

**The George E. Brown Network for Earthquake Engineering Simulation
PreCollege Education and Outreach Workshop
March 17, 2003**

PART I OVERVIEW

Introduction. We organized a one-day educational outreach planning workshop jointly facilitated by Bob Reitherman, CUREE Executive Director and Principal Investigator, NEES Consortium; Thalia Anagnos, San Jose State University and NEES Consortium; Jill Andrews, Caltech Assistant to the Provost for Educational Outreach; and Bob de Groot, Caltech Outreach Coordinator. We hosted 15 experts (see Appendix 1) from a variety of sectors to provide their professional experience and knowledge of the community's educational needs in the context of NEES Consortium potential resources.

What was the goal of our workshop? Our immediate concern was to seek the help and input of our focus group as we move forward to plan the K-12 outreach programs and plan proposals for funding.

What did we do during the workshop? Please see the following materials:

- **“Final Agenda”** is an outline of the workshop (Appendix 2). During our breakout sessions, participants were asked to respond in the context of information presented about NEES to the following questions:
 - **Question #1.1** *In the context of what you have heard about NEES, what are the three most important educational **needs** in your school / community that could be met, or partially met, by NEES?*
 - **Question #1.2** *What are three potential barriers to meeting these needs?*
 - **Question #1.3** *What are three potential benefits to meeting these needs?*
 - **Question #2.1** *How can your school or community use NEES as a resource? Please suggest three specific NEES Consortium Education & Outreach programs.*
 - **Question #2.2** *What are three potential barriers to implementing these programs?*
 - **Question #2.3** *What are three potential benefits to implementing these programs?*
- **“Nominal Group Technique (NGT)”** (Appendix 3) describes the method we used to gain consensus during the morning and afternoon sessions.
- **“Development of the Network for Earthquake Engineering Simulation”** is an important document participants reviewed before the workshop. It was used as a reference during the day's activities. Can be obtained separately from NEES Consortium P.I. Bob Reitherman, reitherman@curee.org.
- **Voting Results.** See Appendix 4.

PART II SUMMARY OF RESPONSES

Question 1.1 In the context of what you have heard about NEES, what are the three most important educational needs in your school / community that could be met, or partially met, by NEES?

Both groups commonly identified the following areas of need:

- Professional development / training in Internet- and computer-based technologies for teachers
- Increased involvement of underrepresented groups in STEM
- Mentoring, internship, and/or research opportunities for teachers and students; need to capitalize on partnerships with other organizations who can augment NEES efforts in this area
- Information for students about career opportunities in STEM
- Sustainable, well-maintained IT infrastructure in the classroom
- Increased understanding of real-world applications of STEM

Group #1 Responses

This group gave its highest score (5.0) to the need for **professional development for both pre-service and in-service teachers**. Three areas they believe teachers need the most help or support are 1) in the use of tools, resources and methods for inquiry-based learning across the curriculum; 2) in recognition of issues of accessibility; and 3) in content knowledge. The group gave equal ranking to the importance of **engaging underrepresented groups** in Science, Technology, Engineering and Mathematics (STEM).

Slightly lower but equal scores (4.8) were assigned to four areas of need: **mentoring internships** and **research opportunities for students and teachers** including appropriate **role models to engage underrepresented groups** (especially women and minorities) and sustain interest; the need for **interactive software to demonstrate engineering principles** linked to National Science Education Standards; the importance of school **administrative buy-in and support**; and the need to create **partnerships** with academics, college students, engineers, organizations who can augment these efforts.

The group's remaining four top ten items (scores ranged from 4.4 - 4.6) include **facilitating installation of computers in the classroom** and training teachers to use related technology and software; **training teachers to use same methods and tools as engineers and scientists**; the need for **increased understanding of science and science-based inquiry**, especially seismic research and its application to planning and hazard mitigation; and the need to better understand **career opportunities** in related fields of science and engineering.

Other items of lesser importance to the group (scores ranged from 3.6 - 4.25) included the need for **evaluation tools**, NEES-unique **models for classroom instruction**; infusion of NEES-related science and engineering into **local informal science venues**; **parental involvement**; **incentives** for teachers and students, such as stipends, fellowships, internships, CEUs; and **access to NEES data** via the Internet.

Group #2 Responses

This group gave its highest scores (4.7) to two needs identified by its members: First, a way for teachers and students to **understand real-world applications of STEM**, perhaps through demonstration tools; and second, the need to **excite students about high-tech careers in science and engineering**. The group agreed that this could be done via exhibits, modules, or other educational resources, particularly those that focus on earthquake engineering with social relevance.

