Passport to Knowledge
Year Two Evaluation Report
August 1996 through July 1997
Live from Mars and Live from Antarctica 2

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Executive Summary

Passport to Knowledge is an innovative educational program that focuses on middle school science learning by combining video broadcast events with extensive print and on-line resources as well as interactive applications of the Internet. The project is funded by the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA). Each year, the project offers teachers at least two different multiple media "field trips" that range in length from several weeks to some that span the entire school year and beyond. Annually thousands of teachers use at least some of Passport to Knowledge's components.

As part of a three year National Science Foundation grant under the Instructional Materials Development program, Passport to Knowledge has contracted with the Center for Children and Technology of the Education Development Center to evaluate the project. This report presents the findings gathered during the second year of the three years.

The purpose of the evaluation is both formative and summative: it describes who is using the program, how they are using it, and what is the project's impact on teaching and learning. The evaluation involves developing and implementing a comprehensive array of documentation and evaluation strategies to provide critical feedback to the Passport to Knowledge staff as their curriculum development work evolves. At the same time, we are providing information and analysis to help the staff, the project funders, and the participants assess the project's impact on student learning and teacher professional development.

This past year Passport to Knowledge produced *Live from Antarctica 2* and *Live from Mars*. The research with teachers this past year reveals the following key points:

- *Passport to Knowledge reaches an extremely broad and diverse audience*. Teacher participants are spread across all grades, but middle school teachers are the most active users, (29% for LFA2, 53% for LFM). LFA2 was more popular with elementary teachers. Middle and high school teachers using the materials are typically science teachers and use the materials with four classes, on average. Module participants consistently include a significant number of adults who are not classroom teachers, and who may not even be working with young people (as much as 60% of the respondents to some surveys).

- *Educators' responses to Passport to Knowledge (PtK) were uniformly positive*. The Passport to Knowledge materials were viewed by participants as being made "by teachers for teachers" -- that they were informative and well-designed to support real classroom practice. Although teachers found all components of each module useful, they indicated that the online resources were the most valuable to them and the ones they would most like to see expanded upon in the future. Teachers particularly

valued the depth of background information provided on relevant topics through module elements such as the “background information” area on the LFM web site, and the scientist biographies for LFA2.

- *The on-line resources continued to grow in importance.* This reflects the fact that more teachers are finding it easier to get on-line then ever before. The web site has become a major avenue for attracting teachers into full project participation. It is the place where teachers get information about the video broadcast schedules and where many (the majority) now obtain the teachers guide. Teachers particularly valued the depth of background information provided on relevant topics through module elements such as the "background information" area on the LFM web site and the scientist biographies for LFA2.

- *Teachers in widely varying classrooms are using Passport to Knowledge materials in hundreds of different ways*. No two classrooms using this material look exactly alike. Passport to Knowledge is successfully supporting activities ranging from grade school students tracking the course of the Pathfinder via the LFM web site, to homeschoolers participating in the PET project with students from across the country, to adult learners in literacy programs communicating with scientists. Within the context of particular educators’ participation, the materials also prove to be flexible. Teachers report that they plan to re-use their Mars or Antarctica material, and many teachers report using the materials with a range of grade levels and across disciplines.

- *While Passport to Knowledge is not meant to be a comprehensive curriculum for middle school science, teachers are able to successfully integrate it with their existing science curriculum.* The vast majority of teachers using either module report that it aligns well with their existing curriculum and their teaching objectives.

- *Over half (53%) of the of participants in LFM, and 66% of LFA2 participants, had never used telecommunications before*. This clearly indicates that a major audience for Passport to Knowledge is teachers who are looking for a meaningful online activity to introduce them and their students to using multiple electronic media as an integral part of their classroom. Passport to Knowledge is serving as a comprehensive, successful technology-integration experience for teachers in schools that are just beginning to get connected to the Internet.

- *Recruiting and investing in a core group of teacher-advocates who were at the forefront of a range of Passport to Knowledge activities proved to be a highly successful decision*. These teacher-advocates have contributed significantly to Passport to Knowledge, most importantly by supporting other participating teachers

with day-to-day advice, suggestions, and collaborative partnerships via a highly active listserv. The advocate experience was beneficial for the program and for other participating teachers, but also for the advocates themselves: Advocates reported that their experience with Passport to Knowledge improved the quality of their own teaching; their mastery of the scientific content; and the quality of their relationships with other teachers and with their own administrators. The Advocates have become a close-knit group, and have established themselves as teacher-leaders in the use of educational technology in their local districts.

- *For some teachers, participation in Passport to Knowledge focused less on student learning and more on their own professional development*. For example, 38% of classroom teachers participating in LFM reported that they were not using LFM with students, but instead were focusing on building their own content knowledge, learning new teaching techniques, interacting with other teachers, and learning to use the online components of the program. Similarly, in relation to LFA2, many teachers reported that they were more likely to be using each component of the module for professional development than for student activities. In both cases, teachers were doing this as a dry run in preparation for using with students in the next academic year. Another group, usually building or district level curriculum leaders or technology coordinators were using the module to evaluate Passport to Knowledge's usefulness for widespread adoption and to prepare themselves to serve as a local resource when adoption occurred.

- *Passport to Knowledge modules continue to attract and hold onto experienced teachers and those who have received acknowledgement as some of this country's best science teachers.* In addition to attracting those new to telecommunications and educational technology integration in science instruction, some of Passport to Knowledge's most ardent and vocal supporters are leading science educators or state or national award winners who have voluntarily self-selected these materials. These are educators who are at the forefront of science reform, who have actively participated in creating science frameworks and benchmarks, and who are collectively among the most knowledgeable users of science curricula and materials.

- *Teachers reported that the Passport to Knowledge materials had a positive impact on affective variables for students.* Teachers uniformly reported that the Passport to Knowledge videos increased their students' excitement about the module topics, their motivation for learning about science and their curiosity about science careers. They also reported that the videos, websites and print materials were valuable instructional resources that were appropriately geared to their students, and were interesting and relevant to them.

- *Passport to Knowledge materials effectively support teachers in moving toward standards-based science teaching.* Key Passport to Knowledge activities such as the Planet Exploration Toolkit activity, the topographic and geographic activities, and the rocket and payload design activity, were uniformly perceived as succeeding in placing students in the role of investigators, contributing to authentic scientific practice and increasing student knowledge in the relevant content domains. Work produced by students exhibits the learning outcomes associated with science standards and benchmarks.

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· *The key barriers that prevented some teachers from fully participating in Passport to Knowledge are the quality of in-school access to the Internet and broadcast television and the rigidity of pre-existing and/or required science curriculum.* However, the flexibility of the Passport to Knowledge materials maximized the number of teachers who could pursue their own and their students interest in these modules despite being constrained by these variables.

· *Teachers clearly indicate that the modules have shelf-life beyond the duration of the live events.* Teachers report using the videos during the live broadcast and on tape over a period of may weeks following the original broadcast. Over 75% of them indicate that they are saving the tapes for repeat use in future years. Teachers also report using the overview video included in the full kits as a means to introduce the module to their students.

· *Those classrooms that actively participate in Passport to Knowledge activities have students producing work that clearly demonstrates appropriate science benchmarks.* This work is produced in classroom discourse, queries to experts, writing assignments, and projects as well as diverse formats ranging from poetry to drawings and models to multimedia presentations.

Foreword

This evaluation report covers the second year of Passport to Knowledge's three year grant from the National Science Foundation for Instructional Material Development. As part of this grant, the Center for Children and Technology at the Education Development Center is conducting an assessment of the challenges faced by Passport to Knowledge and its achievements in meeting those challenges. The work will culminate in a final summative report due in Year Three. However, as shown in this interim progress report, there is already clear evidence of the project's impact on teachers and learners in a wide variety of situations.

Before presenting the details of the evaluation, it is important to set Passport to Knowledge's work in a larger context. As this report will document, Passport to Knowledge is attempting to transform significant aspects of science education for middle school students. It is doing this by developing innovative instructional materials and experiences for students and placing them within a multiple medium communications infrastructure that leverages the respective power of television, video, and the Internet as educational tools.

At the same time, it is using this infrastructure to foster an engaged professional community that centers on teachers but also includes scientists, engineers, parents and other community members. This ambitious undertaking puts Passport to Knowledge squarely in the middle of the intersection of two major forces that are working to reshape American education. One force is the exponential increase in the purchase of technology in general, and computer-based telecommunications technology in particular, for use in education. The second force affecting education today is the widespread public interest in school improvement, the pressure for accountability and results, and the active debate in our society on how best to achieve substantial reform of our schools. These two forces need to be examined in more detail.

The United States, and in fact most countries around the world, are in the midst of a major investment to increase the use of technology in K-12 education. Whether one measures it in terms of financial commitment, or the re-alignment of human resources and energies within schools, or by the heightened public expectations around what technology will do for our children, the scale of this investment is enormous. During the 1996-1997 school year, the period covered by this report, there was significant acceleration in the number of teachers and students gaining access to the Internet.

When Passport to Knowledge began working on its NSF IMD grant in 1995, the National Center for Educational Statistics surveyed schools for the first time to find that

35% of public schools (mostly secondary) had some form of Internet access[1]. In the short time from that survey to their latest data from the fall of 1996, access has grown to 64% of public schools reporting Internet access. The percentage of elementary and middle schools in comparison to secondary schools with access has increased, as has the level of access within classrooms within those schools (from only 3% to over 14% of classrooms)[2]. The gains have continued unabated since that survey and perhaps even accelerated in the past year. And this change in schools only mirrors the changes in connectivity taking place in the larger society in which schools are situated: business, community agencies, and homes are also connecting at a rapid rate.

Recent reports demonstrate this penetration. QED's 1997 report on technology penetration in U.S. public schools for 1995-96 (using sampling techniques that are somewhat inadequate given the rapid rate of investment in many states), estimates that 98% of schools have access to computers (with an average student to computer ratio of 10 to 1), 97% have VCRs and 76% have cable TV access. Over 85% of the schools have access to computers with multimedia capabilities and 54% have CD-ROM drives. Satellite penetration has grown to just under 20% of our schools[3].

Spending on educational technology infrastructure increased at the local, state and federal level. This year marked the beginning of the President's Technology Literacy Challenge program, which provides states with significant funds to direct to local education authorities for planning and implementing technology. This builds upon other sources of systemic funding being used to apply technology within education, such as the Goals 2000 block grants and Title One funds, as well as the significant funding allocations made by many state legislatures this year that explicitly target technology expenditures for schools.

1996 also saw the creation of the Universal Service Program as part of the Telecommunications Reform Act. This program, through its "E-rate" discounts for schools, is already having a profound effect in spurring planning and investments, even though its funds will not be available until 1998 at the earliest.

While there are growing concerns that all this rapid investment and desire for quick fixes might precede, or even hinder, the necessary planning required to ensure its optimal impact, all indications seem to point out that we are only near the bottom of a parabolic curve. The trends toward growing technology investment and the demands for a return on these investments that tail immediately behind them will continue to accelerate.

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[1] National Center for Educational Statistics, Advanced Telecommunications in U.S. Public Elementary and Secondary Schools, May 1995

[2] National Center for Educational Statistics, Advanced Telecommunications in U.S. Public Elementary and Secondary Schools – Fall 1996, Feb 1997

[3] "Technology in Public Schools, 15th Edition", Denver, CO., Quality Education Data, 1997 or **Error! Reference source not found.**

Coupled with this push for technology infusion is the national discourse on school improvement. This manifests itself in the work done on curriculum standards at local and state levels which in turn has benefited from the national work done by professional organizations such as the American Association for the Advancement of Science's Project 2061 Benchmarks for Science Literacy and the National Research Council's National Science Education Standards. This work has evolved from building a consensus on what students should know and be able to do at various levels to specific state and local descriptors that can be used for as the basis for curriculum and teaching decisions and for student assessment of progress. Forty-nine out of the fifty states have some sort of standards in place or under development.

Technology is often cast as a potential means, sometimes as even a necessary component, of successful educational reform. As stated in a recent monograph reporting TERC's work on the Model Schools Partnership:

> "Familiarity with the use of technology represents a necessity for our schools today; but it also represents an opportunity for educators to open new vistas for student learning. The technology that is now becoming available inexpensively – and will soon be ubiquitous – provides unparalleled opportunity to update our model of education. These technologies provide powerful tools that will enable us to expand learning opportunities for students and to support teachers in learning and adopting new professional skills."[4]

Even materials that focus exclusively on connecting schools to local and wide area networks give credence to the role this technology can play in school change. The potential of networking for schools and districts has been depicted in many places. For instance, in NCSA's report on their NSF NIE work, the authors state:

> "Once districts and building networks connect to the Internet, the opportunities grow even larger. Students can share their work with others around the world, providing them access to diverse cultures and perspectives that they would not encounter in everyday experiences. Information is available on the world Wide Web that can provide students access to materials such as scientific journals and up-to-date research data that can take years for textbooks to offer. The Web can also provide access to mentors and experts that would not normally be accessible to children."[5]

There are some voices of caution among the general noise and enthusiasm surrounding this technological magic bullet. Many observers note that technology, by itself, will do little to change or impact education. It is only when the technology is applied within the framework of specific teaching and learning at the district, school, and

[4] Fulton, K in Technology Infusion and School Change: Perspectives and Practices. Model Schools Partnership, Research Monograph. TERC: Cambridge, MA May 1996.

[5] National Center for Supercomputing Applications, A Guide to Networking a K-12 School District. **Error! Reference source not found.** 1997.

classroom levels that we begin to see educational transformations[6]. Where it works, technology use is supported within schools by broader change strategies with ample teacher professional development that includes development within the classroom and during ongoing instruction. This often means focusing on the students as part of the technology integration process rather than just as ultimate beneficiaries of it at some point further down the road.[7]

We now know that it is the particularities of the individual teaching and learning contexts – the orientations and activities of the teachers, students, schools, and families – that make the difference in desirable impacts from technology. Whatever else is effective, it is not the educational technologies per se. The social contexts in which they are utilized are all important. It is the blend of the technology, the content and the teaching strategies.[8]

In light of these developments, projects like Passport to Knowledge can contribute more than just the specific instructional materials they have been funded to develop. They need to be examined for what we can learn about large-scale, implementation models for these types of resources and activities. Few projects in existence today address content, process and pedagogy in an integrated fashion. The scale of Passport to Knowledge, in terms of widespread availability and utilization in numerous contexts, is more characteristic of a national testbed or a design experiment implemented on a national scale[9]. It is a concerted effort to address educational reform at a critical point in the teaching and learning process: the teacher and students interactions with stimulating real-world scientific endeavors. It uses a coordinated mixture of technologies to accomplish this but it also encourages the active participation of teachers and students as more than recipients of an instructional delivery system. It is this combination using various delivery formats while developing a human infrastructure to support its teaching and learning that makes PtK an interesting endeavor.

At the same time, it is important to acknowledge that Passport to Knowledge modules are not intended to be comprehensive whole year or multi-year curricula in science nor are they meant to entirely replace existing instruction. However they are providing *concrete, direct experiences* for both teachers and students in the *meaningful*

[6] Hawkins, J., Panush, E.M., & Spielvogel, R. National study tour of district technology integration: Summary report. New York: Center for Children and Technology, Education Development Center, 1997.

[7] Southern Technology Council, Making technology happen: Best practices and policies from exemplary K-12 schools, 1997.

[8] Pea, R., "Learning and teaching with educational technologies" in H.J. Walberg & G.D. Haertel (Eds.), Educational psychology: Effective practices and policies. Berkeley, CA: McCutchan Publishers, 1996.

[9] Collins, A. and Hawkins, J. "Sections and questions to address in design experiments." Technical Report from the Center for Technology in Education, New York, 1993.

utilization of education technology that fundamentally changes science teaching and learning in participating classrooms. The effectiveness of this project can and should be evaluated based on the learning environments it assists teachers in creating and the capabilities it provides to do things one could not do otherwise, rather than considering effectiveness as a function of the technology itself[10].

Passport to Knowledge's significance lies in part in its widespread availability for immediate use in classrooms today. It does not require that the infrastructure be fully realized before teachers and students can learn how to use it. As enumerated herein, teacher teams at the building level, individual teachers, and even parents at home are choosing to participate in Passport to Knowledge. They are utilizing its resources to aid in their own professional development and they are improving the instructional opportunities for the learners for whom they are responsible. The numbers that detail PtK's audience are impressive. Beneath those statistics lies the equally compelling story of PtK's impact on individual classrooms and teachers. One of the most articulate and widely disseminated such story is that of Rhonda Toon, a public school teacher from Lamar County, Georgia as published earlier this year in Business Week:

> At my rural Georgia school, over 60% of the students receive free or reduced-price lunch, and many of them know little of the world beyond our county. Textiles still play a part in the local economy, but mill closings have devastated many families.
>
> My task as a teacher is enormous. How do I expose these children to the wonders and opportunities available to them? How do I keep bright, talented children focused on education?
>
> One way has been to use technology. For six years, I have had the Internet in my classroom. I have never received any formal computer training. I did what many people do: I purchased a home computer and began to see the classroom applications it could have. But to get the Internet to my classroom, I had to write grant proposals, beg, and borrow…
>
> … The program that has brought the most change in my classroom is Passport to Knowledge (PTK), sponsored by NASA and the National Science Foundation. Kids get to know working researchers. They read their journals online, have their questions answered, and watch researchers on closed-circuit TV from such places as Antarctica, aboard aircraft flying in the stratosphere, or at the Jet Propulsion Laboratory.
>
> PTK includes hands-on student activities. My students have constructed aircraft to hold eggs and dropped them from cherry-pickers to simulate the work of NASA engineers. They have submersed their hands in icy water to study the effects of the cold at the South Pole. The PTK crew has helped me to become a better teacher. But most important, they have helped me show rural kids in Georgia that they can become scientists…
>
> …This past year, as my concern over the need for technology integration has grown, I have gone a step further, leaving the classroom to become regional coordinator of the Gordon Georgia Youth Science & Technology Center. I will train teachers to use technology in their lessons.
>
> This country has plenty of willing and able teachers, but they need resources. I know what it is like to have kids come into my room and not be able to name a single scientist. And I have cried

[10] Jones, B, Valdes, G, Nowakowski, J., & Rasmussen, C., Plugging In: Choosing and using educational technology. North Central Regional Laboratory, 1996.

> when I have had students--after participation in the PTK projects--list not only the names of the scientists they met through this program but their classmates as well. They now see themselves and each other as scientists.
>
> America needs a scientifically literate populace. The use of technology can help us achieve this goal. [11]

Ms. Toon's expression is notable but it is not unique, as a search on the growing archive of messages posted to the various discussion lists used within PtK modules will quickly reveal.

It is within this broader context that our evaluation takes on added interest: our task is not just to document the reach and the impact of Passport to Knowledge modules, such as this year's two offerings, *Live from Mars* and *Live from Antarctica 2*, although that certainly is part of it. In the report that follows, we are presenting the initial work to draw out the larger lessons that can be gleaned from Passport to Knowledge's position. Even at this interim stage in the three year evaluation effort, it is clear that Passport to Knowledge is doing something that has implications for all who anxious to see that the opportunities arising from this historic convergence of public investment, high expectations, and desire for serious improvement in education are not squandered.

This evaluation is a work in progress. Evaluating the impact of any technology on learning is challenging and evaluating it within a project like Passport to Knowledge, which is be used by many different types of teachers, in a wide range of grade levels, who are appropriating it in so many diverse learning situations, is all the more so[12].

This report, along with its final successor produced in year three of the evaluation, add to the work in overcoming these challenges to evaluation by addressing two critical areas as identified in the OERI January 1997 report "The effectiveness of using technology in K-12 Education: A preliminary framework and review."[13] One area is distinguishing between the "hype", assertions, hopes and expectations, and data-based research findings that tell us what really works and what does not. Both in the formative feedback provided to the PtK staff throughout the year, and in the analyses contained

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[11] Rhonda Toon, "A class act on the net", Business Week, July 28, 1997.

[12] As has been noted in many discussions of reform-based science instruction, the process of using new tools and methods within the classroom requires active transformations by teachers and their students for them to work effectively within their specific learning environment. The term *appropriation* seems to fit this more than the more commonly used term *adoption*. See Newman, D., Griffin, P., &Cole, M. The construction zone: Working for cognitive change in school. New York: Cambridge University Press, 1989 and Pea, R.D. Augmenting the discourse of learning with computer-based learning environments. In E. de Corte, Linn, M. Mandl, H., & Verschaffel, L. (Eds.), Computer-base learning environments and problem-solving (pp 314-344). New York: Springer-Verlag, 1992.

[13] Birman, B., Kirshstein, R., Levin, D., Matheson, D., & Stephens, M. "The effectiveness of using technology in K-12 Education: A preliminary framework and review." prepared for the Office of Educational Research and Improvement by the American Institutes for Research, January, 1997.

here, our focus has been on addressing this issue. Secondly, it is often noted that technology's impact on learning is difficult because there are few settings in which it is used optimally.

The accessibility of the Passport modules and their voluntary use by teachers in so many different settings offers a research window that goes beyond the interesting but limited-in-scale projects that characterize many of the current innovative technology applications to education. The need for this research has been underscored in recent studies and policy papers[14]. The ETS study and the newly released Presidential report[15] conducted exhaustive reviews of research on the impact of educational technology and have found only a small number of studies that have tackled the more pedagogically complex uses of technology. Both reports contain calls for new and ongoing evaluations of cutting edge technology projects while acknowledging the methodological and practical challenges facing such work. It is our intention that the evaluation of Passport to Knowledge will make a contribution to addressing these needs both through its findings and through the techniques we are evolving.

[14] Coley, R., Cradler, J., &Engel, P., Computers and Classrooms: The status of technology in U.S. schools. Policy Information Center, Educational Testing Service. Princeton, NJ 1997.

[15] Report to the President on the use of technology to strengthen K-12 education in the United States. President's Committee of Advisors on Science and Technology, Panel on Educational Technology, March 1997

Passport to Knowledge (PtK) develops integrated multi-media projects that blend live television broadcast and videotape, print materials, and on-line resources to give students and teachers first-hand insights into areas where science is an exciting, active process. Each module focuses on a real-world event or activity that is happening now. In doing this, it helps teachers use a spectrum of instructional methodologies and communication technologies. Passport to Knowledge is one of a small number of education projects that are structured around engaging working scientists, engineers and technical support staffs with students and teachers who are themselves engaged in related hands-on investigations of scientific topics appropriate to a middle school science curriculum.

This report examines both the scope of this work and its impact with students and teachers as the project completes its second year of funding from the National Science Foundation (NSF). This period, from August 1, 1996 through July 31, 1997, was also supported by continuing key contributions from several groups within NASA, by PBS, Mississippi State University, the American Museum of Natural History, and many others. It is an interim report and one that emphasizes both what is working for Passport to Knowledge and what might still be enhanced as the project continues to evolve.

As part of an ongoing three year evaluation that will culminate in a comprehensive examination of Passport to Knowledge's impact, the Center for Children and Technology at the Education Development Center (CCT/EDC) worked with Passport to Knowledge staff and the educators and learners that use the materials. Our objectives in this middle year of the research were to continue helping guide the project's development through regular feedback of a formative nature on major project events and initiatives, to examine both the ongoing challenges and any new ones facing the project, and to document its achievements.

