
PD Trainer	9.2%
Curriculum Specialist	6.5%
Administrator	5.2%
SpEd Coordinator	1.3%

Underlying all of these school context factors is the issue of cost. When asked about barriers to classroom technology integration, roughly 40% of teachers cited the expense of Web-based resources, making it second only to time as an obstacle. (See Table 11 in previous section.) However, the impact of cost is broad. Cost is a pervasive factor, affecting not only the resources purchased, but also the numbers of computers in a teacher's classroom, whether there is anyone on staff to keep the computers running, and the kinds of training opportunities available to teachers. Interestingly, frequencies of Internet access did not seem to be tied to the poverty indicator of percent of students eligible to free/reduced price lunch. However, teachers with higher proportions of students eligible were less likely to report the presence of a school computer lab than were teachers of more affluent students. (See Appendix C for full results by category).

While excited by the potential of Web-based resources, the teachers interviewed faced a number of barriers within the schools in their efforts to integrate these resources into their planning and instruction. These barriers primarily were related to budget considerations and the lack of infrastructure supporting technology integration, including equipment, access to existing equipment, and administrative support. As a group, the teachers expressed frustration about trying to fully utilize the technology while not having the support they needed to do so.

One of the most critical concerns for the teachers in our interviews was the lack of computers and easy access to the Internet, as exemplified by the teacher who said there were three computer labs in her school of 1400 students. Another teacher pointed out how her limited access negatively impacted her teaching. She wanted students to be engaged with the technology and with learning but said, "My class size is 26, but I have 4 functioning computers with Internet access in my room. Therefore, it's difficult to integrate Web resources as much as I'd like… [technology integration] often becomes a Power Point, something they see, rather than do." Several teachers echoed the teacher who described how teachers in the building had to compete for the same resources. "There's not enough time to do the sifting and planning. It's hard to get access for the students—either lab time (which requires advanced planning and signing up) or checking out the projector. We compete for the one projector on a daily basis," she said. Another brought the issue of few computers and little access to labs into her description of a current frustration when she said, "I don't have access to take my whole class to the lab because people book the lab for months straight. The art teacher has it now. I know she needs the computers to show all of the art history images, but it means that other classes can't get in. Having equipment available is important. And if the classroom has only one computer with dial-up—that's bad! You need at least enough computers so only 2 kids share one."

Cost was an issue the teachers frequently raised (14). Cost concerns were not limited to teachers from any one region or type of school district, but rather were voiced by teachers in urban, rural, and suburban districts all around the country. They mentioned their frustration that they could not access sites that had good resources because they could not afford to pay for the subscription. They want the resources, but because most teachers do not control the budget for technology spending, or they work in districts with few resources, they can't access them. For example, as one suburban teacher in the south explained, "There's a company in Australia that produces the type of software I'd like to have. I've seen their demo. It has all the skills and concepts and tailored feedback that I'm looking for. But it costs nine or 10 thousand dollars for a lab's worth of site licenses. That's way too expensive. My small school can't afford it." A teacher in a rural east coast school provided a clear example of how this plays out in her school and how it impacts her students directly. She began her comments with "Money!!" and continued, "There are some really, really fabulous sites, but they cost. My school is not willing to pay, and I understand why, but our kids are missing out. I did have a chronically ill student last year, and he could have benefited from a Virtual Lab site like Eureka. But the one I found last year cost $200 for a membership, and then more for other aspects. His parents couldn't pay, and the school wouldn't, not for one student."

Teachers also pointed to the competing budget demands that pit textbooks against technology. For example, one teacher said, "I would love to have virtual textbooks. Ours are good books, but they're ten years old. They're in really bad shape. At $80 per new book, I don't know what would be most effective for the district. I've asked for new books, but when these fall apart completely I don't know what will happen." Similarly, another teacher in a large urban district made a connection between technology costs and the impact on her teacher colleagues when she said, "Funding!! I'm fortunate. I have 'new' (only 4 years old) computers, and 26—well, 24 working—computers that match. But I still need more memory. It's bad to take teachers who are unfamiliar with the hardware and give them crummy hardware to use. No other work environment expects you to use the tools to do your job AND do all the maintenance to keep them running." This last comment reflects the feelings of a number of the teachers who felt they had no tech support and were expected to keep their systems running themselves, often with only the help of their teacher colleagues. At other times, the technology is available, just not useable, as in the description by one teacher, "We're in the second year in a new science building and all the classrooms are designed around technology…but the technology itself was never installed."

At the same time, teachers did value the resources they found on the Internet and some even found "free-ware and share-ware for almost everything I need—art programs, Web editors, etc." And they want to have and learn to use more technology. Teachers listed a number of tools they'd like, ranging from iPods to PDAs to iPack and virtual labs. One teacher spoke for several of the teachers when she said, "It would be nice if all kids had laptops. We have a computer that attaches to TV, but that's not hands-on for the kids. I'd like to have a SmartBoard, it's interactive. I had one during my internship…we could color things in, print notes, save things. The kids want to write on it, so it keeps their attention." A few teachers talked about the positive changes they've seen in terms of technology. One science teacher from a rural school reflected on the fact that previously the biggest challenge in his school was the availability of resources, "but this year, we have a cart full of wireless laptops. That's going over great. Plus, more and more people have access to projectors, which work really great for me." For him, as for those who did have significant access, the new challenge was learning to use the resources effectively. And, for another, greater access created new cost challenges, when he said, “The biggest challenge now is the cost of maintaining. We’re in a rural area and I have a Web development class, but half the time, the computers don’t work. The kids get frustrated!”

As technology does become part of effective teaching, it may look different from older models of teaching. This shift brought some of the teachers interviewed into a new dilemma, that of “getting the administration to understand that I’m not playing when they observe technology use in the classroom. Quiet classrooms are out the window. When we’re playing games, working in groups, that’s real work being done.”

In addition to the challenges teachers faced in school, they mentioned the challenges of technology, access, and costs in terms of their communities. Like the teacher above with the student whose family could not afford the cost of the virtual lab, several teachers mentioned the lack of access or the need for families to spend money on basic needs as a serious challenge to using digital resources. A teacher in the rural northwest captured this when he said, “We’re a poor school district and not all the kids have computers or computer access at home. When they do it’s generally not broadband.” Another suburban teacher said, “My students don’t have access at home so I can’t give them assignments. Many students don’t even have home phones.” This access issue affects the teachers as well as in the example of the teacher in a rural school who said she herself had dial-up, while most of her students didn’t have computers or access. This slowed down her own searches and limited what she could retrieve, “…and it limits what we can do in class.”

Theme 4: Teachers Often Use Simple Search Strategies and They Are Not Often Satisfied with Their Results

When asked to describe a recent search in the interviews, the majority (20 of 26) said they began with Google to do the search. This is not surprising since Google is now the most used search engine (Sullivan 2005). When asked to name their favorite Web site or search engine, 12 again mentioned Google, at times along with other sites. Explanations for the use of Google tend to reflect ease of use and amount of information, as for example, a first year teacher who said Google is her favorite because it limits search results to a desired category, has extensive resources, and the resources are easy to customize to her needs. A teacher with nine years experience mirrored her comments, stating, "I use Google often and find great resources. For example, my kids were struggling with field of view measurements. I found multiple sites and used it that day in class to demonstrate the steps," as does a 15-year veteran teacher who said, "Google is easy to search and usually has the most relevant information, and it downloads quickly." Another said, "My class was confused about Celsius and Fahrenheit temperature scales. So I went to Google and typed in Celsius Fahrenheit. It took about 30 seconds. We found a site with the conversion factor…it was fine."

At the same time, some teachers expressed dissatisfaction with their searches, explaining that their search results are "too broad" and that they did not find what they were looking for. One teacher, describing why she considered her search "not really" successful, said that it took her two different searches and "…the second time I found a new link I didn't notice the first time."

Teachers also mentioned a number of other sites that they used regularly, with both positive and negative results. Among sites mentioned at least twice as being useful were the National Science Teachers Association (NSTA), The Eisenhower National Clearinghouse for Mathematics and Science Education (ENC), dogpile.com, National Council of Teachers of Mathematics (NCTM), and the Glenbrook (Illinois) Physics page, which one teacher said "is like a clearinghouse for physics materials." Several teachers mentioned that they regularly check university Web sites for resources and information. A range of other favorites included Science Teacher, Journal of Chemical Education online, Environmental Protection Agency (EPA) Now, the National Weather Service, and sites maintained by either their school district or state department of education.

Among the reasons stated for liking a site, teachers said they were easy to search, their resources were appropriate for their students, and the information was from a reliable source. In line with the response indicating teachers considered the needs of their students, one teacher talked about her favorite site as, "…easy to search, usually has most relevant information, resources culturally/age/developmentally appropriate."

Once they find a good site, some teachers use them regularly to add content to their classes. For example, one rural teacher said he uses the Cosmic Perspective site "almost daily. I love the applets, images, and insights. I also try to use the Collaboratory in coordinating student projects and research."

Teachers also defined why they found other sites difficult to use. These difficulties include issues around formatting, the time it takes to download, and too much information or links. A difficult site described by one teacher was "slow to load. It has debug errors if you try to click on a link before the picture loads, and it has way too many submenus that are hard to access." Barriers such as slow downloads and "formatting [that] is old and cumbersome and it's hard to navigate and make sense of" make it difficult to integrate the resources into their planning and instruction. As two teachers explained, "there are enough Web sites out there that if I come across a difficult site, I immediately leave it to find a better one," or simply, "I don't use difficult sites."

The teachers interviewed, like their peers in the survey, said that their search was inspired by a specific topic or content need. Of the 24 teachers who responded to the question about the different reasons for searching, sixteen listed topic or content as their first reason for searching. Teachers are also thinking about how the topic applies to their classes; seventeen of the 24 teachers listed the needs of the entire class as their second reason for searching. A few others listed curriculum standards (6) and the needs of individual or small groups of students (3).

When asked to describe a recent search, teachers identified a number of different search strategies and processes, and their outcomes. For example, some teachers seek specific examples for their instruction and end up with multiple sources, such as, "I wanted a list of prime factors. I started with Google and wound up at a University of Utah site. It was instant—lots of links popped up. This was fine. I printed out the first 1,000 for the kids to see. And they could see that there was a link to the next 1,000."

Another teacher said, "I wanted a tutorial about protons, neutrons, and electrons that was interactive and allowed the students to do their own drills… [so I put] tutorial, protons, neutrons, electrons all into Google and it took me about a half hour. I found a site that tells kids whether they got a question right, and there are lots of different topics—significant figures, exponents, etc. in addition to the topic I needed." One interviewee said his students had to look up Pythagorean triple and tessellations on-line so he began by going to one of the professional math sites and using the keyword search for "tessellations, sketchpad activities" and was then able to send students to the sites.

A few teachers reported searching for digital resources in place of a text or for a deeply involved lesson or lab, as did one teacher who needed an "…interactive simulation of momentum—our airtrack equipment is broken. I wanted a simulation or an interactive applet. I went to Google, typed in interactive applet momentum high school. And then to check for appropriateness I go to a lot of college sites. Some are fine for my needs. [But it wasn't successful because] I wanted some sort of lesson plan, something they could do on their own and manipulate variables."

Other teachers who don't get what they want through a simple search adjust their search strategies. One person did some reflective thinking as a result of an unsuccessful search for information on vectors for her class. She analyzed her results and made adjustments in her search, saying "I didn't think and first just typed in 'vectors.' Of course I got all sorts of stuff on fleas, bees, mosquitoes. I narrowed it by adding 'high school.'" Some have the students do the searches because "…they're more adept at searching anyway…I don't have much success; I generally get discouraged. I wind up finding text-heavy documents or pay-for-use sites."

One teacher converted her own learning into a search experience for students: "I had my students watch the movie, "Medicine Man" and we talked about conservation. The movie mentions the Thurmond Award. I needed to find out what that is and if it really exists. I went to Google. First, I just did Thurmond Award and got lots of hits for Strom Thurmond as well as some military sites. Then I tried 'Thurmond Award AND Science' and found Maxwell Thurmond. It turns out he *was* [in the] army, but did research in biotechnology. In class I had my students do the search and since I had already found the information, I was able to guide and teach them to search**."**

Another teacher couldn't find what she wanted and concluded that colleague's references would work better. "I went on-line to find tutorials on style sheets, typing in 'tutorials style sheets downloadable' …I checked the first four to five sites that came up but saw they weren't what I was looking for…I think a Web design book that my colleague recommended will be a better resource. I want something more in-depth than I found on the Web."

When discussing their searches in terms of student needs, teachers' responses mirrored different teachers' expectations of their students and different ideas about teaching and learning strategies. For example, some seemed to have low expectations or biases about their students, and seemed to adjust their search for resources downward. Two teachers were very specific about their belief that they needed to find rudimentary or visual resources because "…they can't read and they're proud of it" and "…they don't want to be here anyway so I have to find things to keep their interest visually." At least three teachers said they were constantly looking for remedial materials, but one tied this to "…variety, I need 30 problems on a page, not just one," while another indicated he wanted different instruction examples along with remediation assessments. Another example is that of a technology teacher who conducted a search for remedial math work for students, a process that took 10 to 15 minutes to find "remedial fractions" printable worksheets for the students.

On the other hand, two other teachers seemed to make higher assumptions about the resources the students had at home, assumptions that might not fit the reality of their largely urban community. For example, one teacher in a school where an estimated 75 to 100 percent of students had free or reduced lunch said, "I like for my kids to be able to use the same site…I want the kids to have the option of entering their information/answers into the site itself so they can go home, access the site, enter answers, print it out, and bring their work back to school."

Other teachers indicated their awareness of different levels in the classroom and the desire to find materials to meet the interests and needs of all students, saying they adapt materials to meet the academic or learning needs of their students (8) including "…knowing my students are visual learners I pull stuff off the Web and break it into chunks and I often need things I can project. I look for things to inspire the kids to try."

A few teachers talked abut how they searched to solve problems with the technology in the classroom or to help students find answers such as the teacher who was trying "to find out why the class digital camera was losing pictures. Kids would take pictures, see them once, but then they'd be gone from the card." This unsuccessful search—it was still in progress at the time of the interview—had the teacher searching through over 50 pages before he put the search temporarily aside.

About five others who indicated technology or school-based barriers are searching for resources to download as handouts or other more conventional materials rather than for interactive sites for the students to use. One teacher described how she worked for students with IEPs: “A recent search I did was for my fundamentals class where I have lots of IEPS. I was trying to find out how PopRocks work. So I went to Google and then to How Stuff Works. I wanted to know if there’s a way to make them and I found how to make the compounds, how to make sugar crystals. It was helpful to me because it lists out materials for the lesson…It’s my first year teaching and before I do something with kids, I need to do it myself.”

Theme 5: The Technology Environment Does Not Reflect the Needs or Use Patterns of High School STEM Teachers or Students

During the interviews, teachers expressed a wide variety of opinions and suggestions for what makes Web sites and resources “teacher-friendly” and “student-friendly.” With respect to design preferences, there were a few disagreements. When the interviewed teachers differed, it was mainly on the subject of “how much multimedia is too much?” For example, one teacher wanted “…more fun, more excitement (fireworks instead of flowers)” while another preferred less excitement, saying, “I want imagery. I don’t need bells and whistles, really don’t like flashy buttons. Scroll over or rollover buttons are fine. Calm, simplicity, and pretty are all fine.”

They tended to agree that they want sites that get them to their destination quickly, and they shared many examples of design elements that either enable this or prevent it from happening. As one teacher said, “If it’s slow I don’t stay. And, one thing I look for is from the first page, can I find the link I’m interested in…” A teacher describing what she meant by an “intuitive site” answered, “I want clarity and a menu of places and a sitemap at the bottom.” Another teacher bemoaned sites that require you to go through many layers, saying, “Too many people build things that are purely sequential. The content is 8, 10, 12 pages deep, and you HAVE to go through all those pages. There’s no link directly to page 34. You have to find your way through 1–33 first.” A third teacher complained about the same problem, and suggested a possible solution: “I like sites for me that have a hierarchical dichotomous key. I want to see the logic.” Menus like this, clearly visible from a site’s homepage, were often cited by the interviewees. Such keys allow teachers to see what is available on a site and to go directly to items of interest, without getting lost along the way. As one teacher stated, “It’s important that a site be able to differentiate. I want to find what I’m looking for, but when they have links here and there, stuff everywhere it doesn’t work. Or else I click on the wrong button and I’m off the site.” A teacher who experienced that problem frequently with her students said, “I like it when each window opens new.”

