The Concord Consortium
Realizing the educational promise of technology
Volume 4, No. 3
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CONTENTS

Ten Things You Need To Know

Advice for Creating Quality Online Professional Development

by Cynthia McIntyre and Bonnie Elbaum
with contributions from Concord Consortium staff

While the goals are different for each professional development NetCourse that we teach, the pedagogy and methodology are similar. Four years ago, when we first began offering a NetCourse on how to bring inquiry into science and math classrooms, the effectiveness of online professional development was largely untested and unproven. The medium was in its infancy. Our course was one of the first large-scale efforts to deliver online professional development to teachers, and its successes and failures raised awareness in the education community about using the Internet for delivery of professional development. Since then we have gone on to develop other NetCourses in online course development and moderation of online discussions.

We have come to recognize, through our experience, some key ingredients to successful online professional development. Through feedback from evaluators, teachers and our own observations, we have also recognized some things we did wrong. Others can learn from our mistakes and successes. For starters, here are ten things to think about when developing online professional development for teachers.

1 *Say "I do"*

Commitment is important. If someone else (e.g., a principal or technology coordinator) signs up teachers for an online course, completion rates plummet. Teachers have to have a strong personal motivation to participate—for example, the content is clear and compelling or they are receiving graduate credit or they have paid tuition. In our first online professional development course, INTEC, many teachers thought they were signing up for a "technology" course, not a course on the pedagogy of inquiry, because they were signed up by their technology coordinators. The ensuing confusion and disappointment was reflected in the low overall completion rate. On the other hand, of those participants who paid for graduate credit, 71% completed the practicum. Of the 51% who were receiving continuing education credits, the completion rate was 74%. But overall, we found that providing course credits has a greater motivational appeal if associated with a degree or certificate program. Professional development points or CE units have motivational value but are not as effective as programs that are more generous in their points or require less effort. In the case of our Virtual High School™ two-semester online professional development course, the completion incentive is clearer: the course is a prerequisite for teachers wanting to participate in VHS™. If a teacher failed to complete the course, the school's VHS participation might be put into jeopardy. Having a clear motivation for signing up is important. Teachers sign up (or are signed up) for many different reasons, and in districts that provide the right incentives, the completion rates are higher.

On the other hand, don't ask for too much. If the NetCourse is long (INTEC was 26 weeks) the commitment can be overwhelming. Shorter courses (no more than 12 or 15 weeks) create higher completion rates and more flexibility for teachers. They can finish the course before other priorities take over.

2 *Variety is the spice of life*

A wide variety of activities provides a balanced approach to learning professional development content online. Participants should be assigned a mix of online and offline activities—offline activities can be as simple as reading from a textbook or as intricate as working with a CBL (Calculator Based Lab). In several of our NetCourses, participants are asked to sum up their experiences with a creative final project that can take the form of anything from a poem to a visual essay. Because the online environment is heavily weighted towards the language arts (in that reading and writing skills are key to a student's success), a variety of online and offline activities, particularly those that tap into

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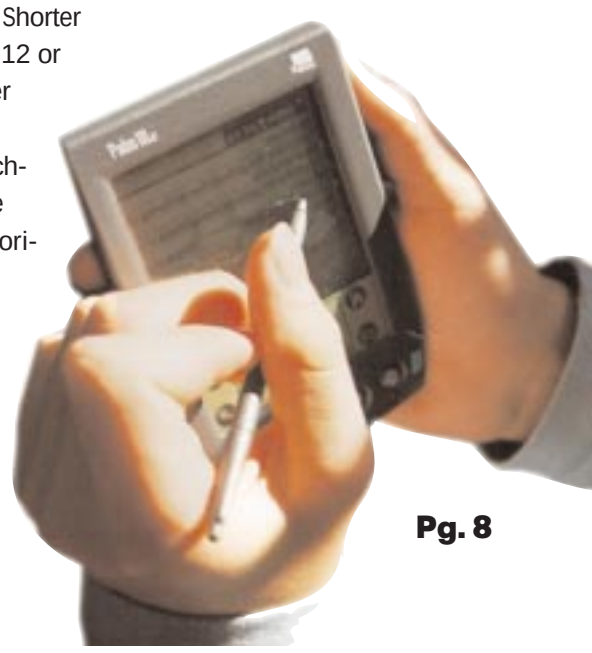

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The Concord Consortium

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@Concord is published biannually by The Concord Consortium, a nonprofit educational research and development organization dedicated to educational innovation through creative technologies.

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The projects described in @Concord are supported by U.S. Department of Education grants R286A000006 and R203F000028, and National Science Foundation grants CDA-9720384 and ESI-9986419. We also receive donations from corporations and individuals. All opinions, findings, conclusions, and recommendations expressed herein are those of the authors and do not necessarily reflect the views of the funding agencies. Mention of trade names, commercial products or organizations does not imply endorsement.

Perspective

Ice Machines, Steamboats and Technology in Education

Robert Tinker

Every revolutionary technology starts with a whimper. Its full revolutionary impact is realized only later after fundamental structural changes are made to accommodate the new technology.

In spite of the decades that computers have been in schools, we have yet to see the revolution they could cause in learning.

The first ice-making machines were used to make ice for ice-boxes. Once or twice a week the ice company delivered a block of ice to your home and you put it in your ice box. It was decades before the ice companies vanished and everyone had their own personal ice machine, called a refrigerator.

Steam was initially viewed as a solution to a problem for sailboats, not as a replacement for them. Steam engines were first installed on sailboats because of the persistent problem of time wasted in the doldrums. Only when there was not enough wind would the steam engine be fired up. In the end, of course, sail power vanished and steam permitted faster, larger, safer, all-metal ships that could move goods much more economically.

In the history of technology there are countless examples of when a new technology was first used to address a narrow problem within the existing order. Only later did it overthrow the old order. The delay is inevitable because structural changes are needed for the new technology. In the case of ice machines, universal access to electricity and lower costs through mass production were needed before everyone could buy a refrigerator. In the case of steamboats, deeper harbors, new construction techniques, and railroads to supply coal and move cargo were needed before large steamers made sense.