At the same time, we are also looking at Passport to Knowledge as a comprehensive research opportunity to gather knowledge about how the power of educational technologies can be harnessed to create meaningful learning experiences for students and teachers. As such, we are concentrating on how PtK is being used as way to explore key questions around improving the practice of science education in our country through the effective use of new educational technologies.

The topics selected by Passport to Knowledge this year – the ongoing Mars missions and the wide range of polar research undertaken by scientists worldwide - are at the forefront of positive public interest in science. PtK leverages the reports in newpapers, on television and in popular magazines. This heightened interest, combined with the significant public accessibility offered by repeated broadcasts of the Passport to Knowledge materials on public television and through cable systems and an open, highly visible web site, creates an unique opportunity for sustained, systemic impact rarely

found in new curriculum development projects. Few curriculum projects in science or any other discipline area are voluntarily picked up and adapted both above and below the middle school target. In fact, PtK modules are used outside school settings entirely -- they consistently attract interested adults. This popularity range makes PtK rare, and worthy of study for that reason alone. However, it is Passport's impact on teaching and learning within middle school classrooms that is our central focus herein.

Our work on the Passport to Knowledge project began in March of 1996 and during the first year we produced two reports. CCT/EDC's first report covered our evaluation work on the Passport to Knowledge module *Live from the Hubble Space Telescope* and it also provided some analysis of the earlier module *Live from the Stratosphere* and the original *Live from Antarctica.*

The second report focused exclusively on survey data from participants involved in the summer of 1996 *Live from Mars* Teacher Workshop. This evaluation analyzed the experience of on-site participants as well as those that participated in the workshop remotely through one or more forms of electronic media.

This is the third report in the series. It is aimed at helping Passport to Knowledge staff, funders, and users – the students and teachers - reflect on the progress and impact of the project and to inform its ongoing development and refinement. Throughout the report, we have integrated summaries of data with qualitative analysis to achieve this dual purpose. As with earlier reports, we summarize these recommendations, in this case for Year Three, in the final section of this report.

Evaluation Activities in Year Two

CCT/EDC's evaluation work on Passport to Knowledge during the current year focused on the main programmatic features of PtK that were offered or developed in the past year. A full description of the modules offered in year two is presented in Appendix Five. Briefly, these include:

The new, multi-school year module *Live from Mars* (LFM) that started in the fall of 1996 and will run through December of 1997. Previous modules were shorter in duration and all occurred within a semester. LFM consists of five broadcast programs, including two at the time of Pathfinder's landing on Mars in July. The materials include a comprehensive teacher's guide, an optional classroom kit with posters, background materials, videotape overviews, and a CD-ROM, as well as an elaborate web site, e-mail lists, and interactive cyber-events such as a regular schedule of web chats with NASA scientists and engineers. Also this module features an on-line collaborative activity, the Planet Exploration Toolkit, that built on the interactive on-line projects of past modules but was for more elaborate and ambitious that what had previously been offered.

A three-program *Live from Antarctica 2* module that followed the Antarctic summer scientific investigations of researchers based in Antarctica. It was more like previous modules in that the live aspects of the program spanned three months in the middle of the school year. LFA2 also had a comprehensive teachers guide, an optional classroom kit, and on-line features that included e-mail lists and a web site. The web site for this module was used to demonstrate and test some design implications of our earlier findings about the range of participants using PtK modules and the increasing importance of the web within PtK.

This was also the year that some of Passport's most experienced teachers along with some new but energetic teachers were selected to form a teacher outreach corps, called PtK advocates, and these teachers offered local presentations, workshops, product development critiques, and on-line assistance.

The focus of our work was on gathering information and analysis to help answer the broad framing questions for PtK's evaluation, rooted in the original grant proposal to NSF, as part of the three year cumulative study of Passport to Knowledge. Those questions were generated at the start of our work in 1996 and still provide the overarching framework for the evaluation. See Appendix One for a list of the questions.

During this year, we significantly increased the number of participants surveyed and interviewed while at the same time we refined and improved our instruments piloted in the first year studies. We also added assessment of student work as a means to better understand the impact of Passport to Knowledge participation on student outcomes. In our previous reports and those covering the evaluation of pre-NSF pilots of Passport to Knowledge, student evaluation questionnaires were used to gather student ratings at the end of their school year. While somewhat useful in gauging students' reactions to module components, these instruments were unable to provide an indepth look at what students were really learning from their involvement with Passport to Knowledge experiences. Therefore, this year we moved to using actual student work products as a basis for looking at learning outcomes. While this work will be most apparent in our overall project assessment in Year Three, these techniques are already bearing fruit as demonstrated in this report.

Methodology

Our work this year utilized several tools devised and piloted in the first year. Based on the feedback from the questionnaire used in earlier evaluations, we undertook a substantial revision to simplify the format while delving deeper into issues related to the framing questions. We had piloted sending out and collecting surveys through e-mail in the first two reports. We made extensive use of that technique this year and augmented it

with web-based surveys and registration forms for both modules. As a result, we have surveyed a good cross-section of Passport to Knowledge users and can make some statements about their habits and opinions with confidence. See Appendix Two for copies of the various survey instruments we have used this year.

The surveys targeted users of the videos, the print guides, the listservs and the web site in order to access usage patterns, types of users, and how the materials were perceived by both teachers and students. Since the basis for these surveys was e-mail and the web site, we augmented this bias by sending out print versions of relevant surveys to postal addresses of users we were able to identify. Our main technique to reach those who do not use the electronic components of Passport to Knowledge was through prepaid quick response postcards for teachers and the inclusion of it in all teachers guides sent out for both *Live from Mars* and *Live from Antarctica 2.* Appendix Three contains the text for these postcards, which is also the same as that used for the web-based registration forms.

We are supplementing the survey questionnaires with case studies based on our work from last year. However, we have expanded the pool of participants to better match the various categories of Passport to Knowledge classroom users. We selected case studies to reflect the range of experience among participants with respect to prior use of telecommunications projects and previous participation in Passport to Knowledge.

We also continued coding messages on the project's e-mail message lists and have now added a web-based search and retrieval tool so that evaluation staff and Passport to Knowledge staff can search for messages based on this coding or on any salient word in the message's title or body. The coding categorizes each message on two dimensions. Author-type refers to who posted the message originally – student, teacher, Passport to Knowledge staff, scientist, and so on. Subject-type codes each message into one or more functional areas that describe the purpose of the message such as request for help or student work sharing. A complete listing of the codes and an explanation of the general break out is in the next section. The database of coded messages is at http://www.edc.org/ptkarch/mailsearch.html.

Finally we looked at science standards from a number of states in an effort to devise effective assessment criteria and rubrics with which to examine student work. While Passport to Knowledge has always referenced the National Science Education Standards from the National Research Council, we wanted to find more specific embodiments of these general principles to use as models for tangible performance statements at various grade levels in various areas of science education.

We ended up focusing on two states' frameworks – Illinois' Academic Standards for Science and the Instructional Goals and Objectives for West Virginia Schools. These

two states have a strong commitment to standards-based educational reform and both have been leaders in using educational technologies, specifically the Internet, as part of their NSF-supported State Systemic Initiative, in the case of Illinois, and the Rural Systemic Initiative, for West Virginia. Both states have put significant effort into working with teachers and other key stakeholders in writing their objectives in language that is understandable to diverse audiences and that can serve as the basis for assessing outcomes. We selected those content and performance objectives that were especially relevant to the two Passport to Knowledge modules used this year and we focused on the objectives related to the middle school grades. Appendix Four provides the list of objectives we gleaned and modified from these two sources.

This year we assessed the adequacy of these selected objectives for use with student work samples. The samples were gathered the *Live from Mars* Planet Explorer Toolkit on-line activity (see Appendix Five for an overview of this online collaborative activity that spanned four months) and some of the summary projects created in many classrooms.

Summary of Findings on Utilization during the 1996-97 School Year

One basic task this year was to continue to provide an analysis of who used *Live from Mars* and *Live from Antarctica2* as well as a look at how these modules were used. While we used a variety of methods to gather the data for this part of the evaluation, a common factor uniting all of them is that the respondents were teachers. Therefore, this portion of our research is ultimately concerned with the impact of PtK on teachers, although we sometimes include data from other interested adults.

Building on the positive response rates found in the evaluation's first year, we expanded our use of electronic survey instruments. We sent the surveys out via e-mail or mounted them as forms in appropriate locations on the web sites. Responses were automatically processed thus removing a costly and time-consuming step that plagues large scale survey research. As a result, we able to send out surveys immediately following a live broadcast and ask questions specific to the program's content and its relationship to the other PtK resources and to classroom practices. We were able to send separate surveys to gather information and reactions to the web and print resources. This is a significant improvement over a once a year or one per module questionnaire where all of the questions are chunked into one instrument and it is administered long after some of the events have transpired.

The nature of these surveys also allowed us to begin to target specific users vs. the entire set of participants. Thus the PtK Advocates, a group comprised of some of the most experienced PtK users and often exemplary teachers in their own right, were broken out for questions specific to their important role within the project.

In addition to the surveys that were sent out following broadcasts or after the web site had been used, we added a voluntary registration process for all new users who wished to identify themselves as teachers. It was voluntary in part due to a desire by the PtK staff and the NASA staff not to force a mandatory registration on visitors to the web sites. Despite the option to opt out of the registration survey, we got good sample sizes and now can make some generalizations about the user base for the PtK modules.

To augment this electronic registration, we also included pre-paid postage postcards in all of the print teachers guides and kits that were sent out. These print forms had the same questions as the on-line forms in effort to reach a potential group of PtK participants who might be active with the videos and the print but were not on-line. While we got a good response rate to these postcards, only a few were from teachers without e-mail or web access. Most returned the postcards because they received it first before going on-line but would have been equally likely to complete the on-line version

when they accessed one of the sites. There were no significant differences between the responses of on-line submissions and those choosing to mail in the postcard.

This leads us to hypothesize that the vast majority of PtK teachers are using at least some of the on-line components of the project. The group that used the television broadcasts and the print materials but lacked e-mail access in the very early days of PtK (two years ago) has now gotten access of some kind. We feel fairly confident in stating that there is no longer a significant number of participants unable to use the on-line components.

Note that this does not mean that there aren't any teachers out there who lack on-line connectivity – even with the dramatic increases in connectivity over the last two years, there are still plenty that face barriers in getting the basic level of access required to use e-mail professionally. Rather, we have no evidence that there are significant numbers of teachers actively participating in this project who are either unable to use on-line tools or choose not to do so.

This has some implications for future resource allocations which we will discuss in more detail in the recommendations section. While PtK has always felt it is important to address equity issues and provide ways to accommodate some level of participation by the largest number of potential teachers, the project has been successful in getting existing participants to use on-line. New participants are coming to the project, in part at least, because it contains on-line aspects. The PtK WWW sites are an increasingly important channel for recruiting new participants. This is a fairly dramatic shift from the work on PtK's pilot program where the on-air aspects served as a strong mechanism for publicizing and enticing teachers on-line. As demonstrated in the next section, the on-line services are increasingly the means for teachers to find out about the on-air components.

What teachers use it?

The registrations, both in their on-line form and as postcards, were targeted to teachers or those working with students. Among classroom teachers, the spread across grade levels continues to be quite distributed for these two modules as found with the earlier modules. However, the largest set of users is middle school teachers.

The following tables provide background information on the teachers who responded to these registrations. We do not have an accurate way of telling just what percent those that chose to complete a registration form are to the complete universe of teachers who use PtK. The return rate for LFA2 postcards (41) represents less than ten percent of the print guides and kits shipped, all of which had postcards in them.

However, we know that many of the teachers who got the print guide completed the on-line version of the registration instead. Yet even the numbers of completed on-line registrations (348) is just a small percentage of the growing number of visitors to the site (weekly average by end of the spring semester exceeded 59,000 hits per week). The numbers for the LFM registrations are at a similar return rate. We know that the majority of people visiting a web site do not enter in personal information if given the choice. However, we think that the combined postcard and on-line responses for both of these modules are high enough (389 for LFA2 and 923 for LFM) to warrant the projection of the percentages to the entire population of teachers using PtK.

Incidentally, these numbers are cited through May of 1997. On-line registrations for both LFM and LFA2 continue to come in, averaging 60+ new teacher registrations per month for LFM and over 20 each month for LFA2.

Table One: Grade Level Taught by PtK Participants –
Voluntary Registration Information

	LFA2 postcards N= 41	LFA2 on-line N=348	LFM postcards N=87	LFM on-line N=836
Lower Elementary K-3	14.81%	23.66%	8.05%	7.78%
Upper Elementary 4-6	37.04%	21.43%	27.59%	27.87%
Middle School 7-8	29.63%	24.55%	52.87%	29.67%
High School 9-12	11.11%	16.96%	8.05%	15.79%

Other K-12	7.41%	10.27%	2.30%	10.05%

The differences between LFA2 and LFM show that, as expected, LFA2 could be adapted more readily to the curriculum found in younger grades and thus was used by a greater number of teachers at this level than LFM.

We combined the Postcard and the On-line data for the remaining questions.

Table Two: Subject Area Taught by PtK Participants

	LFA2 Registrations N=389	LFM Registrations N=923
Generalist (teaches multiple subjects)	49.3%	36.36%
Science Specialist	25.8%	35.53%
Other or Not Applicable	24.9%	28.11%

Table Three: Average Number of Classes

	LFA2 Registrations N=389	LFM Registrations N=923
Per Teacher Registering	3.98 classes	4.56 classes

Table Four: Percent of Participating Schools by Community Population Density

	National Percentages (from 1995 Digest of Educational Statistics	LFA2 Registrations N=389	LFM Registrations N=923
Rural	31.5%	26.8%	25.96%
Suburban	23.7%	26.8%	26.91%
Small City	16.9%	30.9%	25.24%
Medium to Large City (over 1,000,000)	25.6%	15.5%	16.63%

While it appears that PtK might wish to specifically target urban areas in the future since it appears that participants from schools in these areas are under represented, this finding is also in line with the 1997 QED report that indicates lower income urban areas have less access to various types of technology.

Table Five: Average Years of Teaching

	LFA2 Registrations N=389	LFM Registrations N=923
	15 years	14 years

It is interesting to note that a subsequent survey for PtK Advocates found that they are veteran teachers with over 17 years experience on average.

Table Six: Teachers who have Used Other On-line Projects

	LFA2 Registrations N=389	LFM Registrations N=923
None	66.4%	52.75%
Once	5.0%	8.85%
A few	19.5%	23.68%
Many	9.1%	9.81%

This clearly indicates that PtK modules are serving as working in-service programs for teachers. Well over half of all teachers are gaining their initial experiences with using the Internet for classroom instruction via PtK.

Table Seven: Prior Experience with PtK Modules

	LFA2 Registrations N=389	LFM Registrations N=923
Live from Antarctica (original module)	2.6%	8.25%
Live from the Stratosphere	1.7%	6.45%
Live from the Hubble Space Telescope	1.7%	9.93%
Live From Mars	7.4%	N/A
No Prior Ptk Involvement	80.9%	76.79%

These percentages indicate that PtK is successful at appealing to a new and growing audience – it is not just the same group of early adopters although there is a core group of committed participants. The numbers also reflect the rapid growth in PtK participation. There is a significant difference between the two groups however. LFM definitely attracted and held on to the target group of middle and upper middle school teachers. It should also be noted that LFM started in the fall of 1996 and continued throughout the academic year thus completely overlapping LFA2. Some teachers may not have had the time to commit to an additional module while actively participating in LFM.

Taken together, tables six and seven indicate that PtK needs to provide a range of experiences for its different groups of teachers: the large group of teachers who are new to PtK and new to on-line require different amounts of support, modeling, and planning time well in advance of activities. Experienced users can dive in much faster and deal with the rich assortment of possible options. Passport has also addressed this differential by actively using the experienced teachers – those who are advocates and those not formally designated as such – to model for and in some cases even provide mentoring to newer participants.

With a few notable exceptions, LA Unified for instance, PtK is not centrally selected at the district level and its use mandated as might be the case with a comprehensive full year or multi-year science curriculum. The fact that some of this country's best science teachers, those who are recognized as exceptional both regionally and nationally, choose to utilize Passport to Knowledge and become regular, repeat users is one of the strongest indications of its success. Perhaps more impressive is that these sophisticated science teachers provide the backbone of a teaching community that welcomes less experienced teachers and non-science teachers.

For the experienced teacher, working with Passport to Knowledge has led to professional recognition. Several active PtK teachers have received state or national recognition for their classroom work with the modules – see page 44 from PtK's Year Two NSF Progress Report.

We examined those teachers who worked as PtK Advocates this year in a separate survey that went beyond the data collected as part of the registration. As the table below shows, not only have these teachers supported PtK by giving workshops, critiquing activity plans, providing video footage for the broadcasts, and seeding the on-line discussions, they are, to a large degree, representative of the most experienced of PtK teachers.

Table Eight: PtK Advocates

	Advocate Responses N=39	
Previous Modules you have used in the classroom **1. LFA original** **2. Live from the Stratosphere** **3. Live from the Hubble Space Telescope**	1. 2. 3.	52.9% 52.9% 64.7%
Number of years teaching	17.1	
Years of experience with on-line projects **1. none** **2. my first year** **3. two years** **4. three years** **5. four or more years**	1. 2. 3. 4. 5.	0% 15.4% 30.8% 23.1% 30.8%
Offered workshops on PtK modules within your district this year: **1. none** **2. one** **3. two** **4. three** **5. four**	1. 2. 3. 4. 5.	23.7% 42.1% 23.7% 7.9% 2.6%
Offered workshops on PtK outside of your district this year **1. none** **2. one** **3. two** **4. three** **5. four** **6. five or more**	1. 2. 3. 4. 5. 6.	35.9% 17.9% 12.8% 17.9% 0 15.4%
Presentations to groups other than classroom teachers **1. none** **2. Curriculum specialists** **3. Technology coordinators** **4. Building level administrators** **5. District level administrators** **6. State Ed Dept. personnel** **7. People in informal ed programs** **8. Parents**	7. 8. 9. 10. 11. 12. 13. 14.	42.9% 31.4% 25.7% 20% 28.6% 8.6% 5.7% 14.3%
Did you support any other teachers in your building or on-line?	Yes – 66.7%	
Did you write up anything for publication about your experiences with PtK	Yes – 60.5%	

These responses indicate that it will be worthwhile looking at the different groups within PtK teachers as separate and discrete groups. Some initial work on this is reported in the subsequent section on case studies but it needs to be enhanced in the Year Three overall report.

Going back to the registration information collected on PtK users as a whole, the final query on the registration forms focused on whether participating teachers planned to use the PtK module in a team teaching setting. This is one indicator that PtK modules appeal across disciplines and encourage practices that are associated with educational reform. As with our earlier reports, the number of teachers who are team teaching these modules is surprisingly high.

Table Nine: Teachers who Plan to Use PtK in a Team Teaching Situation

	LFA2 Registrations N=389	LFM Registrations N=923
Yes	51.5%	47.13%
No	48.9%	44.98%

Note: in all of the previous tables where percentages in columns do not add up to 100%, the remaining percentages were respondents who either skipped the question or responded "not applicable."

As stated above, these registrations were both voluntary and were mostly limited to responses from teachers using the materials with students. For several of our other surveys, we sent them to all participants who were active subscribers to a relevant list serv for the PtK module. Responses to these surveys consistently indicated that PtK modules appeal to a far broader constituency then what we had defined for registration purposes.

For instance, the survey that examined utilization of the second LFM video "Cruising Between Planets." Of the 579 returned surveys in a few weeks after the original broadcast (an approximately 20% return rate) , the following percentages apply:

Table Ten: Respondents to Reaction Survey to LFM's Second Live Broadcast on April 24, 1997

K-12 teacher working in public or private school and using LFM actively with students.	25.9%
K-12 teacher using LFM for professional development experience	15.5%
Adult responsible for supervising a home schooling program	2.7%
Adult working with students in an informal or after school setting	4.0%
Someone personally interested in the topic but not using it with students	32.2%
Family recreational activity	3.3%
K-12 student doing independent study	1.6%
Other	14.8%

These break outs as to who is participating are similar to what we found in our other feedback surveys. In each case, the majority of the educational respondents are indeed teachers in K-12 schools using it directly for student instruction.

However, there is always a large group of interested adults also participating to some degree (they have at least signed up for one of the listservs and have not unsubscribed). Judging from the responses posted in the other category, some of these are what might be best described as adult learners – people who are interested in the topic and who are following along. The appeal of, and participation in, technology-based educational resources to those outside the formal schooling structure adds an interesting dimension to discussions of life-long learning and community involvement in education. Most of these people would not think of sitting in a fifth grade science class for a semester.

Other adults in this group are scientists, researchers and engineers who are interested observers.

The number of teachers who are "lurking" as part of their own professional development is also significant. It seems that many want to observe and get familiar with the module or how on-line curriculum projects work before bringing in students. This

group, when combined with the information about the number of teachers who are using it with students but for their first on-line instructional experiences, makes a strong case for PtK's impact as an important professional development vehicle apart from its goals of impacting students directly. PtK is clearly playing a role in providing a comprehensive, successful technology integration experience for teachers who are working in schools that are beginning to get connected to the Internet.

Finally, there are more than 10% of the participants who are using PtK with students but in alternative educational settings – the home or in after school clubs and programs.

In summary, PtK modules are being used by their intended audience – middle school teachers. But unlike many curriculum efforts, they are also appealing to and having impact on a wide range of learners outside this target.

How are teachers finding out about PtK modules?

Several of the surveys tried to uncover how teachers found their way to PtK. Indications are that most teachers who use PtK are making an individual selection to add this to their classrooms. Some were directed here during a workshop or by a curriculum or technology coordinator who was familiar with the project.

Table Eleven: How did you find out about Live From Mars? (514 respondents)

Through a posting to an educational e-mail list	24.9%
Through a print mailing	5.5%
At an inservice workshop	3.7%
Television schedule or PBS station outreach	1.9%
Through an Internet Search Engine	9.1%
Link from another NASA site	23.7%
Link from CNN	0.4%
Link from PBS	1.0%
Link from Discovery Channel	1.2%
From a magazine article	2.3%
From another teacher, parent or colleague	5.3%

Other	11.5%

While print mailings are a major way of getting attention, on-line publicity is also effective. Given the rapid change in on-line availability, the growth of links from other educational and non-educational web sites, and the indexing by commercial search engines, we should examine more closely how teachers are finding their way to PtK in year three to determine where best to put scarce marketing efforts for maximum gain.

As stated in the previous section, this year saw an increase in the number of teachers who used PtK in their classrooms that used all three major components. While many adults and students who are unconnected to a PtK classroom utilization visit the web site as their sole PtK experience, most teachers indicate that they do view the video programs and access or download some or all of the teachers guide.

Video

Over 65% of the members of the e-mail lists who are classroom teachers indicate that they watched the associated PtK videos. Taped viewing (vs viewing the live broadcast) ranged from approximately 54% of the viewing for the LFA2 Program 1 "Oceans, Ice and Life" to 73% for the second LFM program "Cruising Between Planets." Again these differences are explained best by the slightly higher appeal of the LFM module for upper grades and the need for using tape in situations where the teacher uses PtK with more than one class period.

LFM and LFA2 programs were carried by PBS stations and by cable companies who carry NASA TV. Across the various broadcasts, teachers used PBS or NASA TV in roughly even numbers and together these two sources accounted for over 80% of the audience with dedicated local or state educational networks (redistributing one of these two feeds) or obtaining a video cassette accounting for the rest. Over 75% of the respondents indicate that they are saving the tapes for repeat use at a later time.