The newness of information was also important to these teachers. This common view was expressed by one teacher who said, “I want something to help me with my teaching, that let’s me know about resources. It’s important for science teachers to stay up-to-date, too.” This desire for current content was related to their annoyance at sites that misrepresented themselves in search engine keywords. A technology teacher from Texas summed it up, saying “What frustrates me most is when sites have a tutorial as a keyword, but when you get there, there’s no tutorial on the site. Developers should be honest with key words.”

Like the majority of survey respondents, the teachers interviewed often mentioned wanting lesson plans to be part of a site’s content. Therefore, when asked about design preferences, related features like teacher feedback and tips often surfaced. For instance, one new teacher said, “What’s helpful to me is when a site lists out materials for the lesson and has some sort of teacher feedback. It’s my first year teaching and before I do something with kids, I need to do it myself. I need warnings, background information, a “what next” section.”

When teachers spoke about using Web resources with students, two related themes came up most frequently. Teachers wanted sites to have multiple entry points to accommodate different learning styles, and they repeatedly stated that materials need to be more visual than text-based. Representative comments included, “There need to be many ways in to the information: text, video, pictures—to attract all kinds of learners;” “Kids think in computer now, they really do. So I need things to help them that are driven by their way of thinking [and] that help me lead from concept to model to manipulation;" "I look for sites that have diagrams and pictures with the text to make it more visual;" "If it's not visual I can't use it. I like a nice and clean site that's labeled and easy to see, read;" and "My students are visual learners, not readers. Too much text is a red flag…A lot of our kids have IEPs. [Sites] need to be easy to see and read."

Reading level and design were closely related for these teachers, as evidenced by this comment: "The vocabulary has to be simple and it can't have too many bells and whistles. This means the site itself has to be very simple. I want the index on the side and the navigation at the bottom of the page and an easy way to go back." A technology teacher voiced this idea as well, saying, "Kids are visual and they don't scroll down the page. A good example is LearntheNet.com, it really lays out the basic architecture of the net and the basic hardware issues in words that are easy to understand." Another teacher said, "I have to align [the resource with] the ability level of my kids…they need step-by-step, something really sequential without assuming that [they] know something." A teacher describing applets wanted tools "with easy directions—1 or 2 steps, maybe 3, that can be modified by me."

"Clear" and "clean" were words used often to describe the layouts that the teachers wished for. One technology teachers said, "I want good design, if its design doesn't match the Web design criteria I teach the kids, then I don't use it." An urban charter school teacher stated, "Well organized is the key… Sidebar tables of contents that don't go away are always good. That way, you can't get buried." Teachers often mentioned that good designs didn't distract students and actively helped students navigate the site: "A site needs to be easy to read, easy to follow, and not too dazzling. I don't want them to get sidetracked." The interviewees generally agreed that organization by subject area helped sites achieve this goal. For example, one teacher suggested that sites "have things by subject area with a summary alluding to that area, with quizzes, study guides, clips to let you know what you'll find there." Using subject area as a broad organizational starting point was popular, probably due to the discipline-specific nature of high school teaching.

Navigation and display issues came up often. One teacher described multiple related concerns when she said, "I want it to print properly from the screen (no cutting off the right side for example). Often, the kids have trouble toggling between directions and the application, so I have them print the instructions. If the text gets cut off, I won't use that site. If you have to scroll left to right you lose big points with me. Schools have small monitors." Another teacher added that "everything should be in multiple formats (PDF AND html, for example)." Lastly, teachers mentioned the comment "things need to work cross-platform and with every browser" again and again. Teachers saw the lack of cross-platform compatibility as a significant barrier because their home computers, school computers, and students' home computers rarely matched.

Teachers placed a high priority on credibility of sites and validity of content. One teacher described a problematic site: "Some of the stuff is not solid in terms of science and I don't want to backtrack and re-teach. So for example [one site is] about sports figures and tries to link sports to technology and to math/science concepts. It's nice to look at but not so good scientifically." Another interviewee simply stated that a resource "has to be from reliable, well-known, and credible places."

Teachers saw the capability of the Web to present compelling, real-life information to their students as one of the main reasons to use digital resources during instruction. The value they placed on such information had design implications. One teacher explained, saying "The virtual frog dissection is good example. We need things that are real, everyday life examples. I want something to help me do projects."

When using Web tools with students, teachers wanted interactive tools, but they returned again and again to the issue of time. They were adamant that sites must load quickly, and listed several technical challenges such as old equipment and browser versions. Comments such as "We have old clunky computers. Sites need to load to these" and "For the kids I want applets that load quickly" were common. Browser version was a related issue; one technology teacher stated that he would use a site "if it works with our browsers…too many bells and whistles and it won't work." Loading time also affected whether or not students with dial-up connections could use sites for homework, as this teacher pointed out: "It should be interactive, so the students can do something but it doesn't take five hours to load. When they go home they might be able to get it to work, but maybe not."

Underlying all of the resources and design features teachers requested for themselves and their students were the issues of evaluating Web resources and the increasing need for students to be able to think critically about the information they find. The teachers recognized their own need to verify sites' credibility and looked for ways to teach their students to do the same. One new teacher summarized the dilemma, saying, "This generation is more vulnerable. They're innocent about the Web. If it's there, they believe it." Another teacher agreed, saying "Kids believe everything they see on the net. It's their primary resource. They forget to look in the encyclopedia. In a few years, students won't even know about them." This teacher continued with a description of class research projects that her students had done: "Plus, they can access lots of information on a topic. However, whether they can assimilate the information they find is a problem. Web research can give them a false sense of accomplishment. I ask for their research and they proudly hand me lots of Web printouts, but they don't understand the information on those printouts." Teachers saw thinking critically about Web resources as an important technological literacy skill they wanted for their students, and they looked for Web resources to support their teaching of this skill.

The instructional resources teachers most wanted for their students were all interactive in nature, ranging from illustrative applets and simulations to engaging games and tailored assessments. Here are some of the things the interviewees had to say: "For my students, I'd like applets with about two variables so it's not overwhelming. One really cool one is about a star's life with mass, color, and temperature. They cut the video into clips of one, four, and five minutes. It's very useful, and this is easier to download. I like it because it's so simple and the students can follow the relationships." "I'd like a simulations site, with 2D collisions, and optics. I want things that happen live." "I need sites for my students that have them input answers into blanks (vs. multiple choice) and then give them appropriate feedback based on their inputs. With multiple choice, it's too easy for the students to choose A, get it wrong, ignore the explanation given, and just try B the next time. Feedback needs to help them think their way to the right answer, not just let them click." "I'd like to see tools with any type of games or question-answer response. I want immediate feedback for kids with interesting subjects. Kids really do have curiosity so anything that keeps that curiosity alive is good." One teacher saw the Web as a way for students to interact with each other, with her, and with peers' work. She described her idea this way: "For my students I'd like computer labs, with ways to interact. I'd like [the students] to evaluate student work and send it to me, a way for me to review for what they missed."

Teachers wanted to know whether the resources they found on-line were kid-tested and teacher-approved. Like the first year teacher who wanted teacher feedback, another teacher said, "The best sites would be teacher swap sites, where normal teachers can swap lesson plans and you know the lessons have been beta'd in real classrooms. It's bad and common for developers to throw something out to the public without ever having regular teachers look at it." Later in their own interviews, digital resource developers reinforced this point from their perspective.

Teachers frequently talked about the design of content on Web sites; they would describe information that they found, and then describe ways to better present that information. For example, one teacher said, "I'd like to see real world career stuff…the University of Ohio Career Information system is nice and inclusive but with wide, wide categories. It has no depth and won't hold interest for students." A math teacher searching for usable data said, "I'd like something already in Excel, where the data is ready to work with. When I look at the main front page, [I want to see if I] can I get the data from that source." Another teacher had difficulty finding high school level chemistry content on-line. She declared, "I find chemistry the hardest area to find stuff. Most chemistry stuff is college level. What I'd like to see for example is a streaming video of an explosion, then show the formula and results. That would be useful." One teacher dreamed of optional musical to go with the on-line activities, saying "I'd like more music on Web sites—that brain-stimulating music they talk about. I'd like to have that as background for students to listen to while they're on sites." Connection to standards was one topic that, while not overwhelmingly a deciding issue for the interviewees, came up with regularity. One mathematics teacher who brought it up said, "I want the links to the standards. For example if it were linked to the National Council of Teachers of Mathematics (NCTM) standards or state standards, oh I can definitely use that!" With respect to presentation of content, one southern teacher was very clear about what she wanted to tell developers, saying, "Keep it simple. A lot of designers want to make complicated sites because they're smart and they can do it. But that's not helpful. Examples of sites I consider simple and worthwhile are MathTools and Purple Math."

Well-designed digital libraries with age-appropriate content could be excellent resources with the capability to meet all of the design preferences that the teachers described, particularly the issues of credibility and organization. In fact, one teacher summed up a litany of design wishes by concluding, "It would be nice to have applications and Web- related resources readily available from a single jumping off site." The teachers' definitions of an ideal site often matched that of a digital library such as the NSDL, which is described as: "exemplary resource collections and services, organized in support of science education at all levels" (NSDL, n.d.). However, as a group they did not know what a digital library was. Only one teacher indicated having heard about digital libraries, saying, "I don't know much but I hear librarians talk about the process." One conjecture is that the term itself is not a familiar one and has not entered into the lexicon of educators. None of the 26 teachers named the NSDL in their list of sites used, nor did they name it in any way. Again, one possible explanation is that, as a relatively new resource, the NSDL has not reached a visible level. Another is that the NSDL may not be showing in searches and is not listed on those sites teachers use, indicating a need to re-examine both search strategies and promotions. A third conjecture is that, although teachers may be finding NSDL resources in their searches, they are not recognized as part of a larger entity. Given that the teachers in both the surveys and interviews said validity, teacher-vetting, and known organizations were important to their selection of resources, this lack of recognition is a challenge the NSDL—and perhaps other digital libraries for teachers—will need to address quickly and comprehensively.

When asked to describe what the term “digital library” suggested, the teachers interviewed tended to transfer the sense of a conventional “bricks and mortar” library to the concept of a virtual library, often also assuming it would be a primarily text-based resource, such as “I would think a big encyclopedia, constantly up-to-date, a single source for information” or “Documents and papers on the Web. You can access them without going to a brick and mortar library; maybe like ERIC, with original papers.” This description was similar to that of almost all 26 teachers interviewed, with variations including as broad a definition as “the Internet itself” to “I guess some kind of an index search for certain topics.”

Three teachers ventured ideas of digital libraries that indicated a broader view such as the one who said, “[For me the] connotation is an organized collection of information all in electronic form and all accessible in digital form. It needs a good search engine and should have listservs/other usergroup rooms for different topic areas and different levels.” Another interviewee, indicating some familiarity with a digital library, said, “On-line access to books in electronic form, PDF, and html. I’ve seen fee-based ones, never one that was attractive price-wise.”

Several issues topped the surveyed educators’ design feature wish-lists, as Table 17 shows. A majority wanted some sort of site search tool, which is in keeping with the interviewees’ overall concern with site organization and ease of navigation. Almost half reported that credibility of a site or resource was a top concern. The educators also wanted links to related sites, multimedia content, and ways to interact with the site and/or site developers, including question submission, on-line help, and access to experts.

Design features that were not as popular overall with the surveyed educators included aspects of Universal Design. Less than 10% of the educators listed features such as audio option, text-only option, and adjustable font-size and color as top concerns. This may be because the teachers taking the Effective Access survey were predominantly able-bodied, as were the students in their classes. Only 3.3% of the educators surveyed reported having any kind of physical disability. Furthermore, only one educator (1.1% of the 92 who answered the question) reported teaching students of whom 75-100% had physical disabilities. 96% of the educators said that less than a quarter of their students were disabled, and the rest of the survey respondents were unsure.

Table 17: Design Features That Teachers Would Most Like to Find on a Web site Devoted to Instructional Resources

Desired Design Features	Percent of Survey Takers Who Cited this Tool as one of their 'Top 3'
Search Tool	54.6%
Assurance That the Site is Backed By A Reputable Sponsor	46.1%
Related Links	43.4%
Way to Submit Questions	42.1%
Multimedia Content	38.8%
On-line Help	34.2%
Access to Experts/Professionals	32.2%
Citations and References	22.4%
Collaboration Tools	15.8%
Access to Phone Help Line	9.9%
Audio Option	7.9%
Text-Only Option	7.2%
Adjustable Font Size and Color	7.2%
Pleasing Colors	4.6%
Few Flashing Buttons/Little Multimedia	3.3%
No Frames	2.0%

Search Tool was universally a top choice. When examining responses by participant gender, school location, and student demographics, at least 47% of educators in each grouping chose it as one of their top three. Its importance increased with classroom digital resource use, however. Teachers using Web resources during 50% or more of their instruction were half again as likely to select Search tool as were teachers using Web resources less frequently. The same pattern held true for assurance of reputability. Half of the frequent digital resource users said that credibility was of top importance, whereas one-third of teachers who use Web materials during less than 25% of their instructional time said the same.

A way to submit questions was popular across the boards, garnering approximately 35–45% of votes from all categories of educators. Teachers whose students were predominantly African American were most likely to want this option; almost 70% of these teachers chose question submittal as one of their top three choices.

Rural teachers were only half as likely to desire multimedia content as their suburban and urban colleagues. Only a quarter of educators in rural schools ranked multimedia content in their top three. This may be due to rural teachers relying more frequently on dial-up Internet connections. However, as a selection, "Few Flashing Buttons/Little Multimedia" was no more popular with rural teachers than with the others.

Rural teachers were also less likely to identify On-line Help as a desired design feature. (Of the group of rural educators, 22.9% chose this option, vs. close to 40% of suburban and urban teachers.) In comparison, rural teachers were almost twice as likely to choose "Phone Help Line" as the educators in the other two categories.

The relative popularity of the "On-line Help" selection was also one of the few gender differences that cropped up in the responses to this survey question. Of the group of male teachers surveyed, 51.8% selected this option, compared with only 23.1% of female teachers. There was very little gender difference when comparing the rates at which male and female teachers selected other desired design features.

Teachers did not commonly cite “Collaboration Tools” as one of their top three design features. Only teachers of Hispanic students seemed to rate this option highly. Of this group of teachers, 33.3% selected “Collaboration Tools” as a top choice; they were more than twice as likely to choose this option as teachers whose students were majority Caucasian or African American. Given today’s students’ propensity for group learning, it would be valuable to know whether teachers ranked “Collaboration Tools” low on their wish lists because they truly saw little need for such design features, or because they were unaware of what tools are currently available, and how these tools could support instruction. Also, it is important to learn what it is about Web-supported collaboration in the classroom that teachers of Hispanic students appreciate.

Theme 6: Content is the Primary Motivator for Teacher Searches and Includes Resources and Materials for Both Planning and Instruction

After time and cost, the next four barriers to technology integration that survey participants cited all related to resource content and instruction. Teachers cited such challenges as the difficulty of customizing resources once they are located (32.5%), concerns about the cultural or developmental appropriateness of resources for students (27.8%), being unsure of a resource's validity (22.5%), and lack of alignment between resources and state standards (18.5%). (See Table 11 under Time, Theme 2.)

First, how do teachers locate the Web resources they use? According to respondents, the top two ways they discover new Web resources is through their own Web surfing. Of the STEM teachers surveyed, 80% or more said that they discover new Web resources through search engines and Web links (see Table 18). Colleagues were third, and professional development sessions were fourth. It should be noted that even though PD sessions were only the fourth most common source reported, approximately the same percentage of teachers listed PD sessions as their source for new educational resources in general. (See Table 14 under School/district infrastructure, Theme 3).

Table 18: How Surveyed Teachers Find Out About New Web Resources

Source	**% of Surveyed Teachers (n = 155)**
Search Engine	85.8%
Web Site Links	80.0%
Colleagues	67.1%
Professional Development Sessions or Conferences	65.8%
Professional Journals/Readings	54.2%
Newsletters	35.5%
Direct Mail	24.5%
Listserv	21.9%
On-line Ads	18.1%
Print Ads	16.1%

Search engines and Web links were the favored sources of new resources for teachers across all categories, and there was relatively little difference in other sources chosen among groups of teachers. For example, there were no gender differences among survey participants with respect to reliance on any of these sources. One difference that did stand out, however, was the variation in popularity of listservs as a source of new Web resources. Teachers who described their instruction as incorporating Web resources more than 50% of the time were twice as likely to say that they learned of new resources from listservs as were teachers whose instruction utilized digital resources less frequently. This could be simply a reflection of tech-savvy teachers' increased time on the Web. It also could indicate that, through the subscription to listservs of interest, teachers learn of resources that are more likely to be appropriate for their discipline-specific and pedagogical needs. It should be noted that the teachers selecting listservs as a primary source of new Web resources were not necessarily the same teachers who heard about the Effective Access project through listserv membership.

