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Teaching, Learning & Computing

Inside this Issue

- 1 Internet Use by Teachers
- 2 Contrasting Teaching Philosophies Among American Teachers
- 3 TLC Research Protocol
- 4 Regular Teacher E-Mail Connect
- 6 The TLC Survey Sample
- 7 Reports & Subscriptions
- 8 Upcoming Conferences

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Internet Use by Teachers

This article is an excerpt from the report, *Internet Use by Teachers*. To order the full report, see page 7.

In a few brief years, the Internet has had an astounding effect on American institutions, and elementary and secondary schools are no exception to this pattern. More than 90% of schools now have some level of access to the Internet, and nearly 40% of all 4th through 12th grade teachers now have Internet access in their own classroom. Teachers' use of the Internet for professional purposes has become pervasive. By last Spring (1998), more than two-thirds of all teachers (68%) reported using the Internet to find information for lessons and 28% reported doing this on a weekly basis or more often. Students' use of the Internet for research and information gathering has become the third most common use of computers by students at school, following only word processing and CD-ROM software in frequency of use. Although these figures are impressive, in some ways the Internet has had a more limited impact on teaching and learning. For instance, far fewer teachers report using the Internet for the purpose of communication. Only 16% use e-mail frequently to communicate with teachers in other schools and only 18% have begun posting information, suggestions, opinions, or student work on the World Wide Web.

Of course, some teachers are making much more substantial use of the Internet than others are. There are numerous factors that may determine whether or not teachers use the Internet in their teaching and whether or not they perceive the Internet as valuable in their teaching. A recent report from

TLC-98, *Internet Use by Teachers* found classroom connectivity, teacher's computer expertise, and teacher's pedagogical beliefs and practices to be the strongest determinants of teacher and teacher-directed student Internet use.

Classroom Connectivity was the most powerful factor in determining the frequency of teacher-directed Internet use by students and teachers' perceived value of the Internet. The highest levels of student use, whether it involved student research or students posting their work, are reported by those teachers with high-speed/LAN-based direct access *in the classroom* where at least four computers are present. This type of connection allows for several computers in one classroom to have simultaneous Internet connection, thus allowing several students or several groups of students to use the World Wide Web at one time. Until very recently, the type of access that schools had was limited to individual telephone modems connected to single computers, sometimes in a teacher's classroom, but more often in an office or computer lab. Teachers are more likely to assign work on the Internet if students can remain in the classroom.

In terms of a teacher's own professional Internet use, having a modem at home may be almost as important for teachers as having one in their classroom. Teachers with a home modem, but no access at school at all use the Internet professionally as much ... *continued on page 3*

Contrasting Teaching Philosophies Among American Teachers

Constructivist ←————→ Traditional

Facilitator

"I mainly see my role as a facilitator. I try to provide opportunities and resources for my students to discover or construct concepts for themselves."

Sense-Making

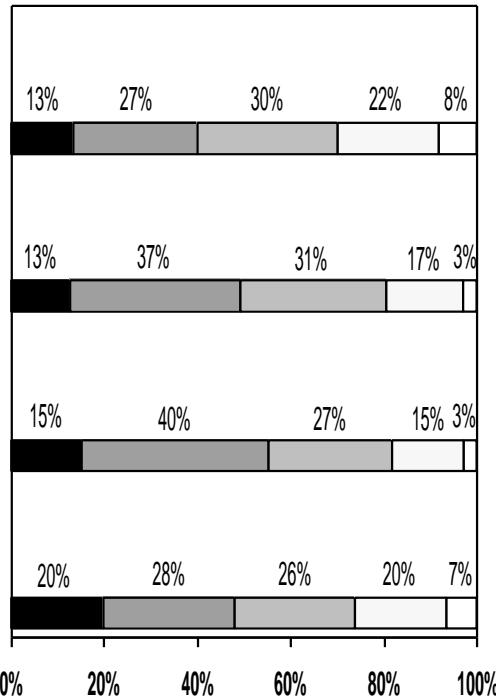
"The most important part of instruction is that it encourage 'sense-making' or thinking among students. Content is secondary."