Print

More teachers are indicating that they are downloading the teachers guide from the web site vs. ordering the hard copy or obtaining it in the full kit. Most teachers indicate that they have used at least one activity from the teachers guide before viewing the video (for instance, teachers indicated that had used on average 1.62 activities associated with the LFM "Cruising Between Planets" before they saw the program). The majority indicated that they used more than one as a follow up to a program. The activities in the guide continue to be highly rated by teachers both in their evaluation rankings and in their comments.

Table Twelve: Which activities did you do with your class prior to watching "Cruising Between Planets?
N=579

Activity 2.1 – Part 1 Modeling Martian Motion	25.9%
Activity 2.1 – Part 2 Mars: Off the Chart	20.1%
Activity 2.2 – Reading the shape of volcanoes on Earth and Mars	18.7%
Activity 2.3 – Robots from Junk	12.9%
P.E.T. Online Collaboration	19.2%

On-line

Over 80% of all survey respondents indicate that they have visited the associated web site and almost 60% say that they visit frequently (several times per month). The majority also says that they are using the web resources and/or the messages posted to the e-mail lists directly with their students as an instructional resource.

We used the surveys to determine which features of the web site and which activities in the teachers guide were being used.

Table Thirteen: Which of the following LFM components have you used?
N=579

Purchased printed LFM Teachers Guide	16.6%
Purchased entire LFM Kit	10.9%
Downloaded Teachers Guide from the web	40.5%
LFM-Discuss mailing list or digest	31.6%
LFM-Updates mailing list	70.5%
P.E.T. Activity (the on-line collaborative exchange for students)	8.0%
Webchat Sessions	7.5%

Table Fourteen: Which areas on the LFM Web site do you find useful? N=579

What's new	45.4%
The Mars Team	29.8%
The Live Video Info	20.4%
Featured Events	32%
Background Info	47.2%
Questions and Answers	25.6%
Teachers Lounge	18.9%
Kid's Corner	18.2%
Photo Gallery	50.2%

For the Live from Antarctica 2 program we asked similar questions.

Table Fifteen: Which aspects of LFA2 did you use? N=78

Did you use any LFA2 e-mail lists as a professional resource	71.2%
Did you use any LFA2 e-mail lists as instructional resources?	58.2%
Did you use the LFA2 web site as a professional resource?	87.0%
Did you use the LFA2 Web site as an instructional resource?	78.6%
Are you currently teaching about Antarctica or polar exploration?	Yes – 55.2%
How would you rate the LFA2 web site in terms of its educational value? **1. One of the best** **2. Better than most** **3. Good** **4. Average** **5. Below average** **6. Poor**	1. 34.78% 2. 41.30% 3. 23.91% 4. 0 5. 0 6. 0
How easy was it to get a sense of all the resources that were available to you on the web site?	1. 89.36%

1. Clearly understood after some exploration **2. Took a lot of work to find everything** **3. Never got a clear sense of what all was there** **4. Did not use enough to have opinion**	2. 2.13% 3. 2.13% 4. 6.38%
How would you rate the design of the LFA2 site? **1. Better than most educational sites** **2. Better than earlier PtK sites** **3. About the same as the other PtK sites**	5. 50% 6. 26.09% 7. 10.87%
Did you find the three pathways through the web site (teacher, student, parent/public) made it easier for you to navigate through the site?	Yes 80.43% No 19.57%

The additional questions on design were asked because LFA2's web site tried to address the different audiences using the site through providing somewhat different site views for these audiences. It also used frames to help clarify what was available on the site.

While the web site has gained dramatically as a tool utilized by PtK participants, the mailing lists remain the central on-line tool for most users. This fits in with our experience with other projects. While people will visit a site when they need to get information or to catch up on something, they prefer to have those aspects that they want to see or participate in on a regular basis delivered to their desktop. E-mail is still a preferred tool for many. Others have some access to the web but e-mail is just more convenient for them.

Both *Live from Mars* and *Live from Antarctica 2* have several active lists. Table Sixteen summarizes the lists, purpose and subscriber numbers as of March 1997 for the two modules. Note that all of these lists with the exception of the PtK Advocates list, are open to subscription by any one and all of them are archived for reading on the web site. Because this last point allows non-subscribers to keep up with message postings, subscription numbers do not reflect total readership since some participants prefer not to receive these messages in their e-mail. Also some very popular K-12 web sites and e-mail lists such as the Global Schoolhouse Network serve as reflectors for the PtK lists. In these cases, one subscriber account is picking up messages and posting them to a reflector list that can have several hundred subscribers who do not show up in the numbers below.

Table Sixteen: Mail list subscribers

List Name	Purpose	Subscribers
Updates LFM	Provides general news to all participants and interested parties for Live from Mars	4,327
Discuss LFM	Teacher discussion and exchange	674
Discuss - Digest LFM	Condensed, overview of discuss list for teachers	143
Debate LFM	Student work exchange and discussion for collaborative projects - mainly Planet Exploration Toolkit this year	137
Updates LFA2	Provides general news to all participants and interested parties for Live from Antarctica 2	1,626
Discuss LFA2	Teacher discussion and exchange	105
Discuss - Digest LFA2	Condensed, overview of discuss list for teachers	47
PtK Advocates	Closed list for teacher advocates to support their work in delivering presentations and providing feedback	90

How are the Lists Used?

All messages posted to these lists have been coded by the evaluation staff first by which module they are dealing with, then by type of author and finally by category of content.

Module classifications consist of: LFM (Live from Mars), LFA2 (Live from Antarctica 2), LFA (Live from Antarctica (original), LFS (Live from the Stratosphere) and LHST (Live from the Hubble Space Telescope).

Author-type codings are mutually exclusive (one code per message): Staff, Expert, Advocate, Teacher, Student, Home Schooler (adult), Other Adult.

It should be noted however that on most of the lists, and for most of their message postings, Advocates are participating as teachers (which they all are). So in any type of analysis, the Teacher category needs to have the Advocates added in to get an accurate representation of what teachers are doing with the lists.

Content codings are not mutually exclusive. One message can have multiple codes assigned to it. Codes are:

Testimonial, Critique, Suggestion, Project info, Response, Request, Resource sharing, Technical question, Content question, Teaching question, Student work sharing, Assessment-related, Sponsored activity, Teacher generated activity, Feedback to staff, Feedback to experts, Feedback to teachers, Feedback to students, Explicit reference to video program(s), Explicit reference to Teachers Guide, Off task

Messages from the lists are collected by the evaluation staff as they are posted. A coding template is attached to the top of each message and codes are assigned after reading the message. Coded messages are converted to HTML format, stored on a web server and indexed using a full-text search engine. This permits staff to search on various combinations of codes or any string of text within the message header or body. This tool can be used to look at responses to particular initiatives, activities or events.

Below in Table Seventeen is a general analysis of the teacher discussion lists for both modules.

Table Seventeen: Live from Mars Discuss LFM messages N = 867 messages posted as of 5/18/97

Author Type	Percent of Messages
Staff	24.57%
Expert	2.77%
Advocate and Teachers	68.74%
Student	0.12%
Home Schooler	1.04%
Other Adult	2.65&

Content Type

Testimonial	9.23%
Critique	0.92%
Suggestion	4.5%
Project Information	12.57%
Response	31.26%
Request	11.19%
Resource Sharing	38.41%
Technical Question	4.96%
Content Question	1.73%
Teaching Question	2.08%
Dissemination Question	0.46%
Student Work Sharing	3.34%
Assessment Related	0.81%
Sponsored Activity	10.38%
Teacher Generated Activity	7.83%
Feedback to Staff	4.5%
Feedback to Students	0.46%
Explicit Reference to Video	9.46%
Explicit Reference to Guide	5.07%
Off Task	6.57%

For *Live from Antarctica 2* Discuss LFA2, the message count was 123 messages.

Author Type	Percent of Messages
Staff	35.8%
Expert	0.8%
Advocate and Teachers	59.3%
Student	0.8%
Home Schooler	2.4%
Other Adult	0.8%

Content Type

Testimonial	25.2%
Critique	0.81%
Suggestion	4.88%
Project Information	18.7%
Response	34.96%
Request	19.51%
Resource Sharing	20.33%
Technical Question	2.44%
Content Question	1.63%
Teaching Question	4.88%
Dissemination Question	0%

Student Work Sharing	6.50%
Assessment Related	0%
Sponsored Activity	4.88%
Teacher Generated Activity	0%
Feedback to Staff	4.07%
Feedback to Students	0%
Explicit Reference to Video	37.4%
Explicit Reference to Guide	12.2%
Off Task	2.44%

Perceptions of Passport Modules

In terms of curriculum integration, over 50% of the respondents indicated that they were teaching about space (in the case of LFM) or Antarctica (LFA2) and the overwhelming majority ranked the content as either closely related or related to the content they are currently teaching. For instance, within the 579 respondents to the Live From Mars video survey that closely followed the broadcast of the "Cruising Between Planets" program, we looked at grade level and program relevancy to the what was being taught in the classroom this year.

Table Eighteen: How relevant was this LFM program to the content you are teaching? (N= 579)

Percent of teachers at each grade level who evaluate the relevancy of LFM Program 2	Closely related	Related	Partially related	Unrelated	Total
Lower Elementary (K-3) N=61	45.45%	54.55%	0%	0%	100%
Upper Elementary (4-6) N=76	38.46%	34.62%	26.92%	0%	100%
Middle (6,7,8) N=79	48.28%	41.38%	10.34%	0%	100%
Secondary (9-12) N=63	38.46%	23.08%	23.08%	15.38%	100%

Each survey that was used to generate the data in the tables also had some open-ended questions for respondent feedback. These responses are gathered in Appendix Five and sorted by module and into relevant utilization categories. They provide additional information on the perceptions of PtK by teachers (and parents, in some cases) who are utilizing it.

Teacher Case Studies

We are augmenting the survey data with a two-year tracking study of 24 teachers. The pool was built from those teachers responding to either the postcards or the on-line registrations collected during the fall of 1996. All teachers who responded to either the postcard survey or the on-line registration forms were classified on two dimensions.

First we grouped them by previous experience with using on-line curriculum projects in their teaching. Categories were no previous experience, one or two on-line projects, many. The second grouping was experience with Passport to Knowledge and contained categories for no previous experience, used one prior module, used more than one prior module. This two dimensional grouping created a 3 by 3 matrix. However, there were no teachers that occupied the cell for no previous utilization of on-line curriculum projects and high previous experience with PtK.

Three teachers were randomly selected from each of the remaining 8 cells to create a pool of 24 teachers who will be tracked over the next two years. This study will help show professional growth and change as these teachers continue or increase their involvement with Passport to Knowledge. It will also give us some insight as to why teachers drop out or decrease their involvement. Data is being gathered through telephone interviews. The results of this will be used in our final report in Year Three.

In the interim, some of these teachers are interesting to use as small case studies that can shed additional light on how teachers are using Passport to Knowledge in their classrooms. Ten of these cases are described below.

The final report will have an expanded case study section which will include some of these teachers from the tracking study but will also include teachers who are exemplars of different types of curriculum integration and best practices.

Our focus for the interviews with the tracking pool this year, which were conducted in the winter and spring of 1997, was on how the two PtK modules were integrated into the ongoing science curriculum. Is PtK bringing in new content or is it supplanting or augmenting existing units. Our questions looked at which components were used successfully or not so successfully and why this happened. We wanted to get an idea of the time frame or period over which use occurred.

We also wanted to understand what PtK use looks like under varying technology access infrastructures and how the differing levels of teacher educational telecommunications experience noted in the surveys affected its implementation. At the

same time, we wanted to see if PtK use helps support or justify classroom technology integration.

A third grouping of questions looked at what students produced as a way of accessing how PtK impacts what students know and can do. What kinds of assessments are being done by these teachers?

Although most teachers are excited to participate in projects like Passport to Knowledge, their ability to participate depends on whether the materials can be integrated into a very "packed" science curriculum. These teachers' stories illustrate that PtK modules fit into various curricula in a variety of ways.

The teachers names have been changed to insure confidentiality.

Case One: Betty, rural Virginia

Situation and Class Characteristics

Betty has been teaching for 21 years and had used the first *Live from Antarctica* module. She originally found out about Passport to Knowledge through the NSTA newsletter. She is currently using aspects of both *Live from Antarctica 2* and *Live From Mars* and has used a few on-line curriculum projects prior to this year.

She teaches 7th grade science and math. The school year is divided into two semesters, with some courses running for one semester and some spanning the entire year. The school has adopted block scheduling with blocks of 87 minutes.

Betty had no Internet connectivity in her classroom at the start of the year. As in the past, she printed out everything at home and brought it into school. In January the school did obtain an Internet connection (in the school's computer lab) and she was able to use the PtK on-line resources more directly with students. However, she continued to do much of her planning and lesson development though her home connection.

How did she use the modules and materials?

In the fall, she used LFM in both her Life Sciences class and in her math class, which has many of the same students. She found the LFM materials especially well suited to her math class and tied existing lessons to the comparison information on Earth and Mars found in the Teacher's Guide (Activity A.3). She also did the stream table investigations (Activity 1.3). She devoted about two weeks to the LFM activities and

then provided updates throughout the year to her students. She used both videos - primarily as a motivator and to help set context for the class activities. Later in the year, they participated at the start of the Planet Explorer Toolkit

In the winter, she moved to a new science class for the semester. She used LFA2 more extensively because it was a closer fit to her life sciences curriculum. She used all three videos and many of the activities. The ones that were particularly successful for her were the initial activity on what we know about Antarctica, the research report on the explorers using the Internet, the timeline and the picture frames (which were mounted for display in the school's entrance hall). They created the Antarctic organism that could survive in that environment. They also did the career reports that were listed in the guide. They did the experiments with blubber and the brine shrimp.

What was the fit with the existing curriculum?

LFM worked better for her with the math class. This was partly because the math class was an entire year and she had more flexibility and also because the science classes were focused on Life Science. LFA2 tied in very well because the 7th grade has an environmental theme and it worked well for this school. Mars was a little harder to integrate simply because the emphasis on physical and space science did not mesh with the need to ensure that her students master certain objectives in the Life Sciences.

How were students assessed?

Betty focused on student work - the student journals, the showcase for the school and the individual reports they did were important aspects of her grading. For the LFA2 career reports and the history of exploration, the students were graded on specific questions that they had to answer.

"The kids were really excited about this and they didn't really know anything about this material before so I could really demonstrate a lot of learning. The fact that we were learning with the computer and the Internet was really exciting because it was the first time for many of my students. With LFA2 the kids were really able to get on the computer, they were able to look at the web site and do the research." All of their grades with these projects were integrated into their regular grades. She was able to really integrate the standards taken from her local learning objectives. Another important aspect was the career focus which is also prominent in their local guidelines.

Reactions and comments

"Science is fun and it is not about reading it in a textbook. They are out there doing science with these materials and they are having a great time. That is really important for the kids."

"The Guide is absolutely great and I really relied on it. It has a lot of material but it doesn't come soon enough. If you were giving it to someone who was not familiar with the topic they would not have enough time to prepare, to collect all the materials and resources in order to feel comfortable. It has great ideas and provides what is necessary for teachers to use them easily. I kept the guide from the first Antarctica program and have used it every year since. I will certainly do that with this year's guides."

"I think that both web sites are incredible. There is a lot of information and it is a safe place for kids to go for information. You don't have them searching all over - they can go to the one spot and get all the information they need. For me personally, the web site is excellent as long as you have the computers and the Internet access -- you almost don't need the print because you can get it online."

"The kids enjoyed the videos. I had various comments like we wanted to see more children." Overall, she thought it was excellent but there were a few times where the kids were used to formal TV -- live TV was a little different for them to get used to.

"But overall they were really positive. They also wanted to become a part of it. There is something when the kids are able to see their faces and their questions on TV that is great. Overall there is just a tremendous amount of material. I also saw definite improvement in the appeal of the videos over the year and certainly since my first experience with LFA a couple of years ago. The videos had a lot of information -- more than what they are used to seeing on television."

Her one point of access in school was the computer lab. "That really limits what you can do with a project like this or with the activities. She tried to participate in the PET, but because of the semester changes it was difficult. The other problem was that the class got bogged down in the introductory part of that activity. We were not quite sure where we were going with it. As I followed it online, it made a lot more sense as we got to the end, but for the kids… it didn't seem like it was going to work out. We were not quite sure where we were going to with it and whether it would be worth the time. It was fun for me but I couldn't figure out how to use it with my class. It made sense by the end but the introduction...I think it emerged online which was neat but hard to decide to invest the time in it."

Betty has used other on-line projects but not in such depth. "If I was to compare Passport to other projects, the amount of information provided is so rich here. There are

so many resources for teachers so we don't have to run around and find the stuff on our own."

"Other teachers in my building do not participate in projects like this but we just don't have the connection. Passport allowed me to get in and begin using it before the others have realized what it can do. For most teachers, there is limited access and lack of knowledge what participating in something like this can actually do for you."

Personal gains - " I really have gained in every way -- it really makes you want to use a lot more technology in your teaching. It exposed me personally to a tremendous amount of learning … I mean I never did anything with Antarctica before Passport -- I never saw it as a compelling way to teach life sciences. I also think the focus on female scientists is excellent."

"All the activities that are suggested are new to me and they worked great."

"I've been supported by the administration and that will help get more connectivity next year."

Case Two: Bob, urban Washington

Situation and Class Characteristics

Bob works in a alternative public school which is comprised of all multi-age classrooms. His students range from 7 to 11 years old (2 through 5th grade). This was his first experience with using on-line materials in his classroom. He found out about Live from Mars through the newspaper. He was interested in the Pathfinder mission and the local Seattle paper gave the URL and he went on from there. "I now have an ISDN line in my classroom and that is because of the LFM project. We didn't have any access to the Internet at all in my school until this year. I asked the parents to pay for a modem and a telephone line so we could participate in LFM and that snowballed -- now the school has an ISDN line. The parents put some money up but it really started a process where a lot of stuff ended up getting donated. We got help from the University of Washington and a lot of the parents donated a lot of their time. The whole school got wired eventually. At first, getting the school networked was not a high priority. I used the press kit and other materials to build a case for doing LFM." He now has 4 computers in his classroom and 2 have Internet access.

"No other teacher participates in projects like this. The principal is very supportive and into technology. The project work is typical for the school but not for

the district. There is an alternative school for each region of the district so that means there are 5 alternative schools out of a total of 60 schools. The rest of the district is pretty traditional."

The school was developed around one of the national "break-the-mold" design models. It features semester-long expeditions – in the fall, Street's class studied a local park. Starting in January, LFM became the spring semester's expedition and work with activities continued through June.

How did he use the modules and materials?

He purchased the full kit. He used most of the activities in the guide and found them very effective and useful. "Often you get curriculum and you can tell that there are a lot of very nice ideas but no one has really tried it. This was not like that -- I felt that this had been tested. It worked within the time that they said it would and really it is probably some of the best curriculum that I have come across. I used the slides, photos from the Viking mission. The craters experiment was a big hit."

He used some the video from the kit and taped the first video broadcast. He found the second broadcast to be more useful because there is a lot more kid's work in it. However, some of it was aimed too high and the younger kids lost interest. About 1.5 days per week were devoted to LFM and Mars related work. It is integrated in a multidisciplinary approach.

Even before the official start, the class joined in on the PET activity. In December they put their Toolkit together and then followed along on-line with the whole process. Although the class has web access in the classroom, the students do not have email. So the all the email was filtered through Street. He did most of this work from home. The students always composed the messages. Sometimes he had them do it for homework and then he would put it all together and post it. All of the messages posted were the kids' own words. He felt that moderation of the list was really good.

Some of the postings from the scientist, Sanjay, were way above his younger students' level. He understands that the program is aimed for the Middle School so he translates it when necessary. Most of the journals that are coming from the Pathfinder mission teams he has to translate as well. About a 1/3 to a half of the kids would really get it. With the younger students, the activities and hands on work from the guide were more flexible and easy to adapt for their use.

He was not familiar with the content so he really enjoyed the experience and learned along with kids. He feels that elementary students like to learn new things – even if some were a bit young.

What was the fit with the existing curriculum?

"The school program is student-directed so the students participate in deciding what they want to study, what they want to learn about and especially what they want to write about. So when they are working on their projects, I just give them suggestions. Often they chose to read about Mars and space and to write books about it. It was the centerpiece to my science time and I also integrated it into social studies by looking at astronomy in different cultures. I did some integration with math but probably the less than in science, social studies and language arts."

"When I teach I try to focus on unifying concepts. This year we were focusing on interdependence and systems and this project helped me with that. It really seemed like the project was trying to get across concepts that they wanted to kids to become scientists to really go through that process and really try to duplicate that by doing the PET investigation. The project also reinforced that they were duplicating the process of the pathfinder scientists. The class did both the egg drop activity and the rover model, they went through the process of being engineers. I really feel that the project wanted kids to know in a concrete way what it was like to be engineers and scientists on a mission team. I also think that the activities were really inquiry based where the kids were really being asked to come up with questions and answers the way scientists do."

How were students assessed?

"I used the student work from the PET activity. Even though I had to push them through the discussion they really got involved in the actual investigation. They did it all, including the soil experiment which they conducted over a couple of days. I really saw levels of interest that I had not seen before in some areas. For example, when they were looking at the rocks and the plants under a microscope, they ended up using a lot of their recess time, which is unheard of for these kids. We also used the toolkit for a second place and went to the desert in eastern Washington and used did it there. They were really into their discoveries and felt like real scientists."

The kids have done mission logs which had been suggested in the guide. "The logs have everything in them. At our Spring conferences with parents, we looked at the logs to see if they were complete and whether it was careful, neat. It was also up to them to develop an organization for their logs on their own. For the final projects, we are developing specific standards. The real question for us is how do you show what you know to your audience. How do you assess that?"

"In terms of the multi-age issue, at the end of the year when I discuss this with the parents, we use the students' work on an individual basis which takes into account the

student's age as well as their capabilities. So with these projects what we are saying is, Ok, you guys have learned a-lot and are expert in something related to space and your job as an expert is to share what you know with your community. What we have done in the past is to always establish standards with the kids in terms of what makes a good project and what makes a good presentation. We created a checklist and then I had them assess each other when they did their presentations. It really worked. They were really thoughtful and they were pretty kind to each other."

"We are using the final component of the curriculum and that means individual projects and presentations. In addition they also do different types of related projects. Some of them do reports, some of them do models of the solar system. They were able to present these reports or displays to each other."

A parent volunteer will be helping Bob to produce and mount a web page and put these reports on it.

Reactions and comments

"All this technology is new to me -- especially using it directly with kids. I had used some e-mail before but that's it. The students have learned how to research on the Internet and that is great. They have received a lot of information that they weren't expecting and also they have just gotten so much information. Overall my goal with them this year in regards to technology is to introduce them and get them comfortable with it and show them, what is possible. Many of the kids are accessing the web during their recess and that is great."

"The materials and specifically the activities have very clear goals and what the concepts are that we are working with. The developers included things like which jobs on the mission team are similar to the roles the kids might wish to sample."

"The project activities are very concrete and exciting. The kids really love the activities and because they are so concrete the kids really go through the process. The curriculum was very easy to use and required very little adaptation. The only weakness was that some of the material is over the kids' head but we still found it useful."