If teachers at all levels of technology integration turn to search engines to find resources, what inspires them to begin a search? The STEM teachers responding to the Effective Access survey were very clear that considerations of discipline topic were most important, followed by pedagogical considerations at the class-wide level. Less than one- third of the teachers stated that curriculum standards fueled their searches. Even fewer cited the specific needs of individual students (see Table 19).

Table 19: What Inspires STEM Teachers to Begin a New Web Search?

Inspiration	**% of Surveyed Teachers (n = 88)**
Specific Content or Topic Area	85.2%
Needs of Entire Class	61.4%
Particular curriculum standard	27.3%
Needs of a Small Group of Students	15.9%
Specific Needs of One Student	5.7%

When examining teachers' responses by category, several similarities and differences emerged. Female teachers were more likely than male teachers to say topic was the reason for a search (92.3% vs. 75.8% respectively). In comparison, male teachers were more likely than their female counterparts to cite standards (36.4% vs. 21.2%) or the needs of a single student (12.1% vs. 1.9%). There were no large gender differences in the frequency with which teachers chose the needs of a group of students or of the class as impetus for searches.

Location also seemed to make a difference. Rural teachers cited standards and the needs of one student more frequently than urban or suburban teachers. Teachers' choice of topic as a driving reason for new searches did not vary by location, so perhaps rural teachers' choice of standards and individual student needs is a result of the differences in student load. (Several rural teachers who participated in this survey taught students across multiple grade levels.) Also, suburban teachers chose the needs of the entire class (74.2%) much more frequently than their rural and urban counterparts (56.7% and 52% respectively). In fact, the teachers most likely to describe their Web searches as inspired by the needs of an entire class were suburban teachers with six to 10 years of teaching experience whose majority of students were Caucasian and not eligible to receive free/reduced price lunch.

As a category, teaching experience surfaced some differences as well. New teachers with five or fewer years of experience were the least likely to say their Web searches are inspired by topic (60%) or by the needs of the entire class (44%). These teachers were more likely to choose needs of a group of students as a search impetus: 24% of new teachers made this selection, vs. 6.3% of teachers with 6–10 years of experience, 14.3% of teachers with 11–15 years of experience, and 17.9% of teachers with over 16 years experience. The one category of teachers that selected the needs of groups of students more frequently than new teachers were teachers of African American students; 33% selected "needs of a group of students."

While the needs of one student or even a small group of students did not tend to launch most teachers' Web searches, survey responses and interviews revealed that these considerations play large roles in teachers' *selection* of resources. After all, almost 30% of the surveyed teachers said appropriateness of Web resources for their students was a top challenge. Teachers' attention to the abilities and needs of learners was communicated through their descriptions of customizing Web resources once they've located useful materials.

Teachers were evenly split when it came to customization of digital resources—48.7% of the teachers said they use Web resources as they appear, while 51.9% of teachers customize Web resources. There was no gender difference with respect to customization. However, teachers of Hispanic students (80%), urban teachers (63.3%), teachers of classes in which the majority of students are eligible for free or reduced price lunch (62.2%), and teachers of classes in which more than 25% of students have IEPs (61.3%) were the most likely to customize Web resources before using them in the classroom.

The main difference between the digital resources that the surveyed STEM teachers use now and the resources they wish to use seems to be levels of interactivity. Handouts, presentation tools, and articles topped their lists of Web-based instructional tools they frequently use now (see Table 20). However, lesson plans/activity ideas, simulations, and tutorials were their top three instructional tools that they wished they could find on the Web (see Table 21).

Table 20: Percent of Teachers Reporting Current Use of Web-Based Tools "Frequently" or "Always" During Their Instruction

Instructional Tool	High Use	n
Handouts	37.3%	153
Presentation Tools	35.7%	154
Articles	32.9%	152
Audio/Visual Files	32.2%	152
Resources for Graphing Calculators	30.5%	154
Simulations	29.4%	153
Applets	21.9%	105
Downloadable Software	17.5%	154
Raw Data	16.4%	152
Resources for Lab Equipment	15.8%	152
Collaboration Tools	11.0%	154
Resources for PDAs	7.9%	152

Lesson plans and activity ideas were by far teachers' number one choice for digital resources that they wished they could find. Lesson plans' popularity was high across all categories—gender, location, student demographics, teaching experience, and current level of instructional technology use. This point was emphasized in the teacher interviews, as well; the interviewed teachers explained that they wanted to see lesson plans that had been tried in real classrooms.

Table 21: Instructional Tools that Teachers Would Most Like to Find on Web Sites Devoted to Instructional Resources

Desired Instructional Tools	Percent of Survey Takers Who Cited this Tool as one of their "Top 3"
Lesson Plans and Activity Ideas	71.7%
Simulations	47.4%
Tutorials	46.7%
Pictures and Graphics	42.8%
Downloadable Software	38.2%
Articles Containing News or Current Information in My Field	31.6%
Audio or Video Files	29.6%
Applets and On-Line Manipulatives	27.6%
Access to Experts/Professionals	26.3%
Raw Data	25.0%
Collaboration Tools	16.4%

Analysis of the teacher interviews underscores the survey data, indicating that topic is the prime driver for teacher searches. Teachers reported that they are looking for content and topics that fit with the current instruction, lesson plans, or other school-related mandates.

Many of the teachers currently use digital resources, ranging from Web sites to CD-ROMs for their curriculum planning (17), often in conjunction with a textbook or with professional journals. Teachers say they like the ease of use and the myriad of resources and materials available on the

Web. They draw from these two sources and create curriculum materials that directly meet their students' needs. For example, as one teacher described it, "We like to use a framework first and then supplement with tried and true activities from the Web that others have developed." Several also see digital resources as a way to expand their own creativity. For example, one first year teacher explained, "For me, the textbook gives great basic information. I then take that and search on the Web for ideas how to expand the textbook and create or borrow ideas, activities, and lesson plans from the Internet." Several teachers draw heavily on the Web to develop their own curriculum, for example, a rural technology teacher who said, "I have to create most of my own curriculum, I use reference books to make sure that I have the material correct and then I turn to Web sites for graphics, lesson ideas, and even self-testing opportunities." Another used the Web to find resources that were not easily available to him, "due to my isolated teaching location, I read about curriculum or look to Web sites for the most current information."

The other nine relied on colleagues, specialists, professional journals, or print resources as the primary resource for their planning, saying they liked having someone who had experience with the same kinds of students, who knew what worked, and what the best practice was.

The teachers interviewed in this study looked for resources aligned to the needs of their students, and to the standards. Several interviewees defined criteria that included finding sites with the appropriate vocabulary or reading level, that were user-friendly, and had hands-on activities. While initially most teachers talked about the needs of the class as a whole, it was clear that they were not seeing this as a homogeneous group, but rather a whole with differentiated needs. This is captured in the comments of one rural teacher who said, "My students are alike in that they are all Caucasian, but they vary greatly in terms of age and ability level. I need to find a wide variety of information so I can tailor it." Several teachers mentioned wanting to find tiered sites and resources, "…so that there are many ways of exploring background information. The information has to fit the curriculum standards and have hands-on manipulatives; places for students to enter answers and get immediate feedback. In my planning I look for sites that are self-explanatory enough so I can start the kids off and they can use it without me having to run from screen to screen answering questions."

While teachers look for specific topics, such as momentum, fuel cells, or velocity vectors, they also look for ways to make the topic engaging, including how it is presented on the site itself. They consider how the material is written and displayed, as well as how it will work with the school's technology and resources. Interviewees reported that their Web site evaluation criteria include considerations such as, "…flashier stuff is often less useful," and "…will it work in our browsers" or "…can I get lab time to do this." Several saw the technology as making their job of planning and teaching easier as one teacher in the northeast explained, "I can find interactive animations and simulations that are often prettier than I can draw on the board. Also, motion is important for complex phenomena like molecular genetics. I can't find examples of that anywhere other than the Web."

In using technology for curriculum planning, this group of teachers also wanted relevance, quality, and appropriate content, with several indicating they went to university sites for quality and validity but had to adapt the resources to their classes. Some indicated they looked for quality and validity by the organization or sponsor name, especially citing those with .edu and .gov in the URL. One science teacher captured the validity issues as she said, "The reputation of the site is important. I want to see that it's from a college or university or some kind of national association like NSTA. I avoid anything obviously tailored for kids, it's too easy for high schoolers and I don't copy from publications...You know it when you see it."

Teachers identified clusters of challenges in finding the right Web content. One set focused on the struggle to find resources that fit the needs of their students, stating that "... [the Web resources] are not culturally appropriate or user-friendly or they are difficult to adapt to student needs." The challenge of ensuring the validity of content was mentioned seven times and "...they don't align with the standards" was mentioned six times.

One teacher expressed additional challenges related to technical aspects of the technology. "PDFs are hard because some of the kids have systems that can read them and some don't. So I skip all PDFs as well as anything too big...other criteria include the fact that I need high school level content determined by the math level....there's a lot out there for middle school but not high school."

Another teacher expressed some frustrations with the available resources at the school. "Once you do find something, you need to [gain]access [to it] for your students—either lab time, which requires advanced planning and signing up, or checking out the projector. We compete for the projector on a daily basis. I've submitted a grant proposal to buy one for my own classroom, but even if that comes through, the other teachers will still have only the school projector."

A number of teachers pointed to the pros and cons of student familiarity with and interest in technology: "they like it," "they're used to it," "it has to be fun" and "kids like games." "Kids like bells and whistles, stuff that keeps them entertained is important," said one teacher. But, another added, "Kids like sites with games, but the games aren't conceptual...they don't teach skills...Feedback needs to help them think their way to the right answer, not just let them click."

Generally, despite challenges, the teachers expanded their instruction using digital resources. One teacher scenario was described this way: "Teaching about elements, mixtures, and compounds is very dry because the kids have heard about it in earlier science classes. But they don't really understand it. I found a Maple Syrup site that shows how syrup is made from tapping the trees to bottling. I showed the video, and at every stage asked the kids to identify whether the substance was a compound or mixture and justify their choices. Everyday life examples shows chemistry can be practical, textbooks don't do that enough."

Another teacher shared this story: "At my last school, I was able to run simulations, pause them, write vectors over them on the board, etc. The kids could predict what would happen next. Very interactive. Physlets out of a NC college—great Java applets. And they were small so I could even run them on my old Mac with dial-up. They are short, on a narrow topic, and are a lead-in from previous topics with direction towards possible next topics."

One teacher at an urban, southern school with highly sophisticated resources in its classrooms said, "We have computers that hook up to the TV. Sites I go to can be seen on TV. Kids often use LearnStar. It can be displayed on TV and they play against one another. Also I can write on the TV screen with my vis-a-vis marker, press pause, etc. It's a lot better than overhead. This technology has allowed me to use Web resources in the classroom....I want the kids to have the same sites. I want them to have the option of entering their information or answers into the site itself so they can go home, access the site, enter answers, print it out and bring their work back to school." Even with limitations of computer equipment, memory, and access to labs, one teacher provided this example from a physics class: "I could get the data from the Web and the data came with a short QuickTime movie of it being collected, then I've got a lab. The benefit is having stuff in class that I can't have or couldn't put together myself." But there are resources that could be on the Web that teachers cannot find, as he continued, "I'm interested in my students using microscopes, capturing images, making measurements. I've looked on-line but my only luck has been going to the university and knocking on doors."

Finally, teachers identified a wide range of design and content features that would help them make better use of technology resources within their STEM instruction. These features include sites that provide good visual (live) representations of math concepts such as geometry, series, and fractals, and of different science phenomena. Teachers are frustrated that they cannot find age- or ability-level resources and say that the amount of text and reading level is really important as is the format. Content is not distinct from the technology that delivers it for these teachers, as one said, "unless it's user-friendly with the right referencing materials, with a good search engine and cross-referenced and easy to use during instruction, it doesn't help. Some images are just too big; some resources are designed with an understanding of high school teaching…"

What teachers say they want for their instruction is, in many ways, the very definition of a digital library such as the NSDL. This was summarized by one science teacher in this way: "There is SO much out there. If we could identify 'teacher approved' sites for students to go to. Is there some type of national foundation that can do that? My kids are accessing information they have no clue about and can't do anything with. If teacher approved sites came up first in the list, it would help them narrow their searches and find more useful information." The irony is that no teacher interviewed knew what a digital library was and none knew of or mentioned the NSDL.

Theme 7: Professional Development is Critical to the Successful Integration of Digital Resources, Yet the Teachers Expressed Frustration About the Lack of Quality On-time Training

For those surveyed, educators who used Web resources more often in their instruction reported having greater amounts of technology and Web-related professional development (PD) than their colleagues who used Web resources less frequently. For example, 83.3% of teachers who incorporate Web resources during more than 50% of their instructional time said that they had participated in PD on using the Web to find resources. Only 64.4% of teachers who incorporate Web resources less than 25% of the time reported the same (see Table 22). Educators who used Web resources frequently also were more likely to have attended PD on related equity issues. Interestingly, the one PD topic with which both groups had approximately the same amount of experience was using technology in STEM instruction. One possible explanation is that teachers who integrate technology frequently into their instruction are drawn to technology-related PD offerings. Another possible explanation is that PD on using the Web and other computer and Internet issues gives teachers the baseline technology skills they need for classroom technology integration, leaving them more likely to do so.

Table 22: PD Experience of Survey Respondents by Frequency of Web Resource Use

PD Topic	**Percent of Respondents Who Had This PD**	**Percent of Respondents Who Had This PD**
	Of Teachers Who Incorporate Web Resources *Less Than 25%* of Class Time (n=90)	**Of Teachers Who Incorporate Web Resources *More Than 50%* of Class Time (n=18)**
Using the Web to Find Educational Resources	64.4%	83.3%
Computer &/or Internet Troubleshooting	57.8%	83.3%
Using Technology in STEM Instruction	46.7%	50.0%
Equity Issues in Technology	16.7%	38.9%
Equity in STEM Instruction	14.4%	38.9%

A majority of survey respondents, regardless of their frequency of Web resource use, indicated that they had participated in some amount of PD on both using the Web and Computer/Internet Troubleshooting (see Table 23). Again, fewer respondents reported having PD around integrating technology into their teaching or around equity issues. However, of the people who participated in PD on these topics, over 80% found the experiences useful. This presents an interesting backdrop to the responses of the teachers who were interviewed. When asked about their technology and Web-related PD, most responded with descriptions of negative experiences and suggestions for improving PD offerings.

Table 23: PD Experiences of Survey Respondents

PD Topic	Percent of Respondents Who Had This PD (n = 151)	Of Those Who Had the PD, Percent Who Found it Useful
Using the Web to Find Educational Resources	62.3%	91.5%
Computer &/or Internet Troubleshooting	61.6%	86.2%
Using Technology in STEM Instruction	45.0%	89.7%
Equity Issues in Technology	19.9%	83.3%
Equity in STEM Instruction	17.2%	88.5%

When asked what PD topics they would like to see offered, survey respondents' most frequent choice was using technology in STEM instruction, as shown below in Table 24.

Table 24: PD Topics that Survey Respondents Would Like to Have

PD Topic	Percent of Respondents who want PD on this topic (who had not had similar PD previously)	n
Using Technology in STEM Instruction	74.3%	74
Computer &/or Internet Troubleshooting	66.0%	50
Using the Web to Find Educational Resources	64.7%	51
Equity in STEM Instruction	52.0%	102
Equity Issues in Technology	48.5%	99

The teachers interviewed described PD in a number of different ways: as training workshops, presentations at conferences, on-line courses, and learning on their own. As a group, they revealed some strong (and often negative) statements about the inadequacies of PD, along with some ardent pleas for relevant, hands-on experiences, and access to new resources and best practices.