The next five responses were given scores of 4.4 – 4.6. They include **quality-ubiquitous Information Technology infrastructure** to facilitate learning, with special emphasis on NEES-related technologies; the need for outreach to **minorities and women** and to **educate non-science-minded adults**; the need for more **hands-on applications**; and **STEM trained, motivated and supported teachers**.

The last three items in their top ten list included the need to **motivate students to learn STEM** because of its relevance to **basic learning processes** and **career potential**; the need for **professional development** correlation to standards and problem based learning; and **technology training** for teachers and other interested adults.

Other issues brought up by the group covered needs such as increased awareness of **careers** in Earth science, engineering and architecture; **mentors and/or role models** who can be engaged via the Internet; public awareness of **safety and mitigation information**; interactive and “fun” **informal educational products**; and **research concepts presented in ways that can be understood** by the general public, such as videos.

Question 1.2 What are three potential barriers to meeting these needs?

Group #1 Responses

Budgetary constraints, lack of sustained **administrative support**, inadequate **professional development** – especially in curricular training, and **lack of time** to implement new programs headed the list of barriers to meeting the needs

stated by this group. They raised the question of whether new activities introduced by the NEES program would **displace existing activities** within the curriculum, and pointed out the need to address integration, beginning with pre-service courses at colleges of education. Lack of time in a **test-driven classroom** was brought up as a factor to consider. The group also cited ongoing difficulties in drawing **underrepresented groups** into STEM education and careers. While they recognize the importance of new ways to engage students in STEM, **scalability** was identified as a possible barrier to implementing pilot programs to broader audiences (i.e., nationwide). **Assessment and evaluation costs**, broad dissemination, and **problems related to computer technologies** were also discussed. **Critical thinking skills** are rarely taught as part of the learning process, yet are crucial to successful STEM students.

Group #2 Responses

Inadequate time for educators to prepare new materials or receive training, **matching K-12 community needs** with those of university educators, problems associated with **delivering data analyses and visualization at appropriate levels**, and the **inadequate basic skills** of NEES audiences were cited as this group's most critical concerns. Other potential barriers to meeting needs addressed by this group included **lack of school / district resources**, difficulties associated with explaining the **relevance of NEES** research to students, and the already **overloaded curriculum** with no room for teachers to adopt new materials. **Information Technology (IT) training** for teachers is largely unavailable and teachers find little or no **time to schedule such training**. Social barriers include **lack of parental interest** or involvement in children's learning; and **negative perception of STEM, especially by underrepresented groups (females and minorities)**.

Both groups commonly identified the following barriers to meeting the needs:

- Lack of financial support or other resources
- Lack of time to implement new materials or take special training
- Difficulties associated with attracting larger numbers of underrepresented students to STEM
- Dissemination difficulties / lack of adoption of new materials due to full curriculum
- Inadequate basic skills and lack of critical thinking as part of learning process
- Problems associated with use of new technologies in the classroom such as lack of support, sustainability issues, and matching data-driven products with skill levels of intended audiences.

Question 1.3 **What are three potential benefits to meeting these needs?**

Both groups commonly identified the following benefits to meeting the needs:

- Increased numbers of underrepresented groups exposed to or choosing STEM careers
- Better prepared students entering STEM careers
- Better informed citizenry
- Increased teacher confidence and performance

Group #1 Responses

This group recognized some important benefits associated with meeting the needs they identified. At the top of their list were **increased numbers of underrepresented groups who would be exposed to STEM careers**; **reduction of loss** of life and property due to **increased public awareness**; and **better-prepared students** who would choose careers in STEM and infuse STEM research with **new ideas**. Social benefits described by the group were a **better-informed citizenry**; **positive payback to Congress and taxpayers**; and increased understanding and **use of new technologies**. Education-based benefits cited were **increased teacher confidence** and more **positive attitudes toward STEM** learning and issues, and the **assessment / evaluation processes as a learning tool and teacher incentive**.

Group #2 Responses

This group's list of potential benefits were **increased numbers of underrepresented groups who would enter STEM careers**; increased excitement and motivation for **continued education** and **technical literacy**; and **better-prepared students** who would enter universities as STEM majors. They predicted that new partnerships between university researchers and K-12 educators could lead to **long-term compatibility**. Educator benefits included **less teacher "burnout,"** and the possibility that **schools could serve as IT Centers** with staff prepared for a range of technical careers. Social benefits they cited include students of STEM becoming more **well rounded adults**; **transfer of knowledge from students to parents**; a **better educated domestic work force**; and **increased public awareness** and better decision making.