"At one point, I was looking for information on a topic and I had not found any information on that specifically on the Web. So I posted a request on discuss LFM and I got a ton of responses back with a lot of ideas including someone came back with how to say Mars in 30 languages. I also made contact with a teacher in Bellevue nearby, he came over to see someone teach astronomy in different cultures in my room and that was great."

Case Three: Cindy, suburban California

Situation and Class Characteristics

Cindy has been teaching fifth grade for five years. Her first experience with an on-line project was the several years ago following the Will Steiger expedition to the North Pole, but it was not nearly as interactive or as directly integrated to curriculum objectives as Passport modules. She used Live from the Hubble Space Telescope as her first PtK experience. Since that time, all fifth grade classes in her building have an Internet connection in their classrooms and at least one computer. This year she has 32 students.

She indicated that she is frustrated with her own administration's focus on teacher skills training around the Internet rather than using projects like this one as a really useful way to use the Internet as an instructional resource. As a result, other teachers in her building are not using projects like this and are thus less enthusiastic about how the Internet can really make a difference for their kids.

How did she use the modules and materials?

She has subscribed to all the listservs for both modules. She had found the Hubble project quite good but has not gone back to the materials. "I think it is much more exciting to use it when it is live -- asking the scientists questions is very motivating for my students. We have submitted questions, and that makes the whole experience more meaningful for the students."

The students have made fairly extensive use of the two web sites and watched all three LFA2 broadcasts. She taped the LFM programs and will use them at the end of the year to get kids to watch the summer landing. The class did submit a response to one of the on-line challenge questions and received an honorable mention. This is her first time thinking about teaching space and she is finding it challenging. She hasn't had time to really utilize the guide yet.

What was the fit with the existing curriculum?

"Either module fits within our curriculum frameworks for the state. I focus on the research process rather than specific factual knowledge and PtK is a good springboard for student research."

How were students assessed?

Cindy used mostly informal measures to assess the student research process. She looked at participation in discussions and cooperative work patterns.

Reactions and comments

She liked that the modules show students how real science works. "These are real people doing real jobs. The students are also really taken with the fact that these people with important jobs take the time out to respond to them."

She feels that the program is a bit geared to older kids. "Some of the updates posted on the web and to the lists were over their heads so I had to translate it. But you don't want to lose the information so I am not sure how to resolve that."

Overall, even her limited participation increased her and her students technology skills and they learned more about space exploration and Mars. She would not have included space into her curriculum without the PtK materials and is planning to build on this experience next year.

Case Four: Evelyn, suburban New Jersey

Situation and Class Characteristics

Evelyn is a middle school teacher. She currently teaches five periods of science at the seventh grade level covering earth and life science. The school day is divided up into 42 minutes periods. She has been using Passport modules extensively for several years. She is a PtK advocate and attended the summer workshop in Washington DC. She was also one of the beta testers for the Live from Mars activities.

Initially, she felt she was on her own within the district. But now, administrative support for her work with Passport has grown and now she has a phone line in her room. That has really helped this year. But she still is not using the web to its full potential because the equipment is problematic. She will be getting a large screen monitor so that the kids will be able to see when she wants to use the web for group or whole class activities.

The in class project work fostered by Passport is very atypical of her district. However, the curriculum is changing too. "All these reforms have helped make it easier to do the type of teaching that I have wanted to do."

In her role as an advocate, she has distributed the materials in her building and in the other middle school in the district. She is also participating in the New Jersey State Systemic Initiative and has distributed materials there as well.

Evelyn has significant experience with other project based science curricula. She has participated for 3 years in the kids as global scientists weather program. "I have also done smaller projects with some other teachers. I always compare everything to the weather project because that has been a great experience, but I really feel that the PtK project is comparable if not better."

How did she use the modules and materials?

She is using both LFM and LFA2 with all her classes. She incorporated large parts of LFM into her earth science class and used parts of it with her four life science classes. LFA2 was used more extensively with her life science classes.

Her students were in the 3rd LFA2 broadcast and they filmed a segment of that program at her school. The students were taped asking questions which the scientists answered live during the broadcast.

She is not a heavy user of video in the classroom and feels that her students watch so much TV anyway. So she does not watch the PtK programs in their entirety – instead she shows parts of them and finds it easier to integrate that way.. However, she thinks that the video is an important component and provides a lot of information.

What was the fit with the existing curriculum?

She has not used it as a replacement unit. "My earth science class is at high school level and I have no freedom in the curriculum but I have integrated Passport modules all the way through. I will be spending more time with it at the end of the year because we are participating in the red rover project. While this is not a direct part of LFM, that is where I found out about it."

"We have done a number of the activities/labs and I have incorporated those into the actual units. For example, We are doing a weather project and as soon as that is done we will be doing the stream tables. So I incorporate these labs with various curricular units. It is one of the ways that I can justify this to my district."

She picks and chooses over the year depending on which labs and activities fit into the curriculum. Sometimes she would devote an entire week to LFM like doing the balloon activity, and Newton's laws activities. "LFM is so spread out. We have been participating in the PET activity. I am also involved in another weather project so it has been hard to fit everything in but we are just about finished with that other project."

She was more familiar with LFM because she had tested the curriculum last year. "With LFA2 and actually with LFM I found that the activities and labs that were suggested were things that I probably would have done anyway. Or they were ones that I really wanted to try. So I felt the activities from both modules were very easy to integrate into the curriculum."

How were students assessed?

She had the students put individual portfolios together – "a scrapbook of their work." As part of this, they held classroom discussions about what they knew and the things that they wanted to know. At the end, they added what they had learned from having gone through this process. For some of the activities which Bendixsen used as labs, the students maintained lab notes using the same notation methods used in other labs performed scientists. When she does use the activities from the guide as labs, they are graded the same way she has graded labs and project work in the past. Although the grading system is the same in many ways, the use of project-based activities such as Passport is moving her to add more portfolio assessment.

She also uses a custom-designed evaluation form at the end of the project. In terms of the PET project, the evaluation was more informal because the real work occurred as class and small group discussion. So for grading, she uses their journals, the labs count for 70%, their questions count for 10%, and the evaluation at the end counts for 10%. "I have found that kids who can't succeed on the regular tests do really well with this type of project work and assessment. Thus the Passport work is central to their grade overall for the year."

Reactions and comments

"Jan Wee (the on-line facilitator) is excellent as support staff and has really helped the project to become organized. The entire staff is very understanding -- they offer timelines but they also understand the constraints that teachers face. When we first started the PET project and we submitted the proposal and we had some concerns about the project, they really listened and revised. They sent it out to the Advocate listserv and had us look it over and they revised it based on what we said. I think that it is terrific that this project is so participatory and teacher oriented."

"The new scientist that joined the PET discussion has been really great and has added a lot to the discussion and the project. This interaction between the students and the scientists is a real motivator."

"Passport has pushed me to come up with a new way to work with the kids. So instead of saying on any given day, 'OK this is what you do', I now approach it as a longer term project that really builds both content and skills."

"I see one problem in getting more teachers participating is getting the phone lines installed. Everyone is talking about getting classrooms hooked up but it is just not happening. Even if we manage to get the phone line, then we don't have the computer that is supposed to be on the other end. The computer that I have took 30 minutes to get connected to the Internet, it was a 386 which was upgraded to a 486 so it doesn't run the script fast enough and I get clicked off. It was interesting when I went to the summer workshop in Washington that everyone I talked to it was the same story. The people that had phone lines got them from grants they had written. Most of the time the teachers had to really work to get what they needed so that prevents a larger group of teachers from this type of project."

"This was an excellent way to have the kids follow what is going on with the Mars mission. To have them closely follow from launch to finish has been hard because it is over such a long stretch of time. LFA2 was easier because it was within the month."

"My ranking of the most important items within Passport are first of all to give you communication with scientists, for that is truly unique. The attitude of the scientists

connected with this is really important. No one is talking down to me or to the students and yet they gave us a ton of information. It really gives you a different view of what a scientist can be. I think they have really chosen the scientists well."

"Timing is everything. If you want to do the penguin activity and you do not have advance notice, it might be difficult. So the more notice, the better."

"I have had some concerns from teachers to whom I have given workshops that because of the nature of the projects, you do all of this work and then it is not useful again next year. I totally disagree with that. I know that I will use it next year. I think the materials are complete enough. You may not have the email or the question component but the rest of the program is there and it is enough."

"Another stumbling block is if the module topic does not fit into the curriculum at all. I think if you can focus more modules on the environmental aspects than I think you can work with this and integrate it, than you only lose the physical science teachers."

Case Five: Emily, urban California

Situation and Class Characteristics

Emily has been teaching for 20 years in a school not far from NASA Ames. She has had classroom connectivity for four years and now has two computers in her classroom that are connected. "I got very excited about Passport to Knowledge and Live from Mars when I went to a workshop and heard Marc Siegel talk about it." She wrote a grant for the project so that the entire 5th grade could use it. . She teaches most of the subjects to her class and is not trained as a science teacher per se but it is one of her favorite subjects. "However, I became very comfortable with all of it."

She tried Jason but found it was too impersonal so decided to drop out. She also participated in GLOBE, the international science data project started by Vice President Gore -- she felt that it changed dramatically from year to year. "It is primarily email but it was good. Yet there is really no way to compare it to something like PtK because GLOBE is just e-mail and my students did not have the sense of contact with other students. That was one of the benefits of something like PET."

However, while all of the teachers in the district are doing something with technology, doing online projects is still unusual. So other teachers are curious about her work with Live from Mars.

How did she use the modules and materials?

LFM was used for the whole year. Her students took on the role of e-mail mentors with a second grade classroom. Her students met with the second grade students at one point near the end of the year and presented their team projects to them.

She divided her students into work groups. One group worked with Rover activities. Another group worked on an online magazine and they used Pagemill so that could be mounted on the web. They scanned art digital photos but were restricted in what they could actually show since there is a firm district policy about not showing student faces on the web.

The amount of time devoted to Live from Mars varied over the year. When things were due in the PET activity, it got intense. "We did put the toolkit together and we participated in the online debate and we had fabulous in-class discussions. We acquired all the tools and we investigated the area around the school."

Earlier in the year, she downloaded part of the guide from the Web, -- " it was just incredible to be able to download things that were just ready to go. The class did a nightwatch activity and we did a number of things about the night sky."

They watched both videos. "It was one of the great moments of the year because they read one of the questions from our students during the broadcast. The students liked the videos in any case but that made it really exciting for them."

She split her class into groups, each group was in charge of a piece of the grant proposal. "They were in charge of everything. One group was in charge of building the junk rover (rubber bands and balloons -- from the Teacher's Guide). The group was in charge of figuring out the materials and then telling me what I needed to buy. Then they built a prototype."

"Every group had to have a project manager and that was the main person that I talked to as the work progressed. We also had a material specialist and a technical specialist in each group. That went well -- they had a responsibility and they were really into it."

"Another group did the PET activity. In each case, the whole class did everything -- these groups were just in charge of making it happen. Each group wrote up an action plan and then I would sit down with them to review it. They also had to write down what they hoped to accomplish, what they needed of me and anything else that they needed to and then I would respond. They did an incredible job.-- they were doing real things that depended on them."

"Another group was in charge of live chats. Dr. Jeff Briggs came to talk to them and they were so excited because he had been part of one of the live chats. It was very funny because the group got the whole class organized for that chat and then they realized that it had happened 2 days before. But it was really one of those things that happen in the real world that you grapple with. There was a group that was in charge of scientists' visit. They would meet the scientist at the front of the school and then make sure that the thank you note happened after the visit."

"We would download all the bios of the scientists and the whole class would read them for homework and make up questions. Then the chat group would pick the questions and then they would be directly involved with the live chat."

What was the fit with the existing curriculum?

LFM fit directly into her curriculum. She has always had a space component given the proximity to Ames but now there is so much good curriculum out there on this

topic as opposed to five years ago. She stated that it is now a matter of picking and choosing because there is so much good curriculum. Passport made that work a lot easier by tying it all together and linking it to current, live events.

How were students assessed?

"The kids really did a lot - they produced the online magazine, the rover models and just a tremendous amount of organization and coordination. One group was in charge of checking the site every day to see if there was anything new or changed. They would then show the whole class what was new and they started to explore the other links and related sites. Another group found out all this material about Mars and they are going to present it to the class and then make up a little quiz for the class."

She informally and formally assessed the kids. "It is so interesting because the kids are so different in this setting than they would be in a paper and pencil situation. I watched them from day to day and also I had the forms that the kids had filled out about their accomplishments, what they still needed, and questions that they had. These became another way I assessed them everyday. The other thing that all students did was the Mars mission logbook. We didn't get to do as much as I would have liked. We got so involved with other aspects of the project that it was hard to keep them up and assess them."

"I think what was different was just going around from group to group and listening to their conversations. Because they were really in charge it allowed me to really go around the room and listen to their thinking, rather than just the pencil and paper tests I've used in the past."

This has really helped her integrate technical skills development into her teaching. All of the students got to use e-mail, web tools, and word processing as a regualr part of the daily work for LFM.

Reactions and comments

"One of the most exciting thing is that it was really a current event that continued throughout the year. It was constantly getting updated, no comparison to using an encyclopedia or a textbook as a learning tool. The contact with the real world , especially the conversations with the scientists was great - even though I've had opportunities to bring scientists into the school in the past given my location. The scientist became heros, they were no longer boring or just diversions."

"It was great but I was overwhelmed by all that was offered..so I wasn't sure where to start and what to choose. That was certainly better than the other way around but it was still too overwhelming for a first timer to PtK. When they added the tour to the web site, I thought that was a real plus. We need more of that. To even get a sense of how long these activities would take was hard."

"I thought sometimes the directions were sketchy - like the rover activity. I think that was intentional so that it was open ended and the kids really had to think. But it is tricky to have this work at all...Some of my engineer friends had looked at the rovers and said good luck because we have bought all these motors and stuff. The kids also built the Marscape and they did a lot of research on it. Well unfortunately the rovers that were powered by balloons and rubber bands were not quite able to make it over our Mars scape. This is real life stuff so I think that was a good lesson but you don't want the frustration to get too high. Also, getting some of the materials was hard, so there was some frustration."

"I personally have gained in terms of professional development, teaching practice, and content knowledge. I have always done project work but I have really gotten a lot of this one. This was so much more student directed -- it was an adventure because I did not really know where it was going to go. The students were much more in charge than they have ever been with anything else."

"It was so exciting to be in contact with all of the people that we were.working with on-line and on-air -- with the scientists and other teachers. It made us feel that we were part of something than just our isolated classroom family in a single school."

"I think using Passport will totally depend on the teacher but I still think it can be a little overwhelming. I think it would be hard for a teacher when they got busy to not put this aside after doing just a few activities -- which would be too bad."

Case Six: Jane, suburban Washington

Situation and Class Characteristics

Jane has been teaching for three years in an integrated science and math program for 7th graders. She found out about Passport and Live from Mars at a Washington State Teachers' Association meeting where somebody was presenting the Passport to Knowledge material. "They were talking about how they had used it and how wonderful it was so I really got excited about trying it. I ordered the full kit that week." This was her inspiration to try working with a telecommunications project in her classroom for the first time. She had just gotten a connection in her class on one computer.

How did she use the modules and materials?

She had used it for about 2 months and completed about half of the guide. She is team teaching and has also integrated it with some Social Studies curriculum.

They have not done the on-line activities as a whole class because they do not have the capability for every student to be on-line together. Instead, she had small groups of kids monitor the on-line activities and then they share it with the rest of the class. The students usually print out the materials and then report it. The information is mostly the updates (from web site) since Ms. Sullivan has not subscribed to any of the lists.

She taped the November broadcast and it was very helpful in terms of integrating the rest of the materials in the class. "It also was a great kickoff to the activities for the students -- it really helped motivate them".

In the 2 months that she worked with LFM guide and print materials from the kit she used LFM about 3 periods out of every week.

How were students assessed?

She assessed the kids in different ways. She graded the labs. Some of the things that they do are in groups and they will actually grade themselves. "I have been doing that for about 3 years: they assess themselves and then they assess each other on a point scale. All of the group work was graded this way and then formally integrated into their grade overall with the lab worked added in as well."

Reactions and comments

This content was new to her -- she had not done much with space or geology before. She stated that the whole project is really interesting for her. "The project incorporates basic skills but it is integrating it with something that is going on currently. That makes it far more motivating and exciting for the students. I really like the way this project does that. I have never taught space science but it is a hobby of mine and I have a little background in it in college."

It wasn't too difficult for me as a first timer to both telecommunications and to Passport to make it work. It will now be a regular part of her curriculum.

Case Seven: Jack, rural Colorado

Situation and Class Characteristics

Jack is a first year teacher working in a small rural school system. He currently teaches science at the middle school and each semester also teaches either physics or chemistry at the high school. This is his first online project experience. He found out about PtK through the NSTA newsletter.

He does have extensive experience with technology however -- to make money while at the university, he worked at computer center as a graduate assistant and is comfortable with network management and web page development. Neither of his schools has a connection in the classroom. They do have three dial up lines but it can be difficult to use them in the library or the computer lab as they are tied up often. "I'm not involved with other online projects yet. I was thinking about getting involved with the Jason project but it is not as rich as this."

He is lobbying heavily to get access in his classroom by tying his PtK work to some grant money that is going to the community college.

How did he use the modules and materials?

In his classroom work, he used it with 6th graders. He has too many curriculum commitments to utilize this with the upper grades, but now that he has some experience with it, he will use it with the 7th and 8th grade classes next year. For now, he has more latitude within the curriculum at the 6th grade level.

He used PtK as a springboard into a variety of topics that were in his assigned curriculum. He would spend more time than the guide suggested on particular topics.

He began using LFM as a core set of materials for his class work in November, but feels that he did not make it as far through the guide as other people. His class really got into the Martian topography. The students decided that before they could analyze Martian topography, they would need to understand more about the principles of topography. So they followed a tangent into using topographic maps of the local area and then started integrating GPS. The class did field trips out into the area near the school and did a little bit of ground truthing of elevation along with taking latitude and longitude readings. From this data, they built a topographic map and then build a 3D map that was suggested in the LFM teacher's guide.

This is how LFM was used throughout the year: each activity would lead to other related activities that then eventually were linked back to LFM.

"It has been great. The kids love being out of the textbook and doing hands on. I was able to us the activity on Newton's law. We noticed that the Pathfinder has a pretty interesting landing scenario... we combined Newton Law's activities and some of the other activities in the guide. The kids built catapults to launch eggs and figured out how to protect the egg during flight and landing. The kids got a point for every meter they successfully threw the egg. It was very open ended because they can build the structures any way they want with any materials that they want."

"My girls are more successful than the boys. I am not sure why they are doing better -- they are grasping the concepts of mapping much quicker."

He tried to be involved with the PET activities - they submitted sets of tools and talked about the characteristics of their environment. Because of the lack of classroom connection, there was such a huge amount of mail and it was hard for him to keep up. Part of the problem was the net connection and part of it was they got wrapped up doing other activities in the guide that were a bit more manageable for him. It was hard to be involved in all of it although he wanted to do everything.

They did not participate in the CuSeeMe or chat discussions but he did submit pictures to the Web site. The class got very involved with the challenge questions. He prints out the email and some of the web pages. He is subscribed to debate and discuss lists.

They watched the first program, but it did not have as big a "wow" effect because their viewing of the tape got delayed well beyond when the program aired. He seemed to think that it would have been more exciting for the students to watch the program live, but the program did maintain their interest and it had useful information in it. However, the video in the kit went over very well - especially seeing what the surveyor and the pathfinder were going to do - the animation was good for them. He hasn't shown the

April broadcast yet. The kids were interested in the November broadcast just not as interested. Since he is in a mountain community, there is limited cable feed into the school.

They are also working on getting a dish. "If I can find a way I will - this material is worth it and I can show the videos to make the case for getting it live in the future."

What was the fit with the existing curriculum?

He was familiar with the content but had not expected to be able to find good resources to include it in his teaching -- pleasantly surprised with PtK. "I was familiar with robotic missions that had gone to Mars before. My undergrad degree is in geology and geo-physics, so I'm familiar with planetary geology and the physics covered by LFM. I was pretty comfortable with all of it but there were things I learned along with my students."

The students designed and built catapults, topographic maps, and rockets. With the rockets, the students designed different types using fishing line and balloons and payloads. "I have a lot of flexibility with these 6th graders, so we spent a lot of time with that one -- a full two weeks of class periods. We typically exceeded whatever time I had budgeted because the kids really got into these activities and they led to other offshoots that were already integrated with what I needed to cover for the year."

"The Mars mission logbooks had mixed success -- some of them were incredible and some of the kids lost them every other week. We also created star charts and observation charts and of course Hale Bopp was a big deal -- it was great being part of an on-line community when that event came along."

How were students assessed?

"I assessed the studentson different scales - project products got evaluated, obviously the logbooks got a grade. Every day I give the kids a performance grade based on subjective things like team work, task orientation, and participation. But most of it was formal as much as possible. Informally I tried to discuss with them what my expectations are and where they are at with their thinking."

Reactions and comments

"This provided me with an integrated curriculum. I think it helps teachers by providing them with a curriculum that directly helps them achieve National Science Standards in their classrooms. I thought it was great that through a particular topic, Mars, we were able cover a variety of scientific topics for this grade level as opposed to

just teaching separate, isolated scientific concepts. I think it works better for students to pull it together through a topic like this. So with Live from Mars you have some physics, some life science and some history, technology, robotics. While there are a lot of people who would disagree with me about a push for core knowledge, I think this works better. It helped my students achieve in science through a hands-on approach."

"There has definitely been a huge amount of research and time put into these projects by the staff. The materials are incredibly thorough. To the best of their ability they have tried to pull lots of different people into it. They show how you could tie it into other areas like history, they have been able to get all levels of teachers involved... elementary, middle and high."

"Also it is so flexible: you can do the PET if you want, you can get involved in the challenge questions -- there is a wide variety of avenues in which people can get involved. If there is a weakness, it is that the schools we work in need to rely more an active net connection. Also teachers need to make decisions on what parts of the program that they are getting to get involved with and that can take some effort to figure it all out. I guess these are not weaknesses on the program's part but these are the challenges that teachers are going to face when using it."

"I love the flexibility. It is great that they have a program that is appealing to traditional teachers where they have a lesson that they can follow a b c right out of the manual or they have these open ended exercises where the kids are discussing things like the PET. It allows teachers the ability to jump in and out depending on their needs."

"My involvement in LFM has made me realize as a first year teacher the kinds of materials that I need to have at hand to be a good science teacher. Also how critical it is that I get a net connection. It has furthered my understanding of my teaching philosophy in practical terms."

Case Eight: Robert, suburban New York

25 years

Situation and Class Characteristics

Robert is a computer teacher who teaches a mandatory course for all 6th, 7th and 8th graders that lasts a 1/2 year. He now teaches 10 classes a year that cover the use of the word-processor to spreadsheet to graphic design. "We have an extensive school home page on www, and this became a main reason for involvement in LFM." He has been teaching for 25 years.

Last year he did a web search for Hubble and found the LHST site. He was overwhelmed with all of the materials and their appropriateness. He had his students watch the second program but they found the module a little hard to follow because they came into it a little late. "The concept was great and when I saw that PtK would be offering more projects this year, I decided to bookmark the site and go back to it when the next project started up. When the Mars project came up, it was perfect because I could see that it was interdisciplinary, the science, science fiction, the art and the writing. It was an interest of mine through NASA and the astronomical society, so I ordered the kit and I sat down with the science teachers. We divided the materials up because I couldn't use everything and I didn't want to waste it."