The teachers interviewed indicated that they had completed PD in a variety of areas including math, science, and engineering content as well as workshops on Web design and computer science. When asked about the kinds of PD that they wanted, their comments reflected a desire for PD opportunities that had immediate application to their classrooms, a view captured by one teacher who said, "I'm part of the GLOBE training and have been since 1996. We're all master teachers and we trained 200 schools in a number of states. Teachers want stuff they can use in their class immediately." Good PD enables teachers to grow as professionals and as leaders within their school community. For example, one teacher felt that the PD she received helped her to organize her lessons and relate them to the state standards in a way that supported her teaching: "Continuing Ed helps me feel confident, especially around the standards. I'm a professional technology teacher and I've learned where to identify my curriculum standards and objectives and state curriculum goals. That framework gives me what I need." Another talked about how PD helped her both as a teacher and as a colleague, saying, "I went to a lot of in-service from our state department of education and I've learned a lot that I shared with others. One of the ones I liked was using the on-line site to help build a lesson and then create it in less than 15 minutes."

At the same time, interviewees had strong reactions to the training workshops and PD available to them. Many of the teachers were clear that the PD they had received was not designed with knowledge of who was in the audience. As one teacher said, "Most [PD workshops] have been frustratingly basic. I used to be my school's tech coordinator, but I'd go to PD sessions and there was never anything advanced, never tailored to different levels of technical expertise. It wasn't useful for either extreme. Teachers who were techno-phobic couldn't keep up, and the instructor would get mad at experienced users who tried to jump ahead." Other teachers said the workshops were not addressing their students. As another high school teacher said, "You know, none have been really helpful. A lot was aimed at a junior high level. WebQuest is really neat, but the ones I've seen are all at too low of a level."

Training was often out of sync with school resources and technological capacity, or it was not provided at the right time. One teacher, frustrated at this lack of planning said, "They (PD workshops) haven't been helpful when they aren't taught hands-on or fast enough. For example, we all have Smart Boards. But they scheduled the PD for us before the Smart Boards arrived. Now, [the Smart Boards] mostly sit off to the side collecting dust because we don't have time to teach ourselves, and the training last summer was not hands-on." Another added, "It really hasn't impacted my day to day teaching. I could get training but then not be able to use it for six months. If you can't use it right now then it's not much use teaching you. They want you to do everything. I don't have time to sit down and learn to use it."

As a group, the teachers focused on key factors they felt were important to good PD experiences, but were often missing. Words they used to describe good PD included: peer teaching, hands-on, tiered, easy to implement, and best practices. One of the most important factors for these teachers was that the PD had validity—that it was teacher-tested—but they reported that often this teacher perspective was missing. For example, one teacher described ideal PD this way: "I especially liked teachers teaching teachers: what works in the classroom, what doesn't work…them saying don't go there…This is more like folks in the trenches helping others."

Similarly, another teacher linked peer training to best practice, saying, "[The best PD for me] has best practices where real teachers teach a lesson and treat us like students so we can see how it goes in the classroom. Also, they showcase real student work. The best PD is when you can do this AND each have a computer in front of you." This teacher also reflected what several others talked about: PD needed to be hands-on. Requests for hands-on training ranged from the mechanisms of different software to basic searches. One teacher, describing such training, said, "Starting with search engines other than Google. And then adapting and integrating. (For example, does your school have an LCD projector? Then you can do this. If not, here's another option. Here are the ways to make Physics interactive. If you have this tool, and this, then you can freeze frame and show them X.) Also, I want to know what's out there. Even if I have no chance of getting it. [I'd like to know] how to integrate this stuff with respect to standards and curriculum. I would like sites to show this connection through quick-find indexes."

The desire to stay current was a recurring item in the interviews. It was obviously an important consideration for these teachers: they want to be kept current, they want new resources, and they want to find them easily. One teacher's wish list for PD support included, "I wish I could get e-mails about new sites to narrow my searches." Another said, "I want to know what's new out there in terms of interactive simulations, multimedia physics studios, JAVA applets, little animations. New resources…I hear about things via word of mouth, like this on-line telescope where classes can submit a date and time, and the telescope will take a picture of the sky at that point and send the image. It would've been nice to know about when I was having to pull together astronomy lessons." The connection between hands-on activities and the classroom was made by another teacher who said, "The PD when from Vernier (a firm that makes physics lab equipment) was very useful. We got to use the equipment." Another talked about the positive impact of training using a resource that the district had developed, "The in-service focused on our [district] Web sites, how to get into links, use the links, how to easily access sketchpad."

The teachers interviewed often did not get PD geared to their learning styles. This is defined as "the tiering issue, make instruction valuable to people at different levels of expertise," or "never tailored to different levels of technical expertise." Others said they did not like workshops but preferred self-directed or on-line PD. One teacher, reflecting the views of several others said, "I don't like workshops. I like my time at home and knowing that I can go back to [it]. Then I want something to help me do projects and stay up to date." Another brought a number of these issues together when he said, "I teach at a small rural school. Any PD is self-taught or I get it from a once-a-year conference. I quit going to workshops…too touchy-feely. I teach AP Computer Science and I need to get through CONTENT. Workshops for teachers are too elementary."

Another frustration teachers raised was the lack of time or support to integrate what they've learned into their teaching. "It hasn't been useful, especially not for giving me experience. I need to practice, sit down and play with stuff. Schools spend 99 cents of the dollar on technology, but only one cent on training. We spend money on stuff but not for training or for time spent."

Technology Interviews - Observations

In order to align educators' and technology developers' experiences, expectations, and practices with regard to digital resources, researchers conducted a small number of interviews with technologists. Observations from the interview transcripts yield two key findings.

Involvement of technologists with potential users appears to fall along a continuum. Some technologists remain relatively separate from their users and develop technologies based on their perception of what an "intuitive" interface is, or what they think their users might consider intuitive. One example of this is the following statement from an interviewee: "I stay shielded from audience needs." This same developer goes on to say, "…no training is necessary for the teachers (to use this resource), we tried to design the site so that it's not necessary" but admits that he has no way of really knowing whether teachers feel the site design is intuitive. In other cases, usability testing is performed, but it comes late in the technology development cycle—once a prototype has already been developed. A different developer described how this happened for her product: "Our on-line interactives have been around for about 10 years. They've evolved. Originally, we had just a few interactives up. Since then, we've expanded. We have lots of downloadable, printable things to supplement for the teachers. We do usability testing now." In the "best case" scenarios, technologists are involved in an iterative process through several cycles of user involvement, testing, and feedback. As one developer described, "Ideas are recommended to us by teachers and faculty, and we bring them back and have the [high school and college] interns develop it. Then, teachers look at existing materials and say, 'This is great, but if it did this…'"

Several factors appear to determine where the technology development process is placed along this continuum. One factor is technologists' prior direct experience with end-users and the contexts in which users operate and use their products. The more direct experience technologists have, the more likely they are to seek a higher level of user involvement in their design work (e.g., if a technologist has spent time in a classroom or has teaching experience). Another factor is the level of resources available to support user involvement (e.g., time, funding, staff availability); it follows that the fewer the resources, the less the involvement of users. For one developer's project, usability testing with teachers occurred once the project hired an evaluation director. Now, that project also employs professional educators on staff in addition to the technologists. The structure of the design team can also influence the level of user involvement in technology development. Interviews showed that hierarchical design teams, where a separate group mediates technologists' access to users, can be a source of frustration to developers who often want to know how successful/unsuccessful users are using their products. Finally, technologists are concerned with addressing access issues as they relate to technology infrastructure (e.g., testing across computer platforms, versions of operating systems and browsers). However, other issues relevant to the contexts and settings in which resources are used can be overlooked—for example, low vs. high bandwidth constraints which are common in schools.

To sum up, user involvement in defining the "ground-up" functional specifications of a technology appears to be rare. While some projects have developed sophisticated, sustainable ways of involving educators and/or students in their design process, most technologists seem to pay limited attention to the rich diversity among users. This lack of attention is often due to budget and workplace constraints, but technologists miss opportunities to respond to growing populations of diverse users and, instead, tend to treat users as a homogeneous group (e.g., all high school teachers). Currently, there is a need for opportunities that will bring varied market segments together with technologists in order to share “best practices” and create products that can support teachers and students in their learning tasks. Additional research on ways to encourage this collaboration is needed.

RECOMMENDATIONS

The Effective Access team conducted a limited, multi-level investigation of high school STEM educators and their use of digital objects. The team sought to identify teachers' unique needs in the digital library environment, to provide a better understanding of the possible impact of electronic resources on teaching and learning, and to develop a framework for future development of digital resources and technology supports.

It is not possible to generalize the team's findings to all STEM teachers because of the nature of the research design and sample size. However, the team's surveys and interviews produced important insights for all those who care about the intersection of technology, teaching, and learning, including the leaders of the NSDL. The results of the study also align with much of the current literature and with the team's own experience in developing digital resources for teachers. Based on this, the team has framed a set of suggestions for both future research and the development of technology-based resources. These preliminary ideas can help stimulate discussion among policymakers and practitioners, help further the development of effective resources for STEM educators in high school, and encourage others to continue and deepen this initial research.

This section outlines a few broad ideas that apply to all audiences who have responsibility for STEM education and then presents a series of suggestions that are organized into four categories: Design and Development; Professional Development; School and District Infrastructure; and Research.

The potential of digital resources, including digital libraries such as the NSDL, to engage students, introduce them to STEM inquiry, and infuse instruction with tailored, equitable pedagogy and practice is not yet fully realized. Teachers' most frequent use of digital resources is still for planning. When they use resources in the classroom with students, they most often use text-based materials. Some of the educators who participated in the Effective Access study are using the Web in new and creative instructional ways, and all were aware of the possibilities. They wanted more interactive tools, more student-centered resources. They simply didn't always know where to find these resources or if such tools are available. As a nation, we need to invest in new ways to share information about these resources; craft PD experiences and hands-on opportunities that help *all* teacher *use* them to improve instruction; and improve, enhance, and simplify the interoperability, architecture, and search features of digital sites.

STEM teachers from all backgrounds and experience levels are excited by the potential technology offers to improve student learning and achievement. Whether they are early adapters or reluctant users, teachers are finding ways to integrate technology-based resources into their classrooms. Effective use and integration of technology suggests the need for a partnership between the developers of both technology and content and STEM teachers—ideally in the beginning stages of the development process—to understand what teachers need, when they need it, and how they will use it for planning and instruction.

The demand for development of 21st century skills by employers and educators, the changing demographics, and the diversity of students require a reexamination of pedagogy and the role of technology in schools, home, and community. Technology tools need to support critical thinking, inquiry-based learning, and teamwork for both students and teachers with very different learning styles and available resources.

Design and Development

The design and development of technology-based or technology-enhanced education involves two different areas, which may not always be integrated: technology design and development and content design and development.

1. The architecture and design of sites can make or break a teacher's desire to search for or use Web resources. *Developers should design Web sites so that the contents can be easily located and accessed, helping teachers to avoid digging around in layers of a site to find what they want*.

2. Cross-platform problems are daily issues for teachers. For a resource to be usable, it must work on multiple computer systems and multiple browsers. There is no one computer or system used by all schools. Teachers and students might have PCs at home but Macs at school or vice-versa. Also, if teachers are using a central school computer lab, they may have little or no control over the type of browser installed. *Developers should test site design, downloads, and the organization of materials on a variety of machines and with a wide range of browsers and include slow-speed/dial up options in testing*.

3. Use of collaborative Web tools for teacher planning and instruction fell low on the list of tools teachers use or wish to find. With teamwork and collaboration an increasing demand in workplaces, and young students who often learn best through group interaction, *trainers and technical assistance (TA) providers should offer professional development that helps teachers use collaborative tools, and technologists should make such tools easier to use.*

4. Teachers and their students need help learning to make the best use of the resources on the Web or on a specific site. *Developers should design tutorials or navigation aids to be brief, or if not possible, to be divisible into sections that can be completed independently in shorter amounts of time*.

5. Teachers are using, and want more, interactive, individualized lessons for their students. They value up-to-date, real-world data, examples, and information, including information about STEM careers. Teachers value resources that have best-practices, teacher-vetted materials and that have opportunities to collaborate or seek assistance from content experts and teacher colleagues. *Content developers should provide teacher-tested, immediately applicable lesson plans or activities that are linked to the state standards. Information and resources (including tutorials and trouble shooting) need to be carefully matched to keywords, address different situations and levels, and have appropriate assessments. Developers should consider creating assessments and other learning tools that have multiple ways of providing direct feedback to students and that encourage critical thinking.*

6. Teachers look for resources that meet the needs of the students in their classes. Digital resources, like textbooks and other print resources, are most effective when they are culturally relevant and accessible to diverse students, such as those with different learning styles, academic levels, reading levels, disabilities, and to those whose first language is not English. *Developers should offer multiple presentation options, ranging from PDFs to Java to html documents. Sites may need to be more visual, simple, and exciting (but not over-stimulating), and be geared to a wide range of reading levels, as well as age levels. Early testing with students can help better determine colors, organization, and other structural issues. And, while teachers in this study did not explicitly indicate language as a concern, we would suggest that resources offered in a range of languages other than English supports the teaching and learning for students whose first language is not English.*

7. Teachers, like students, have different skill and ability levels in using digital resources. Even if newer teachers are familiar with technological aspects of a resource, they may need guidance in how to integrate the resources into STEM teaching. *Content developers should*

build lesson guides, integration suggestions, and examples of how to use resources into sites. Sites can also include easy-to-understand tutorials or navigation guides that enable teachers to learn to use the site and its resources. Tutorials should be interactive, organized into modules, and have an easy to access "help" function, either on the site or via phone.

8. Technology and resources cost money to develop. But teachers do not have individual funding resources to pay for most of these. Often, organizations also reserve key materials for "members" who pay a fee for service, sometimes as a way to provide additional membership incentives. When these costs of development are passed on to the teachers, and their schools do not cover them, technology-based services stand the chance of becoming exclusionary and limiting access to educators in less prosperous communities. Technology developers and educators should partner with industry leaders and funders to *explore alternative ways of funding, underwriting, or otherwise supporting the market value of the technology resources so that important digital resources are freely or inexpensively available to all teachers.*

Professional Development and Teacher Preparation

Teachers voiced a number of serious issues with PD regarding search, use, and integration of Web resources into planning and instruction. As with lessons for students, effective PD experiences for teachers should be inquiry-based, interactive, related to academic needs, and demonstrate why it is worth investing the time to do it.

1. Adults learn best when they can quickly apply what they are learning to their immediate concerns or environment. Often, however, professional development focuses on a general topic or need, rather than the reality of a specific group of teachers. *Trainers should match professional development to the technology set-up that most of the teachers in the school or district have. That is, meet the teachers where they are, provide success experiences, and motivate them to expand their technology learning and use. For example, if teachers have a single computer in the classroom, then PD money and time should focus on how to integrate the one computer into class activities, perhaps investing in projectors and training teachers in ways to use them interactively with the students. In comparison, if most teachers in a school or district take their students to a central computer lab, then PD should focus on ways to make use of the 1-1 student-computer ratio.*

2. Teachers are willing to commit time to learning to use technology effectively, if they know what the time commitment is and how it will benefit them. Professional development also needs to be coordinated with the timelines and resources of the schools or districts. *Trainers and TA providers should offer hands-on training using the resources teachers have available, so that teachers can immediately transfer new practices to their classrooms. Initial training can be extended and enriched through use of on-line mentors or opportunities to discuss the training with peers in other sites.*

3. Teachers consider their students' needs, but may have difficulty finding resources to engage diverse students. Teachers in this study said they wanted more training on equity in the classroom and integrating technology into STEM—both designed to support student diversity. *Trainers and TA providers should build in specific strategies to respond to student diversity, including techniques for effective Web searching and "news updates" that inform teachers of resources that support a student-centered focus.*

School and District Infrastructure

Teachers often reported that the successful integration of technology and technology-based resources into STEM instruction relates directly to the support provided by the school or district administration.