Question 2.1 How can your school or community use NEES as a resource? Please suggest three specific NEES Consortium Education and Outreach programs.

Both groups commonly identified the following NEES-related resources:

- Classroom demonstration kits using instructional models, materials and posters related to NEES research
- Professional development for teachers such as workshops, seminars, and RET opportunities
- Use of NEES data in various forms to enhance teachers' and students' technical expertise and analysis skills
- An "Ask an Expert" program that links "real" scientists and engineers with students and teachers via the Internet or teleconferencing networks

Group #1 Responses

This group gave the highest score (5.0) to eight of the 17 products, projects or programs they recommended. Six of the eight were related to **teaching enhancements**, such as a **partnership with the University Consortium on Instructional Shake Tables (UCIST)**; **classroom projects** that parallel research and a related **traveling "kit"** with models, posters, activities, etc.; **professional development for teachers via an Internet-based "Educators Workbench,"** sustainable **workshops for teachers**; and **Research Experience for Teachers (RET)** opportunities at NEES Institutions. Data related products suggested were an **education-friendly database organized around topics in science**, such as the "Data and Story Library" project (see <http://lib.stat.cmu.edu/DASL/>) and **provision of existing data via the Web** so students can conduct similar experiments and analyze data. Their top ten suggestions also included broad dissemination of NEES information via television and the Internet by partnering with the **Discovery Channel** and its many cable networks that feature educational programming.

Other suggestions with ratings of 4.2 – 4.6 were **exhibits and activities** designed for science centers and museums; an Internet-based **"Ask an Expert"** program; **training for engineers** who want to make presentations to classrooms; creation of activities that capitalize on **national conferences**, such as EERI; and site-specific **clubs for younger students**.

Group #2 Responses

This group gave the highest score (5.0) to only one of they 18 products, projects or programs they recommended: to develop concepts and instructions for simple, inexpensive **models to demonstrate structural engineering principles** that can easily be put together in the classroom. The next six highest scoring items included a **"Hollywood Squares" or science bowl type game**; interactive web-

based **modules**; **lesson plans and materials with hands-on activities** and aligned to national standards; creation of nationally-disseminated **digital labs with role-playing scenarios**; **teacher training in K-12 curriculum** with a concentration on grades 6-12; and development of a strong **Research Experience for Teachers (RET)** program.

Other top ten programs suggested included a **mobile lab** with dedicated staffing; one-week **training camps at NEES sites**; and **partnerships** with the Southern California Earthquake Center (SCEC), Incorporated Research Institutions in Seismology (IRIS), EarthScope and others in **development of informal science products**.

The remaining list included **sustained professional development** for teachers; **oral history series** related to earthquake experiences; an **“Ask an Expert”** program via teleconferencing networks; **student competitions** related to NEES research; and **seminars** for parents, students and teachers.

Question 2.2 **What are three potential barriers to implementation?**

Both groups commonly identified the following implementation barriers:

- Lack of funds
- Lack of time
- Problems related to computer technology, e.g., hardware and software, maintenance

Group #1 Responses

This group gave the highest score (5.0) to three of the 11 barriers they listed. These were **lack of funds**, **lack of time** for developing products, especially tutorial materials or curricular enhancements, and **lack of administrative cooperation and buy-in** at schools. Barriers with scores of 4.6 – 4.8 were lack of **physical models for experiments** at schools; **quality control** of products; long-term **maintenance of technology-based tools**; and whether **willing and able engineers** could host RET teacher participants in their labs during summers. Remaining barriers identified were **firewalls** or problems related to access because of **hardware or software anomalies**; **timing** in relationship to research; and issues related to **sharing of pre-published data**.

Group #2 Responses

This group gave the highest score (4.7) to one of the 15 barriers they listed: **lack of current technology in classrooms or homes**. Barriers with scores of 4.4 – 4.5 covered such issues as **lack of money, time, and energy to create a labor-intensive outreach program**; **limited public understanding** of the importance of technology; **a disinterested public** due to infrequent earthquakes and related

disasters; difficulties associated with **integration of NEES concepts into existing curricula**; and long term **maintenance for an IT infrastructure**.

Remaining issues in the group's top ten barriers were **lack of student interest**; **negative attitudes on the part of educators**; lack of **marketing expertise**; and **minimal participation by university faculty in teacher mentoring programs**.

Other barriers listed were **equity issues** related to partnerships; **language barriers**; **time** needed to design interactive games; and **lack of resources for broad dissemination of products**.

Question 2.3 What are three potential benefits to implementation?