"The district paid for it. I spoke to the superintendent about resources available on the Internet, I specifically mentioned Passport to Knowledge and the Kit, that we got all of these materials and a two year project and it only cost $100. I recently spoke to a parent group and I brought the kit and I said here is an example of how important it is that kids **are** on the Internet, look at these resources look at the access the kids have to scientists and look at the kit. Parents are concerned as taxpayers about whether this is costing a lot of money. Form a practical point I got some wonderful materials for $100 and even after the project is over we will still use them."

He has participated in Scholastic network. He stated that they do not have anything this extensive but they do have experiments in using the Internet and using online service and online conferencing which had been useful.

How did he use the modules and materials?

He met with Arts and Science teachers in the 8th grade because some of the material was not appropriate for his class for what he was planning to do. He gave these teachers, labs - visuals etc for them to use in their classes. He coordinated with them so that they would use the materials at the same time that he was working on the project in his computer class.

His 10 classes were assigned to design Mars handbooks for the Web. Each class took one specific topic. One class took the 2 moons of mars, another class took past exploration of mars, others took the one of the present two missions. The students researched then these topics.

Part of the research was using the materials from the kit. They used the teacher's guide, the posters were hung up in the classroom and used as reference materials, the videotape (the one in the kit) was used with all of the classes. The other materials that the students used were found on the Internet at the LFM site and then they jumped off from there, mostly to NASA sites but they used others as well.

Each student then wrote a paper and outlined it using all the materials that they had found. Each class is now putting together the best of the writings and putting it together for the web. The next step is have the English teachers proofread the material before it is mounted.

This demonstrates the interdisciplinary team approach in his school. In addition to the English teacher working with the students on their writing while he mentors their technical skills, the science teachers are doing the experimental activities from the guide -- most of the kids did the stream tables experiment. The science teachers had done work on earth formations but added this in as a nice compliment and extension to that work.

It was completely integrated into the curriculum. He has also decided that althought PtK will be doing other projects in the future, he is going to keep their handbook on the Web and keep adding info as it comes in from the two probes. Other classes will update and add materials. He and the other teachers now envision this as a two year project.

He subscribed to all the listserves. He used the first LFM video but did not get the second one taped.

He has used some clips form the original version of War of the Worlds to tie in science fiction with science fact. "Now that the student have basically finished with the writing they are now creating pictures of Martians and all of the pictures have to be fact based, what Martians would look like, taking into account all of the information that we have about Martian climate etc. My intent was to get the 6th graders involved with doing some creative writing. So that the students' work will integrate both science research and science fiction."

What was the fit with the existing curriculum?

Basically he has used this material to be the foundation of his curriculum for the entire semester. For example, if there are problems encountered while they are trying to format text or download pictures off the web site, then it becomes the basis for entire lesson. So problems are encountered and then they figure out how to solve them.

How were students assessed?

"It is formal and informal depending on the work. With the web writing, I wanted the content to be firm and factually correct, but for the design and the graphics there were other criteria but it was looser." His assessment practice was essentially identical to what he has been doing for the past several years.

Reactions and comments

"The power of the use of various forms of communication, the use of television, the Internet, the ability of email are real strengths of this project and none of this would have been possible a few years ago. I especially like the fact that it shows the different content areas to be interdisciplinary. One of the terrible things that we do at the secondary level is to convince kids that there is math and there is science and there is art and none of those people talk to one another. All of these projects show that they are all interconnected. I think that is a very important lesson. I also think the fact that they are dealing with scientists as real people, watching them live through television, through emailing and the web site is great."

"For us, we are publishing on the web and we get responses from readers. The fact is we are not doing the same old routine of take test get a grade. There is something more that they are getting out of doing this work.. I also think the fact that they are collaborating is crucial. Even with the video programs, it is not somebody lecturing on the television, 'this is what you should know about Mars and the Hubble..' -- it is groups of people working together, it is people saying I don't have the answer, do you have the answer...:"that is the way the real world works. I think in school, we tend to give the opposite impression that there's a teacher who knows all the answers. As we were working on this Mars handbook there were lots of times I didn't know the answer. I did have some ideas of where we could go to get the answers, but I didn't have all the answers and that is a good thing."

"I think the background material in the kit about Mars was very helpful. The guide elaborated on different activities and science experiments and I was glad that I shared it with the science teachers."

He is the only teacher who has connection in the district. As much as he can, he acts as a resource person for other teachers, for example, getting the science teachers involved with PtK. The lack of connectivity is not only a major obstacle for teachers doing this type of work, it is a major problem in the district.

He has put in an enormous amount of effort to overcome fear on the part of administrators. They were afraid of what would happen if the kids had access to these materials. There are safeguards but the important thing is to develop good activities from an educational standpoint. He makes sure that these are shown to parents and administrators so that they can see all the great work that the kids are doing. "I remember when VCRs came out and there was a lot of resistance to having that technology available. There was a lot of concern that if teachers had VCRs then they would just show movies all day. That was a big battle. Eventually it was seen as a valuable teaching tool and of course you don't do it all day. So the same is true of the Internet."

For four consecutive years he was told that there was absolutely no way that he was going to be allowed to have access to any sort of online communications/Internet access. Every year he was told; 'No', with very specific concerns and every year he addressed them. This year they finally said yes and then the day before the phone line was put into the room he was summoned by the superintendent who told him that they were going to watch his every move and that if anything happened the phone line would be yanked. "Thanks to PtK, everything has been fine but there is still this fear that I am now the only person that can handle it."

"I never had done anything in the class with this much science content, involving so many classes. LFM allowed me to be much more organized than he has done on previous projects, therefore the kids accomplished more."

Case Nine: Renee, small city, Wyoming

Situation and Class Characteristics

Renee teaches 7th grade science to four periods of students in her middle school. She has been teaching for three years. She found her way to Passport to Knowledge last year while learning to use the World Wide Web. She found the Live from the Hubble Space Telescope site and has been a active participant since.

She now has a dial up line in her classroom and uses her own personal computer, which she brings into the school.

While she is one of the few teachers using on-line materials in the building, she has been sharing materials she gathers with others in other disciplines. The school is encouraging a teaming approach and PtK fits in well with that. She has linked up with an eighth grade teacher who is now getting started with using Passport. "My excitement about this project got her interested." This new team approach has also meant that she can block out schedules to get longer periods for PtK work when needed.

It also extends to more cooperative teaching. For example, while using the LFM activities around land forms on Mars, the language arts teacher worked with her students on their student notebooks and used the interviews with scientists as the basis for some research and writing activities.

In class projects are becoming more typical for her school and district.

How did she use the modules and materials?

"Astronomy is one of my units, usually it takes about 8 weeks of the year. Live from Mars has been great because instead of just using a textbook, I have been teaching what is currently happening in space science. I used a lot of the activities and the labs from the guide. We also were involved with some of the online interviews with the scientists. The tie in to earth science worked very well -- the activities around the different land formations on Mars, like the craters. I did several of those and they worked out well."

"I used the challenge questions for the kids and gave them a week to provide the answers and then gave out prizes for the person that got the answer. There was something going on all the time."

They participated in the PET activity. They had to stop after they submitted their proposals because of other curriculum work. She had just received email at the time of the interview that the final toolkit was going to be decided on. She brought the kids up to date and definitely plans on picking it up again when it moves to investigation of the local sites with the toolkit.

She was not able to watch the video live because her local PBS station did not carry it. She thought it was really important, so she started a mini letter writing campaign to the PBS station to complain that they did not carry the program. In the meantime, she got it videotaped at the local college and they sent it to her. She was very positive about the videos, although was disappointed that it was a logistical headache to get them.

"I used the current videos on tape and they worked well with my students. I am going to definitely tape the one in the summer. The other teachers as well as the kids are really interested in seeing the landing. I am planning on continuing with the new 7th graders and the kids who will be in the 8th grade next year, so I will be providing those materials to their teachers. There will not be the same live interaction next year but I think my new kids will get a lot out of these videos. We call once a week to the NASA line and finds out what is going on with the different missions."

What was the fit with the existing curriculum?

"I really love the flexibility. I can drop in and drop out when I need to. That is particularly helpful considering the type of curriculum that I teach throughout the year. Even though there was an intensive period of time that we used these materials, I will constantly go back to it because there is stuff about Mars in the papers and TV all the time. We are going to start a physics unit in a couple of weeks and there is so much of the LFM and the LHST material that I can use there".

"This was not only integrated into my Astronomy curriculum -- it was my whole curriculum. I integrated what was in the guide into what we did. I added onto what they had. Other activities I made into take home projects. In one instance they had to create the first team of colonizers. I used this as a science career study: who would they take and why would they take them? How would they build that team? They looked at the Arizona biosphere team and other science expeditions. Another project was to draw the kind of buildings that you would need as well as the different necessities that you would need to survive. These were extension projects but they were all things that we had built from the background that we had gotten from the LFM project."

How were students assessed?

"I used all the lab sheets that were in the guide and expanded them in some places. The students made charts and graphs and recorded data. I think that is a real important piece of science learning. I graded all the activities but what I weighed most heavily were the ones that required the students to use the information gleaned and then put it together in a new way."

"In the colonization project, I looked for evidence that they knew facts about what Mars was really like so they would understand what kinds of people, what kinds of teams were needed. They had to evaluate why they had chosen certain people over others because they could only choose 16 people."

"In the career study where knowing what the different scientist do, the students classified them by their specific titles as opposed to something general. A lot of this knowledge came after they had actually talked on-line to one of the scientists and saw the video."

"Another project I used for grading was putting together travel brochures, they incorporated a lot of information about terraforming. We had actually talked about terraforming during one of the online chats. The kids loved it. There were some brochures that made Mars into this inter-planetary park and it turned into discussions about what should be preserved. We had a lot of really interesting ethical discussions."

"I did give them grades for these projects. The learning was more active than in a more traditional curriculum and it got to more of my kids with different learning styles."

Reactions and comments

Renee has participated in other computer-based education curriculum projects but they were not as extensive or as comprehensive. She felt that the link with NASA made it real and this solid link really shows in the quality of the materials.

"I like the project goals - It exposes kids to the possibilities. It allows kids to be on the cutting edge. We are not getting science from the outdated textbooks we have access to here. I am constantly showing kids materials or pictures that were taken only a year ago and now we know something different about it. When I was working with the Hubble material, I showed my class an old picture of Neptune and I said, “see this spot, it is not there anymore.” It also keeps the teacher hopping because next year's program won’t be the same and you can’t just keep the same lesson plans forever. That is really part of the excitement of it. I think the experience of talking to the scientists is really important, of having a kind of inside track with the people who are really there and doing this stuff. The kids were so excited to have their questions answered. I mean 10 years ago that would have cost a fortune to have the scientist come visit. Now I have this

program and it fits in so nicely with my curriculum. It is so user friendly. I can decide on Monday to be involved in that web chat and go with it. I used to have to prepare for a long time and now I have become much more spontaneous."

"I can use what I want and leave out what I don't want. They are in tune with the fact that each class out there is different, they really listen to that. I think that is the greatest strength. I think we all have some learning to do in terms of the web chats, about the type of facilitation that is needed for those types of web chats. I don't want to say that we should restrict the amount of people on.- I am not sure how to do that most effectively. I am sure that as we all get comfortable with the technology it will get better, but right now that is the only weakness in the various components that I have used."

"For the Hubble project, I was completely unfamiliar with the content and the guide and the on-line community really helped me get comfortable with the material. They told me where to look and what to look for. It does take a lot of time but it is something that I love so I don't mind. I am much more comfortable with the Mars project, but when they get into rockets and the engineering, it is all new to me. So we are all learning together. That aspect is probably what I have gained the most. An awareness and the professional networking. I now know where to go to ask my questions!"

"My administration is very supportive and likes this work. They feel it helps justify trying to find the money so that the school is providing the equipment for all the teachers."

Case Ten: Martin, suburban Michigan

Situation and Class Characteristics

Martin is 7th grade science teacher working in a boys academy who uses PtK as an optional activity. He has 2 groups of students every other day, they are coming instead of going to the study hall or whatever other free time they have. Most of the kids are his students but some of them are 8th graders. He started doing this project outside of the classroom because he wanted to use the activities but was not sure how to fit it into the existing science curriculum that was highly structured. He has been able to use pieces of the LFM module in his regular science classes where they can replace an existing activity that addresses an equivalent objective.

"My regular science is really packed. There was no way to put it in there without totally changing the curriculum, which takes a year to get it approved. The best way to do this now and get kids involved was to do it after school or during these study halls that the kids have. The study hall period turned out to be the best way to do it."

"

How did he use the modules and materials?

He started using LFM in November after finding out about it while browsing the Internet. He ordered the full kit and uses it with both of his study groups between two and three times per week. Once he got the materials, he went to the study halls, showed the students the materials and asked for volunteers. So the kids who were interested came and joined the group.

He used the PET activity extensively. The study group students participated directly in deciding what was going into the toolkit. The regular science classes were taken outside to do the data readings. There has been 19 kids in the volunteer group and an additional 56 kids for the data collection phase of PET. They spend about 40 minutes a day on LFM but towards the end of the debate about the toolkit the students stayed after school and put several hours in.

Another thing that they have been working on is the rovers. They have old LEGO kits so the kids have been building rovers with LEGOs that they can drive with the computer.

He has watched both videos. They taped both and but did not have NASA connection in the building, so they had somebody tape it for them. The students especially loved the second program because it was all about the rover so it related directly to their work.

What was the fit with the existing curriculum?

Now that he is familiar with the materials, he plans on integrating this into the regular curriculum next year where the 7th grade will spend 1 day a week on all the activities in the guide. Plans to tape the program in the summer. Most of the kids that he has been working with will be in the 8th grade, therefore they will still in the school. He plans to pull them out of a study hall and have them join in with his 7th graders. He will try and do some activities with the 8th graders so that they can still be a part of it next year because it has worked so well with them this year in the informal study groups.

How were students assessed?

"In terms of the PET we did a lot of debating and followed debate-lfm really closely, trying to figure out which tools to put into the toolkit. We spent a lot of time discussing amongst ourselves as well as talking about the proposals from the other schools. We had a laugh about our original proposal because we needed a shoebox that would have fit Paul Bunyan's shoes. I thought there were very good discussions on-line. I have the connection, so I got the mail and printed it out and then copied it so the boys could read it. Because they all have accounts in school, I can forward messages to them. I am also subscribed to updates-lfm and I forward all the messages to the students. There has been a lot of discussion and a lot of research."

"We all got really hung up in the navigational aspect of this project. We were trying to calculate our own longitude and latitude - using the instruments in the toolkit we actually came pretty close - surprisingly. We actually did everything wrong that you could possibly do but we kept slugging away. We finally figured out what we were doing wrong."

"Everything was done through me but the kids would type up the response and then forward it to me and then I would post it to the list. Other times we would talk and I would jot down all the suggestions, write it up and send it."

"Given the study group format, there was no formal assessment. I think it is a real testament to the quality of the program that they didn't have to come and they came anyway and bugged me about it constantly. They really love it."

Reactions and comments

"It has been challenging to learn enough to feel confident with the students. The students have been challenged because the program is so unique, everything is so new to them and is very different than anything else that they have encountered so far. They just love it. They will meet without me. After school they will go down into the media center and get onto the computer and look at the debate list. The school has several connections but not in the classroom where the group meets so the kids have to go to the connection which are at various locations in the school, media lab, library etc. Several of the kids have connections at home so they do this work there as well."

"I felt that the primary goal of PtK is to give real credibility to the science that the kids are doing. The kids really felt that, they felt involved. Especially when they were able to participate in some of the web chats and talk to the scientists. We did two of the chats but I think it was an important component because they really felt what they were doing was significant."

"Secondly, I think it helped them develop some interpersonal skills. When we would debate, the fact that you may disagree with someone and you have to do it sociably and not get into fights. Also that had do be done in the context of the class as well as behaving that way with other classrooms. We had some great discussions around what we were going to send out and other classes contacted us and told us either they liked the idea or they didn't like the idea and we had to figure out how to respond. So I think the kids really learned how to respond, work and deal with other groups and especially people we don't know."

"I think the curriculum materials that were sent out were great, I wish we could have used more of them. One of my science students used some of the curriculum materials on craters and rivers on Mars, he found it really useful. He is not one of my stronger students and he found it accessible. So I think it is well done. I have not had an opportunity to do this with my class but I definitely plan to use it next year."

"The other strength is the validity of the program by having real scientists involved. To be able to get help from astronomers and payload specialists was amazing."

"I learned a lot in getting involved, I didn't even know my own email address because I was such a novice. In our school, we aren't computer savvy, but we are learning. Getting on the Internet is a little intimidating because we do not know what we are getting ourselves into but we will get over that in a year or two. PtK made it really easy to get involved and I felt chagrined that I did not get involved sooner. The web page is very nicely broken down and you can just read and go where you want to go, especially considering that this was really my first time not only seeing it but involving kids with it."

"I now have much more facility with email use. I know what listservs are and how to use web pages in an educational setting. We have learned a lot about the different information that we can access, we just found out that we can access out own weather radar picture."

"We also learned a great deal about Mars exploration. It has been great for me because I was pretty disillusioned with the NASA program because I used to feel that we were sending out a lot of shuttles and I wasn't sure that they were doing important work. This is very exciting. It has been fun watching the 7th and 8th graders working together because in our school we are really separated by grade."

"The 8th graders that I had in this group I had as 7th graders last year and they were not particularly leaders last year, but they definitely were this year. It was great to see them grow. Now I can make a great case to mix the kids together and see them work together."

"I have gotten support from by the administration -- the principal loved the materials and the school bought the kit. He definitely plans on getting the school involved next year."

Passport to Knowledge's Impact on Students

Passport to Knowledge gives explicit objectives for student outcomes to be derived from participation in these modules. In both the *Live from Mars* and the *Live from Antarctica 2* Teacher's Guides, the student outcome objectives are:

- obtaining content information more current than that found in textbooks;
- acquiring general knowledge about the exploration of space/Antarctica;
- developing positive scientific attitudes towards science and technology;
- attaining a better understanding of the scientific method and research process;
- practice in applying new technology tools and research skills.

While several teachers have reported significant gains in student achievement test scores in science which they attribute to PtK, it would be difficult to factor out PtK's specific contributions since these modules were always designed to work in concert with the existing science curriculum. Impact is obviously related to which components a teacher uses and the previous sections provide evidence that this varies considerably among participants. Teachers are encouraged to adapt and adopt the PtK components in each module in a wide variety of ways to suit the needs of their students and the logistical realities of their environment.

Certainly the stories depicted in the case studies gathered from the ongoing tracking study provide evidence of both content mastery and student skill acquisition in both science processes and technology applications. These can be augmented with postings by teachers to the various project mail lists that describe their student achievements obtained through use of the modules.

There are three areas where Passport's impact on students can be assessed. First, we have asked teachers to evaluate their students' attitudes and enthusiasm towards science and scientific careers as a result of their utilization of PtK components. These areas continue to be assessed in our surveys and we will continue to do so in Year Three of the evaluation.

Second, we can look at student work products submitted through collaborative activities such as the PET project in LFM this year or by student work offered up for posting in the web site gallery or on school/classroom home pages.

Third, teachers can look at student behavior in their classrooms -- in their work products, in their questions and in their classroom discussions -- for evidence of all five of the points listed above.

While the first method is done in many studies of project-based science and we have done it here, the second and third techniques are rarely done in a consistent way with teachers sharing a common set of standards from which to make judgements. The work on national, state and local standards provides just such a yardstick to help look at student work, be it written, oral, models or drawings, or electronic.

Changes in Students' Attitudes towards Science and Scientific Careers

In this year's evaluations, as in those of the previous year, this first type of student outcome was addressed by asking teachers, as part of the surveys reported on in the previous sections, to consider the impact on students of a specific PtK module or a specific component within a module. Questions focused on eliciting teachers' judgements on how valuable various aspects of a PtK module were on student learning and attitudes (see Appendix 2 for the questions).

Teachers using Live From Mars, for instance, stated that the LFM module

1. Significantly increased their students excitement about studying Mars (87.5% of the respondents).
2. Enhanced their curiosity in careers in scientific research (79.4%)
3. Directly improved the motivation of students to learn about space-related topics (90.9%)

Live From Antarctica 2 produced similar evaluations from teachers:

1. 93% of the responding teachers felt that LFA2 significantly increased students' excitement about Antarctic research.
2. 84.1% stated that LFA2 increased their students' curiosity about careers in scientific research.
3. 93.3% stated that LFA2 increased students' motivation to learn more about Antarctica.

Some teachers also did end-of-project evaluations with their students. Here is an example from Tim McCollum, an experienced PtK teacher:

```
To: discuss-lfm@quest.arc.nasa.gov
From: cxtdm@eiu.edu (Tim McCollum)
Subject: PTK Open House & 96/97 Wrap-up
jwee@mail.arc.nasa.gov

Hi Fellow PTK'ers,
        Two more weeks and it's summer vacation......yea!

        Hope your 96/97 PTK involvement has been an enjoyable, rewarding
and positive experience for both you and your students.  I'm looking very
```

forward to the continuation of LFM in the fall and focusing on the tropical rain forest in the spring. As classroom teachers collaborating with the PTK initiative we certainly aim to model the goal of being lifelong learners.

On Monday evening, May 12th, we held a Passport to Knowledge Open House. During the event, students and parents drove our Lego Dacta rover - M.A.R.I.O (Manually Activated Rover for Investigation and Observation.....named by the kids!), shared their own contributions to the LFM and LFAII web sites, and were treated to a wonderful slide presentation on Antarctica by a husband/wife team of retired professors from our local university. The couple had been to the Palmer Station area two years ago and their program related very well to our LFAII experience.

Now that the PTK initiatives for this school year are winding down, I'd like to offer some words of insight (and humor). In attempting to gather some narrative feedback from my students (190 - 7th & 8th graders), I asked three questions. Perhaps some of their responses could be of use in planning your next PTK involvement.

1. Both LFM and LFAII involved following the work of real scientists. What new insights and understandings have you gained about their actual work, their tools, and how they communicate their discoveries to others?

* I learned that scientists work hard, not only with their hands but with their minds.
* Scientists don't just sit in the lab all day.
* When they plan to put a spacecraft on another planet, they must think of everything!
* These projects made me realize that scientists are more than the Far Side "white lab coats and beakers" stereotype.
* They have to learn to work together as a team.
* I learned that sometimes it is hard to get information to other people.
* It has opened a whole new door of science that I might like to pursue.
* I learned how they use their tools and knowledge to overcome their problems.
* I have a greater respect for those who give up portions of their lives to live in desolate places to do research.
* I thought it was neat how they shared their work with us.
* They have to organize a lot of data so it can be accurately used for reference.
* I learned that they don't always get the recognition they deserve.
* Oil isn't as easy to clean up as I thought.
* A scientists's work is never done.