1. Technology-based resources are effective when they can be used in the classroom in the way they were designed to be used; this includes having enough computers for effective instruction, whether in the individual classroom or in labs, as well as appropriate additional hardware and software. This also requires that the technology be readily available and offer different ways to engage with the resources in order to address the different instructional needs of a classroom. *School administrators and development offices should explore additional funding sources to provide enough technology resources for the students in the school. While the ultimate goal may be a laptop for every student and teacher, consider how intermediate steps can support technology integration. As part of curriculum and instruction, school technology leaders, curriculum specialists, and teachers should consider reviewing software and technology from an equity matrix that might include: tiered designs, gender-fair approaches, cultural relevance, or reading levels.*

2. Cost is one of the major challenges to the integration of technology into classrooms. First, the technology itself is expensive and small schools or schools with budget challenges may defer technology spending. Teachers, in an effort to expand their teaching tools, often purchase supplemental resources for their classrooms. The costs of technology tools, access, and on-line subscriptions or licenses may be prohibitive for individual teachers. *Administrators, school technology leaders, and business partners should examine the costs and benefits of alternative technologies and explore how industry partners can provide resources for the classroom. Consider collaborative agreements with other schools or districts to provide subscriptions or other resources at a lower cost.*

3. Technology support is a hidden investment that can make or break technology integration. When curriculum planning is coordinated with technology planning, it is easier to determine the appropriate level of tech support and money needed to keep the equipment operating, to keep the resources up-to-date, and to free teachers from the challenge of having to maintain technology themselves. *If teachers must maintain the technology, school technology leaders and administrators should consider training and incentives that will build a peer network so teachers can help one another. Consider what other technological barriers might prevent the full integration of technology into the STEM curriculum; such as school firewalls that prevent access to key sites.*

4. Teaching with technology may look very different from conventional models of instruction; Web exploration can be an extremely noisy affair, with lots of group interaction, or it can happen very quietly, with students working individually. *Administrators can demonstrate their understanding and support for technology-based STEM teaching and learning by talking with teachers, observing how technology makes a difference, and providing this understanding to other teachers, administrators, and funders.*

Research

The Effective Access team's research findings support the belief that technology and its impact are context-based and that it does in many ways reflect the beliefs, values, and biases of those who develop it. Further, the findings point to a need for an organized, collaborative, and broad research agenda, conducted in partnerships with students and teachers, school and district administrators, and technology developers. This coordinated research agenda, across disciplines, could build on the team's initial work and suggest emerging trends and future directions. A full-range of research, including intensive case studies, causal modeling, quasi-experiments, and "design experiments" can provide a deeper understanding of the design, use, and impact of technology in education.

1. *Researchers should conduct further studies, using random samples of teachers and technologists*, that take the ideas and insights from the Effective Access study to understand better the patterns of utilization among different groups of teachers; the adaptations that are being carried out in the classroom; and the technology designs that best "fit" the needs of STEM teachers.

2. *Researchers should conduct long-term research and evaluation* that examines how teachers' access to and use of technology-based education tools changes their sense of themselves as educators, the ways in which it changes classroom pedagogy and practice, and the impact of these changes on student outcomes.

3. *Researchers should conduct linked, contextualized studies* to determine what role the factors raised in this study play in specific environments and if there is an impact on teacher development and student outcomes.

4. *Researchers should conduct exploratory research that includes targeted groups*, such as members of a design team, to ensure that technology and digital resources can engage and support diverse learners.

5. *Researchers should investigate the role and impact of different forms of teacher professional development* on the integration of technology into STEM teaching and the relationship to student outcomes across diversity.

Looking to the Future

If computer-based, culturally responsive learning environments for STEM education, such as those envisioned for the NSDL, can be shared with schools throughout the United States, our country will have taken a big step toward developing new scaffolds for learning and student achievement in STEM. If the NSDL, with its potential to support teachers in their planning and instruction, can intensify its leadership role and examine its design, structure, organization, and tools to better meet the needs of K–12 as well as higher education, it will become the resource that teachers in this study dreamed of when they described what they need and want. Further research is needed on tools that programmers, developers, educators, and administrators use to create pedagogically sound, culturally responsive, technology-based experiences for STEM education. If the NSDL is to become the favorite icon on every educational computer, educators need to know about it, learn to use it effectively, and value its resources. To this end, the Effective Access team's research supports the development of hands-on workshops about the NSDL around the country, led by a team of teachers and technologists and NSDL developers, to mobilize support for and use of the digital library system.

The successful implementation of these recommendations requires the development of strong partnerships between education technology developers and end-users—whether they are high school teachers, parents, or students. Therefore, the Effective Access team recommends that NSF convene an annual summit that brings together technologists, researchers, teachers, and educational intermediaries to explore the "next generation" of technology for learning. The Summit agenda would report on the research, inspire the participants to work together, conduct hands-on activities that demonstrate effective utilization of digital resources and produce an inventory of ideas that can be shared face-to-face in many public venues and on-line with practitioners and policymakers.

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Appendix A: Instruments

Contents:

- Survey Questions
- Focus Group Protocol
- Educator Interview Questions
- Technical Developer Interview Questions

Effective Access Survey Questions and Response Choices

1. Within the last three years have you taught science technology engineering or mathematics (STEM) to young people between the ages of 14 and 18 years old?
Either in a formal classroom setting or an informal after-school summer or workshop setting)

2. When you need educational resources for CURRICULUM PLANNING (e.g. background information lesson plans or project ideas) which resources do you rely on most?

- Textbooks
- Other Print Curriculum Resources
- Encyclopedias (print)
- Books
- Newspapers
- Professional Journals/ Readings
- Magazines
- Colleagues
- Administrators
- Specialists
- CD-ROMS
- Web Sites
- Applets/ Interactive Electronic Tools

3. Which source do you use the most for curriculum planning?

4. Which source is your second most relied upon for curriculum planning?

5. What do you like about the two sources that you use the most for curriculum planning?

6. When you need educational resources to use DURING INSTRUCTION (e.g. handouts group activities assignments workshop materials) which resources do you rely on the most?

7. Which source do you use the most during instruction?

8. Which source is your second most relied upon for use during instruction?

9. What do you like about the two sources that you use the most during instruction?

10. How do you typically find out about new educational resources? (Check all that apply.)

- Colleagues
- Print Advertisements
- On-line Advertisements
- Direct Mailings (flyers
- Newsletters
- On-line Sources
- Professional Development Sessions/ Conferences
- Professional Journals/ Readings

11. How often do you collaborate with colleagues to share educational resources? (Choose one.)

- Never
- Once a month or less
- A few times per month
- Once a week or more
- Daily

12. How much time do you spend searching the Web for personal (not work-related) information?

13. Do you EVER use the web to find educational resources for curriculum planning or STEM instruction? [If the answer is NO, survey skips ahead]

14. How do you find Web-based educational resources? (Check all that apply.)

Colleagues
Print Advertisements
On-line Advertisements
Direct Mailings (flyers
Newsletters (print)
Listservs or Electronic Newsletters
Links on Web sites
Search engine
Professional Development Sessions/ Conferences
Professional Journals/ Readings

15. How long do you typically spend looking for educational resources on the Web? (Check one.)

Less than 1/2 hour per month
1/2-1 hour per month
1-5 hours per month
5-10 hours per month
10-20 hours per month
More than 20 hours per month

16. How much time are you typically willing to devote to learning how to use a new Web-based resource?

17. When you begin a new web search for curriculum planning or instructional purposes what most frequently inspires your search? Choose 2.

Resources that relate to a specific topic or content area
Resources that fit a particular curriculum standard
Resources that meet specific needs of one particular young person
Resources that meet specific needs of a small group of young people
Resources that meet specific needs of your entire class or activity group
Other (please specify)

18. How comfortable are you with each of the following?

Searching for Web-based educational resources
Downloading Web-based educational resources
Using Web-based educational resources for curriculum planning
Integrating Web-based educational resources into instruction
Teaching others to use Web-based educational resources

19. How often do you use the following Web-based resources in your science technology engineering or mathematics CURRICULUM PLANNING?

Web sites or electronic documents for background information
On-line lesson plans
On-line tutorials

20. How often do you use the following Web-based resources in your science technology engineering or mathematics INSTRUCTION?

Downloadable handouts
On-line activities (e.g. simulations virtual manipulatives)
On-line audio/video images
On-line articles
On-line raw data or data sets
Downloadable software for computers
Presentation tools (e.g. Power Point)
On-line collaboration tools (e.g. synchronous/ asynchronous discussion boards)
Downloadable resources for graphing calculators
Downloadable resources for hand-helds/PDAs
Downloadable resources for probes/other lab equipment
Applets/ Interactive Electronic Tools

21. On average what percentage of your instructional time with learners incorporates Web-based resources?

0-25%
25-50%
50-75%
More than 75%

22. When you use Web-based educational resources do you usually use the resources as they appear or do you typically customize the resources you use?

23. How have Web-based educational resources changed the way you plan or structure your instruction?

Web resources have not changed my instruction.
Web resources have not changed my planning.
My planning and/or instruction has changed in the following way:

24. List a favorite Web site or search engine you use for professional development curriculum planning or instructional purposes. Briefly describe the purpose of the Web site if applicable.

25. What do you value most about the Web site or search engine you listed above? (Check up to three.)

Easy to search.
Well-known.
Usually has the most relevant information.
Resources are appropriate for my audience.
Limits search results to desired category.
Downloads quickly.
From a reputable source.
Web site's links are up to date.
Resources are culturally/ age/ developmentally appropriate.
Extensive resources are available.
Resources are easy to customize for my needs.
Web site complements resources already used.
Other (please specify)

26. Which of the following INSTRUCTIONAL TOOLS would you most like to find on a Web site devoted to educational resources? (Check three.)

Access to experts/ professionals
Lesson plans and activity ideas
Downloadable software for computers
Audio or video files
Pictures and graphics
Articles containing news or current information in my field
Raw data
Applets and on-line manipulatives
Simulations
On-line tutorials
Collaboration tools
Other (please specify)

27. Which of the following DESIGN FEATURES would you most like to find on a Web site devoted to educational resources? (Check three.)

On-line help
Access to phone help-line.
Access to experts/ professionals
Search tool
Way to submit questions
Collaboration tools
Text-only option
Audio option
Adjustable font size and color
Pleasing colors
Multimedia content
Few flashing buttons/ little multimedia
Related links
Citations and references
Assurance that the site is backed by a reputable sponsor
No frames
Other

28. Give an example of a Web site that you find difficult to use but use anyway.

29. What makes this Web site difficult and why do you continue to use this website?

30. Please check the top three challenges you face in seeking and using Web-based resources (Check three).

Resources don't align with STEM standards.
Resources are difficult to adapt to my needs.
Takes too long to locate resources.
Resources are not culturally/ age/ developmentally appropriate.
No support from colleagues or superiors.
Not comfortable with using the web.
Unsure about the validity of Web-based resources.
Products/ Web sites are too expensive.
Limited Internet access.
Printing problems
Internet connection problems (e.g. speed
Problems with computer hardware.
Other (please specify)

31. When you use Web-based educational resources, who provides you with the technical or curriculum integration support you need? (Check the three most supportive staff members.)

Media Specialist/ Technology Coordinator
Administrator
Special Education Coordinator
Professional Development Trainer
Teacher/ Colleague/ Facilitator
Librarian
Curriculum Specialist
No one (other than myself)

32. Gender

33. What is your native language?

34. Do you have a physical disability?

35. What is your ethnic background?

36. In which state do you live?

37. What is your own educational background?

38. Have you participated in professional development sessions focused on the following topics? If so, did you consider it useful or not useful?

Computer and/ or Internet troubleshooting
Using the Web to find educational resources
Using technology during STEM instruction
Equity in STEM teaching
Equity issues in technology
Science Content
Technology Content
Engineering Content
Mathematics Content

39. Current Job Title

40. Years in Current Position

41. How many years teaching experience do you have? (include this current year if applicable)

42. Which of the following age groups have you worked with in the past 3 years?

0-10 year olds
10-14 year olds
14-16 year olds
16-18 year olds
College/ University Students
Adults

43. In the past 3 years which of the following STEM content areas / courses have you taught?

Engineering
Computer Science / Media
Mathematics and/or Statistics
Science
Other (please specify)

44. What type of computer technology do you have consistent use of in your home?

45. What type of computer technology do you have consistent use of in your workplace?

46. Which best describes the computer technology available to you and your class/activity group? (Check all that apply)

Single computer in the classroom, NO Internet access
Single computer in the classroom, with Internet access
Several computers in the classroom, NO Internet access
Several computers in the classroom, with Internet access
A centralized computer lab to which my class and I often have access
A centralized computer lab to which my class and I rarely have access
A class set of handheld devices
A class set of graphing calculators
Other (please specify)

47. Location of your STEM instruction

Rural
Suburban
Large Urban
Small Urban

48. Setting

Formal (school classroom)
Informal (workshop/ after-school/ summer program)

49. Gender Distribution of Students

All Female
All Male
Fairly Equal Gender Distribution
Mostly Female
Mostly Male

50. Ethnic Majority of Students

Hispanic
Native American
Caucasian
Asian
African American
Other (please specify)

51. What percentage of your students are NOT native English speakers?

Less than 25%
25-50%
50-75%
75-100%
Unsure

52. What percentage of your students has a physical disability?

Less than 25%
25-50%
50-75%
75-100%
Unsure

53. What percentage of your students have Individualized Education Plans (IEPs)?

Less than 25%
25-50%
50-75%
75-100%
Unsure

54. What percentage of your students receive free or reduced priced lunch?

Less than 25%
25-50%
50-75%
75-100%
Unsure

Focus Group Steps	Time	Notes to Facilitator	**Questions-** Responses should be verbal unless noted.
1. Introduction and demographic survey	5 min	Assure participants that we won't give out their contact info	
2. Warm up	5 min		**2)** Please introduce yourself—say your name plus one aspect of using Web resources that you like and one aspect that frustrates you.
3. How do you FIND Web resources and INTEGRATE those resources into your teaching?	20 min	Examples of Web resources that participants may find helpful include lesson plans, background information, applets, etc.	**3a)** When you get ready to design a lesson which integrates technology, what is your starting point? (e.g. with lesson standards, content, specific students, etc.) **3b)** On the Web, where do you begin? (e.g. search engine, particular Web site, etc.) **3c)** As you find resources, how do you choose which ones you will use? **3d)** How do you use the resources in your classroom? <u>Potential Prompts, if needed:</u> 1) Describe a lesson or class in which you used Web based resources. 2) How would you like to use Web based resources? 3) How do you think Web based resources might be beneficial to your students or to your teaching?
4. Group Activity: Design a perfect resource	10 min	Distribute examples of Web sites for participants to look at during the Group Activity. Examples are to be used as a reference to generate ideas.	The goal of the National Science, Technology, Engineering, and Mathematics (STEM) Digital Library—the NSDL—is to provide on-line collections and services that support STEM education at all levels. **4)** What features or services would ideally be present in a STEM based Web site that you would use for your lesson preparation or during instruction?
5. Reflection	10 min	Ask participants to briefly describe the student they wrote about as they answer question #5b in order to give some context for their thoughts.	As we all know, classes contain a wide range of students with different backgrounds, diversities, and abilities. Resources or teaching methods that work well for one student may not suit another. Picture in your mind one of your students. **5a)** Who is this student? On a piece of paper, write a nameless description that includes details about the student's personality and performance in class, grade-level, gender, race, native language, SES. Why did this particular student come to mind? **5b)** Think about the resource you just designed as a group. Would this resource look any different if you had designed it for this particular student? **5c)** How would you add to or modify the resource that you just designed in order to better meet the needs of this particular student? **5d)** Would focusing on this one student change how you look for or choose resources for class? If so, how?
6. Closing	5 min		**6)** What important things haven't been touched on today?

Effective Access Educator Interview Questions

1. Describe a recent Internet search (successful or not) that you conducted:
***What was the purpose of the search?
***What were your steps, as you carried out the search?
***How long did the search take?
***How successful do you consider the search?

2. Describe one student or one class. How do the needs of this student or this class influence what you want from a Web site?

3. When using the Internet for curriculum planning, what are your criteria for choosing or discarding potential sites, information, and resources?

4. When using the Internet to find resources to use during class with students, what are your criteria for choosing or discarding potential sites, information, and resources?

5. If you were to work with a developer of Web sites, what would you most like him or her to know about your design preferences? (you may want to answer this question by simply describing features of a real site you like)

6. If you were to work with a developer of Web-based educational tools, what would you most like him or her to know about the kinds of tools you need for your students? (you may want to answer this question by simply describing features of a real Web-based resource you like)

7. What types of training or professional development around Web resources have truly impacted your day-to-day teaching?
***If you haven't participated in any Web-related PD, what kinds of opportunities do you wish you had access to?

8. What do you consider to be the biggest benefits of integrating Web resources into the classroom?

9. What do you consider to be the biggest challenges when trying to integrate Web resources into the classroom?

10. What does the term "digital library" mean to you?[*]
[*]*This question was the only question that interviewees did not have the opportunity to see beforehand.*

11. How did you hear about this survey?

12. Is there anything else that you would like to add that was not covered in this interview?

Effective Access Technical Developer Interview Questions

1. Describe your Web-based education resource.
   - What is the purpose of your resource?
   - How was your resource designed to be used? Do teachers or students now use the resource differently from the original design?
   - Describe a typical teacher in your target audience. If teachers use the resource with their students, describe a typical student.
   - In what kind of educational setting is your resource meant to be used? (e.g. during curriculum planning, with students in high school, in a summer workshop). If the resource is meant to be used with students, does each student need a computer?
   - What are the technical requirements for using your resource?
   - How long does it take a teacher or student to learn how to use your resource?
   - What kinds of technical support are available?
   - How do teachers find out about your resource? (If search engine, what search terms would return your resource within the first page of results?)