There is a dawning realization that the current economic boom has technology to thank for the structural changes it has caused in business. Productivity is up, businesses are far less hierarchical, and financial markets have been democratized. But the technologies we see today will look feeble and clumsy tomorrow because the technological revolution is far from complete. We are only part way through fundamental improvements in the technologies that enable computers and networks. One indicator of this ongoing change is “Moore’s Law,” an observation made in 1965 by Gordon Moore, several years before helping to start Intel. Moore observed then that the number of transistors on a microchip was doubling every eighteen months. Remarkably, this incredible rate of advance has remained true for thirty years, and could for another thirty.

This kind of exponential change applies to the entire information industry, not just computer chips. Experts expect these changes to continue for ten to twenty more years, but no one really knows. The result might be a trillion-fold increase in performance since 1965 and a million-fold increase from today.

One would think that the enormous advantages technology has brought to business would be reflected in education. But in spite of the decades that computers have been in schools, we have yet to see the revolution they could cause in learning. Educators are still delivering block ice made by ice machines, still using steam only in the doldrums. This is because business competition rewards improvements while education is organized to conserve and pass on the best of the old. In addition, education is highly labor-intensive, and the cost of labor has been bid up by the buoyant economy. We are, nevertheless, overdue for a surge in educational performance driven by the technology—as soon as we are willing to make the necessary structural changes.

It is impossible to predict what new applications these improvements in the underlying technology will enable, but it is certain that the structural changes necessary to exploit them fully in education will take additional decades. Developers of educational technology are writing just the opening speech of the most dramatic play educators have ever witnessed. Our grandchildren will write the next intervening scenes, and their children will enjoy the finale.

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Why Don't Face-to-Face Teaching Strategies Work In the Virtual Classroom?

by Sarah Haavind

How to Avoid the "Question Mill"

It's easy to say that leading a course online is different from leading a face-to-face class. It's harder to explain exactly what's different and how to make the shift in order to meet tried-and-true instructional goals. One can fail miserably applying the typical approach to the virtual classroom. As more experience with online teaching accumulates, effective, alternative strategies that meet the intended goals are emerging. Here are a couple of strategies applied to two classical instructional goals: getting a discussion going and summarizing an activity.

Getting a Discussion Going

How many times have you seen a course or workshop leader throw out a few pertinent questions to get a discussion going, perhaps as a follow-up to a brief presentation? If the first few queries are met with silence, most instructors reword the question or add another question to spur response. This is a time-worn face-to-face strategy because it can be quite effective. Someone eventually poses a response, then another hand goes up, and the discussion is off and rolling. Here and there as a point is made or dialogue wanes, the leader chimes in with a few more queries to pick up the pace once again. But what happens when the same leader tries this online?

We call it the "Question Mill." With the intention of focusing discussion on the salient content, the online discussion leader jumps into the dialogue and poses three or four potential avenues of further exploration. The result? There are two. The first is silence. Reading the list of questions, the participant gets

lost after the second or third query and quickly clicks to the next posting. The second result is avoidance. Five or six responses appear, but they are unrelated to one another. The participant choses a different query for comment. The dialogue remains unfocused and confusing for other readers. Both results quell rather than enhance the discussion.

When a discussion leader in front of a room lists four or five possible pathways of exploration, listeners tune in to what interests them and tune out the rest. But when listed on a page, all the questions confronting the reader demand equal attention. What once faded in and out now becomes a cacophony of choices for the online participant, and the reader just turns off.

What's the alternative? For starters, the assignment must be purposefully vague. This increases the potential of eliciting a participant's real thinking on a subject. As a few postings are made to the discussion, the instructor culls from the comments a theme or thread worthy of careful focus or deeper digging and holds it up for the group to consider. Such an intervention might include three or four short quotes or paraphrases from earlier comments followed by a bit of explanation or clarification and then a single question to elicit more focused dialogue.

Summary vs. Landscape

Summarizing is another strategy that can curtail rather than enhance dialogue. When it works, summarizing can

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SUMMARY vs LANDSCAPE

A sample online dialogue

The first posting below begins with a healthy touch of whimsy on the topic of inquiry. The moderator weaves her commentary and all respondents' notes into a metaphor about plucking daisies and categorizes contributions into "love it" and "love it NOT." However, the summary is out of place considering the fine landscape the moderator set out previously. A conclusion isn't necessary. An open door and suspension of judgment are what the group really needs.

There are lots of ideas and questions about the nature of inquiry. I seem to detect what I call a "Daisy Effect." Remember the childhood ritual of plucking petals out of a daisy and reciting "loves me, loves me not"? I notice a similar pattern in your responses: Our current sweetheart is "inquiry"—and we recite "love it, love it NOT!"

We LOVE inquiry for a lot of reasons. Many of you noted that inquiry takes us beyond rote memorization. [Moderator states participants' rationales for liking inquiry.] Next daisy/inquiry petal please … On the other hand—our sweetheart inquiry—we love it NOT … [Moderator gives participants' drawbacks.]

In summary, I sense that you feel that using inquiry is demanding and hard to do, but that it is worth the work since the learning and teaching are better. I think my plucking ended on a "love it" petal. What do you think? Do you agree or disagree?

Below is a recrafting of the last paragraph of the posting above. Can you feel the difference between the "summary" tone above and the "landscape" set below? Which one will foster further dialogue?

So what's our bottom line?

Love it -> Tally = 5 Love it not -> Tally = 5

Hmmmmmm. Score tied!

What our group seems to have individually and collectively expressed is a healthy sense of ambivalence toward inquiry.

But … ambivalence is good!

If we were all "gung ho" after reading a few articles and trying some activities, I'd be a bit suspicious! Ambivalence, skepticism, and suspension of judgment is essential to a scientific approach, and it is always involved when we are facing a potential change in our thoughts and behaviors. This is an excellent start.

This rewritten paragraph emphasizes the variety of responses and encourages exploration of the reasons why participants hold various positions about inquiry teaching. The moderator compliments participants on not rushing to judgment and keeps dialogue open on the topic.

Teaching Strategies
continued from page 3

clarify and give participants a sense of direction. It can also close doors and block paths to alternative approaches. Summaries abstract ideas and place them in a hierarchy of meaning that the moderator determines. Positions can appear to harden when the moderator tries to capture them in a summary. Often, the important nuances of reasoning disappear as the moderator highlights the contentions or assumptions reflected in the comments.