Interest, Effort

"It is critical for students to become interested in doing academic work - interest and effort are more important than the particular subject -matter they are working on."

Many Things Going On

"It is a good idea to have all sorts of activities going on in the classroom. Some students might produce a scene from a play they read. Others might create a miniature version of the set. It's hard to get the logistics right, but the successes are so much more important than the failures."



Explainer

"That's all nice, but students really won't learn the subject unless you go over the material in a structured way. It's my job to explain, to show students how to do the work, and to assign specific practice."

Curriculum Content

"The most important part of instruction is the content of the curriculum. That content is the community's judgement about what children need to be able to know and do."

Curriculum Content

"While student motivation is certainly useful, it should not drive what students study. It is more important that students learn the history, science, math and language skills in their textbooks."

Whole Class Activities

"It's more practical to give the whole class the same assignment, one that has clear directions and one that can be done in short intervals that match students' attention spans and the daily class schedule."

What pedagogical philosophy guides most American teachers? Do they believe in the traditional instructional model of whole class structured explanation, guided practice, and a common curriculum contained in textbooks? Or do they believe that a learning process which stresses student interest, initiative, and "sense-making" is more important than a particular curriculum and see themselves more as a facilitator and resource provider than a source of content knowledge for students?

We found that fewer teachers professed to believe in the traditional, fixed-curriculum, fact and skill-oriented model of teaching as supported a more "constructivist" teaching philosophy. This is true among high school teachers as well as elementary and middle-level teachers. However, there is not a professional consensus on this issue; a

great many teachers at all levels still support the traditional model. Here are our results for one set of survey questions that presented pairs of contrasting quotations from teachers about their teaching philosophy.

The first bar shows that about 4 teachers in 10 saw themselves primarily as a facilitator of student initiative, while 3 in 10 saw themselves as someone who structured knowledge for students and directed their practice of subject material. The others placed themselves in the middle between these alternatives.

The second bar is somewhat more one-sided. About one-half of all teachers said it was more important to encourage "sense-making" or thinking among students; while only about 20% believed that the content of the curriculum was more important. The third bar shows a similar balance between developing student interest in academic work (more

than 50%) versus their attaining the knowledge in their textbooks (under 20%).

The fourth bar shows that a plurality of teachers value having a diverse set of complex activities going on in their classroom rather than having the whole class doing the same activity -- a set of brief activities with clear directions.

What do these same teachers report doing in their classrooms? Are they following in practice what they say they most strongly believe in? Under what conditions are they able to implement their teaching philosophies? In particular, do computer resources make it more likely that teachers professing constructivist philosophies put those beliefs into practice? These questions, as well as more detailed inquiry concerning teachers' philosophies themselves, will be among the many issues addressed in future reports with the TLC—1998 survey data set.



...continued from page 1
 as teachers with an Internet connection in their classroom but no modem at home. However, it's really classroom access that determines whether or not teachers *direct students* in using the World Wide Web, with the biggest effect coming from having any classroom connection at all, rather than having to connect elsewhere in the school building or at home.

Computer Expertise ranked as the second most important factor. Teachers were asked to access their own computer skills by rating their ability to perform tasks such as file handling, setting up database files, and using word-processors, presentation software, and using hypermedia authoring programs. Those with high computer skills were twice as likely to use the Internet for their own professional purposes and with students. They were also twice as likely to perceive the Internet as valuable in teaching.