2. What was your role in the design of this resource?

3. Describe the design process of this resource
   - What inspired the creation of the resource?
   - How were specific features of your resource designed to meet the needs of teachers?
   - How were teachers and/or students involved in the design or testing of your resource?
   - What did you learn about the needs of your target audience during the design and testing of your resource?

4. Briefly describe any experience you have teaching or working in schools.

5. What important design or implementation issues haven’t been touched on?

Appendix B: Methods

Contents:

- Sampling chart
- States of residence of survey respondents
- ANOVA calculations

Sampling methods for each survey and total responses

Survey	Time Frame	Sampling	Responses
1	Jan-March 2003	-survey announcements posted on education and equity listservs such as NICI and DLESE k12, link to survey from GDTI web page, ENC web page, and NSTA community bulletin boards	82
2	April-June 2003	-postcards announcing survey mailed to 3000 math and science department heads and technology coordinators in 14 states and D.C.	32
3	Oct-Dec 2004	-survey announcements sent via e-mail directly to 2089 STEM teachers in 28 states	102
4	Oct-Dec 2004	-survey announcement posted twice on MathTools discussion board (Part of the MathForum @ Drexel)	20

Survey Participants by State of Residence

State	Survey 2	Survey 3	Survey 4	Total
Arizona	0	3	0	3
California	6	1	0	7
Colorado	0	1	0	1
District of Columbia	1	0	0	1
Florida	1	2	1	4
Georgia	0	3	0	3
Hawaii	0	2	0	2
Idaho	1	3	0	4
Illinois	0	3	0	3
Kansas	0	2	0	2
Louisiana	0	2	0	2
Maryland	1	0	0	1
Massachusetts	0	2	1	3
Michigan	1	0	0	1
Mississippi	0	1	0	1
Missouri	0	0	1	1
Montana	3	4	0	7
Nebraska	0	3	0	3
Nevada	0	2	0	2
New Hampshire	0	3	0	3
New Jersey	0	1	0	1
New York	0	1	0	1
North Carolina	0	14	1	15
North Dakota	3	0	0	3
Ohio	0	1	0	1
Oklahoma	0	1	1	2
Oregon	0	10	1	11
Pennsylvania	2	1	0	3
South Carolina	0	3	0	3
South Dakota	2	1	1	4
Texas	0	4	2	6
Utah	0	1	0	1
Virginia	0	0	1	1
Washington	0	3	0	3
West Virginia	3	0	0	3
Wyoming	1	0	0	1

Survey respondents from 35 states plus the District of Columbia answered the state of residence question in surveys two through four. State of residence was not a question in Survey 1. 40 respondents skipped the question, seven from Survey 2, 24 from Survey 3, and nine from Survey 4.

ANOVA Calculations

Before combining the results from the four surveys, analysis of variance was conducted on several key questions. The questions were chosen because they could be matched to a numeric scale, and because they were the questions used to analyze responses. From the calculations, it was determined that there was more variation in responses within each group of survey participants than among the four groups, so the responses were combined together for the final analysis.

Survey Question: On average, what percentage of your instructional time, with learners, incorporates Web-based resources?

		0-25%	25-50%	50-75%	>75%	Response Average	Total Responses
Teacher Survey #1		35	8	1	2	1.35	46
Teacher Survey #2		15	4	0	1	1.35	20
Teacher Survey #3		42	20	7	3	1.60	72
Teacher Survey #4		5	4	3	3	2.27	15
	totals	**97**	**36**	**11**	**9**	1.56	**153**
	%	**63.4%**	**23.5%**	**7.2%**	**5.9%**		

ANOVA
Source of Variation

Total		113.8
Between Groups		10.5
Within Group		103.2

R^2 =Variation Between Groups/Total SS = 0.0926
Of the total variation in instructional time spent using Web resources, 9% can be explained by differences among survey groups

Survey Question: Gender

		Male	Female	Average	Total
Teacher Survey #1		19	37	1.7	56
Teacher Survey #2		11	13	1.5	24
Teacher Survey #3		27	50	1.6	77
Teacher Survey #4		8	7	1.5	15
	totals	**65**	**107**	1.6	**172**
	%	**37.8%**	**62.2%**		

ANOVA
Source of Variation

Total		40.4
Between Groups		0.7
Within Group		39.8

R^2 =Variation Between Groups/Total = 0.0162
Of the variation in gender distribution, 2% can be explained by differences among survey groups

Survey Question: Do you EVER use the web to find educational resources?

		YES=1	NO=2	Avg	Total Respondents
Teacher Survey #1		56	1	1.02	57
Teacher Survey #2		22	0	1.00	22
Teacher Survey #3		82	5	1.06	87
Teacher Survey #4		16	0	1.00	16
	totals	176	6	1.03	182
	%	**96.7%**	**3.3%**		

ANOVA
Source of Variation

Total		5.8
Between Groups		0.1
Within Group		5.7

R^2 =Variation Between Groups/Total = 0.0184
Of the variation in basic Web use, 2% of the variation can be explained by differences among survey groups

Survey Question: Location

		Rural	Suburban	Urban	Avg	Total
Teacher Survey #1		19	22	19	2.00	60
Teacher Survey #2		11	5	8	1.88	24
Teacher Survey #3		28	29	21	1.91	78
Teacher Survey #4		4	4	7	2.20	15
	totals	**62**	**60**	**55**	1.96	177
	%	**35.0%**	**33.9%**	**31.1%**		

ANOVA
Source of Variation

Total		118.2
Between Groups		1.3
Within Group		115.4

R^2 =Variation Between Groups/Total = 0.0112
Of the variation in location distribution, 1% can be explained by differences among survey groups

Survey Question: How comfortable are you doing the following?
Searching for Web Resources

		Very Uncomfortable	Uncomfortable	Fairly Comfortable	Comfortable	Very Comfortable
Teacher Survey #1		6	1	9	9	21
Teacher Survey #2		4	0	4	3	10
Teacher Survey #3		2	1	7	19	44
Teacher Survey #4		1	0	1	1	12
	totals	13	2	21	32	87
	%	**8.4%**	**1.3%**	**13.5%**	**20.6%**	**56.1%**

ANOVA
Source of Variation

Total		229.6
Between Groups		15.5
Within Group		214.1

$\mathbf{R^2}$ =Variation Between Groups/Total = 0.067425

Of the variation in comfort level, 7% can be explained by differences among survey groups

Appendix C: Survey Results

Contents:

Survey Question: How have Web resources changed your planning or instruction?

Category	N	Instr-No	%	Plan-No	%	Change	%
Gender—Male	58	21	36.2%	20	34.5%	31	53.4%
Gender—Female	91	20	22.0%	17	18.7%	63	69.2%
Location—Rural	57	19	33.3%	16	28.1%	32	56.1%
Location—Suburban	47	14	29.8%	10	21.3%	31	66.0%
Location—Urban	49	10	20.4%	12	24.5%	33	67.3%
Majority of Students—Hispanic	15	3	20.0%	2	13.3%	12	80.0%
Majority of Students—African American	20	3	15.0%	4	20.0%	15	75.0%
Majority of Students—Caucasian	107	33	30.8%	28	26.2%	64	59.8%
Student Eligibility for Free/Reduced Price Lunch: <25%	41	9	22.0%	11	26.8%	27	65.9%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	46	16	34.8%	12	26.1%	27	58.7%
Student Eligibility for Free/Reduced Price Lunch: >50%	45	12	26.7%	11	24.4%	28	62.2%
Instruct'l Time with Web Resources: <25%	97	37	38.1%	29	29.9%	50	51.5%
Instruct'l Time with Web Resources: 25-50%	35	4	11.4%	6	17.1%	28	80.0%
Instruct'l Time with Web Resources: >50%	20	3	15.0%	3	15.0%	17	85.0%

Survey Question: When you use Web resources, do you use them as they appear, or customize them?

Category	N	As Appear	%	Customize	%
Gender—Male	57	29	50.9%	30	52.6%
Gender—Female	89	45	50.6%	47	52.8%
Location—Rural	55	30	54.5%	26	47.3%
Location—Suburban	46	26	56.5%	23	50.0%
Location—Urban	49	20	40.8%	31	63.3%
Majority of Students—Hispanic	15	4	26.7%	12	80.0%
Majority of Students—African American	19	8	42.1%	11	57.9%
Majority of Students—Caucasian	105	60	57.1%	50	47.6%
Student Eligibility for Free/Reduced Price Lunch: <25%	41	23	56.1%	19	46.3%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	44	24	54.5%	20	45.5%
Student Eligibility for Free/Reduced Price Lunch: >50%	45	19	42.2%	28	62.2%
Instruct'l Time with Web Resources: <25%	95	60	63.2%	29	30.5%
Instruct'l Time with Web Resources: 25-50%	35	9	25.7%	26	74.3%
Instruct'l Time with Web Resources: >50%	20	7	35.0%	14	70.0%
<25% Students with IEPs	52	24	46.2%	29	55.8%
25-50% Students with IEPs	28	12	42.9%	16	57.1%
>50% Students with IEPs	3	1	33.3%	3	100.0%

Survey Question: On average, what percentage of your instructional time incorporates Web resources?

Category	N	1 0-25%	%	2 25-50%	%	3 50-75%	%	4 >75%	%	Time Avg
Gender—Male	58	32	55.2%	18	31.0%	4	6.9%	4	6.9%	1.66
Gender—Female	90	61	67.8%	18	20.0%	6	6.7%	5	5.6%	1.50
Location—Rural	58	34	58.6%	13	22.4%	8	13.8%	3	5.2%	1.66
Location—Suburban	46	35	76.1%	8	17.4%	1	2.2%	2	4.3%	1.35
Location—Urban	47	27	57.4%	15	31.9%	1	2.1%	4	8.5%	1.62
Majority of Students—Hispanic	15	6	40.0%	5	33.3%	1	6.7%	3	20.0%	2.07
Majority of Students—African American	19	12	63.2%	5	26.3%	1	5.3%	2	10.5%	1.74
Majority of Students—Caucasian	108	75	69.4%	21	19.4%	7	6.5%	5	4.6%	1.46
Student Eligibility for Free/Reduced Price Lunch: <25%	42	28	66.7%	10	23.8%	1	2.4%	3	7.1%	1.50
Student Eligibility for Free/Reduced Price Lunch: 25-50%	44	29	65.9%	8	18.2%	5	11.4%	2	4.5%	1.55
Student Eligibility for Free/Reduced Price Lunch: >50%	45	24	53.3%	14	31.1%	3	6.7%	4	8.9%	1.71
Teaching Experience: 1-5 yrs	43	27	62.8%	13	30.2%	1	2.3%	2	4.7%	1.49
Teaching Experience: 6-10 yrs	27	15	55.6%	8	29.6%	4	14.8%	0	0.0%	1.59
Teaching Experience: 11-15 yrs	26	19	73.1%	5	19.2%	1	3.8%	1	3.8%	1.38
Teaching Experience: 16+ yrs	51	34	66.7%	7	13.7%	4	7.8%	6	11.8%	1.65

Survey Question: How long do you spend looking for education resources on the Web (per month)?

Category	N	1 < 30 min	%	2 30 - 1 hr	%	3 1-5hrs	%	4 5-10 hrs	%	5 10-20 hrs	%	6 >20 hrs	%	Time Avg
Gender—Male	57	4	7.0%	6	10.5%	13	22.8%	10	17.5%	12	21.1%	12	21.1%	3.98
Gender—Female	88	4	4.5%	13	14.8%	30	34.1%	17	19.3%	12	13.6%	12	13.6%	3.64
Location—Rural	56	5	8.9%	7	12.5%	16	28.6%	9	16.1%	11	19.6%	8	14.3%	3.68
Location—Suburban	44	2	4.5%	6	13.6%	12	27.3%	14	31.8%	6	13.6%	4	9.1%	3.64
Location—Urban	48	2	4.2%	6	12.5%	16	33.3%	4	8.3%	8	16.7%	12	25.0%	3.96
Majority of Students—Hispanic	15	1	6.7%	0	0.0%	4	26.7%	2	13.3%	3	20.0%	5	33.3%	4.40
Majority of Students—African American	19	2	10.5%	3	15.8%	5	26.3%	1	5.3%	4	21.1%	4	21.1%	3.74
Majority of Students—Caucasian	105	6	5.7%	16	15.2%	31	29.5%	21	20.0%	18	17.1%	13	12.4%	3.65
Student Eligibility for Free/Reduced Price Lunch: <25%	41	3	7.3%	8	19.5%	10	24.4%	9	22.0%	5	12.2%	6	14.6%	3.56
Student Eligibility for Free/Reduced Price Lunch: 25-50%	43	2	4.7%	5	11.6%	9	20.9%	10	23.3%	6	14.0%	11	25.6%	4.07
Student Eligibility for Free/Reduced Price Lunch: >50%	43	4	9.3%	2	4.7%	18	41.9%	4	9.3%	10	23.3%	5	11.6%	3.67
Instruct'l Time with Web Resources: <25%	94	7	7.4%	18	19.1%	33	35.1%	16	17.0%	15	16.0%	5	5.3%	3.31
Instruct'l Time with Web Resources: 25-50%	35	2	5.7%	1	2.9%	9	25.7%	10	28.6%	6	17.1%	7	20.0%	4.09
Instruct'l Time with Web Resources: >50%	20	0	0.0%	0	0.0%	2	10.0%	1	5.0%	4	20.0%	13	65.0%	5.40
Teaching Experience: 1-5 yrs	42	2	4.8%	7	16.7%	13	31.0%	6	14.3%	9	21.4%	5	11.9%	3.67
Teaching Experience: 6-10 yrs	27	3	11.1%	3	11.1%	10	37.0%	2	7.4%	4	14.8%	5	18.5%	3.59
Teaching Experience: 11-15 yrs	25	1	4.0%	3	12.0%	8	32.0%	6	24.0%	3	12.0%	4	16.0%	3.76
Teaching Experience: 16+ yrs	50	3	6.0%	4	8.0%	13	26.0%	12	24.0%	9	18.0%	9	18.0%	3.94

Survey Question: How long do you spend looking for resources for personal use on the Web (per month)?

Category	N	< 30 min	%	30 - 1 hr	%	1-5 hrs	%	5-10 hrs	%	10-20 hrs	%	>20 hrs	%	Time Avg
Gender—Male	46	3	6.5%	7	15.2%	10	21.7%	8	17.4%	5	10.9%	13	28.3%	3.96
Gender—Female	66	9	13.6%	8	12.1%	16	24.2%	13	19.7%	5	7.6%	15	22.7%	3.64
Location—Rural	43	6	14.0%	8	18.6%	12	27.9%	2	4.7%	6	14.0%	9	20.9%	3.49
Location—Suburban	37	3	8.1%	5	13.5%	8	21.6%	11	29.7%	2	5.4%	8	21.6%	3.76
Location—Urban	34	3	8.8%	2	5.9%	7	20.6%	9	26.5%	2	5.9%	11	32.4%	4.12
Majority of Students—Hispanic	12	1	8.3%	2	16.7%	2	16.7%	3	25.0%	0	0.0%	4	33.3%	3.92
Majority of Students—African American	17	1	5.9%	0	0.0%	5	29.4%	1	5.9%	2	11.8%	8	47.1%	4.59
Majority of Students—Caucasian	73	10	13.7%	11	15.1%	19	26.0%	13	17.8%	7	9.6%	13	17.8%	3.48
Student Eligibility for Free/Reduced Price Lunch: <25%	30	5	16.7%	4	13.3%	8	26.7%	5	16.7%	2	6.7%	6	20.0%	3.43
Student Eligibility for Free/Reduced Price Lunch: 25-50%	36	2	5.6%	5	13.9%	8	22.2%	10	27.8%	2	5.6%	9	25.0%	3.89
Student Eligibility for Free/Reduced Price Lunch: >50%	35	4	11.4%	6	17.1%	6	17.1%	4	11.4%	4	11.4%	11	31.4%	3.89
Instruct'l Time with Web Resources: <25%	61	9	14.8%	9	14.8%	13	21.3%	10	16.4%	7	11.5%	13	21.3%	3.59
Instruct'l Time with Web Resources: 25-50%	28	2	7.1%	3	10.7%	5	17.9%	8	28.6%	1	3.6%	9	32.1%	4.07
Instruct'l Time with Web Resources: >50%	17	0	0.0%	2	11.8%	4	23.5%	3	17.6%	1	5.9%	7	41.2%	4.41
Teaching Experience: 1-5 yrs	32	5	15.6%	1	3.1%	6	18.8%	9	28.1%	2	6.3%	9	28.1%	3.91
Teaching Experience: 6-10 yrs	19	1	5.3%	2	10.5%	5	26.3%	4	21.1%	1	5.3%	6	31.6%	4.05
Teaching Experience: 11-15 yrs	19	3	15.8%	3	15.8%	3	15.8%	2	10.5%	3	15.8%	5	26.3%	3.74
Teaching Experience: 16+ yrs	42	3	7.1%	9	21.4%	13	31.0%	6	14.3%	4	9.5%	7	16.7%	3.48

Survey Question: How long are you willing to devote to learning a new Web-based resource?