If a moderator wants to help participants build meaning from their discussions, a more useful intervention would be to summarize by portraying a "landscape," which may include multiple perspectives on the issues discussed. Maintaining a suspension of judgment is critical.

The sidebar example (see page 3) shows an example of both methods. The moderator juxtaposes participants' comments, setting out a landscape for further reflection, but curtails dialogue with the summary at the end.

If you're interested in developing effective moderation techniques, see the review of the new book, *Facilitating Online Learning*, at right.

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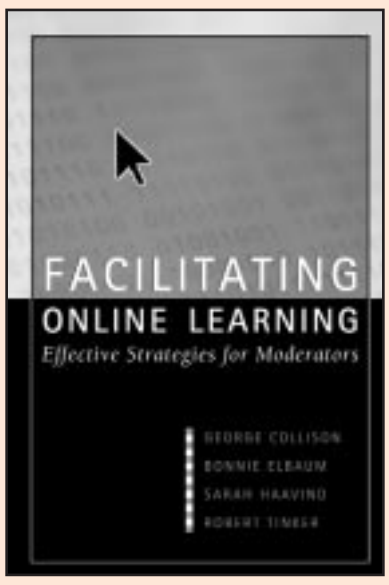

Facilitating Online Learning: Effective Strategies for Moderators

by George Collison, Bonnie Elbaum, Sarah Haavind, Bob Tinker

Atwood Publishing
http://www.atwoodpublishing.com

The Internet is transforming the educational landscape. Substantial skills are required to foster effective dialogues in any setting. The demands on the instructor are even greater when learners are at distant sites. *Facilitating Online Learning* distills the experience of a team at The Concord Consortium.

Members of this group have extensive experience with learning networks, dating to projects such as the landmark National Geographic Kids Network. They have continued to extend this expertise in current projects such as the International Netcourse Teacher Enhancement Coalition (INTEC), developed to support a network of teachers exploring inquiry-based science and mathematics teaching.

Facilitating Online Learning provides practical advice on ways in which netcourse instructors can move out of the middle and facilitate collaborative dialogs among online learners. It is a classic guide that should be on the bookshelf of anyone who is moderating an online course.

Glen L. Bull
Curry School of Education
University of Virginia

Facilitating Online Learning: Effective Strategies for Moderators is a readable and valuable contribution to the relatively new but tremendously hot area of netcourses and e-learning, providing welcome explanations, strategies, and real examples of moderating that can meet the needs of classroom teachers, university faculty, and professional development staff.

Experienced and novice online educators, looking either for new techniques to add to their inventory or for strategies to improve their overall teaching in online mode will find this book informative and useful.

Linda Harasim
Simon Fraser University
at Harbour Centre

Facilitating Online Learning is a successful example of removing the distance from "distance learning." An effective moderator of online courses must have a repertoire of disciplined strategies for interaction with students. This book is a roadmap for traveling from "wallowing in the shallows" to "reasoned discourse" with copious examples that assist. It is not a philosophical examination of strategies but a real "how to" in an area sorely lacking any guidelines.

Many years ago I "taught" an online course to thirty students across the country. I learned how deeply personal people are when they speak with their fingers rather than their voices. How I could have used the advice contained in this volume. I certainly will distribute it to those who are designing courses as well as those moderators with whom I am working.

So much of online learning is scanning of text or streaming of lectures with didactic instruction from the moderator. *Facilitating Online Learning* is a fresh breeze in a stale and humid environment. Bravo and thanks!

Inabeth Miller
Jason Foundation for Education

The inquiry-based approach of teaching and learning has been highly praised in the business and industries training, in teachers' education, and last but not least, in school science, mathematics and technology teaching. This book describes the new profile of successful facilitators leading virtual learning communities into guided inquiry.

The Concord Consortium staff—the authors of the book—have had a practical and very successful experience in revolutionizing the classical teaching approaches through the use of information technologies in all these domains.

By reading *Facilitating Online Learning*, you are invited to share their exciting stories and their important practical conclusions.

Goery Delacote
Exploratorium Museum

Ten Things You Need To Know
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different learning styles, are crucial.

We've found mixed results when adding a face-to-face component to an online professional development course. When we first started INTEC, many projects had reported that it was difficult to create effective online communities of teachers, particularly at the secondary level. So we hedged our bets and built in a face-to-face local study group. In retrospect we see that the site-based team sapped online discussion and adversely affected recruitment and motivation. We now know it's possible to build a strong online community without a face-to-face component. VHS teachers have reported this time and again. VHS has also had good results from including a limited face-to-face component to one of their professional development courses.

Create a community

A NetCourse experience is enriched when participants feel that they are part of a community of learners, who are in it together. By creating a community, participants are less likely to feel isolated in the online medium. Instead, they work within a support structure of individuals who are invested in the group's success. In addition to ice-breaking activities, designed to tap into the creativity and individuality of each participant, we provide a place online where participants are encouraged to "hang out," share personal stories or professional news. With this space for human interactions, bonds are formed. Without it, there are one or two inevitable outcomes: the social and personal creeps into content-rich discussions, diluting their educational potency, or teachers fail to fully interact and the discussion area becomes a series of one-way postings where participants simply hand in work.

Pity the lowly modem

When we first started teaching online professional development courses, the technology environment in schools was quite different. The most common access to the Internet by our participants was AOL via a modem. In VHS, we found schools with a single telephone modem connected to a network accessed by multiple computers delivered even poorer performance. Keeping these limitations in mind, INTEC included text-based pages in its user interface design. These may be faster to load, but graphics are important for demonstrating a concept or illustrating a point. Even so, it's important to recognize that page-loading time is an issue. Designing for the smallest page size, creating graphics that are compressed, using animated GIFs instead of QuickTime or MOV files help speed up the tedium of waiting for a page to appear. Today, as urban schools get wired, more bandwidth is becoming available. Rural America, however, is still often limited to less than telephone modem speeds.