2. What lessons, activities, and/or topics did you find most interesting and enjoyable?

* The study of penguins because I think animals of remote places are interesting
* Listening to our PTK Open House speakers
* The live broadcasts because they were really happening as we were watching
* We got to ask questions about what we wanted to know and got answers
* By participating we got to find out what was really happening instead of being left out
* Driving the rover, shrimp & krill labs, the oil spill lab, the PET project, the CFC lab
* The chat sessions because we got to ask questions to REAL scientists (and they got me out of math)
* All the interaction helped give a better idea of what we were learning
* Journal writing for the web site
* By getting to experience some of the same things as real-life scientists so you can see if you want to go into that kind of profession
* The blubber glove, it was fun, cold and wet!
* The web site because you could go at a pace you liked and you learned

more that way
* Red Rover, being able to drive something hundreds of miles away
* The challenge questions, they made us think
* The MOLA project and converting our paper models into 3-D on the computers

3. What suggestions can you make about student participation in future PTK projects?

* More "hands-on" activities
* More chat sessions
* More MOLA type projects to show how things work
* Stopping the video tape at times for discussion
* More time to browse the web sites

Hope these few bits of insight offer some food for thought in planning for your future PTK involvement. Happy summer.....on to Mars!

Tim

.....

Tim McCollum 217-345-2193 (school)
Charleston Jr. High School 217-345-8121 (fax)
920 Smith Dr. cxtdm@eiu.edu
Charleston, IL 61920

Error! Reference source not found.
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Another example comes from an excerpt from an end of the year message from an elementary teacher Marilyn Kennedy Wall:

To: discuss-lfm@quest.arc.nasa.gov
From: mkennedy@head.globalcom.net (Marilyn Kennedy)
Subject: You were there...

You Were There....
at our "Mission to Mars" Night

This past week students, parents, and guests of three school communities joined together in first ever "Mission to Mars" Night. This special event not only celebrated our involvement with PTK "Live from Mars" project, but it also highlighted the efforts of what can happen when three county schools are drawn into collaboration through the tools of technology. After being part of the "Live from Mars" virtual conference in DC this past July and seeing the excitement that is generated when "strangers" from 50 states come together focused on a project and maintain that focus through online collaboration, I knew I had a mission. The best way to spread the word was to directly involve "interested" teachers, and invite them to join my students and me on this "out of world" venture.

….

Tuesday was our culminating Big Night out. It seemed so long ago way back in October that we planned this event and marked it on our calendars. May seemed so far away! This "Mars to Mission Night" was the celebration of the partnership and collaboration of the three schools. Teaching in a large county like ours, students and parents tend to stay in their own local county areas, so this event was unusual in and of itself, the intermingling of the three different districts of the county. There is more mingling of students on the middle and high school levels, but our elementary schools are more parochial in their school events.

The students worked together to set up the centers for the invited parents and guests. Students selected their "favorite" Mars activities to demonstrate, using our PTK teachers' guide, activities suggested by you, and activities I found at NSTA. It was fun watching parents "be students" and students "be teachers" at each activity center. Students instructed their guests on making craters, helping them discover shield volcanoes and lava layering. The students as teachers modeled the Solar System with their solar system snack just as we had done with them. They had their parents conduct investigations into the possibilities of "life" on Mars. My own class had spent this last five months creating 3-D futuristic International Space Stations complete with descriptions and explanations with their essays on importance if "Space Exploration" (an idea I borrowed from Chris Rowan). Students explained various Mars Internet sites and helped their guests use pieces of space astronomy software. And the finale of our "Mission to Mars" was the students showing off their "Mars Rover Center", with their town "Sojourner"Rover and they instructed their parents on the programming of the rover over their Martian terrain.

What an awesome night! I could not have been more proud of these 4th and 5th grade students as they worked together as hosts of this special celebration, enlightening the audience with their knowledge about this year's "Missions to Mars"….

Anyway, I just wanted to share the kind of energy that is created when traveling along with PTK on the "Mission to Mars" !!!

Thank you all for such a fabulous year!!

Marilyn K. Wall
John Wayland Elementary
here in the Shenandoah Valley in
Bridgewater, VA

Posted Student Work

The second area for examining student outcomes were the posted examples of student work. Both modules' web sites contain a gallery of student work. These clearly show mastery of electronic design and publishing tools by students. They also depict the impact of some of the LFM and LFA2 activities on students.

While the opportunity to foster student work sharing will continue to be a part of Passport web sites and an activity encouraged on the list, we launched an effort this year to conduct a more systematic analysis of student work produced by PtK.

Our objective is to use an amalgam of age, process, and content items adapted from state standards documents, which are in turn based on the National Science Education Standards and the Benchmarks for Science Literacy, to form a customized checklist that covers the content areas covered by this year's PtK modules. We then used this checklist to look at the student submissions.

The objective for this work is:

Does student work that is produced from direct participation in a PtK activity show evidence of grade-appropriate science learning as outlined in the science literacy benchmarks, science standards, or state frameworks?

a. Can independent evaluators apply a checklist of these outcomes with high inter-rater reliability?
b. Can the evidence be directly attributable to PtK?

The results of this analysis are discussed below. The next step is to extend this work so that teachers can use the checklist or a modified version that includes their own relevant local or state standards to assess additional work that is not publicly submitted, or is in some other form than electronic. This would include classroom reports, homework, presentations, models and classroom discussions.

This methodology is derived in part from work *Project 2061* of the American Association for the Advancement of Science has done around building an evaluation tool for teachers to use in identifying curriculum strengths and weaknesses[16]. The AAAS work derived and tested a process for training teachers to apply a valid and reliable procedure to reviewing large scale, comprehensive curriculum materials in science. The premises underlying this process involved making defensible judgements about how well the materials are likely to contribute to the attainment of specific learning goals while focusing on both the content and the instructional properties.

While the process developed by these authors is rigorous and promising in terms of helping educators screen materials for adoption, it produces judgements of the likelihood of effectiveness and not any empirical analysis of student learning produced by the use of the materials. Furthermore, the process was designed with full, comprehensive curriculum packages in mind.

We are adapting this process, albeit on a less rigorous scale, to address the objectives listed on the previous page. In this second year of the evaluation, we concentrated on a direct examination of student work produced and submitted on-line. We will refine and expand the process to include teachers in Year Three of the evaluation.

Due to the flexible nature of PtK and its actual utilization, we decided to pick two exemplary state science frameworks to use as the basis for our exploration (see the Methodology section in the Introduction for more details and Appendix Four for the

[16] Roseman, Jo Ellen, Kesidou, Sofia, and Stern. Luli. Identifying Curriculum Materials for Science Literacy: A Project 2061 Evaluation Tool. Paper Prepared for the colloquium " Using the National Science Education Standards to Guide the Evaluation, Selection and Adaptation of Instructional Materials", National Research Council, November 10-12, 1996.

actual list of outcomes we used). These embodied the NSES and the Benchmarks, but are more detailed at the content and process level and therefore are easier to use as a framework for student work analysis.

Our process had three staff reviewers independently look at the collected work samples or on-line web sites submitted. Each assigned the work as many codes from our list as she or he thought relevant. We did this for 30 separate pieces of work and compared notes. Our inter-rater reliability was above 90%. The remaining 104 items (N=134) were coded individually.

The activity that proved to be the most fruitful in providing evidence that was suited to this type of analysis was the **Error! Reference source not found.**. This activity generated a significant amount of student produced e-mail. The several levels of sequential work were oriented to student problem solving, analysis, and peer review so provided a great deal of evidence for the types of content and process outcomes that are stressed on the list of outcomes in Appendix Four. These type of multi-stage on-line collaboration project has become a staple of PtK modules so it was a good place to look for clear evidence of student learning.

The PET activity has student messages occurring over a four month span that show detailed evidence of all four broad categories. Classes that participated in the complete cycle all had messages that showed multiple outcomes in the Design, Process, Interpretation and Sharing specific categories. The specific items that occurred the most often in the written student messages were:

Table Nineteen Outcomes Demonstrated in Student Work N= 134 items

Percent of items showing indicators:		
32 %	D-1	Develops questions on scientific topics
48%	D-2	Chooses the steps necessary to answer a question.
71%	D-5	Proposes a design to solve a problem based on given criteria.
76%	P-1	Demonstrates accurate recording and reporting of observations.
76%	P-3	Collects data for investigation using measuring instruments.
56%	P-4	Collects data using consistent measuring and recording techniques.
36%	I-1	Describes an observed event
54%	I-2	Records and arranges data into logical patterns and describes the patterns.
28%	I-3	Compares individual and group observations and results.
76%	I-4	Participates in and understands the importance of peer reviews in improving the scientific process.
64%	S-1	Describes individual and group investigations clearly and accurately in oral or written reports.
36%	S-2	Constructs charts and graphs to display data and uses these to produce reasonable explanations.
54%	S-3	Reports the process and results of a scientific investigation in oral and written presentations.

62% S-4 Makes, presents and defends conclusions drawn from investigation to a classroom audience in written or oral form.

34% ES-3 Analyze and explain naturally occurring earth and space events.

24% ES-4 Describe and explain interactions of earth components and solar system components.

48% ES-5 Compare and explain short and long-term planetary and celestial variations (e.g., latitudinal effects on weather and climate, relative positions of the planets and stars).

Sample student items:

The following items were research papers typical of the type described in the case studies and suggested in several of the Teacher guides' activities. These are not direct experiments or investigations. However, they show clear evidence of communicating and technology usage as defined in the broad statements B-2 (student uses precise and complete descriptions and the presentation is supported by evidence. Descriptions show careful observations, organization of data, and translation of findings into clear language) ands B-3 (student uses appropriate tools, equipment to access information and share ideas or communicate results). These papers were part of a class submission from a fifth grade.

The following print outs of student postings to the PET activity list are examples of

1)

I-2 Records and arranges data into logical patterns and describes the patterns

2)

D-1 Develops questions on scientific topics

D-2 Chooses the steps necessary to answer a question.

P-1 Demonstrates accurate recording and reporting of observations.

I-4 Participates in and understands the importance of peer reviews in improving the scientific process.

3)

I-4 Participates in and understands the importance of peer reviews in improving the scientific process.

We have also included several additional messages from some of the classrooms described in the case study section to give the reader a sense of how the PET project evolved.

These student samples and the entire pool of 134 items of student work we analyzed represent a small fraction of the student work produced in PtK classrooms this year. This technique, the analysis of student work submissions according to science standards, is a viable means to explore the impact of PtK on student learning. In year three, we will take steps to increase the amount of work available electronically to be analyzed and will provide teachers with the tools to use it in their own assessment of student learning.

Teacher testimonials have been both ample and highly supportive of PtK's worth and will continue to be valuable sources for judging its effects. The structure of this outcome list (or a locally adapted version to incorporate local frameworks) provides the rigor to go beyond the anecdote. This will provide valid evidence of what PtK provides in terms of concrete instructional opportunities in a way that teachers can use to justify its use in their classrooms. Furthermore, building a common language among teachers and a shared sense of what constitutes appropriate expectations when encouraging and

assessing student work within the context of PtK activities will help ensure that PtK's potential as a science learning tool is maximized during its implementation.

Marketing

Continue to target NSF systemic initiatives to increase PtK adoption in large urban districts as well as Rural Systemic Initiatives. The proposed development of comprehensive kits during Year Three may make large scale adoptions easier.

Build a PtK web site that links all of the modules and provides an umbrella for the project that is distinct from the various NASA projects. A PtK-wide e-zine (aka newsletter) would help unify the project and continue to build the user base of the permanent PtK community.

Evergreening

Certain known events, like the service mission to the Hubble Space Telescope, can be leveraged to provide a natural link to bring teachers back to an older module. PtK might consider using Advocates to create mini-events that can be conducted on-line that will help make these sites dynamic again, even if just for a brief period of time.

There seems to be an appetite for a multi-media kit -- especially if done as a hybrid Internet on CD-ROM design with links to live resources.

Teachers have continued to register for the Live from Antarctica 2 site, long after it was over. We are still getting 30 to 50 LFA2 registration forms from the web form that is active on the site. PtK should think about how to reach out to these people who are coming to the party a bit late.

Use of the Advocates

The Advocates as a group are a significant asset for the project. They may be able to take on more roles in maintaining the evergreening process, in mentoring new users, and moderating mini-events.

The web sites are now seen as a central part of the project. Consider using the advocates and their classes as sources to grow and maintain the site.

Consider how to grow the Advocates as a formal part of PtK -- how can users become Advocates as they gain experience in using PtK in their classrooms.

Assessment

Much of PtK's impact occurs within classrooms and is not available for sharing. Work with teachers to use the outcomes checklist and vocabulary as the basis for 1) planning for PtK's adoption and use, 2) evaluating student progress, and 3) reporting on-line, through surveys, and in the case study interviews.

The assessment conversation can help teachers improve their own implementation of PtK within their classrooms and should be leveraged as an explicit form of embedded professional development in future materials so that assessment becomes a central part of the PtK experience. This is in keeping with the various reports on the role of assessment that are part of the standards literature (see Project 2061's Blueprints On-line for instance).

Carefully develop a few (2 to 3) on-line activities ala PET that will provide several points for student work postings that are likely to reflect a range of sophistication levels in student work that reflects benchmarks and standards. This will provide the necessary material to do a more comprehensive analysis of student outcomes and will provide the basis on which to engage teachers in a discussion around assessment, student outcomes, and standards.

Evaluation Plans:

We had anticipated that our prepaid postcards would reveal a group of teachers who only used the print guide and the videos. However, relatively few users overall returned these and those that did indicated that they had on-line access and used on-line aspects of PtK. This low response rate and the significant increase in the number of teachers who can access on-line resources either at school or at home suggest that the pre-paid print post cards may not be the best use of resources in subsequent modules. While we will want to continue to monitor how PtK is being used by non-networked teachers, we suggest using a tear-out or reproducible page in the teachers guide for faxing or mailing back next year for those who do not wish or are not able to register on-line.

General Notes:

We feel that PtK has made good use of the various listservs to match interest levels with the amount of information being sent out. Those that want to keep abreast of what is happening can subscribe to the updates list for short synopses and notice of important events. Those teachers wishing to engage in a more in-depth professional support and development community subscribe to the discuss lists which are oriented to teachers. Here topics include discussion about events and activities within the modules but also include stratgies, sharing positive experiences, sharing frustrations, and sharing resources and tips. The debate lists have evolved from the use for debate (as in the Great Planet Debate from *Live from the Hubble Space Telescope*) to a vehicle for

student/teacher work on on-line collaborations in general. Questions to NASA scientists and experts along with the answers are contained on their own list. Ovverall the satisfication with the list system seems high and is an effective way to provide a lot of information and participation without frustrating users with a deluge of information.

We remain critical of the existing web site designs. Our design for LFA2, while given good marks by the teachers, really only pointed the way and highlighted some possible directions. The LFM site is rich and diverse yet critical activities such as Weather Worlds or the on-line teacher's guide remain buried and are often missed. This has not been a big problem for the active participants since they tend to get their information from the e-mail lists. But it fails as a recruiting system for teachers new to the project, which the data collected this year is clearly showing as an important and growing role for the project's web sites.

While we acknowledge the benefits of having a site that appeals to the general public as well as those engaged in teaching and learning activities, PtK has shown that it can focus on the educational uses and *still attract* a sizable percentage of people outside formal K-12 schooling situations. Given the percentage of new-to-online and new-to-PtK teachers that are being drawn to the project, this weakness is hindering PtK's impact. Our small foray into an alternative design was meant to demonstrate that the power of the web and hyper-media environments is that there is no need to limit navigation or format to one route. While it does take more resources and time, one can attempt to be "all things to all people" or at least to those are important constituencies for Passport to Knowledge.

This also implies that we need to re-organize and utilize our evaluation case studies in the coming year. We have used these to provide details and insights into perceptions of PtK and its place in one's curriculum. We looked at barriers to full PtK use by teachers at different levels of experience. While this is important, the rapid increase in access requires that we refocus the case studies around different levels of technology integration among PtK users. Rather than viewing teachers as a group with similar attributes, we need to research the differential needs of various subgroups within the teaching community and how projects like PtK that offered various experiences can be best configured to suit these needs.

Questions Guiding our Work

Given the broad set of purposes for this study, the study proposed the following questions to help structure the work over the three-year scope of the anticipated evaluation work.

Questions about assessment/evaluation of students. What do teachers consider to be the relevant outcomes for their students from this program? What range of assessment techniques do they use? How can we embed assessment strategies into PtK activities to help ourselves and teachers better assess learner outcomes?

Questions about students' views of the program. What understanding of scientists' jobs do students take away from the program? What do students interpret the purpose of the program to be?

Questions about the educational use of technological components. What kinds of questions do students ask the experts through email or real-time desktop conferencing? What kinds of questions are most stimulating for the experts? for other students? How can students develop questioning skills that will improve their use of telecommunications as an information gathering and sharing tool?

Questions about multiple media/multiple points of entry. How are teachers making use of the multiple entry points to this program (using on-line, print, video)? What combinations/variations in emphasis are most common, most effective? What kinds of teachers (by grade level, by school community, etc.) tend to use what kinds of combinations of media? How does the availability of these programs via broadcast television, on the WorldWideWeb, and through the Internet change curriculum marketing and adoption processes when working with classrooms and schools?

Questions about implementation. How do teachers justify adding this program to their curriculum? Logistically, how do they accomplish this?

Questions about program awareness. How do teachers find out about the program? What influences them to try it?

Questions about barriers. What do teachers (with varying levels of participation) report are the prominent barriers to full participation in this program? What strategies do they use to respond to these barriers?

Questions about PtK's role in professional development and educational reform. What were teachers' original points of focus about the program (i.e., using new educational technology applications, learning about content area, stimulating student

interest in science, etc.)? How does their point of focus change after participating in the program? What kinds of teaching strategies do they try out in conjunction with the programs? What assessment techniques do they adopt/adapt due to the nature of the learning that is fostered by the programs?

Questions about scientific expertise and comfort level with new content. How do teachers handle the challenges of working with students around content they are not deeply familiar with? Do they interpret this as a challenge, as an opportunity?

Questions about leveraging the experience. How do teachers respond to the question "what next?" What are they most interested in doing with the materials, with the pedagogical approach of the program, in the future? How successful is PtK at stimulating/supporting teacher change?

Questions about expert/teacher/student relationships. What are teachers' and students' attitudes about experts, and how those change over the course of the program? What are experts attitudes toward teachers and students, and how do they change over the course of the program?

Questions about continued participation. What brings people to continue from one program to another, or to drop out?

Questions about most and least active classrooms. What do the most active classrooms have in common? What do the classrooms that begin the program but them drop out have in common?

Questions about demographics. What grade levels, what kinds of school communities (urban, suburban, rural), what content areas (biology classes, earth science classes, computer classes) are getting involved in this program?

This appendix contains the full text of all surveys used in Year Two.

Live from Mars - Countdown Program

This form was sent to mail list participants in early December of 1996 after the first broadcast of the first program in the *Live from Mars* module.

(Authentication marker -- ~3%e%LFMV1%0%0%0%9LAufIwp%8640&
-- do not remove.)

To respond to this survey, create a reply e-mail message that contains the survey. Some e-mail systems require you to manually copy and paste the survey into your reply. Make sure the reply contains the survey authentication marker.

To answer a question, type an x between the brackets, like this: [x]. For fill-in-the-blanks, type between the brackets like this: [your response]. Please make no other changes to this survey.

1. How did you watch the Live from Mars Countdown television program?
Choose one:
[ ] a) Live (Go to question 3)
[ ] b) On videotape

2. If you watched it on videotape, did you watch it on November 19th (the day of the original broadcast)?
Choose one:
[ ] a) Yes
[ ] b) No

3. What network did you watch/tape the program from?
Choose one:
[ ] a) NASA TV
[ ] b) PBS
[ ] c) Educational Network
[ ] d) Other, please specify... [ ]

4. Did you watch the program:
Choose one:
[ ] a) by yourself or with other teachers (go to question #7)
[ ] b) with a class or group of students (go to question #7)
[ ] c) with a larger group?

5. If it was a larger group, was it:
Choose one:
[ ] a) a group convened outside of school (a museum, planetarium, etc.)
[ ] b) in your school?

6. Are you currently teaching about Mars and/or space exploration?
Choose one:
[ ] a) Yes
[ ] b) No (go to question #15)

7. Did your class do any Passport to Knowledge-related activities? from the guide prior to watching the program?
Choose all that apply:

[ ] a) Activity A.1 Mars Mission Log Books
[ ] b) Activity A.2 Become a Member of the Mission to Mars Team
[ ] c) Activity A.3 Mission Planning: Earth/Mars Comparisons
[ ] d) Activity A.4 Mission Planning: Geography

[ ] e) Activity 1.1.A Rocket Science 101
[ ] f) Activity 1.1.B Rockets and Payloads
[ ] g) Activity 1.2 Mapping the Topography of Unknown Surfaces
[ ] h) Activity 1.3 Follow that Water - Investigations with Stream Tables
[ ] i) On-line Collaborative Activity: Planetary Exploration Toolkit
[ ] j) Other, please specify... [ ]
[ ] k) None

8. Did you use any follow up activities related to the program?
Choose all that apply:

[ ] a) Activity A.1 Mars Mission Log Books
[ ] b) Activity A.2 Become a Member of the Mission to Mars Team
[ ] c) Activity A.3 Mission Planning: Earth/Mars Comparisons
[ ] d) Activity A.4 Mission Planning: Geography
[ ] e) Activity 1.1.A Rocket Science 101
[ ] f) Activity 1.1.B Rockets and Payloads
[ ] g) Activity 1.2 Mapping the Topography of Unknown Surfaces
[ ] h) Activity 1.3 Follow that Water - Investigations with Stream Tables
[ ] i) On-line Collaborative Activity: Planetary Exploration Toolkit
[ ] j) Other, please specify... [ ]
[ ] k) None

9. If you have the program on videotape, do you plan to use the tape in conjunction with any other lessons or activities in the future?
Choose all that apply:

[ ] a) Yes
[ ] b) No

10. To what extent was the segment of the program about the purpose/function of the Pathfinder/Surveyor missions relevant to the
content you are teaching about Mars?
Choose one:

[ ] a) closely related
[ ] b) related
[ ] c) partially related
[ ] d) unrelated

11. To what extent was the segment of the program about geological information relevant to the content you are teaching about Mars?
Choose one:

[ ] a) closely related
[ ] b) related
[ ] c) partially related
[ ] d) unrelated

12. To what extent was the segment of the program about history of Mars exploration relevant to the content you are teaching about Mars?
Choose one:

[ ] a) closely related
[ ] b) related
[ ] c) partially related
[ ] d) unrelated

13. To what extent was the segment of the program about the history of NASA and Space Exploration relevant to the content you are teaching about Mars?
Choose one:

[ ] a) closely related
[ ] b) related
[ ] c) partially related
[ ] d) unrelated

14. To what extent was the segment of the program about the importance of studying Mars relevant to the content you are teaching about Mars?
Choose one:

[ ] a) closely related
[ ] b) related
[ ] c) partially related
[ ] d) unrelated

15. How would you rate the effect of watching the video on students' excitement about Mars Exploration?
Choose one:

[ ] a) increased it
[ ] b) no change
[ ] c) boredom

16. How would you rate the effect of watching the video on students' curiosity about scientific research careers?
Choose one:

[ ] a) increased it
[ ] b) no change
[ ] c) boredom

17. How would you rate the effect of watching the video on students' motivation to learn more about space exploration?
Choose one:

[ ] a) increased it
[ ] b) no change
[ ] c) boredom

18. How would you rate students' overall understanding of the material presented in the video?
Choose one:

[ ] a) clear understanding
[ ] b) some understanding
[ ] c) little understanding

19. Did you feel that the questions asked by the students in the video were relevant and appropriate to the content you are teaching about Mars?
Choose one:

[ ] a) Yes
[ ] b) No
[ ] c) Not teaching about Mars currently

20. Do you think your students felt that the questions asked by the students in the video were relevant and interesting?
Choose one:

[ ] a) Yes
[ ] b) No
[ ] c) Not teaching about Mars currently

21. Did you feel that the answers given to those questions were useful and understandable?
Choose one:

[ ] a) Yes
[ ] b) No

22. Do you think that your students thought that those answers were useful, understandable, and interesting?
Choose one:

[ ] a) Yes
[ ] b) No

23. Do you think that the Question and Answer format is an effective way to share information with students about the Mars Global Surveyor and Pathfinder missions?
Choose one:

[ ] a) Yes
[ ] b) No

24. Please add any comments or details you might have about your students' interactions with the program. [ ]

Thank you for participating in this survey.