Both groups commonly identified the following implementation benefits:

- Student involvement in research will result in increased appreciation for science and engineering
- Leveraged resources

Group #1 Responses

This group gave the highest score (5.0) to one of the six benefits they listed: an **increased appreciation for research and student involvement**, which allows teachers and others to foster students' interest in **STEM careers**. Next, the group gave the score of 4.6 to the opportunity to **collaborate with EarthScope** on a variety of products and programs. Other benefits mentioned were the **opportunity for students to gain clear, meaningful feedback on their work** (via interaction with researchers); more **engineers engaged in education**; better **appreciation for unpredictability and uncertainty** in research; and **leveraged resources**.

Group #2 Responses

This group gave the highest score (5.0) to three of their list of 14 benefits. These were **presentation of exciting materials to inspire and motivate students**; **interdisciplinary learning opportunities** that offer students the chance to develop life skills; and **a community of teachers who are supported, comfortable, successful role models** in collaboration with scientists and engineers.

Other benefits the group described had to do with **increased opportunities for students to use math and science skills**; inclusion of earthquake engineering in the **curriculum**, especially physics; and increased **public exposure to science and engineering**.

Appendix 1. Workshop Participants.

Group	Name (last)	Name (first)	Organization, Affiliation
2	Anagnos	Thalia	NEES Consortium; San Jose State University
1	Andrews	Jill	Caltech Educational Outreach
1	Brown	Marta Macias	George E. Brown Center for Innovation
1	Dargush	Andrea	MCEER E & O Director
2	de Groot	Robert	Chemistry & Chemical Engineering, Caltech
2	Johnson	Roberta	UNAVCO / UCAR E & O Director
2	Lafflam	Lisa	Institute for Educational Advancement
1	Lathrop	Scott	NCSA Education, Outreach and Training
2	McQueen	Danielle	George E. Brown Center for Innovation
2	Morgen	Brian G.	University of Notre Dame
1	Mulfinger	Eric	Marshall Fundamental Secondary School /
2	Pardoen	Gerry	PEER Center; UC Irvine
1	Reitherman	Bob	CUREE / NEES Consortium
1	Taber	John	Inc. Research Institutions in Seismology
2	Traeger	Tom	La Canada High School

Appendix 2. Agenda.

Final Agenda NEES CONSORTIUM PRECOLLEGE EDUCATION & OUTREACH WORKSHOP March 17, 2003		
7:30 – 8 a	Check in, Registration. Continental Breakfast.	Location: Caltech Athenaeum. See map in packet for directions.
8 – 9 a	Introduction to the Workshop. Explanation of NEES Consortium Development Project and E/O goals.	Presenters: Bob Reitherman / Thalia Anagnos
9 – 9:30 a	Questions and Answers.	Facilitators: Bob Reitherman / Jill Andrews
9:30 – 9:45 a	Explanation, directions for breakout sessions.	Jill Andrews
9:45 – 10 a	Break	
10 – noon	Breakout session I: the group will be divided into 2 breakout groups. Each group will focus on the most important educational needs in schools and communities, as well as barriers and benefits to meeting those needs within the context of resources unique to NEES. Ideas will be discussed and ranked.	Group 1 (led by Andrews); Group 2 (led by de Groot)
12 – 1 p	Lunch	
1 – 3 p	Breakout session II: Each of the 2 breakout groups will convene and address how schools and communities might use NEES as a resource via specific NEES Consortium Education & Outreach programs. Ideas, as well as barriers and benefits related to these, will be listed and ranked.	Group 1 (led by Andrews); Group 2 (led by de Groot)
3 – 3:15 p	Break	
3:15 – 4:30 p	Presentations on results from breakouts	By group leaders
4:30 – 5 p	Wrap up: suggest and discuss strategies to lay the foundation for the precollege education and outreach component of the 2004-2014 operation of NEES Consortium, Inc. A proposal, which will be written by the NEES Consortium to NSF, will use outcomes from this workshop to plan use of the Internet and NEES for educational purposes. The proposal will be written this summer and presented to NSF September, 2003.	Reitherman & Andrews
5 p	Adjourn	

Appendix 3. Nominal Group Technique.

Research on group dynamics indicates that more ideas are expressed by individuals working alone but in a group environment than by individuals engaged in a formal group discussion. NGT is a method for collective inquiry. Group consensus can be reached faster and everyone has equal opportunity to present their ideas. Individual ideas and judgments are generated and effectively aggregated. The technique is helpful in identifying problems, establishing priorities, and postulating and exploring policies and problem solutions. The method helps foster stakeholder participation in planning.