Quality is the gold standard

It's hard to think of a more important issue for all NetCourses than quality. With the huge growth in online course offerings, an educator might not be able to separate the wheat from the chaff of online professional development. Quality control standards are essential. The National Content and Curriculum Standards that we use for VHS was developed by a group of university-level distance learning experts, state department of education curriculum experts, and VHS teachers, trainers, and administrators. It lists criteria for high quality online courses. It's important to set standards and constantly have them reviewed by knowledgeable experts. In INTEC, we did not adequately educate our advisory boards about the criteria for a good course. And we should have solicited more input from potential participants about what they needed. Adequate needs assessment is a companion to quality control. Make sure the course is a good match for what the participant needs. Find out if the potential participant has prior experience with online professional development. A great course is worthless if it addresses the wrong content.

Work anywhere, anytime

A successful professional development NetCourse must fit into participants' busy schedules. All our NetCourses are offered on a scheduled asynchronous basis—participants get online based on their own schedule, at daybreak with a cup of coffee or at 3 a.m. wearing their pajamas. Assignments have weekly due dates, and participants must post to the discussion area throughout each week, but within those guidelines there is freedom to work when it is most convenient. A scheduled asynchronous NetCourse allows teachers from around the world to work unhindered by geography, time zones, or local scheduling constraints.

Talk it out

All successful online professional development courses need a space for communication. The class discussions that take place in our NetCourses are at the core of learning. Threaded dialogues with comments, responses, and comments to responses are displayed in a chronological and logical order that's easy to follow. Unlike email listservs or synchronous chat, discussions are permanently recorded and available to all students in one central location. Because they're not time-bound and there is no need to "raise your hand" to speak, participants think about what they're going to say before saying it, which gives the course greater depth. Participants can reply to course content questions on readings, share feelings about the process and nature of their learning, and respond to their colleagues' inquiries.

The NetCourse instructor must establish posting requirements, otherwise participation is spotty; when participants find a discussion area continually devoid of discussion, there's little reason for them to come back. By establishing participation guidelines and encouraging participant-to-participant interaction, a NetCourse creates a community of learners who are invested in the course and in furthering not only their own learning but that of their classmates.

Too many online courses revert to the traditional "sage on the stage" model: publishing lectures and funneling knowledge in a one-way direction, from teacher to student. Learning is dependent on discussion between the participants about the content of the activities. The approach we developed is captured in the book *Facilitating Online Learning*, written by a group here at The Concord Consortium, and taught in our online professional development course Moving Out of the Middle. The goal of this approach is to facilitate dialogue between students rather than through the moderator.

Dynamic and thoughtful interactions don't happen automatically. A facilitator is needed to guide participants from the side and help them engage in meaningful discussion, which makes the connection between the course content and their own teaching practices. Without some kind of imposed order, a discussion area becomes chaotic and overwhelming—a space

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Beam Me Up, Scottie!

Handheld computers extend the range of wireless communication in schools

by Stephen Bannasch

Symbol has created rugged systems with integrated bar code scanners and 802.11 2-Mbps wireless Ethernet communication. It comes with a high-capacity rechargeable lithium-ion battery.

Small handheld computers are becoming both more powerful and less expensive. Consider this: the cheapest handheld models, currently priced at $150 to $600, are similar in computing power to a 1988 vintage Mac. (Of course that Mac didn't run for weeks on a couple of AAA batteries.) By combining much of the computing power of a desktop system with the portability of a graphing calculator, handhelds could become the first truly personal computer used by students both in and out of school.

Currently most systems are designed as personal and business organizers. The existing suite of applications needs to be adapted and new ones created in order to optimize these systems for student use. The best designs will also include low-power wireless networking to support ubiquitous communication and practical solutions for working with devices such as probes and cameras.

Currently I'm reviewing the communications and expansion capabilities of the PalmOS and Windows CE Pocket PC platforms, but within the next year I also expect a number of interesting handheld systems to appear based on GNU/Linux.

The PalmOS family of handheld computers as well as the more expensive Pocket PC systems running Microsoft CE v3.0 include several methods for communicating with external devices, other computers and over a network. No common standard has been adopted, so each device uses a slightly different method for this kind of communication. The implications for schools include capability, flexibility and price. Let's look at the choices.

All systems include a basic RS-232 serial port, and all but the most ancient Palms include wireless IR communications. Some of the handhelds can use USB to connect and synchronize data with a desktop computer; however, none of the systems allows connection of USB devices to the handheld. A few systems are capable of using a wireless Ethernet to communicate over a local area network. When selecting a system for use in a school, it is also important to remember that only the PalmOS family will work with MacOS computers.

The simplest wireless networking is based on IR communications. All the CE Pocket PCs include this. Starting with the Palm III, it was included on Palm systems. This allows applications or data to be easily beamed directly from one handheld to another handheld of the same type.

IR communication uses a narrow focused beam of modulated infrared light to transfer data. It is line-of-sight, which means it won't go around corners or through walls and the range extends to approximately one meter. IR communications is based on the IrDA networking protocols. These protocols allow both peer-to-peer communications as well as supporting TCP/IP encapsulated traffic. This means that with the correct hardware and software, such as the Clarinet EthIR LAN, a Palm or Pocket PC can use an IR network connection to send and receive email and browse the Web.

The Palm VII series introduced CDPD wireless WAN capability. This supports wide-area wireless LAN communication in most metropolitan areas of the U.S., using a small portion of the analog cellular phone system allocated to digital packet data. Nominal bandwidth is 19,200 bps but practical speed is about 4800 bps. This is one sixth the rate of a 28,800 bps modem. While this may seem quite slow, it compares well to the capability of an alphanumeric two-way pager. In addition, services like AvantGo will cut out the extraneous content of web sites and make them available without all the graphics. Unfortunately for school use, the monthly service cost is fifty dollars for unlimited usage.

A similar wireless WAN capability is available for the Compaq iPaq Pocket PC by using a Sierra Wireless AirCard 300. This is a PC card CDPD modem and can be combined with a service from Aether Systems to provide portable email and Web access.

Casio's Cassiopeia handheld is not wireless yet, but they have a compact flash expansion slot normally used for memory expansion that they say by sometime this fall could be used for wireless Ethernet expansion.