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Live from Mars - Cruising Between Planets Program

This survey was sent out to mail list participants (discuss-lfm and updates-lfm) immediately after the first broadcast of the second LFM program in April 1997.

(Authentication marker -- ~3%e%LFMVID2%0%0%0%9LAufIwp%6231&
-- do not remove.)

To respond to this survey, create a reply e-mail message that contains this survey. Most e-mail systems do this automatically when you reply to this message but some systems may require you to manually copy and paste the survey into your reply. *** Make sure the reply contains the survey authentication marker..

Once you have selected reply, to answer each question, type an x between the brackets, like this: [x]. For fill-in-the-blanks questions, type between the brackets like this: [enter your response between the brackets]. Please make no other changes to this survey.

1. Your name: [ ]

2. What is your involvement with, or interest in, Live From Mars?
Choose one:

[ ] a) As a K-12 teacher working in a public or private school actively using it with students.
[ ] b) As a K-12 teacher or educator using it for professional development but currently not with K-12 students.
[ ] c) As an adult responsible for a home schooling experience.
[ ] d) As an adult working with students in an informal or after-school setting.
[ ] e) As someone who is personally interested in Mars and/or space but not using it with students or children.
[ ] f) As a recreational family activity.
[ ] g) As a K-12 student doing either independent study or home schooling.
[ ] h) Other, please specify... [ ]

3. Did you watch the Live from Mars "Cruising Between Planets" television program?
Choose one:

[ ] a) Live
[ ] b) On videotape

4. If you watched it on videotape, did you watch it onApril 24th (the day of the original broadcast)?
Choose one:

[ ] a) Yes
[ ] b) No

5. What network did you watch/tape the program from?
Choose one:

[ ] a) NASA TV
[ ] b) PBS
[ ] c) Educational Network

[ ] d) Other, please specify... [ ]

6. Which of the following Live From Mars components have you used?
Choose all that apply:

[ ] a) Purchased or obtained the printed Live from Mars Teachers Guide
[ ] b) Purchased or obtained the entire Live from Mars Kit
[ ] c) Downloaded all or some of the Teachers Guide from the Web site
[ ] d) Joined the LFM-Discuss listserv or digest version or used it on the web site
[ ] e) Joined the LFM-Updates listserv or used it on the web site
[ ] f) Joined the P.E.T. Activity or followed along on the web site
[ ] g) Joined a Webchat session(s)
[ ] h) Taped the first LFM broadcast - "Countdown"
[ ] i) Taped the second LFM broadcast - Cruising Between the Planets"

7. Have you visited the Live From Mars WWW site?
Choose one:

[ ] a) Not yet
[ ] b) Once
[ ] c) Several times
[ ] d) A couple of times a month
[ ] e) Once per week on average
[ ] f) Several times per week on average

8. How did you find out about the Live From Mars WWW site?
Choose one:

[ ] a) Through one of the LFM e-mail lists.
[ ] b) In the Teachers Guide I obtained from Passport to Knowledge
[ ] c) Through a print mailing
[ ] d) At a workshop
[ ] e) By watching the first or second LFM television programs
[ ] f) Through a Internet Search Engine (i.e. Yahoo or Alta Vista)
[ ] g) Through a link from another NASA site
[ ] h) Through a link from CNN
[ ] i) Through a link from PBS
[ ] j) Through a link from Discovery Channel
[ ] k) From a magazine article or notice
[ ] l) From another teacher, parent or collegue
[ ] m) Other, please specify... [ ]

9. Which areas on the Live From Mars Web site do you find useful?
Choose all that apply:

[ ] a) Haven't visited
[ ] b) What's New
[ ] c) The Mars Team
[ ] d) Live Video info
[ ] e) Featured Events
[ ] f) Background info
[ ] g) Questions
[ ] h) Photo Gallery
[ ] i) Teachers Lounge
[ ] j) Kid's Corner
[ ] k) PET Mystery Site Contest

10. Please share any comments you have about the web site, what you like, what you want to see more of, etc. [ ]

The remaining questions are intended for K-12 teachers or people working in a home schooling or informal educational setting. Please skip if you are not involved in teaching.

11. If you are actively using Live From Mars with students, what grade level do you work with?
Choose one:

[ ] a) Lower elementary (K-3)
[ ] b) Upper elementary (4-6)
[ ] c) Middle (6, 7, 8)
[ ] d) Secondary (9-12)
[ ] e) College
[ ] f) Other, please specify... [ ]

12. Are you currently teaching about Mars and/or space exploration?
Choose one:

[ ] a) Yes
[ ] b) No (go to question #15)

13. Did your class do any Passport to Knowledge-related activities from the guide prior to watching the program?
Choose all that apply:

[ ] a) Activity 2.1 Observing Mars in the Night Sky - Part 1 Modeling Martian Motion
[ ] b) Activity 2.1 Observing Mars in the Night Sky - Part 2 Mars Off the Charts
[ ] c) Activity 2.2: Reading the Shapes of volcanoes on Earth and Mars
[ ] d) Activity 2.3: Robots from Junk
[ ] e) On-line Collaborative Activity: Planetary Exploration Toolbox
[ ] f) Other, please specify... [ ]
[ ] g) None

14. Did you use any follow up activities related to the program?
Choose all that apply:

[ ] a) Activity 2.1 Observing Mars in the Night Sky - Part 1 Modeling Martian Motion
[ ] b) Activity 2.1 Observing Mars in the Night Sky - Part 2 Mars Off the Charts
[ ] c) Activity 2.2: Reading the Shapes of volcanoes on Earth and Mars
[ ] d) Activity 2.3: Robots from Junk
[ ] e) On-line Collaborative Activity: Planetary Exploration Toolbox
[ ] f) Other, please specify... [ ]
[ ] g) None

15. Please share any comments you have on these activities and how well they worked with your students. [ ]

16. If you have the program on videotape, do you plan to use the tape in conjunction with any other lessons or activities in the future?
Choose all that apply:

[ ] a) Yes
[ ] b) No

17. To what extent was the Program Two: Cruising Between the Planets relevant to the content you are teaching about Mars?
Choose one:

[ ] a) closely related
[ ] b) related
[ ] c) partially related
[ ] d) unrelated

18. How would you rate the effect of watching the video on students' excitement about Mars Exploration?
Choose one:

[ ] a) increased it
[ ] b) no change
[ ] c) boredom

19. How would you rate the effect of watching the video on students' curiosity about scientific research careers?
Choose one:

[ ] a) increased it
[ ] b) no change
[ ] c) boredom

20. How would you rate the effect of watching the video on students' motivation to learn more about space exploration?
Choose one:

[ ] a) increased it
[ ] b) no change
[ ] c) boredom

21. How would you rate students' overall understanding of the material presented in the video?
Choose one:

[ ] a) clear understanding
[ ] b) some understanding
[ ] c) little understanding

22. Did you feel that the questions asked by the students in the video were relevant and appropriate to the content you are teaching about Mars?
Choose one:

[ ] a) Yes
[ ] b) No
[ ] c) Not teaching about Mars currently

23. Do you think your students felt that the questions asked by the students in the video were relevant and interesting?
Choose one:

[ ] a) Yes
[ ] b) No
[ ] c) Not teaching about Mars currently

24. Did you feel that the answers given to those questions were useful and understandable?
Choose one:

[ ] a) Yes
[ ] b) No

25. Do you think that your students thought that those answers were useful, understandable, and interesting?
Choose one:

[ ] a) Yes
[ ] b) No

26. Do you think that the Question and Answer format is an effective way to share information with students about the Mars Global Surveyor and Pathfinder missions?
Choose one:
[ ] a) Yes
[ ] b) No

27. Please add any comments or details you might have about your students' interactions with the video program. [ ]

Thank you for participating in this survey.

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Live from Antarctica 2 - Video Programs

This survey was sent out in February 1997 after all three video programs that comprised LFA2 were broadcast. The short time between individual broadcasts dictated a single survey to evaluate the videos rather than one after each program as with LFM programs. Survey was sent to participants on discuss-lfa and updates-lfa.

(Authentication marker -- ~3%e%LFA2VID%0%0%0%9LAufIwp%32864&
-- do not remove.)

To respond to this survey, create a reply e-mail message that contains the survey. While most e-mail system have a feature that allows you to quote the message to which you are replying, there are some e-mail systems that require you to manually copy and paste the survey into your reply.

Please make sure the reply contains the survey authentication marker (found at the top of the questions).

To answer a question, type an x between the brackets, like this: [x]. For fill-in-the-blanks, type between the brackets like this: [your response]. Please make no other changes to this survey. Thanks for your help.

1. Did you watch the Live from Antarctica 2 program, "Program 1: Oceans, Ice and Life?"
Choose one:
[ ] a) yes
[ ] b) no

2. Did you watch the Live from Antarctica 2 program, "Program 2: The secrets of survival?"
Choose one:
[ ] a) yes
[ ] b) no

3. Did you watch the Live from Antarctica 2 program, "Program 3: Seeing the future?"
Choose one:
[ ] a) yes
[ ] b) no

4. Did you watch any of these programs live?
Choose one:
[ ] a) yes
[ ] b) no

5. Did you feel it was important for you and your class to watch the program(s) (live or on videotape) on the day that they were broadcast live?
Choose one:
[ ] a) yes
[ ] b) no

6. How did you find out about the Live from Antarctica 2 programs?
Choose one:
[ ] a) Online mailing list
[ ] b) World Wide Web site
[ ] c) 800 number
[ ] d) Other, please specify... [ ]

7. What network(s) did you watch or tape the program(s) from?
Choose all that apply:
[ ] a) NASA TV
[ ] b) PBS
[ ] c) Educational network
[ ] d) Other (please specify)

8. Did you watch the program(s):
Choose all that apply:
[ ] a) by yourself/with other teachers
[ ] b) with one class/group of students

[ ] c) with multiple classes a different times
[ ] d) with multiple classes at the same time
[ ] e) Other, please specify... [ ]

9. If it was a larger group, was it:
Choose one:
[ ] a) a group convened outside of school.
[ ] b) in your school.
[ ] c) Other, please specify... [ ]

10. Did you use any of the LFA2 e-mail lists as a professional resource for yourself
Choose one:
[ ] a) Yes
[ ] b) No

11. Did you use any of the e-mail lists for LFA2 as a direct instructional resource for your students?
Choose one:
[ ] a) Yes
[ ] b) No

12. Did you use the LFA2 Web site as a professional resource?
Choose one
[ ] a) Yes
[ ] b) No

13. Did you use the LFA2 Web site as an instructional resource for students?
Choose one:
[ ] a) Yes
[ ] b) No

14. Did you use or are you using the Live from Antarctica 2 teacher's guide?
Choose one:
[ ] a) yes
[ ] b) no

15. If yes, where did you get the guide?
Choose one:
[ ] a) downloaded it from the World Wide Web site
[ ] b) ordered guide separately
[ ] c) ordered the Live from Antarctica 2 kit with the guide

16. Are you, or were you, teaching about Antarctica or polar exploration? (if no, skip to Question 18)
Choose one:
[ ] a) yes
[ ] b) no

17. If you have the program(s), do you plan to use the tape(s) in connection with any other lessons or activities in the future?
Choose one:
[ ] a) yes
[ ] b) no

18. To what extent were the segments of the program(s) about how the scientists live and work in Antarctica relevant to the content you are teaching about Antarctica?
Choose one:
[ ] a) closely related
[ ] b) related
[ ] c) partially related
[ ] d) unrelated

19. To what extent were the examples in the program(s) of specific biological research being done by the scientists relevant to the content you are teaching about Antarctica?
Choose one:

[ ] a) closely related
[ ] b) related
[ ] c) partially related
[ ] d) unrelated

20. To what extent were the segments of the program(s) about the geophysical and environmental character of Antarctica relevant to the content you are teaching about Antarctica?
Choose one:
[ ] a) closely related
[ ] b) related
[ ] c) partially related
[ ] d) unrelated

21. How did you relate the video program(s) to what you did with your students in the classroom? [ ]

22. How would you rate the effect of watching the program(s) on students' excitement about Antarctic research?
Choose one:
[ ] a) increased it
[ ] b) no change
[ ] c) boredom

23. How would you rate the effect of watching the program(s) on students' curiosity about scientific research careers?
Choose one:
[ ] a) increased it
[ ] b) no change
[ ] c) boredom

24. How would you rate the effect of watching the program(s) on students' motivation to learn more about Antarctica?
Choose one:
[ ] a) increased it
[ ] b) no change
[ ] c) boredom

25. How would you rate students' overall understanding of the material presented in the program(s)?
Choose one:
[ ] a) clear understanding
[ ] b) some understanding
[ ] c) little understanding

26. Did you feel that the questions asked by the students in the program(s) were relevant and appropriate to the content you are teaching about Antarctica?
Choose one:
[ ] a) yes
[ ] b) no
[ ] c) not teaching about Antarctica currently

27. Did you think your students felt that the questions asked by the students in the program(s) were relevant and appropriate to the content you are teaching about Antarctica?
Choose one:
[ ] a) yes
[ ] b) no
[ ] c) not teaching about Antarctica currently

28. Did you feel that the answers given to those questions were useful and understandable?
Choose one:
[ ] a) yes
[ ] b) no

29. Do you think that your students feel that the answers given to those questions were useful and understandable?
Choose one:

[ ] a) yes
[ ] b) no

30. Do you think that the Question and Answer format is an effective way to share information with students about Antarctica?
Choose one:
[ ] a) yes
[ ] b) no

31. If you participated in past PtK modules, how would you compare the Live from Antarctica 2 programs with past programs? [ ]

32. Did you use any of the e-mail lists (discuss-lfa, digest-lfa, or updates-lfa) with your students?
Choose one:
[ ] a) No
[ ] b) Yes: please tell us explain how you used it... [ ]

33. Please add any comments or details you might have about your students' interactions with the program(s). [ ]

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Live from Antarctica 2 On-line and Print Utilization Survey - sent on 5/29/97

(Authentication marker -- 3%e%LFA2FW2%0%0%0%9LAufIwp%31650&
-- do not remove.)

To respond to this survey, create a reply e-mail message that contains the survey. Some e-mail systems require you to manually copy and paste the survey into your reply. Make sure the reply contains the survey authentication marker.

To answer a question, type an x between the brackets, like this: [x]. For fill-in-the-blanks, type between the brackets like this: [your response]. Please make no other changes to this survey.

1. Your name: [ ]

2. What is your involvement with, or interest in, Live from Antarctica 2?
Choose one:
[ ] a) As a K-12 teacher working in a public or private school actively using it with students.
[ ] b) As a K-12 teacher or educator using it for professional development but currently not with K-12 students.
[ ] c) As an adult responsible for a home schooling experience.
[ ] d) As an adult working with students in an informal or after-school setting.
[ ] e) As someone who is personally interested in Mars and/or space but not using it with students or children.
[ ] f) As a recreational family activity.
[ ] g) As a K-12 student doing either independent study or home schooling.
[ ] h) Other, please specify... [ ]

The Live from Antarctica 2 Website:
3. Did you visit the Live from Antarctica 2 website?
Choose one:
[ ] a) Yes
[ ] b) No (Go to 'The Live From Antarctica 2 Teacher's Guide...')

4. How would you rate the LFA2 web site in terms of its educational value?
Choose one:
[ ] a) One of the best
[ ] b) Better than most
[ ] c) Good
[ ] d) Average
[ ] e) Below average
[ ] f) Poor

5. How easy was it to get a sense of all the resources that were available to you on the web site?
Choose one:
[ ] a) Clearly understood after a little exploration
[ ] b) Took a lot of work to find everything
[ ] c) Never had a clear sense of what was there
[ ] d) Did not use enough to have an opinion

6. How would you rate the design of the LFA2 web site?
Choose one:
[ ] a) Better than most educational sites
[ ] b) Better than the earlier PtK web sites
[ ] c) About the same as the other PtK sites
[ ] d) Not as good as the other PtK sites
[ ] e) Not as good as most educational web sites
[ ] f) No opinion

7. Did you find that the three pathways through the web site (teacher, student, and parent/public) made it easier for you to navigate through the site?
Choose one:
[ ] a) Yes
[ ] b) No

8. Did you use the web site primarily as a resource for your own professional development, or for direct classroom instruction?
Choose one:
[ ] a) professional development
[ ] b) direct classroom instruction

Following (Questions 9-15) is a list of key areas within the LFA2 web site. Please rate each area in terms of its value to you as a **professional resource**:

9. Teacher's guide (downloadable)
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

10. Scientist biographies
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

11. Field journals
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

12. Information on video broadcasts
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

13. Researcher Q&A
Choose one:
[ ] a) 4- little or no value

[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

14. Student activities
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

15. Links to related materials
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

Following (Questions 16-22) is a list of key areas within the LFA2 web site. Please rate each area in terms of its value for **classroom instruction**.

16. Teacher's guide (downloadable)
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

17. Scientist biographies
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

18. Field journals
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

19. Information on video broadcasts
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

20. Researcher Q&A
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

21. Student activities
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

22. Links to related materials
Choose one:
[ ] a) 4- little or no value
[ ] b) 3-
[ ] c) 2-
[ ] d) 1- high value

23. How often did you visit the web site?
Choose one:
[ ] a) Never
[ ] b) Once
[ ] c) A few times
[ ] d) Frequently (once a week or more)

24. How would you advise the PtK staff to spend its resources for WWW resources in future modules:
Choose all that apply:
[ ] a) More examples of actual student work and class projects
[ ] b) More on-line projects that involve sharing work across classrooms
[ ] c) More exchanges with scientists/researchers in the field
[ ] d) More background resources and information on the topics
[ ] e) Better access to archives of the e-mail lists associated with the module
[ ] f) More use of higher-end web features: webchat, cu-see-me, quicktime, audio files
[ ] g) Clearer overview on how to get involved with the project
[ ] h) Keep using the same format and amount of material as this module

25. Please give us any comments you have on the LFA2 web site: [ ]

The Live From Antarctica 2 Teacher's Guide:

26. How useful did you find the teacher's guide to be for your own professional development?
Choose one:
[ ] a) 4) little or no value
[ ] b) 3)
[ ] c) 2)
[ ] d) 1) high value

27. How useful did you find the teacher's guide to be for classroom instruction?
Choose one:
[ ] a) 4) little or no value
[ ] b) 3)
[ ] c) 2)
[ ] d) 1) high value

28. Please indicate which activities from the LFA2 teacher's guide you used in your classroom:
Choose all that apply:
[ ] a) Activity A.1 Putting Antarctica on the Map
[ ] b) Activity A.2 The "Old Antarctic Explorers"
[ ] c) Activity A.3 Careers in Antarctic Science and Science Support
[ ] d) Activity A.4 Getting There: Planning Ahead is Half the Battle!
[ ] e) Activity 1.1 Life On, Under and In...The Ice
[ ] f) Activity 1.2 Ship Science
[ ] g) Activity 1.3 Oil Water Don't Mix..or Do They?
[ ] h) Activity 1.4 The Ocean in Motion
[ ] i) Activity 1.5 Effects of Light and Dark on Phytoplankton
[ ] j) Activity 2.1 Unobtrusive Observation
[ ] k) Activity 2.2 Staying Warm in Frigid Water - Heat Exchange
[ ] l) Activity 2.3 Penguin Adaptation
[ ] m) Activity 2.4 Comparative Marine Biology
[ ] n) Activity 3.1 An Ozone Primer
[ ] o) Activity 3.2 the Effect of UV-B on Plants
[ ] p) Activity 3.3 From Data to Death
[ ] q) Activity B.1 "Antarctic Expo" or Community Showcase

[ ] r) Activity B.2 Design the "next" Palmer Station
[ ] s) Activity B.3 "Antarctica: Who Needs it?"

29. Do you plan to use any of these activities from the guide in the future?
Choose one:
[ ] a) Yes
[ ] b) No

30. Please indicate which of the following activities you have not yet used but plan to use in the future:
Choose all that apply:
[ ] a) Activity A.1 Putting Antarctica on the Map
[ ] b) Activity A.2 The "Old Antarctic Explorers"
[ ] c) Activity A.3 Careers in Antarctic Science and Science Support
[ ] d) Activity A.4 Getting There: Planning Ahead is Half the Battle!
[ ] e) Activity 1.1 Life On, Under and In...The Ice
[ ] f) Activity 1.2 Ship Science
[ ] g) Activity 1.3 Oil Water Don't Mix..or Do They?
[ ] h) Activity 1.4 The Ocean in Motion
[ ] i) Activity 1.5 Effects of Light and Dark on Phytoplankton
[ ] j) Activity 2.1 Unobtrusive Observation
[ ] k) Activity 2.2 Staying Warm in Frigid Water - Heat Exchange
[ ] l) Activity 2.3 Penguin Adaptation
[ ] m) Activity 2.4 Comparative Marine Biology
[ ] n) Activity 3.1 An Ozone Primer
[ ] o) Activity 3.2 the Effect of UV-B on Plants
[ ] p) Activity 3.3 From Data to Death
[ ] q) Activity B.1 "Antarctic Expo" or Community Showcase
[ ] r) Activity B.2 Design the "next" Palmer Station
[ ] s) Activity B.3 "Antarctica: Who Needs it?"

31. How would you advise the PtK staff to spend its resources for the print/on-line Teacher's Guide in future modules
Choose all that apply:
[ ] a) More activities
[ ] b) More information about careers in science and engineering
[ ] c) More profiles of scientists/researchers in the field
[ ] d) More background resources and information on the topics
[ ] e) More information about relating the activities to curriculum standards
[ ] f) More activities that assess students learning in standardized ways
[ ] g) More information about how to use PtK in the classroom
[ ] h) Clearer overview on how to get involved with the project
[ ] i) Keep the same format and amount of material as used in this module

32. Please tell us anything else about the Teacher's Guide: [ ]

33. Of the three major components in future Passport to Knowledge modules, which one do you feel should be the highest priority in terms of assigning development resources:
Choose one:
[ ] a) The video programs
[ ] b) The on-line resources and activities
[ ] c) The print materials

34. Any other comments about LFA2 specifically or Passport to Knowledge in general that you would like to share? [ ]

Thank you for participating in this survey.

==========
The following survey was sent to PtK Advocate teachers on 5/15/97

(Authentication marker -- ~3%e%PTKADVO%0%0%0%9LAufIwp%58937&

-- do not remove.)

To respond to this survey, create a reply e-mail message that contains the survey. Some e-mail systems require you to manually copy and paste the survey into your reply. Make sure the reply contains the survey authentication marker.

To answer a question, type an x between the brackets, like this: [x]. For fill-in-the-blanks, type between the brackets like this: [your response]. Please make no other changes to this survey.