		1		2		3		4		5		6		
Category	**N**	**< 30 min**	**%**	**30 - 1 hr**	**%**	**1-5 hrs**	**%**	**5-10 hrs**	**%**	**10-20 hrs**	**%**	**>20 hrs**	**%**	**Time Avg**
Gender—Male	57	6	10.5%	15	26.3%	23	40.4%	7	12.3%	1	1.8%	5	8.8%	2.95
Gender—Female	88	9	10.2%	32	36.4%	26	29.5%	9	10.2%	8	9.1%	4	4.5%	2.85
Location—Rural	56	7	12.5%	23	41.1%	12	21.4%	7	12.5%	2	3.6%	5	8.9%	2.80
Location—Suburban	44	4	9.1%	13	29.5%	19	43.2%	5	11.4%	3	6.8%	0	0.0%	2.77
Location—Urban	49	6	12.2%	12	24.5%	19	38.8%	4	8.2%	4	8.2%	4	8.2%	3.00
Majority of Students—Hispanic	15	0	0.0%	3	20.0%	3	20.0%	4	26.7%	2	13.3%	3	20.0%	3.93
Majority of Students—African American	19	5	26.3%	5	26.3%	5	26.3%	0	0.0%	2	10.5%	2	10.5%	2.74
Majority of Students—Caucasian	105	11	10.5%	38	36.2%	38	36.2%	11	10.5%	4	3.8%	3	2.9%	2.70
Student Eligibility for Free/Reduced Price Lunch: <25%	42	3	7.1%	13	31.0%	19	45.2%	4	9.5%	1	2.4%	2	4.8%	2.83
Student Eligibility for Free/Reduced Price Lunch: 25-50%	43	6	14.0%	13	30.2%	10	23.3%	6	14.0%	5	11.6%	3	7.0%	3.00
Student Eligibility for Free/Reduced Price Lunch: >50%	44	6	13.6%	13	29.5%	14	31.8%	4	9.1%	3	6.8%	4	9.1%	2.93
Instruct'l Time with Web Resources: <25%	94	12	12.8%	38	40.4%	29	30.9%	9	9.6%	4	4.3%	2	2.1%	2.59
Instruct'l Time with Web Resources: 25-50%	35	5	14.3%	6	17.1%	16	45.7%	3	8.6%	3	8.6%	2	5.7%	2.97
Instruct'l Time with Web Resources: >50%	18	0	0.0%	4	22.2%	5	27.8%	3	16.7%	2	11.1%	4	22.2%	3.83
Teaching Experience: 1-5 yrs	42	4	9.5%	10	23.8%	16	38.1%	4	9.5%	4	9.5%	4	9.5%	3.14
Teaching Experience: 6-10 yrs	27	4	14.8%	13	48.1%	8	29.6%	1	3.7%	0	0.0%	1	3.7%	2.37
Teaching Experience: 11-15 yrs	25	2	8.0%	10	40.0%	8	32.0%	3	12.0%	0	0.0%	2	8.0%	2.80
Teaching Experience: 16+ yrs	50	6	12.0%	13	26.0%	16	32.0%	8	16.0%	5	10.0%	2	4.0%	2.98

Survey Question: Which source do you use the most during INSTRUCTION? Which source is your second-most relied upon for use during instruction?

Likelihood of Textbooks or Web sites being a Top 2 resource used during INSTRUCTION

Category	N	Textbooks	%	Websites	%
Gender—Male	63	42	66.7%	29	46.0%
Gender—Female	101	66	65.3%	53	52.5%
Location—Rural	61	38	62.3%	28	45.9%
Location—Suburban	55	41	74.5%	31	56.4%
Location—Urban	52	33	63.5%	23	44.2%
Majority of Students—Hispanic	16	7	43.8%	8	50.0%
Majority of Students—African American	23	12	52.2%	9	39.1%
Majority of Students—Caucasian	117	87	74.4%	56	47.9%
Student Eligibility for Free/Reduced Price Lunch: <25%	62	45	72.6%	25	40.3%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	44	26	59.1%	27	61.4%
Student Eligibility for Free/Reduced Price Lunch: >50%	39	22	56.4%	16	41.0%
Instruct'l Time with Web Resources: <25%	94	70	74.5%	33	35.1%
Instruct'l Time with Web Resources: 25-50%	36	21	58.3%	23	63.9%
Instruct'l Time with Web Resources: >50%	20	7	35.0%	17	85.0%
Teaching Experience: 1-5 yrs	49	33	67.3%	27	55.1%
Teaching Experience: 6-10 yrs	29	17	58.6%	14	48.3%
Teaching Experience: 11-15 yrs	29	20	69.0%	11	37.9%
Teaching Experience: 16+ yrs	56	36	64.3%	26	46.4%

Survey Question: Which source do you use the most during CURRICULUM PLANNING? Which source is your second-most relied upon for use during curriculum planning?

Likelihood of Textbooks or Web sites being a Top 2 resource used during CURRICULUM PLANNING

Category	N	Textbooks	%	Websites	%
Gender—Male	65	33	50.8%	28	43.1%
Gender—Female	102	64	62.7%	54	52.9%
Location—Rural	57	35	61.4%	28	49.1%
Location—Suburban	57	43	75.4%	30	52.6%
Location—Urban	53	30	56.6%	28	52.8%
Majority of Students—Hispanic	17	5	29.4%	11	64.7%
Majority of Students—African American	23	14	60.9%	11	47.8%
Majority of Students—Caucasian	119	84	70.6%	54	45.4%
Student Eligibility for Free/Reduced Price Lunch: <25%	49	30	61.2%	22	44.9%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	51	31	60.8%	30	58.8%
Student Eligibility for Free/Reduced Price Lunch: >50%	49	30	61.2%	22	44.9%
Teaching Experience: 1-5 yrs	49	30	61.2%	30	61.2%
Teaching Experience: 6-10 yrs	29	22	75.9%	13	44.8%
Teaching Experience: 11-15 yrs	29	18	62.1%	11	37.9%
Teaching Experience: 16+ yrs	58	32	55.2%	30	51.7%

Survey Question: What best describes the computer technology available to you and your class?

Category	N	1 cpr, No net	%	1 cpr, w/ net	%	cprs, no net	%	cprs, net	%	lab, access	%	lab, no access	%	1-1 ratio	%
Gender—Male	34	0	0.0%	12	35.3%	1	2.9%	14	41.2%	11	32.4%	8	23.5%	8	23.5%
Gender—Female	57	2	3.5%	31	54.4%	4	7.0%	21	36.8%	27	47.4%	14	24.6%	2	3.5%
Location—Rural	32	1	3.1%	14	43.8%	2	6.3%	12	37.5%	13	40.6%	6	18.8%	4	12.5%
Location—Suburban	33	0	0.0%	21	63.6%	2	6.1%	11	33.3%	13	39.4%	11	33.3%	3	9.1%
Location—Urban	27	1	3.7%	9	33.3%	1	3.7%	12	44.4%	12	44.4%	6	22.2%	3	11.1%
Majority of Students—Hispanic	10	0	0.0%	2	20.0%	1	10.0%	4	40.0%	3	30.0%	1	10.0%	4	40.0%
Majority of Students—African American	14	0	0.0%	8	57.1%	0	0.0%	6	42.9%	5	35.7%	5	35.7%	0	0.0%
Majority of Students—Caucasian	58	2	3.4%	30	51.7%	3	5.2%	22	37.9%	25	43.1%	15	25.9%	4	6.9%
Student Eligibility for Free/Reduced Price Lunch: <25%	28	1	3.6%	14	50.0%	1	3.6%	11	39.3%	13	46.4%	9	32.1%	2	7.1%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	26	1	3.8%	10	38.5%	3	11.5%	10	38.5%	9	34.6%	4	15.4%	5	19.2%
Student Eligibility for Free/Reduced Price Lunch: >50%	26	0	0.0%	11	42.3%	1	3.8%	13	50.0%	9	34.6%	8	30.8%	3	11.5%
Instruct'l Time with Web Resources: <25%	47	2	4.3%	26	55.3%	2	4.3%	19	40.4%	23	48.9%	12	25.5%	2	4.3%
Instruct'l Time with Web Resources: 25-50%	23	0	0.0%	6	26.1%	1	4.3%	9	39.1%	8	34.8%	5	21.7%	5	21.7%
Instruct'l Time with Web Resources: >50%	15	0	0.0%	7	46.7%	2	13.3%	5	33.3%	7	46.7%	2	13.3%	3	20.0%

Survey Question: Which of the following DESIGN FEATURES would you most like to see? (Choose 3)

Category	**N**	Online help	**%**	**Phone help**	**%**	**Access to Experts/Prof'ls**	**%**	**Search tool**	**%**	**Way to submit ?s**	**%**
Gender—Male	56	29	51.8%	6	10.7%	21	37.5%	32	57.1%	23	41.1%
Gender—Female	91	21	23.1%	9	9.9%	25	27.5%	47	51.6%	38	41.8%
Location—Rural	57	23	40.4%	8	14.0%	17	29.8%	30	52.6%	26	45.6%
Location—Suburban	46	17	37.0%	3	6.5%	17	37.0%	22	47.8%	16	34.8%
Location—Urban	48	11	22.9%	4	8.3%	14	29.2%	30	62.5%	21	43.8%
Majority of Students—Hispanic	15	6	40.0%	1	6.7%	7	46.7%	10	66.7%	6	40.0%
Majority of Students—African American	19	8	42.1%	0	0.0%	5	26.3%	11	57.9%	13	68.4%
Majority of Students—Caucasian	106	31	29.2%	12	11.3%	33	31.1%	53	50.0%	40	37.7%
Student Eligibility for Free/Reduced Price Lunch: <25%	40	10	25.0%	6	15.0%	12	30.0%	19	47.5%	14	35.0%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	44	17	38.6%	3	6.8%	17	38.6%	28	63.6%	13	29.5%
Student Eligibility for Free/Reduced Price Lunch: >50%	44	16	36.4%	5	11.4%	18	40.9%	25	56.8%	24	54.5%
Instruct'l Time with Web Resources: <25%	95	28	29.5%	7	7.4%	24	25.3%	50	52.6%	39	41.1%
Instruct'l Time with Web Resources: 25-50%	35	14	40.0%	5	14.3%	14	40.0%	18	51.4%	16	45.7%
Instruct'l Time with Web Resources: >50%	20	8	40.0%	3	15.0%	10	50.0%	14	70.0%	7	35.0%
<25% Students with IEPs	53	17	32.1%	5	9.4%	17	32.1%	28	52.8%	18	34.0%
25-50% Students with IEPs	28	11	39.3%	5	17.9%	9	32.1%	20	71.4%	10	35.7%
>50% Students with IEPs	3	0	0.0%	0	0.0%	1	33.3%	2	66.7%	3	100.0%

Survey Question CONTINUED: Which of the following DESIGN FEATURES would you most like to see? (Choose 3)

Category	Collaboration tools	%	Text only opt'n	%	Audio opt'n	%	Adjustable font	%	Pleasing Colors	%
Gender—Male	11	19.6%	5	8.9%	6	10.7%	2	3.6%	4	7.1%
Gender—Female	13	14.3%	6	6.6%	5	5.5%	8	8.8%	3	3.3%
Location—Rural	6	10.5%	4	7.0%	7	12.3%	3	5.3%	2	3.5%
Location—Suburban	9	19.6%	5	10.9%	3	6.5%	4	8.7%	2	4.3%
Location—Urban	9	18.8%	2	4.2%	2	4.2%	4	8.3%	3	6.3%
Majority of Students—Hispanic	5	33.3%	1	6.7%	2	13.3%	1	6.7%	1	6.7%
Majority of Students—African American	3	15.8%	2	10.5%	0	0.0%	3	15.8%	2	10.5%
Majority of Students—Caucasian	13	12.3%	8	7.5%	9	8.5%	7	6.6%	3	2.8%
Student Eligibility for Free/Reduced Price Lunch: <25%	9	22.5%	5	12.5%	4	10.0%	3	7.5%	0	0.0%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	8	18.2%	3	6.8%	4	9.1%	4	9.1%	2	4.5%
Student Eligibility for Free/Reduced Price Lunch: >50%	4	9.1%	3	6.8%	3	6.8%	2	4.5%	4	9.1%
Instruct'l Time with Web Resources: <25%	15	15.8%	8	8.4%	7	7.4%	7	7.4%	1	1.1%
Instruct'l Time with Web Resources: 25-50%	4	11.4%	2	5.7%	4	11.4%	3	8.6%	3	8.6%
Instruct'l Time with Web Resources: >50%	3	15.0%	1	5.0%	1	5.0%	0	0.0%	2	10.0%
<25% Students with IEPs	10	18.9%	5	9.4%	5	9.4%	4	7.5%	1	1.9%
25-50% Students with IEPs	5	17.9%	1	3.6%	2	7.1%	2	7.1%	3	10.7%
>50% Students with IEPs	1	33.3%	1	33.3%	0	0.0%	0	0.0%	0	0.0%

Survey Question CONTINUED: Which of the following DESIGN FEATURES would you most like to see? (Choose 3)

Category	Multimedia content	%	Little multimedia	%
Gender—Male	22	39.3%	1	1.8%
Gender—Female	34	37.4%	4	4.4%
Location—Rural	14	24.6%	2	3.5%
Location—Suburban	19	41.3%	0	0.0%
Location—Urban	25	52.1%	3	6.3%
Majority of Students—Hispanic	8	53.3%	0	0.0%
Majority of Students—African American	6	31.6%	1	5.3%
Majority of Students—Caucasian	37	34.9%	4	3.8%
Student Eligibility for Free/Reduced Price Lunch: <25%	16	40.0%	1	2.5%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	17	38.6%	2	4.5%
Student Eligibility for Free/Reduced Price Lunch: >50%	19	43.2%	1	2.3%
Instruct'l Time with Web Resources: <25%	32	33.7%	3	3.2%
Instruct'l Time with Web Resources: 25-50%	18	51.4%	2	5.7%
Instruct'l Time with Web Resources: >50%	7	35.0%	0	0.0%
<25% Students with IEPs	23	43.4%	0	0.0%
25-50% Students with IEPs	10	35.7%	0	0.0%
>50% Students with IEPs	1	33.3%	0	0.0%

Survey Question: How do you find out about new Web resources? (Check all that apply)

Category	N	Colleagues	%	Web links	%	Search Engine	%	PD/conf	%	Prof'l Journals/ Readings	%	Listserv	%
Gender—Male	59	39	66.1%	48	81.4%	50	84.7%	37	62.7%	33	55.9%	14	23.7%
Gender—Female	90	62	68.9%	72	80.0%	77	85.6%	63	70.0%	49	54.4%	20	22.2%
Location—Rural	58	39	67.2%	48	82.8%	49	84.5%	41	70.7%	32	55.2%	16	27.6%
Location—Suburban	46	34	73.9%	34	73.9%	42	91.3%	27	58.7%	27	58.7%	9	19.6%
Location—Urban	49	31	63.3%	41	83.7%	40	81.6%	34	69.4%	25	51.0%	9	18.4%
Student Eligibility for Free/Reduced Price Lunch: <25%	42	32	76.2%	32	76.2%	36	85.7%	27	64.3%	24	57.1%	9	21.4%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	45	28	62.2%	40	88.9%	41	91.1%	30	66.7%	30	66.7%	14	31.1%
Student Eligibility for Free/Reduced Price Lunch: >50%	45	29	64.4%	34	75.6%	37	82.2%	31	68.9%	21	46.7%	6	13.3%
Instruct'l Time with Web Resources: <25%	97	67	69.1%	76	78.4%	84	86.6%	65	67.0%	52	53.6%	17	17.5%
Instruct'l Time with Web Resources: 25-50%	36	21	58.3%	30	83.3%	29	80.6%	22	61.1%	20	55.6%	8	22.2%
Instruct'l Time with Web Resources: >50%	20	15	75.0%	16	80.0%	18	90.0%	14	70.0%	12	60.0%	8	40.0%