Palm has licensed the PalmOS and underlying hardware designs to a number of other manufacturers who have extended the platform in interesting ways. Handspring makes the PalmOS Visor system with the Springboard expansion interface slot. This is an expansion slot on the back of the system into which many different modules can be attached. The interface is electrically quite similar to that of a PC card slot on a laptop and as such is a much more powerful interface than a serial port. Springboard modules not only include hardware expansion but also have the programs for accessing the hardware built into the module. Handspring has extended the PalmOS so that when a Springboard module is inserted, the software associated with it is automatically run. Additionally, the Handspring includes a high-speed USB slave interface for communication. This replaces the serial port on the Palm and allows much faster communication with newer computers that have standard USB ports.

Xircom has announced that a series of networking products called SpringPorts will be available this fall for the Visor. These include two different wireless RF LAN technologies. One is the new high-speed 11 Mbps version of wireless

Ethernet called 802.11b (802.11 is the older 2 Mbps standard). The second is based on the new emerging Bluetooth short range, very low power wireless RF networking technology. The 802.11 wireless Ethernet is well established and is a mature technology. It has a 2 Mbps nominal bandwidth and usually a 50-meter range from a wireless hub. These systems are designed to use much less power than wireless Ethernet and also communicate over shorter ranges. Bluetooth devices are just starting to appear on the market.

Symbol has also licensed PalmOS, the Visor system from Handspring, and Windows CE from Microsoft. Around these hardware and software platforms they have created rugged systems with integrated bar code scanners and 802.11 2-Mbps wireless Ethernet communication. In order to support the increased power consumption of these accessories, the Symbol comes with a high-capacity rechargeable lithium-ion battery.

All members of the Palm family of handheld computers come with an RS-232 serial port. This is the default port that connects to the Palm cradle and is used for downloading applications and synching data with a larger computer. The serial port can also be used to communicate with external serial interface devices such as GPS systems and probeware.

True RS-232 communication specifies that data is transmitted using a ±9-12 volt signal. To minimize power consumption the Palm devices transmit using only a 0-5 volt range. Without handshaking the Palm devices support communication speeds of 2400 bps. However, if the RTS and CTS hand-shaking signals are used, 115,200 bps is possible.

If you plan on building or adapting devices to connect to the Palm serial port it is best to buy the HotSync cable for the model of Palm you have. This is a cable that connects to the Palm and terminates in a standard female DB-9 connector for a PC serial port. This should be adaptable to any device with a serial interface. Palm also supplies a Mac adaptor for this cable that terminates in a mini-DIN-8 adaptor.

The Palm allows wireless networking between devices.

A more powerful handheld system than the Palm family is one based on the latest version 3.0 release of Windows CE from Microsoft. Typically these systems have four times the memory and much faster processors than the Palm family. The latest Pocket PC models range in price from $500-600.

CE systems come in many different form factors, of which three are useful in schools. The Pocket PC is basically a pumped-up Palm. It is a handheld with a small vertically oriented screen without a keyboard. Additionally, there is a handheld clamshell form. This includes a horizontally oriented screen as well as a very small keyboard. Lastly, there is a CE family, similar to a small laptop, that includes a full-sized keyboard and a 640x480 pixel screen.

The Casio E-115, the Compaq iPaq H-3600 and the HP Jornada 548 are Pocket PC systems. All three systems come with serial ports and IrDA networking built in.

The Casio supports a compact flash expansion slot, as well as IR and serial port networking, and a 16-bit color screen. Compact Flash (CF) is an expansion interface analogous to a PC card interface but smaller. It can be used to expand the memory of a system. IBM even has a tiny 300 MB hard drive, which can be attached. Casio expects to have CF wireless Ethernet cards available some time later this year.

The HP Jornada is similar to the Casio and comes with a CF expansion port. However, they have not announced wireless Ethernet capability yet.

The Compaq iPaq comes with neither a CF nor a PC expansion slot. But you can purchase an expansion "jacket" that slips over the body to add either expansion port. Compaq makes the WL100 and 802.11b 11 Mbps wireless Ethernet PC card that works with the PC card jacket.

Ubiquitous low-power wireless networking will make all these systems much more interesting for use by students; however, the educational market is not large enough to drive the technological advance by itself. Wireless Ethernet systems are practical but moderately expensive and power hungry. Wireless systems based on Bluetooth technology appearing this year should be cheaper, smaller, and use less power. The business and home market should be large enough within the next two years to enable successful adaptation for education uses.

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JASON Academy

New Online Courses for Teachers Suport Science Education

After Dr. Robert Ballard discovered the RMS Titanic sitting on the bottom of the ocean, the explorer and oceanographer received thousands of letters from students wanting to join the next expedition. In response, he founded the JASON Project, a science, geography and environmental education program, supported by the JASON Foundation for Education. The project has been praised as a leader in distance learning for students and teachers alike.

In September 2001, the JASON Foundation will start a new venture, the JASON Academy, which will provide online professional development courses for teachers of science. The Concord Consortium is helping the JASON Academy create probe-based activities for those courses, which will be for middle-grade science teachers. Online courses in earth systems, marine science, and energy will include activities related to the use of temperature, light, and voltage SmartProbes™ .

For more information, contact Stephen Bannasch.
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The Future of Handheld Computers in Education

A conversation with Palm, Inc.

Through her research at The Concord Consortium, Carolyn Staudt has become excited about the educational uses of handheld computers. She spoke with Mike Lorion, Vice President for Education at Palm, Inc., about the future of handhelds in the classroom and some of the challenges ahead.

Handhelds are being used by K-12 students to do scientific experiments inside the classroom and in the field.

Carolyn Staudt Mike, as you and I know, new handheld technologies are finding a place in education. I've been doing research on using handhelds in grade schools and middle schools for several years, and the results are exciting. Coupled with inexpensive networks, handheld computers are enabling students to carry their own personal tools of inquiry everywhere—class, school, home. Kids can use them in the classroom or take them out in the field! Since they're equipped with a drawing program and a facility for taking notes, they're able to link together the student's own thoughts and questions. Handhelds provide an integrated system of inquiry.

Mike Lorion I think the technology goals of the country, so to speak, map very well to what we're doing. There are some pieces of research that say that students and faculty are taking to individual-type devices—whether that be single-use devices like cell phones, or graphing calculators. The content is in a form now where it can be easily accessible because it has been brought to this network base infrastructure. And the infrastructure to deliver it to the students is there based on what's happening with the wiring of the classrooms and the e-rate.