Pedagogical Beliefs and Practices was the third most important factor in determining Internet use and perceived value. Teachers' pedagogy was measured on a scale ranging from traditional to constructivist and was based on how

they answered eleven questions related to their teaching philosophy and fifteen questions related to their actual teaching practice. In the traditional model of teaching/learning, the teacher helps the student to master a sequential set of skills, facts, and concepts primarily by having the whole class read the same material in a textbook, explaining the content to students using various forms of questioning and direct explanation, and having students practice their understanding repetitively until they can demonstrate their competency on a test. In contrast, a "reform" or "constructivist" approach to teaching proceeds from a theory of learning that suggests that students only understand ideas deeply when they do work that requires them to actively manipulate and apply the ideas and concepts under consideration. This often requires the teacher to organize complex individual and group projects based partly on student interests. In the constructivist model, students learn skills and concepts in the context of using them to do something – for example, in making a product.

Results revealed that the more constructivist the teacher, the greater their average use of the Internet and the more positively they viewed it. For ...continued on page 5

TLC Research Protocol

Computer Technology and
 Instructional Reform:
 A National Survey of Teachers and
 Their School Contexts

Rationale:

Efforts to systematically improve American schooling have increasingly focused on the basic nature of classroom instruction--how it has traditionally operated versus how recent research on human cognition suggests it *might* be organized with possibly revolutionary impact on the competencies that students possess. Several strands of theory-driven research undergird these recent efforts to reform instruction:

One of these strands is a theory of learning known as "constructivism." Constructivism states that students' conceptual understanding of a subject does not occur by reception and digestion of information and explanations but through a "construction of meaning" that comes from an active and thoughtful reconciling of new information and prior beliefs.

A second strand of research emphasizes the importance in the school curriculum for all students of higher cognitive skills such as making and testing conjectures, reasoning about why and how things are as they are, solving problems where the method for solution is not clear, being aware of what one knows and does not know about a subject, synthesizing information, critical thinking, etc.

A third aspect of instructional reform relates to social structures for learning -- tasks where students communicate and collaborate with one ...continued on page 5

Regular Teacher E-Mail Contact with Teachers at Other Schools

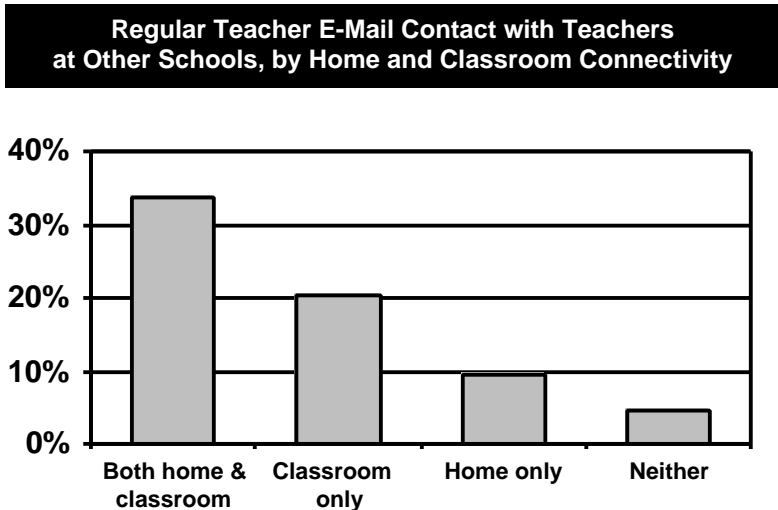
by Internet Access and Age

In an amazingly brief period of time, electronic mail has become a critical part of many people's lives, at work and at home. Is this true for teachers as well? Although they belong to the "knowledge economy," teachers practice their craft in greater isolation from peers than do other professionals. As a result, electronic mail may be even more valuable for them than for those who work more closely with other adults. Yet, the fact that teachers have so few work associates in other settings may actually result in their feeling *less* of a need for professional e-mail communications.

As of Spring, 1998, only 16% of U.S. teachers had conducted a regular e-mail conversation with a teacher at another school. (By "regular," we mean that the teacher indicated he or she had had e-mail contact with teachers at other schools on more than 5 occasions during the school year.) This seems like a fairly low participation rate for a category of adult professionals.