1. I attended last summer's PtK workshop in Washington DC.
Choose one:
[ ] a) Yes
[ ] b) No

2. I used LFM:
Choose one:
[ ] a) as an instructional resource with students
[ ] b) as a professional development resource for myself but not with students
[ ] c) did not get a chance to use it

3. I used LFA2:
Choose one:
[ ] a) as an instructional resource with students
[ ] b) as a professional development resource for myself but not with students
[ ] c) did not get a chance to use it

4. Please indicate which other previous PtK modules you have used:
Choose one:
[ ] a) Live From Antarctica (original)
[ ] b) Live from the Stratosphere
[ ] c) Live from the Hubble Space Telescope

5. Please enter the number of years that you have been teaching. (numerals only) [ ]

6. For how many years have you been using some form of on-line communications (e-mail or WWW) as a professional or instructional tool?
Choose one:
[ ] a) 0 - haven't used any yet
[ ] b) 1 - this year was the first year I used on-line telecommunications
[ ] c) 2 - two years
[ ] d) 3 - three years
[ ] e) 4 - four years or longer

7. Did you give any formal workshops or presentations to other teachers within your district about using PtK this year?
Choose one:
[ ] a) None
[ ] b) One
[ ] c) Two
[ ] d) Three
[ ] e) Four
[ ] f) Five or more

8. Did you give any formal workshops or presentations to teachers from other districts about using PtK this year?
Choose one:
[ ] a) None
[ ] b) One
[ ] c) Two
[ ] d) Three
[ ] e) Four
[ ] f) Five or more

9. Did you give any presentations to groups other than classroom teachers?
Choose all that apply:

[ ] a) None
[ ] b) Curriculum specialists
[ ] c) Technology coordinators
[ ] d) Building-level administrators
[ ] e) District-level administrators
[ ] f) State Ed Department personnel
[ ] g) People who work in informal education programs (after-school groups, etc)
[ ] h) Parents
[ ] i) Other, please specify... [ ]

10. Did you directly support any other teachers (team teach, do demonstrations, act as an advisor or resource) who were using PtK?
Choose one:
[ ] a) No
[ ] b) Yes, in person
[ ] c) Yes, through e-mail
[ ] d) Both in person and through e-mail

11. Did you write up anything about PtK for publication in a local newspaper, school newsletter, professional publication, a non-PtK e-mail list or other on-line resource?
Choose one:
[ ] a) Yes
[ ] b) No

12. If yes, could you describe it: [ ]

13. What impact did attending the summer workshop (if you did) have on your involvement as an advocate? [ ]

Please rate each of the following statements using the indicated scale:

14. Being a PtK advocate improved my work with my students.
Choose one:
[ ] a) definitely
[ ] b) this might be so for me
[ ] c) N/A or no opinion
[ ] d) I don't think this is true for me
[ ] e) definitely not true for me

15. Being a PtK advocate improved my work with other teachers.
Choose one:
[ ] a) definitely
[ ] b) this might be so for me
[ ] c) N/A or no opinion
[ ] d) I don't think this is true for me
[ ] e) definitely not true for me

16. Being a PtK advocate was seen as something positive by my supervisor(s).
Choose one:
[ ] a) definitely
[ ] b) this might be so for me
[ ] c) N/A or no opinion
[ ] d) I don't think this is true for me
[ ] e) definitely not true for me

17. Being a PtK advocate improved my professional skill within my content specialty(ies).
Choose one:
[ ] a) definitely
[ ] b) this might be so for me
[ ] c) N/A or no opinion
[ ] d) I don't think this is true for me

[ ] e) definitely not true for me

18. Being a PtK advocate allowed me to become, or reinforced my role as, a educational leader within my school or district.
Choose one:
[ ] a) definitely
[ ] b) this might be so for me
[ ] c) N/A or no opinion
[ ] d) I don't think this is true for me
[ ] e) definitely not true for me

19. Being a PtK advocate allowed me to become, or reinforced my work as, a technology utilization leader in my school or district.
Choose one:
[ ] a) definitely
[ ] b) this might be so for me
[ ] c) N/A or no opinion
[ ] d) I don't think this is true for me
[ ] e) definitely not true for me

20. Being a PtK advocate improved my attitude about teaching.
Choose one:
[ ] a) definitely
[ ] b) this might be so for me
[ ] c) N/A or no opinion
[ ] d) I don't think this is true for me
[ ] e) definitely not true for me

21. Being a PtK advocate took too much time.
Choose one:
[ ] a) definitely
[ ] b) this might be so for me
[ ] c) N/A or no opinion
[ ] d) I don't think this is true for me
[ ] e) definitely not true for me

22. Could you describe any other positive effects of being an advocate that have come about this year? [ ]

23. Any cons? [ ]

24. How should PtK staff use advocates in the future? [ ]

25. Any other comments? [ ]

Thank you for participating in this survey.

Appendix Three - Postcard and Registration Form

Text for postcard and on-line registration used with *Live from Antarctica 2* and *Live from Mars* (Note there are only minor changes in versions used with Live from Mars)

Name _____
School Address _____
work telephone number _____
e-mail address _____

Grade level (Please check only one.)
☐ lower elementary ☐ upper elementary
☐ middle school ☐ high school ☐ other _____

Subject(s) taught (Please check only one.)
☐ generalist ☐ science specialist ☐ other specialist _____

Number of classes in which you will use Live from Antarctica 2? _____

How would you describe the size of the area in which your school is located? (Please check only one.)
☐ rural ☐ suburban ☐ small city ☐ medium/large city (over 1,000,000)

Which previous Passport to Knowledge modules have you participated in?
☐ Live from Antarctica (1995 original)
☐ Live from the Stratosphere
☐ Live from the Hubble Space Telescope
☐ Live from Mars
☐ None

How often have you used on-line curriculum projects other than Passport to Knowledge modules?
☐ Many times ☐ A few times ☐ Once ☐ Never

Are you planning to team-teach this curriculum? ☐ Yes ☐ No

Appendix Four - Standards-based Outcome Statements

These are content and performance standards derived from the Illinois Academic Standards in Science (draft as of June 1996) and the Instructional Goals and Objectives for West Virginia Schools (draft as of September 1996) which are local interpretations and applications of the National Science Education Standards. This preliminary checklist can be used as a foundation for assessing evidence of student knowledge and skills in three main areas of science: essential factual knowledge and unifying concepts; scientific inquiry; and the interaction of science, technology and society.

Broad

B-1 Problem Solving: Student recognizes and investigates problems; formulates and proposes solutions supported by evidence and reason. Steps include gathering evidence, reviewing and understanding findings, and comparing one's solutions with those of others.

B-2 Communicating: Uses precise and complete descriptions and the presentation of conclusions supported by evidence. Descriptions show careful observations, organization of data, and translation of findings into clear language.

B-3 Using technology: Student uses appropriate tools, electronic equipment, computers and networks to access information, share ideas or communicate results.

B-4 Team work: Student contributes productively as member of a group.

Specific

Designing the Investigation

D-1 Develops questions on scientific topics

D-2 Chooses the steps necessary to answer a question.

D-3 Formulates hypotheses in a way that can be evaluated by data collection.

D-4 Formulates hypotheses referencing prior research and knowledge.

D-5 Proposes a design to solve a problem based on given criteria.

Appendix Four - Standards-based Outcome Statements

D-6 Designs procedures to test selected hypotheses.

Appendix Four - Standards-based Outcome Statements

Process of Investigation

P-1 Demonstrates accurate recording and reporting of observations.

P-2 Demonstrates and can explain why keeping accurate and detailed records is important.

P-3 Collects data for investigation using measuring instruments.

P-4 Collects data using consistent measuring and recording techniques.

P-5 Demonstrates how to vary only one experimental component at a time and control for external variables.

P-6 Tests the design using instruments, techniques, and/or measurement methods.

Interpreting Findings

I-1 Describes and observed event

I-2 Records and arranges data into logical patterns and describes the patterns.

I-3 Compares individual and group observations and results.

I-4 Participates in and understands the importance of peer reviews in improving the scientific process.

I-5 Makes and supports conclusions with statistical evidence from data.

I-6 Evaluates claims made from actual experiments, taking into account methods, sample size, sources of error and existing scientific knowledge.

1-7 Analyze sources of error in repeated experiments that yield different or variable results.

1-8 Analyze the validity of scientific evidence and reasoning in a public policy issue.

Appendix Four - Standards-based Outcome Statements

Sharing Findings

S-1 Describes individual and group investigations clearly and accurately in oral or written reports.

S-2 Constructs charts and graphs to display data and uses these to produce reasonable explanations.

S-3 Reports the process and results of a scientific investigation in oral and written presentations.

S-4 Makes, presents and defends conclusions drawn from investigation to a classroom audience in written or oral form.

S-5 Defends the results of an investigation in oral and written presentations to audiences that include professionals and technical experts.

Content - Physical Sciences

PS-1 Describe and compare various sources of energy.

PS-2 Describe and compare characteristics of various sources of energy.

PS-3 Explain interactions of energy with matter.

PS-4 Describe and demonstrate the properties of the states matter.

PS-5 Describe and demonstrate the chemical and physical characteristics of matter.

PS-6 Distinguish among the different types of motion (e.g. uniform, variable, periodic).

PS-7 Compare the causes and characteristics of motion (e.g., inertia, action/reaction, equilibrium conditions, distance vs. time relationships).

PS-8 Explain observable physical events by applying the principles of accelerated and relative motion (e.g., force/mass relationships, acceleration relationship to distance, velocity and time, reaction rates).

Appendix Four - Standards-based Outcome Statements

Content - Life Sciences

LS-1 Identify plant and animal features that help them live in different environments.

LS-2 Compare and assess features of organisms for their adaptive, competitive and survival values.

LS-3 Describe relationships among various organisms in their regional environment.

LS-4 Analyze factors that influence the size and stability of populations.

LS-5 Compare physical, ecological and behavioral factors that influence interactions among organisms.

LS-6 Analyze and explain biodiversity issues and interactions related to organisms and the resources they need to survive.

Content - Earth and Space Sciences

ES-1 Describe the components and characteristics of the earth's land, water and atmospheric systems and familiar solar system objects.

ES-2 Identify and explain natural cycles and patterns in earth and space systems.

ES-3 Analyze and explain naturally occurring earth and space events.

ES-4 Describe and explain interactions of earth components and solar system components.

ES-5 Compare and explain short and long-term planetary and celestial variations (e.g., latitudinal effects on weather and climate, relative positions of the planets and stars).

ES-6 Compare and explain large-scale dynamic processes that affect biosphere (e.g., cloud cover, geological events, jet stream) and movements of celestial objects (gravitational interactions, chemical reactions).

ES-7 Analyze and compare the effects of processes that shape the surface of the planets (including earth) and theories that explain observable changes in celestial objects.

Appendix Five -
Year Two Highlights and Module Components

Year 2 Highlights

NATIONAL INFORMATION INFRASTRUCTURE AWARDS: PASSPORT TO KNOWLEDGE was a finalist in the 1996 N.I.I. Awards, along with NASA's K-12 Internet Initiative, winning 2 of the 6 slots in the Education category, a singular achievement. (All PTK materials – video, print and online – cite NSF and NASA as the project's principle funders.) PTK's online Web Sites continued to be widely cited for their excellence, securing 23 awards, including the "Internet World" "Site of the Year" award

NSF F.Y. 1997 BUDGET REPORT: PTK's LIVE FROM ANTARCTICA was cited several times in NSF's 1997 budget report to Congress, as a model for combining research and education: "…Antarctic Research and Education: LIVE FROM ANTARCTICA. Modern telecommunications technologies have enabled NSF to bring Antarctic science to classrooms around the United States. In the 1994-1995 Antarctic summer, the pioneering public television series, Live From Antarctica, offered students in middle schools and high schools four hour-long "electronic field trips." The live telecasts enabled students to see and examine Antarctica's harsh environment and its research projects (weather, biology, animal life, etc.) with the guidance of the researchers in the field, including researchers at South Pole Station. Students from several sites around the country interacted with NSF funded scientists. The programs were broadcast across the United States, on public television, and reached thousands of classrooms in 46 states. There were follow-up question and answer sessions via the Internet. With a small investment, this $750,000 project – with support from several Federal agencies and private-sector organizations in addition to NSF – demonstrates how the combination of distant, exotic regions or phenomena can inform and educate the public about contemporary science as well as motivate and inspire young people. The father of a sixth-grader wrote, "I've never seen a science project that was more alive with the breath of what it means to do the work of science." One hearing-impaired student pointed out that using the electronic medium for learning has the effect of equalizing the educational playing field for hearing impaired or other physically-challenged students. An early evaluation of 128 teacher responses representing 272 classrooms and 6,559 students indicated that 99 percent were able to integrate the project fully or partially into their teaching goals and objectives. The same percentage said they are likely to use the materials again with a new class of students.

OFFICE OF SPACE SCIENCE REPORT: PTK's 1995-96 (NSF Year 1) projects were also cited in NASA's Office of Space Science Report, "Implementing the Education and Public Outreach Strategy" (page 34). "Educational television and other

media can be used both to reach large audiences and to give a human face to science. For example, two recent space science related segments of the "PASSPORT TO KNOWLEDGE" series – "Live from the Stratosphere" and "Live from the Hubble Space Telescope" – were broadcast over more than 100 PBS stations. The teacher's guides, activities and videotapes produced in conjunction with the series have been used in thousands of classrooms. These programs also showed science as a human activity, revealing that a wide range of skills are needed, teamwork is important and people of all types are involved… Interactive video and multimedia systems can be used to provide interaction among scientists, teachers and students and museum personnel participating in education programs. They also provide an opportunity for student collaborations over large geographic areas and connectivity between experts, teachers, and their classrooms for guidance in inquiry-based science activities."

RESEARCHER INVOLVEMENT: Both in LIVE FROM MARS, but still more so in LIVE FROM ANTARTICA 2, PTK interacted with NSF and NASA researchers to develop activities for the Teacher's Guides and online. Researchers brainstormed ideas, reviewed working drafts, and signed off on final text.

AWARDS: Several PTK teacher participants achieved national and state awards as a result of participating in the project, including the national Philips New Media award, and Presidental Teacher of the Year awards

NATIONAL EXPOSURE: PTK achieved carriage by more than 180 PBS stations (including live broadcast in New York, Los Angeles, San Francisco) and 49 large and medium-sized independent school districts. Several state-wide networks, such as Iowa, New Hampshire and Vermont carried the video components of the Modules for the first time.

LOS ANGELES SYSTEMIC INITIATIVE (NSF Urban Systemic Initiative): LA SI acquired 250 LIVE FROM MARS kits and 100 Teacher Guides for special Spring 1997 workshops, and the LAUSD Science and Technology Coordinator uses the LIVE FROM MARS Web Site as a model to demonstrate the uses of the Internet in big city classrooms.

NSF SCIENCE AND TECHNOLOGY WEEK: PASSPORT TO KNOWLEDGE was cited as a Resource in NSF's materials in support of NSTW 1997, and LIVE FROM MARS Teacher Guides and promotional flyers were supplied to all NSTW regional workshops. (Program 2 was consciously positioned to air during Science and Technology Week, since its content was so closely aligned with the week's theme of "Webs, Waves and Wires: The Future of Communications."

Appendix Five -
Year Two Highlights and Module Components

Appendix Five -
Year Two Highlights and Module Components

Module Components

In Year 2, PASSPORT TO KNOWLEDGE executed two "electronic field trips", LIVE FROM MARS and LIVE FROM ANTARCTICA 2. As in previous years, each Module included live videos telecast over PBS stations and NASA-TV, online materials hosted and co-developed by NASA's K-12 Internet Initiative as an in-kind contribution to the project, and printed Teacher's Guides, posters, and – for the first time – a comprehensive multimedia kit created for each project.

LIVE FROM MARS: Module Overview

1) VIDEO
Two LFM videos were produced and distributed during the 1996-1997 school year. (Two summer specials were broadcast on July 6th and 9th, designed for informal science venues such as museums and planetariums) with concluding programs in October and November.

Program 1, "COUNTDOWN" aired live, November 19, 1996, from Cape Canaveral Florida and Worcester, MA, childhood home of Robert Goddard, America's "father of rocketry." Live cameras took students inside the clean room where Mars Pathfinder was being readied for launch, and allowed live and e-mail questions to the project manager. Taped sequences showed Mars, its geology, most significant features, the history of its exploration, and plans for future missions. Area-students (whose teacher was a PTK Advocate) took students on a kids'-eye tour of the Cape. The stream-table activity from the Guide, simulating liquid water flow on ancient Mars, was demonstrated by Worcester students.

Program 2, "CRUISING BETWEEN THE PLANETS" aired live, April 24, 1997,from NASA/Cal Tech's Jet Propulsion Laboratory. The video noted that this was tied to NSF's Science and Technology Week, whose theme was "The Future of Telecommunications." By coincidence, April 24 was also "Take Your Daughters/Children to Work Day." Two science guests brought daughters, who were featured on camera, while the narrator noted that electronic field trips use telecommunications to take students all across America to places where cutting-edge science is being conducted.

The video included an "guided tour" of the Pathfinder lander and its Sojourner micro-rover in a sandbox set up to resemble the likely landing site. Live and e-mail questions were posed to Donna Shirley, manager of the Mars Exploration Program, and to members of the Pathfinder team. Taped sequences provided a behind-the-scenes tour of JPL, from early days to futuristic technologies, showed students engaged in Activities suggested in

the LFM Teacher's Guide and online (The Egg Drop Test, Planet Explorer Toolkit and "Red Rover, Red Rover") and previewed Pathfinder's July 4th landing on Mars.

2) PRINT MATERIALS
The LFM Guide followed the model established in earlier Modules. The 64 pages provide an easy-to-use, comprehensive overview of the entire project, providing suggestions for how to access and use the video and online components, and a multimedia bibliography.

In addition to input from Mars experts, working teachers from elementary, middle and high school grades reviewed the draft copy and final text for clarity, accuracy and ease of implementation.

3) MULTIMEDIA KITS
The LIVE FROM MARS Multimedia kit includes:

The LFM Teacher's Guide and blackline masters of student worksheets
An original, full color, LFM poster, featuring current and future missions
The Planetary Society's oversize poster/map, "An Explorer's Guide to Mars"
"Mars: Past, Present and Future" commissioned by PTK from NASA's slide set supplier, Finley-Holiday Films, Inc.
The "Mars Navigator" CD-ROM
A 60:00 minute Teacher Orientation video including Mars researchers describing the science to be undertaken by the upcoming missions, background on the spacecraft, an extended hands-on demonstration of the stream-table activity, and other NASA animations ("Mars the Movie", a video news release on the Martian meteorite discovery, and more.)
NASA Factsheets on both Mars Pathfinder and Mars Global Surveyor
2 Teacher and Student Guides developed for NASA JPL by TERC (Boston)

4) ON-LINE
The project's online resources were developed and supported by NASA's Learning Technologies Project (LTP, formerly NASA Quest) as an in-kind contribution to LIVE FROM MARS. PTK developed content, contacts with NASA and university Mars experts, and provided information to LTP.

LTP staff recruited experts to write Biographies and Field Journals and to serve as guests for interactive Web Chats, added current images and data as the Mars missions progressed, and provided complete technical support for the mail lists and Web site. The online materials may be accessed at:

Error! Reference source not found.

THE "PLANET EXPLORER TOOLKIT" (P.E.T.)
AN ONLINE COLLABORATIVE ACTIVITY

Modeled on the "Great Planet Debate" during the LIVE FROM THE HUBBLE SPACE TELESCOPE Module, in which students reached a consensus decision after debating online about which of 4 planets to observe with the HST, "P.E.T." was designed to simulate the work of spacecraft designers and parallel the planning process through which Mars Pathfinder had been outfitted with certain instruments. Students were told their goal was to document a site conveniently near them, with instruments that had to fit inside a regular shoebox and be less than $200.00 in total value. (Students were to borrow, not buy the sensors.) Teachers and students, mentored by university and NASA scientists, shared ideas, reached decisions on a standard "kit of parts", and then "launched" their instrument package to a site on "a planet near them." Results were posted online, together with pictures of the student "Mission teams." The 4-months long project climaxed with a set of "Mystery Sites", which students had to identify by comparing patterns of data with those already logged.

Appendix Five -
Year Two Highlights and Module Components

LIVE FROM ANTARCTICA 2: Module Overview

LIVE FROM ANTARCTICA 2 consisted of three live video programs, telecast over PBS stations and NASA-TV, an original Teacher's Guide and Multimedia Kit, a Web site developed in part by EDC as an experiment in providing materials customized for (a) Teachers, (b) Students and (c) Parents and Public (other adults). Once more, the Web site was hosted by NASA LTP, which also managed several online mail lists to support teachers and students.

1) VIDEO
Program 1, "Oceans, Ice and Life" aired January 23rd 1997. Featuring marine biologist Robin Ross, head of this year's NSF-funded Long-Term Ecological Research field team, it described the interaction of the climate, ocean and geology in shaping Antarctic biology. Live interactions with Al Hickey, aboard the R.V. *Polar Duke* described the research process, and physical circumstances of living and working in the Antarctic.

Program 2, "The Secrets of Survival" was telecast live on January 30th from Humble Island, and Palmer Station, Antarctica. Iowa State researcher Carol Vleck took viewers on a tour of the island's Adelie penguin colonies, where parents were seen feeding chicks just weeks old. NSF's Polly Penhale described the huge elephant seals which share Humble Island with the penguins. Mary Lenox showed students around Palmer Station, and NASA's Ann Devereaux described the sophisticated satellite technology which allowed the live interaction between the U.S. and Antarctica.

Program 3, "Seeing the Future" aired February 6th, 1997. Montana State researcher Bill Fraser and Tad Day (from Arizona State), amid sleet and high winds, described their work with bird populations and monitoring the effects of UV-B on plant growth. Antarctic researcher, David Karl, seen first in taped sequences aboard the *Polar Duke* but now back in Hawaii, interacted with his colleagues on location. Students in Hawaii discussed the results of a hands-on demonstration suggested in the Teacher's Guide, and designed to parallel Tad Day's research. Student questions focused on how science in the Antarctic might reveal patterns of global climate change and allow us to see the future of the planet.

2) PRINT MATERIALS
An original Teacher's Guide was developed for the project, following the design and format of the LFM Guide. To a greater extent than ever before, PTK was able to engage NSF' researchers in review and comment on the Guides. Tad Day, for example, helped create the hands-on UV-B experiment. Carol Vleck suggested ways to simulate in students' playgrounds back in the States the penguin monitoring techniques she and her team would be applying in the field. This provided the most sophisticated coordination of

video, hands-on and online activities every achieved in a PTK project. An original full-color poster was also created, using images from NSF Artist and Writers program grantee, Ann Hawthorne.

3) MULTIMEDIA KITS
The LFA 2 Multimedia Kit contained:

The LFA 2 Guide and blackline masters of student worksheets
The original full color poster
An oversize USGS wall map of the Antarctic
A set of filters to facilitate the hands-on UV-B experiments
A 90:00 minute Teacher Orientation video, including sequences from PTK's first LIVE FROM ANTARCTICA Module, and 3 NSF training videos: (1) "Antarctica the Beautiful", (2) "Keeping Safe on the Ice", and (3) "Living and Working in Antarctica: Palmer Station."
5 copies of the NSF/Children's Television Workshop color brochure
NSF's "Your Stay at USAP Antarctic Stations"
NSF's "Facts about Antarctica", and
A color brochure describing the USAP (ASA-NSF)

4) ONLINE
The LFA 2 site provided 3 paths through the online materials, for Teachers, Students and "Parents and Public".