Now, if we could finally get to the point where in classrooms students could show the same affection to learning as they do to games. Students have already gone to handhelds for that stuff. Six million Game Boys sold in this country last year, six million. If we think our screen is small, we have a 3x advantage.

The trouble I saw in the ten years that I was doing technology schools at Apple was that you still have to get past the booting and you still have to get past the problems. Versus, I press the button, it comes on, I do things.

CS With PCs there are too many steps in order to get connected to their stored materials. Handhelds provide a personal tool that enables students to have an immediate reservoir for their experiences. With a simple push of a button and a tap of the screen, students record their thoughts or enter the results of a survey. Simple snap-on devices allow the students to record photographs, GPS locations, or even temperature and heart rates anytime, anyplace. With infrared or wireless capabilities, these tools can become their link between other student researchers and experts on the Web.

ML Right. The other part of it, though, is how do we make teachers feel comfortable enough with the technology so they truly use it all the time?

CS First, you have to change the role of the teacher in the classroom. When you empower students with their own personal collection, research, and collaboration tools, their educational experience expands beyond the teacher-centered classroom. The role of the teacher shifts to one that is more meaningful. Teachers become true mentors that help students learn through their own experiences and ask their own questions. You encourage them to think. Foremost in all of the curriculum standards that exist in our country is the promotion of inquiry.

One way to support this new role for teachers is to provide them with handhelds. Give the teachers themselves the tool that will change the focus of their classrooms. But there is something more important. That is introducing teachers to teaching strategies—ones that use handheld applications—that match their existing course objectives and curriculum. These strategies are alternatives to lectures. They allow teachers to encourage the collection and research of individual student artifacts that can be shared with classmates.

You can easily put a handheld in the hands of six or seven students for the price of one desktop computer. My dream is to put handhelds in the hands of all kids so they can connect to the Web anytime. I want to see collaboration with students from around the world. As a former teacher, I guarantee that the added value of personal exploration and exposure to more diverse environments will provide a more meaningful educational experience for teachers and students.

ML Guaranteed. Traditionally, the way the desktop applications have been used is a student really has to get on there and do something for twenty minutes. Now you've taken a third of the class time. We think, though, with our package of technology—just the mobility aspect alone—we think we can do a lot for learning around that.

CS I was at a presentation where someone complained that every student was required to get a TI calculator and now they're going to have to buy a Palm. They saw it as an add-on, when it actually could replace that calculator. And it's better because of the note taking capability and all the beaming that can happen with it.

ML You can do the same thing with a Palm as with a graphing calculator, but what I can't do with a graphing calculator is get an image that's really defined by the size of the screen. I can also do animations, so if I was doing a mathematical problem, I could check sine waves and frequency. I can actually do a simulation of this based on the animation tools that we've put in. Then you can take the data and instead of looking at it in the form of a graph you can look at it as a table as well.

CS Often students have to collect data in a traditional laboratory or classroom activity. The lesson centers around the collection of the data and not the analysis of that data. By using the handheld computer, the students can do so much more. They can explain directly on the device what they see, display and manipulate the data in different ways, while still recording their thoughts and predictions. They can instantly perform another activity to prove their assumptions. This opens the door to true problem solving. Just imagine that these questions can now be asked wherever the students are…in the grocery store, in the car, at a family reunion, at a sports event, wherever. The students are asking "What if" questions and instantly acting on them.

Many teachers are afraid of allowing a handheld computer into a classroom test. I remember when the American Chemical Society made students memorize the periodic table on their year-end standardized tests. That no longer happens. What's more important—understanding the trends that exist on a periodic table or memorizing the atomic numbers and weights? No, a handheld won't be allowed into an AP test as of right now. But if you teach kids how to think about challenging questions, not just memorize answers, it doesn't matter how much information you have stored on a handheld.

ML Let's look inside a kid's backpack. Kids carry around a year's worth of curriculum in their backpack in the form of bound paper. They've got a number of different other tools that they use. It's a huge communica-

tions vehicle. When you think of the permission slips and the notes to parents and all these things that go back and forth, it's pretty much how the school communicates to parents outside of the twice-a-year parent-teacher conference.

Now, when you look at the digital landscape, at all the things that are happening, the handheld computer is communication, but it's also infotainment, edutainment, whatever you might want to call it. It should handle lots of these functions to the degree that people really need them. Obviously they're not going to be the ultimate video camera, but you can use it as a video camera. You can plug in a camera and do an okay version of a digital camera. There are a lot of things that you can do around this technology.

On the content side there are a ton of things going on as far as what's available.

CS Many of the applications that already exist on handhelds provide lots of organizational capabilities—spreadsheets, databases, alternative displays for data. On top of this, the portable and beamable ability of the handhelds allow students to capture information in context and share it with others. Educational software is being developed that allows students to record their own personal ecological footprints, breed their own species of fish in a simulated pond—and even beam fish to or from another student's pond! They can calculate statistical results from an on-the-spot poll. And that's just for starters. I don't think people know these things exist.

ML From a networking standpoint, what we've been able to do with HotSync server really gives the ability for the handheld to fit very nicely in the networked architecture of a school. You have the ability to communicate with email servers, administrative applications, and databases that include student records, but also to content.

Now here, I think, is the *big idea*. Let's assume that first of all we've got this server. And on this server we have to make sure there's every student and their "locker." Outside of files being stored and those kinds of things for each one of the students, what's the other most important information that they have? It's what they have to do. Every student has a calendar that deals with multiple courses, multiple teachers, and multiple activities. I want a way that

Microsoft talks a lot about "anywhere, anytime" kind of networking. What the handheld brings is the anyone.

students, when they go to a web interface, can say here are the four classes that I'm taking, here is my extramural activity, here's my sports activity, here's my personal stuff, now give me an integrated calendar.

CS That is exactly what one of the schools I work with is doing. Parents can come to the school's web site at any time and see what their kids are doing every single day in class.