Factors such as availability of Internet access, age (younger teachers might be expected to be more comfortable with e-mail), or the breadth of a person's professional network, could certainly affect how likely a teacher is to use e-mail for professional communication. Our initial investigation into these factors found that younger teachers actually were *less* likely to use e-mail professionally than older teachers, most likely because they knew fewer teachers at other schools.

We also found that teachers with classroom Internet access were four times as likely to have conducted regular e-mail exchanges than teachers without classroom access (28% vs. 7%). The teachers most apt to use



Location of Internet Access	Have not done (since Sept.)	Occasionally	Regularly (more than 5 times since Sept.)	
Both home and classroom	32%	34%	33%	} 28%
Classroom only	47%	33%	20%	
Home only	70%	21%	9%	} 7%
Neither	85%	10%	5%	
All teachers	61%	23%	16%	

Source: Teaching, Learning and Computing – 1998, "Internet Use by Teachers," <http://www.crito.uci.edu/TLC>.

e-mail professionally were those with both home and classroom access. One-third of such teachers used e-mail to communicate professionally, using the definition of having had "more than 5 contacts with teachers at other schools during the school year." (See figure above.)

Teachers with classroom Internet access but who don't have Internet at home are more likely to use e-mail professionally than are teachers who have Internet at home but who don't have it in their classrooms. This is somewhat surprising because home access suggests personal interest in the Internet, whereas the issue of

classroom access may be substantially outside of a teacher's own control. The fact that teachers with classroom access but not home access are more likely e-mail users than those in the opposite situation suggests the impact on teachers of providing them with Internet at a convenient place where they conduct their other business—namely in their own classroom. This is a small indication that providing teachers with the resources of a professional may result in greater professional communication.

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example, among the most constructivist quartile of teachers, nearly two-thirds (65%) believed the presence of the Internet in the classroom was essential compared to one-third (34%) among the most traditional quartile of teachers. Similarly, for teacher Internet use, the most constructivist teachers were two-and-one-half times as likely as the most traditional teachers to use the Internet for their own professional use.

Other Conditions that predicted greater use, in order of their importance, include participation in staff development on Internet use, a high frequency of informal contacts with other teachers at their school, being a teacher who had a high level of professional leadership activity in the previous three years, being relatively young, having home Internet access, having made more personal investments in their own education, and finally, having had a few years of teaching experience (at least four years).

Formal Staff Development and Informal Contacts both appear to contribute to greater use of the Internet. Three out of ten teachers report having attended a *formal* workshop teaching how to use the Internet or other on-line activities, and those teachers were more likely to use the Internet than other teachers. Teachers who reported a high level of *informal* contact with other teachers—i.e., frequently observing other teachers' classes or having casual conversation concerning a wide range of topics such as ideas for student or group projects, issues in their subject-matter field, or personal matters—were also more likely to use the Internet more than those with fewer informal contacts. When more closely examined, this difference between high-informal contact teachers and others was even more substantial and even more widespread than the differences between those who attended *formal* staff development and those who did not.

Professional Leadership Activities such as mentoring less experienced teachers, leading workshops for disseminating new ideas, or writing and publishing for other teachers, is an important determinant of Internet use, both in terms of teachers' own professional activities and use by students.

Internet Access at Home A majority of teachers (59%) have Internet access at home, but as discussed earlier, home access is a stronger predictor of the use of the Internet for *teacher's* professional use and not student use which seems to depend more on *classroom* access.

Teacher's Educational Background, though close to last on the list of statistically significant conditions, is likely to be more important than the statistics would indicate. For example, those teachers with more educationally advantaged background (with higher degrees and more courses taken, higher undergraduate grades, and graduating from a more selective school) are more likely to have computer expertise and more likely to have become involved in professional leadership activities—both important predictors of Internet use.