Survey Question: When you begin a new Web search for curriculum planning or instructional purposes, what most frequently inspires your search? (Choose 2)

Category	N	Votes	Topic	%	Curric. Standard	%	1 Student	%	Small Group	%	Whole Class	%
Gender—Male	33	68	25	75.8%	12	36.4%	4	12.1%	6	18.2%	21	63.6%
Gender—Female	52	98	48	92.3%	11	21.2%	1	1.9%	7	13.5%	31	59.6%
Location—Rural	30	60	25	83.3%	11	36.7%	3	10.0%	4	13.3%	17	56.7%
Location—Suburban	31	62	26	83.9%	6	19.4%	2	6.5%	5	16.1%	23	74.2%
Location—Urban	25	46	22	88.0%	6	24.0%	0	0.0%	5	20.0%	13	52.0%
Majority of Students—Hispanic	9	18	8	88.9%	3	33.3%	0	0.0%	3	33.3%	4	44.4%
Majority of Students—African American	11	20	10	90.9%	4	36.4%	0	0.0%	1	9.1%	5	45.5%
Majority of Students—Caucasian	57	108	48	84.2%	12	21.1%	3	5.3%	7	12.3%	38	66.7%
Student Eligibility for Free/Reduced Price Lunch: <25%	26	53	21	80.8%	6	23.1%	2	7.7%	4	15.4%	20	76.9%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	25	48	21	84.0%	7	28.0%	2	8.0%	2	8.0%	16	64.0%
Student Eligibility for Free/Reduced Price Lunch: >50%	23	47	20	87.0%	8	34.8%	1	4.3%	6	26.1%	12	52.2%
Instruct'l Time with Web Resources: <25%	47	86	40	85.1%	8	17.0%	1	2.1%	6	12.8%	31	66.0%
Instruct'l Time with Web Resources: 25-50%	24	52	20	83.3%	9	37.5%	3	12.5%	7	29.2%	13	54.2%
Instruct'l Time with Web Resources: >50%	16	32	14	87.5%	7	43.8%	1	6.3%	1	6.3%	9	56.3%
Teaching Experience: 1-5 yrs	25	40	15	60.0%	7	28.0%	1	4.0%	6	24.0%	11	44.0%
Teaching Experience: 6-10 yrs	16	32	14	87.5%	3	18.8%	2	12.5%	1	6.3%	12	75.0%
Teaching Experience: 11-15 yrs	14	29	12	85.7%	4	28.6%	1	7.1%	2	14.3%	10	71.4%
Teaching Experience: 16+ yrs	28	57	25	89.3%	8	28.6%	1	3.6%	5	17.9%	18	64.3%

Survey Question: Which of the following INSTRUCTIONAL TOOLS would you most like to find on a Web site devoted to educational resources? (Check 3)

Category	N	Access to Experts	%	Lesson Plans	%	Software	%	A/V files	%	pix/ graphics	%
Gender—Male	57	15	26.3%	40	70.2%	24	42.1%	16	28.1%	25	43.9%
Gender—Female	90	24	26.7%	68	75.6%	32	35.6%	27	30.0%	36	40.0%
Location—Rural	56	15	26.8%	42	75.0%	24	42.9%	13	23.2%	19	33.9%
Location—Suburban	46	13	28.3%	29	63.0%	14	30.4%	18	39.1%	24	52.2%
Location—Urban	49	11	22.4%	37	75.5%	20	40.8%	13	26.5%	21	42.9%
Majority of Students—Hispanic	15	2	13.3%	13	86.7%	5	33.3%	3	20.0%	6	40.0%
Majority of Students—African American	20	4	20.0%	12	60.0%	9	45.0%	7	35.0%	7	35.0%
Majority of Students—Caucasian	105	27	25.7%	75	71.4%	41	39.0%	30	28.6%	43	41.0%
Student Eligibility for Free/Reduced Price Lunch: <25%	40	12	30.0%	29	72.5%	14	35.0%	9	22.5%	19	47.5%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	45	12	26.7%	29	64.4%	17	37.8%	16	35.6%	21	46.7%
Student Eligibility for Free/Reduced Price Lunch: >50%	45	8	17.8%	33	73.3%	23	51.1%	13	28.9%	17	37.8%
Instruct'l Time with Web Resources: <25%	95	20	21.1%	61	64.2%	37	38.9%	26	27.4%	36	37.9%
Instruct'l Time with Web Resources: 25-50%	35	12	34.3%	30	85.7%	13	37.1%	12	34.3%	19	54.3%
Instruct'l Time with Web Resources: >50%	20	7	35.0%	16	80.0%	7	35.0%	6	30.0%	8	40.0%
<25% Students with IEPs	52	13	25.0%	39	75.0%	11	21.2%	20	38.5%	26	50.0%
25-50% Students with IEPs	28	9	32.1%	22	78.6%	12	42.9%	10	35.7%	12	42.9%
>50% Students with IEPs	2	0	0.0%	1	50.0%	1	50.0%	0	0.0%	0	0.0%

Survey Question, CONTINUED: Which of the following INSTRUCTIONAL TOOLS would you most like to find? (Choose 3)

Category	%	Applets	%	Simulations	%	Tutorials	%	Collaboration Tools	%
Gender—Male	26.3%	19	33.3%	28	49.1%	32	56.1%	11	19.3%
Gender—Female	23.3%	22	24.4%	41	45.6%	37	41.1%	14	15.6%
Location—Rural	17.9%	10	17.9%	26	46.4%	23	41.1%	7	12.5%
Location—Suburban	37.0%	21	45.7%	25	54.3%	22	47.8%	10	21.7%
Location—Urban	20.4%	10	20.4%	20	40.8%	25	51.0%	8	16.3%
Majority of Students—Hispanic	20.0%	5	33.3%	5	33.3%	9	60.0%	5	33.3%
Majority of Students—African American	25.0%	6	30.0%	10	50.0%	10	50.0%	4	20.0%
Majority of Students—Caucasian	24.8%	27	25.7%	52	49.5%	45	42.9%	14	13.3%
Student Eligibility for Free/Reduced Price Lunch: <25%	25.0%	16	40.0%	18	45.0%	21	52.5%	8	20.0%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	20.0%	12	26.7%	20	44.4%	22	48.9%	8	17.8%
Student Eligibility for Free/Reduced Price Lunch: >50%	24.4%	10	22.2%	26	57.8%	22	48.9%	8	17.8%
Instruct'l Time with Web Resources: <25%	24.2%	22	23.2%	41	43.2%	32	33.7%	12	12.6%
Instruct'l Time with Web Resources: 25-50%	31.4%	11	31.4%	21	60.0%	24	68.6%	9	25.7%
Instruct'l Time with Web Resources: >50%	20.0%	8	40.0%	9	45.0%	13	65.0%	3	15.0%
<25% Students with IEPs	19.2%	17	32.7%	27	51.9%	26	50.0%	8	15.4%
25-50% Students with IEPs	21.4%	10	35.7%	12	42.9%	16	57.1%	8	28.6%
>50% Students with IEPs	0.0%	0	0.0%	0	0.0%	1	50.0%	0	0.0%

Survey Question: Have you participated in professional development sessions focused on the following topics? If so, did you consider it useful or not useful?

Teachers using Web resources during <25% Instructional Time

Topic	% (n = 90)	% Useful
Computer &/or Internet	57.8%	86.5%
Using Web	64.4%	89.7%
Using technology in STEM instruction	46.7%	88.1%
Equity in STEM instruction	14.4%	84.6%
Issues of Equity in Technology	16.7%	80.0%

Teachers using Web resources during 25-50% of their Instructional Time

Topic	% (n = 34)	% Useful
Computer &/or Internet	58.8%	90.0%
Using Web	50.0%	100.0%
Using technology in STEM instruction	41.2%	85.7%
Equity in STEM instruction	14.7%	80.0%
Issues of Equity in Technology	20.6%	85.7%

Teachers using Web resources during more than 50% of their Instructional Time

Topic	% (n = 18)	% Useful
Computer &/or Internet	83.3%	93.3%
Using Web	83.3%	93.3%
Using technology in STEM instruction	50.0%	100.0%
Equity in STEM instruction	38.9%	100.0%
Issues of Equity in Technology	38.9%	85.7%

Survey Results: Relationships among Educator Categories

Rural/Suburban/Urban

Category	N	Rural	%	Suburban	%	Urban	%
Gender—Male	65	24	36.9%	19	29.2%	22	33.8%
Gender—Female	106	37	34.9%	37	34.9%	32	30.2%
Majority of Students—Hispanic	19	2	10.5%	3	15.8%	14	73.7%
Majority of Students—African American	24	5	20.8%	3	12.5%	16	66.7%
Majority of Students—Caucasian	122	50	41.0%	52	42.6%	20	16.4%
Student Eligibility for Free/Reduced Price Lunch: <25%	51	12	23.5%	30	58.8%	9	17.6%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	52	21	40.4%	17	32.7%	14	26.9%
Student Eligibility for Free/Reduced Price Lunch: >50%	50	20	40.0%	6	12.0%	24	48.0%
<25% Students with IEPs	55	19	34.5%	24	43.6%	12	21.8%
25-50% Students with IEPs	30	11	36.7%	6	20.0%	13	43.3%
>50% Students with IEPs	4	1	25.0%	1	25.0%	2	50.0%
<25% Non-native English speakers	147	60	40.8%	53	36.1%	34	23.1%
25-50% Non-native English speakers	16	1	6.3%	5	31.3%	10	62.5%
>50% Non-native English speakers	9	1	11.1%	0	0.0%	8	88.9%

Survey Results: Relationships among Educator Categories

Hispanic/African American/Caucasian students

Category	N	Hispanic	%	African American	%	Caucasian	%
Gender—Male	53	10	18.9%	8	15.1%	40	75.5%
Gender—Female	105	9	8.6%	16	15.2%	76	72.4%
Location—Rural	61	2	3.3%	5	8.2%	50	82.0%
Location—Suburban	59	3	5.1%	3	5.1%	52	88.1%
Location—Urban	54	14	25.9%	16	29.6%	20	37.0%
Student Eligibility for Free/Reduced Price Lunch: <25%	51	2	3.9%	1	2.0%	46	90.2%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	49	7	14.3%	5	10.2%	35	71.4%
Student Eligibility for Free/Reduced Price Lunch: >50%	50	10	20.0%	16	32.0%	22	44.0%
<25% Students with IEPs	53	4	7.5%	5	9.4%	41	77.4%
25-50% Students with IEPs	30	4	13.3%	8	26.7%	13	43.3%
>50% Students with IEPs	4	2	50.0%	0	0.0%	2	50.0%
<25% Non-native English speakers	146	5	3.4%	20	13.7%	115	78.8%
25-50% Non-native English speakers	14	6	42.9%	3	21.4%	3	21.4%
>50% Non-native English speakers	9	8	88.9%	0	0.0%	0	0.0%

Survey Results: Relationships among Educator Categories

Gender, educators

Category	N	Male	%	Female	%
Majority of Students—Hispanic	19	10	52.6%	9	47.4%
Majority of Students—African American	24	8	33.3%	16	66.7%
Majority of Students—Caucasian	116	40	34.5%	76	65.5%
Location—Rural	61	24	39.3%	37	60.7%
Location—Suburban	56	19	33.9%	39	69.6%
Location—Urban	54	22	40.7%	32	59.3%
Student Eligibility for Free/Reduced Price Lunch: <25%	50	19	38.0%	31	62.0%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	51	24	47.1%	27	52.9%
Student Eligibility for Free/Reduced Price Lunch: >50%	48	19	39.6%	29	60.4%
<25% Students with IEPs	55	20	36.4%	35	63.6%
25-50% Students with IEPs	29	12	41.4%	17	58.6%
>50% Students with IEPs	4	2	50.0%	2	50.0%
<25% Non-native English speakers	143	51	35.7%	92	64.3%
25-50% Non-native English speakers	15	10	66.7%	5	33.3%
>50% Non-native English speakers	9	4	44.4%	5	55.6%

Survey Results: Relationships among Educator Categories

Free/Reduced Price Lunch

Category	N	<25%	%	25-50%	%	>50%	%
Gender—Male	65	19	29.2%	24	36.9%	19	29.2%
Gender—Female	104	31	29.8%	27	26.0%	29	27.9%
Majority of Students—Hispanic	19	2	10.5%	7	36.8%	10	52.6%
Majority of Students—African American	24	1	4.2%	5	20.8%	16	66.7%
Majority of Students—Caucasian	120	46	38.3%	35	29.2%	22	18.3%
Location—Rural	62	12	19.4%	21	33.9%	20	32.3%
Location—Suburban	59	30	50.8%	17	28.8%	6	10.2%
Location—Urban	53	9	17.0%	14	26.4%	24	45.3%
<25% Students with IEPs	55	24	43.6%	16	29.1%	9	16.4%
25-50% Students with IEPs	29	3	10.3%	11	37.9%	13	44.8%
>50% Students with IEPs	4	0	0.0%	0	0.0%	3	75.0%
<25% Non-native English speakers	147	48	32.7%	45	30.6%	37	25.2%
25-50% Non-native English speakers	16	2	12.5%	6	37.5%	7	43.8%
>50% Non-native English speakers	8	1	12.5%	1	12.5%	6	75.0%

Survey Results: Relationships among Educator Categories

Percent of Students NOT native English speakers

Category	N	<25%	%	25-50%	%	>50%	%
Gender—Male	65	51	78.5%	10	15.4%	4	6.2%
Gender—Female	105	92	87.6%	5	4.8%	5	4.8%
Majority of Students—Hispanic	19	5	26.3%	6	31.6%	8	42.1%
Majority of Students—African American	24	20	83.3%	3	12.5%	0	0.0%
Majority of Students—Caucasian	120	115	95.8%	3	2.5%	0	0.0%
Location—Rural	62	60	96.8%	1	1.6%	1	1.6%
Location—Suburban	59	53	89.8%	5	8.5%	0	0.0%
Location—Urban	54	34	63.0%	10	18.5%	8	14.8%
<25% Students with IEPs	55	48	87.3%	4	7.3%	2	3.6%
25-50% Students with IEPs	30	26	86.7%	1	3.3%	3	10.0%
>50% Students with IEPs	4	2	50.0%	2	50.0%	0	0.0%
Student Eligibility for Free/Reduced Price Lunch: <25%	51	48	94.1%	2	3.9%	1	2.0%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	52	45	86.5%	6	11.5%	1	1.9%
Student Eligibility for Free/Reduced Price Lunch: >50%	50	37	74.0%	7	14.0%	6	12.0%

Survey Results: Relationships among Educator Categories

Percent of Students with IEPs

Category	N	<25%	%	25-50%	%	>50%	%
Gender—Male	35	20	57.1%	12	34.3%	2	5.7%
Gender—Female	57	35	61.4%	17	29.8%	2	3.5%
Majority of Students—Hispanic	10	4	40.0%	4	40.0%	2	20.0%
Majority of Students—African American	14	5	35.7%	8	57.1%	0	0.0%
Majority of Students—Caucasian	59	41	69.5%	13	22.0%	2	3.4%
Location—Rural	32	19	59.4%	11	34.4%	1	3.1%
Location—Suburban	33	24	72.7%	6	18.2%	1	3.0%
Location—Urban	28	12	42.9%	13	46.4%	2	7.1%
<25% Non-native English speakers	80	48	60.0%	26	32.5%	2	2.5%
25-50% Non-native English speakers	7	4	57.1%	1	14.3%	2	28.6%
>50% Non-native English speakers	5	2	40.0%	3	60.0%	0	0.0%
Student Eligibility for Free/Reduced Price Lunch: <25%	28	24	85.7%	3	10.7%	0	0.0%
Student Eligibility for Free/Reduced Price Lunch: 25-50%	27	16	59.3%	11	40.7%	0	0.0%
Student Eligibility for Free/Reduced Price Lunch: >50%	26	9	34.6%	13	50.0%	3	11.5%