ML If I'm a parent with several kids, I can go to my Palm and find out when my kids' homework is due, what permission slips have to be signed. This is what will revolutionize communication between teacher and student and parent. It can really make that triangle get much better.

Microsoft talks a lot about "anything, anywhere" kind of networking. What the handheld brings is the "anyone."

So what are we doing in the future? Obviously, better color, expandability. We'll have little postage stamp cards you'll be able to plug in, because for some functions like the encyclopedia and dictionary, you want to have it all there and you want it to be very quick. I don't want to get it from the Web.

CS So how do you respond to the equity issue? What are you going to do about kids whose parents can't afford the devices?

ML Rather than us discounting every one of our products by ten percent, I'd rather grant the schools extra units with their purchase in order to meet the needs of the students who can't afford them.

CS In one of our projects, parents who want to buy a Palm can buy it outright. If they want to rent it, the rent is low. But if that's impossible, the child can use an institutional Palm from a classroom set. They're not going to restrict any child from having one.

ML If you look at some of the studies we've done around the usage of handhelds overall, and we've been doing this for a while, one of the things that's pretty apparent is that people tend to use handhelds somewhere between ten to fifteen times a day but for two to three minutes per usage.

CS Because they're using them as organizers.

ML But I think based on that kind of usage pattern it's much easier to adapt to the existing curriculum. You don't have to figure out how to get students to sit down for twenty minutes in order to incorporate it into the curriculum.

CS With data logging and the note taking and drawing, kids do twenty minutes plus. It's hard to get them in and out in a 45-minute period. In fact, you want them to continue even outside of class, in their world.

ML But it's focused on a lot of the existing curriculum, right?

CS Right.

ML In partnership with Scholastic we gave five kids Palms VIIs with keyboards and sent them to the Republican and Democratic conventions as reporters. They could upload their stories to Scholastic for publication on the Web.

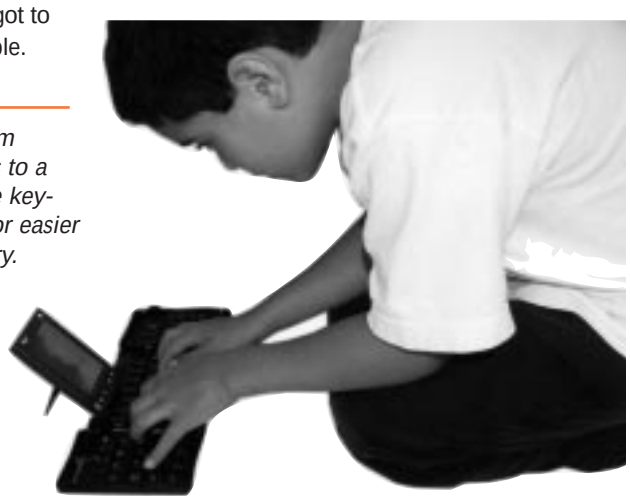
CS See, that's what I call collaboration. The mobility and the beaming are by far the most powerful reason why I want to put them in kids' hands.

ML Of course you're not going to sit down and write your whole report on the Palm, but it complements all the other multimedia tools.

CS Concerning writing on the Palm, second graders in one of my research classes felt a lot better working on the Palm to write. I was having them just use the memo pad, but they were all using the on-screen keyboard without the stylus. They were using their two thumbs, like a Game Boy. According to the teacher, the writing capability in that class improved from the year before.

ML What do you think with lower-grade kids is the number one problem as far as using Palms in the classroom?

CS Durability. When you take those kids out to the playground and they accidentally drop one, they're devastated. For younger kids it's got to be durable.



The Palm attaches to a portable keyboard for easier text entry.

ML The number one thing we get complaints about is the size of the screen.

CS I was told it was not the under-size screen but the keyboard—kids' motor abilities would not allow them to use it. But then I went to a second grade classroom and the kids had absolutely no problems with the size of the screen. Now, whether it's color or not does make a difference to them.

I'm going to jump back, because I remembered another problem with the handhelds in classrooms is batteries. Anything you put in the hands of students has to be rechargeable because teachers or parents cannot keep up with the batteries. And it becomes an equity problem again because it's expensive.

ML We're moving to all rechargeable.

CS That's great. But to wrap up, let's just say that the most important challenge to using handhelds in the classroom is to develop meaningful strategies. Teachers, students and parents need to be reassured that the software that goes onto to the handheld makes kids think and helps them learn.

For more information about the use of handheld computers and probes in education, visit: our web site probesight.concord.org or contact Carolyn Staudt at The Concord Consortium. carolyn@concord.org

Telecommunications Project for Math Education Funded

Online video case studies provide interactive professional development

The U.S. Department of Education has announced the funding of an innovative telelcommunications project that uses the Internet to deliver online professional development in the use of standards-based mathematics approaches to grades four and five math teachers.

The greatest challenge generated by the new mathematics standards is that effective implementation requires teachers to make fundamental changes in teaching practice, acquire a deeper understanding of content, and become familiar with technology. It is likely that much of the current backlash against the standards is fueled by examples of poor implementation by unprepared teachers. If the nation is to benefit from the increased student mathematics learning promised by the new standards, and for the standards to function as intended, an intensive teacher professional development effort is urgently needed.

In response to this need, The Concord Consortium is leading and coordinating the Seeing Math Telecommunications Project on behalf of a consortium of private and public partners who have extensive experience in telecommunications and mathematics education. Partners include COMAP, a mathematics education group in Lexington, Mass., and TeachScape in New York, who provides online teacher professional development.

The project will develop six highly interactive online digital video case studies, which will be made available free to teachers. Video case studies, when properly supported, are far more effective in improving teaching techniques than abstract discussions or readings on how to teach. A video shows an entire environment and explains how to respond to typical student issues. Online video case studies can be made highly interactive by linking them to lesson plans, student work, relevant standards and assessments, background content, expert commentary, teacher reflection, and moderated online discussion groups.

Busy teachers need ways of upgrading their teaching strategies that are available anytime, anywhere. Because the Internet is increasingly able to handle video on demand, online case studies and courses provide a cost-effective way of providing alternatives.

For more information about the Seeing Math Telecommunications Project, contact Alvaro Galvis. alvaro@concord.org

Things You Need To Know
continued from page 5

where few have the energy or motivation to participate.