Age and Years of Teaching Experience, compared to other predictors, has a relatively small relationship to Internet use and valuation by teachers. Generally, the younger the teacher, the more computer savvy the teacher. Overall, those under age 30 in their first few years of teaching are the ones most likely to use the Internet professionally (that is for their own use in preparing lessons). They are also the teachers who consider the Internet to be essential in their classroom. However, those in their first few years of teaching are less likely to use the Internet *with their students*, perhaps due to the need to ...continued on page 6



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another to accomplish joint tasks or improve their understandings. Many academic researchers and curriculum materials developers have advanced the argument that *computer-based technologies* can facilitate student accomplishment in constructivist-oriented classrooms and in those where higher cognitive competencies and social structures for learning are emphasized.

Purpose:

This research project is investigating the extent to which teachers' use of computers have, or might be expected to change teaching practice in directions consistent with these theories of learning, instruction, and curriculum content. In particular, the study will...

- determine the prevalence of different uses of computers by teachers and their students, as well as the personal educational philosophies (beliefs about learning; priorities for instruction) underlying each of those different uses;
- determine the prevalence of different philosophies and different instructional practices among teachers, independently of those teachers' pattern of computer use;
- determine the relationship between the extent and types of teachers' computer use and their basic instructional beliefs and practices;
- specify the differences in school contexts (e.g., pattern of school expenditures on technology; structure of social support for technology use) and personal backgrounds (teachers' previous technology experiences and educational backgrounds) between technology-using teachers with a constructivist perspective and other teachers--those who teach with similar philosophies, but without technology supports; those who use technology but without a constructivist approach; and those ...continued on page 6

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first settle into their profession before experimenting with new methods. In terms of actually using the Internet for student projects, teachers with four to seven years of experience were most likely to do so.

In thinking about how to extend Internet use to larger numbers of teachers, the implications of TLC's research are obvious. Most importantly, educational leaders must not limit Internet connectivity to computer labs and locations outside of the classroom. Next in importance, increasing teachers' computer expertise

can be accomplished by encouraging participation in staff development and promoting informal contacts among teachers. Formal training must teach the relevance of various features and information provided by new technology to the teacher's own instructional and curricular priorities. More frequent informal contacts may help set theory into practice. By creating a more team oriented environment where professionals mentor and collaborate with each other, teachers are more likely to share their methods of using the Internet in the classroom with their peers.

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who do neither; and

- communicate teachers' own perceptions about the importance of their experience with computers in changing various aspects of their teaching practice, including the kinds of assignments they give and how they interact with their colleagues and students.

Secondary Issues:

- School investments into technology – hardware and teacher training/support.
- Distribution of computer technologies and patterns of use within schools and across different types of schools in 1998 versus 1983, 1985, 1989, and 1992.

The TLC Survey Sample

The TLC study's purposes are being addressed through a national survey of elementary and secondary school-level technology coordinators, principals, and teachers of mathematics, science, social studies, English, and other subjects. The survey includes teachers from a national probability sample of schools and from two targeted samples of schools--high-end technology-using schools and schools that participate in 52 identified national and regional educational reform programs.

Much of the data analysis, including all of the analysis for this issue's report on teacher Internet use, is drawn exclusively from the national probability sample of schools. The more complex analyses of differences among teachers make use of data from teachers in both the probability sample and the high-end technology and school reform purposive samples.

Selection of Schools:

The **national probability sample** of schools consists of 898 public, private, and parochial schools selected from a national database of 109,000 schools supplied by the firm of Quality Education Data (QED) of Denver, CO, a marketing information division of Peterson's Guides. Schools were sampled according to their size (estimated number of full-time teachers of grade 4 and above) and according to

how much computer technology they had (using an index incorporating ten different measures of per-capita technology presence).

The **two purposive samples** were compiled from a multitude of sources:

- 1) The "**educational reform**" **purposive sample** (470 schools) came from rosters compiled of 52 different educational reform efforts. Forty programs provided more schools than were needed so that probability sampling was employed to select the particular schools that would be incorporated into the study.
- 2) The "**high-end technology**" **purposive sample** (258 schools) was compiled from three types of sources: publicly available information from school Web sites and books, from one high-end technology education reform program, and from the Quality Education Data database (the schools with the highest technology presence index).