8 *Learn it together*

A new creativity is often generated from NetCourse participants collaborating in team activities that emphasize making decisions, defining teammates' roles, and creating a final product together. Sample group activities include participants working in pairs to review each other's work, small group discussions, solving a mystery based on instructor clues, writing a report together, or creating a web page or PowerPoint presentation as a team. Like the mix of offline and online activities, a successful online course must include both independent work and teamwork. While independent study alone is a viable option for education in certain circumstances, a course is a course precisely because of the collaboration between learners involved.

9 *Tell me how I'm doing*

Assessment in our professional development courses is based on participation and completion of assignments. Because participants can feel estranged in an online course, providing timely evaluations of work is critical. Weekly or bi-weekly evaluations are essential. Private discussion threads provide further opportunities for discussing evaluations. Peer feedback and self-assessment are both hallmarks of a good NetCourse.

Each type of software used to deliver a course online has its own unique system for evaluation and assessment. Make sure the one you choose provides the assessment needs you require. Software that allows all work to be collected and stored in a centralized, searchable database is handy because it allows the instructor and participant to access a permanent record of work in one location. The instructor can easily sort and search to find problem areas, samples of best work, and powerful evidence of how a student's thinking has changed and progressed over time.

10 *Build it to scale*

One of our objectives has been to deliver professional development courses at a rate less than that of a traditional face-to-face program. A key to doing this is scalability—growing without creating everything from scratch each time. One of the ways we have done this is by using moderators for the online discussion. The pyramid structure we've used, with expert moderators providing support to groups of cohort moderators, works and is less expensive than using course experts to moderate. Moderators are not experts in the field, but facilitators trained in course moderation. Our experience with online professional development courses, such as Moving Out of the Middle, proves moderators can be trained to support an online course. Using trained moderators allows us to build a support structure without adding to operational costs.

Theoretically, it would seem possible to amortize course costs over time by continuing to offer the same course repeatedly, but realistically, any online professional development course worth its salt is evaluating feedback and making changes on a regular basis. So developing creative ways to scale while at the same time keeping costs down is important.

What's Next?

Here at The Concord Consortium we're working with the Jason Foundation for Education to create probe-based activities for professional development courses for middle grade science teachers. At the Curry School at the University of Virginia and Peabody College at Vanderbilt University, we are providing faculty development netseminars. Our newest project, the Seeing Math Telecommunications Project, will deliver teacher professional development using video case studies.

Only four years ago these kinds online courses were virtually unheard of. Today they're an essential part of professional development education.

Cynthia McIntyre and Bonnie Elbaum are co-facilitators for the Netcourse Instructional Methodologies course.
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WWW resources in this issue

The Concord Consortium
www.concord.org
info@concord.org

Ten Things You Need to Know: Advice for Creating Quality Online Professional Development
by Cynthia McIntyre and Bonnie Elbaum

International Netcourse Teacher Enhancement Coalition
intec.concord.org

Virtual High School™
vhs.concord.org

Curry School at University of Virginia
curry.edschool.virginia.edu

Preparing Tomorrow's Teachers to Use Technology
www.pt3.org

Peabody College at Vanderbilt University
peabody.vanderbilt.edu / peabody

Horizon Research, Inc.
www.horizon-research.com

COMAP
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TeachScape
www.teachscape.com / about.html

The Jason Foundation
www.jason.org

Jason Academy: New Online Courses for Teachers Support Science Education

The Jason Foundation
www.jason.org

Why Don't Fact-to-Face Teaching Strategies Work in the Virtual Classroom? How to Avoid the "Question Mill"
by Sarah Haavind

Books by Concord Consortium
www.concord.org / books

Facilitating Online Learning, published by Atwood
www.atwoodpublishing.com

Moving Out of the Middle
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Facilitating Online Learning: Effective Strategies for Moderation

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The Future of Handhelds in Education: A Conversation with Palm, Inc.

Palm, Inc
www.palm.com

ProbeSight: Handhelds and Sensors
probesight.concord.org

Telecommunication Project for Science Education Funded

COMAP
www.comap.com

TeachScape
www.teachscape.com / about.html

***Beam Me Up, Scottie!* Handheld Computers Extend the Range of Wireless Communication in Schools**
by Stephen Bannasch

Bluetooth
www.bluetooth.com

Casio
www.casio.com

Clarinet IrDA Ethernet bridge
www.clarinetsys.com / Product_Overview.html

Compaq
www.compaq.com

Handspring
www.handspring.com

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Palm Hardware Development
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PalmOS Hardware Comparison Matrix:
www.palmos.com / dev / tech / hardware / compare.html

Palm Hardware Page—Unoffical
www.massena.com / darrin / pilot / luiz / hardware.htm

Pocket PC Home Page
www.microsoft.com / mobile / pocketpc / default.asp

ProbeSight: Handhelds and Sensors
probesight.concord.org

Sierra Wireless
www.sierrawireless.com

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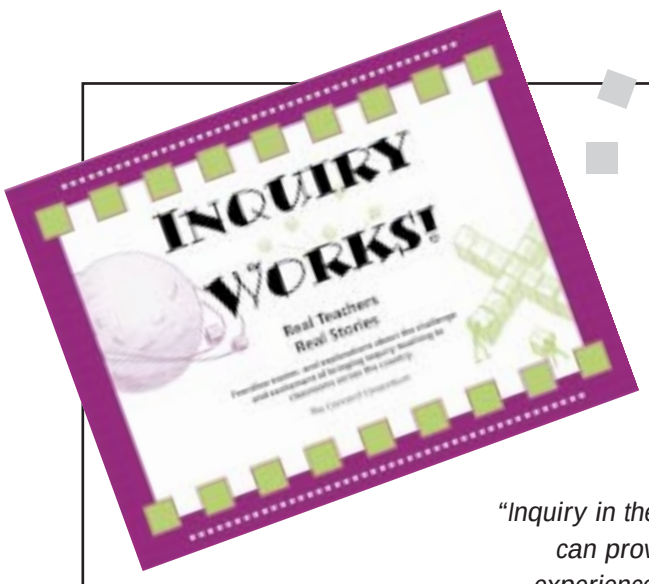

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