Selection of Teachers:

At each of the 1,616 studied schools, samples of 3 (elementary) or 5 (middle and high school) teachers were drawn through probability sampling methods. A teacher roster form was sent to the school principal as the first major mailing to the school (following an introductory letter). That form asked the principal to roster either 10 (elementary)

or 15 (secondary) teachers of grade 4 or higher (in some cases limited to the same subject taught by a reform program-participating teacher), starting with teachers with last names beginning with a randomly selected letter of the alphabet and proceeding alphabetically. The roster form asked for 4 additional pieces of information about the rostered teachers that were used to assign sampling weights to each rostered teacher (e.g., subject taught, use of computers, use of projects in teaching). In addition, two other sources of teachers were incorporated as purposive samples. Approximately 250 teachers were individually selected from the purposive school samples based on reports (public or program-supplied) of their participation in educational reform activities. And finally, approximately 800 teachers were chosen through nominations by principals (as part of the roster form) as exemplary practitioners of constructivist approaches to teaching.

Attained Sample:

With a 75% response rate at the roster stage and close to a 70% response rate at the individual level, the survey database includes information from 1,150 schools including completed questionnaires from approximately 4,100 teachers, 800 technology coordinators, and 850 principals.

Reports

1. *Internet Use by Teachers* - Currently available.
2. *Computer Presence in American Schools*
3. *Computer and Software Use by Teachers*
4. *School Decision-Making on Technology*
5. *Staff Development and School Support for Teachers' Computer Use*
6. *Pedagogical Beliefs and Practices Among American Teachers*
7. *School Technology Investment Alternatives*
8. *Teacher Pedagogy and their Use of Computers*
9. *School Context and Personal Factors in Teachers' Use of Computers*
10. *Computer Use in Reform and High-End Technology Settings*
11. *Dynamic Relationships Between Pedagogy and Computer Use*
12. *A Summary of Teaching, Learning, & Computing-1998*

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If you would like to contact us, give us suggestions or learn more about Teaching Learning & Computing, please visit our web site at <http://www.crito.uci.edu/TLC> and join our discussion group.

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March 1999

Upcoming Conferences

Friday, March 26th

9:30–10:30am, Boston Back Bay Hilton
National Science Teachers Association
Science Teachers' Computer Use and Pedagogy

Monday, April 19th

6:15–7:45pm, Queen Elizabeth Hotel, Montreal
American Educational Research Association
Session 8.20:
Computers and How They Are Being Used in American
Schools and Classrooms
Staff Development and School Support for Computer and
Network Use
School Technology-Related Decision Making
Teacher Pedagogy and Technology Use

Tuesday, April 20th

10:35-12:05am, Montreal Bonaventure Hilton
American Educational Research Association
Session 13.62:
Constructivist-Compatible Teacher Beliefs and Practices:
Prevalence and Differences by Instructional Setting

Wednesday, April 21st

10:35-12:05am, Queen Elizabeth Hotel, Montreal
American Educational Research Association
Session 25.58:
School Professional Cultures and the Emergence of
Constructivist-Compatible Pedagogies

Friday, April 23rd

2:15-3:45pm, Marriott Chateau Champlain, Montreal
American Educational Research Association
Session 53.47:
Instructional Practices and Computer Use in Schools
Participating in Major Reform Programs: Comparisons with
a National Probability Sample

Friday, April 23rd

9:00-10:00am, Moscone Center, San Francisco
National Council of Teachers of Mathematics
Session 494:
Pedagogical Philosophy and Uses of Computers. How and
Why Secondary Mathematics Teachers Differ From Others

Tuesday, June 22nd

Atlantic City, NJ
National Educational Computing Conference
TLC 1998: The National Survey of Computer Technology and
Instructional Reform
Response Panel for the National Survey of Technology and
Reform

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