Results

- A list of 20 to 100 ideas about an issue.
- A preliminary prioritization of these ideas according to a specific relation (for example, educational programs or activities related to NEES science).
- Increased understanding of generated ideas.
- Opportunity to assure that ideas of each member of the group are part of the output.

How the Method is Applied

- One person will serve as **group leader**, working as a facilitator and recording ideas on wall-mounted poster paper.
- The first five minutes will be spent **clarifying the trigger questions**. There are 3 trigger questions in each breakout session.
- The next fifteen minutes will be spent in **silent generation** of ideas in writing. Please try to think of **three ideas in response to each question**. Order your responses according to importance. **Please write legibly**; we will collect your responses at the end of the day.
- The next 30 minutes will be a “round robin” recording of ideas. **Each group member presents, but does not discuss, one of the ideas on his or her list**. The ideas are recorded by the facilitator on wall-mounted poster paper. Each idea is assigned a number. The facilitator then asks each person for a second idea, and so on, **until all ideas are recorded**. Spontaneous “hitchhiking” of ideas is encouraged, but **no discussion or justification of ideas during this part of the session**.
- The next 30 minutes will be spent **clarifying the resulting list of ideas**. The facilitator asks if the group has questions, interpretations, or explanations of each idea.
- The next 30 minutes will be spent **ranking the ideas**. Each group member will write his or her assigned value next to each idea on the poster paper. The value assigned should be between 1 and 5, with each value having the following meaning:
 - 1 = strongly disagree
 - 2 = disagree
 - 3 = neutral
 - 4 = agree
 - 5 = strongly agree
- During the final 10 minutes of each breakout session, facilitators will **aggregate the scoring** for each idea in each category. This information will be presented to the group at the plenary session.

Appendix 4. Voting Results

GROUP 1		
Score (1-5)	1.1 In the context of what you have heard about NEES, what are the three most important educational needs in your school / community that could be met, or partially met, by NEES?	Hitch-Hiked # of Times
5.00	Professional development for pre-service and in-service teachers: 1) use of tools, resources and methods for inquiry based learning across the curriculum; 2) recognition of issues of accessibility; 3) content knowledge.	2
5.00	Engaging underrepresented groups in Science, Technology, Engineering and Mathematics (STEM)	
4.80	Mentoring internships, research opportunities for students and teachers including role models to engage underrepresented groups (especially women and minorities) and sustain interest.	
4.80	Interactive software to demonstrate engineering principles linked to National Science Education Standards.	
4.80	Administrative buy-in and support at schools	
4.80	Partnerships with academics, college students, engineers, organizations who can augment these efforts via mentoring, other resources	1
4.60	Facilitate putting computers in the classroom and train teachers to use the technology related to computers and provide software.	1
4.60	Teachers trained to use same methods and tools as engineers and scientists (I.e., materials or kits)	1
4.40	Increased understanding of science and science-based inquiry; need to understand seismic research and its application to planning and hazard mitigation.	
4.40	Need to better understand career opportunities in the field.	
4.25	Assessment and evaluation tools	
4.00	A NEES-unique applied science or mathematical problem or model to be used on a variety of levels, I.e., construction issues.	1
4.00	Community resources augmented by NEES: science centers, museums, libraries, etc.	
4.00	Parental Involvement	
4.00	Need for incentives (stipends, fellowships, internships, CEUs, etc.)	
3.60	Make use of Internet capability in schools: 1) with access to NEES data; 2) Curriculum development and activities	1
GROUP 2		
Score (1-5)	1.1 In the context of what you have heard about NEES, what are the three most important educational needs in your school / community that could be met, or partially met, by NEES?	Hitch-Hiked # of Times
4.70	Need a way for teachers / students to understand real world applications of math/science: simple, effective demo tools of math and science in our environment.	1

4.70	Excite students about high-tech careers in science and engineering: 1) exhibits, modules, educational resources; 2) particularly Earthquake Engineering; 3) particularly social science issues.	3
4.60	Quality ubiquitous Information Technology infrastructure to facilitate learning (teachers, equipment such as telepresence / teleoperation capabilities) in schools; maintenance.	1
4.40	Outreach to minorities and women to enter STEM fields	1
4.40	Educate non-science minded adults (including legislators) about significance of NEES	
4.40	Hands-on applications	
4.40	Better trained, motivated, and supported teachers to teach STEM	
4.30	Students motivated to learn STEM because of its relevance to their excitement of learning process (e.g., inquiry) and career potential.	
4.10	Professional development correlation to standards and problem based learning (PBL)	
4.00	Technology training for teachers and other interested adults.	
4.00	Make students and counselors aware of careers in Earth science, engineering and architecture	1
3.70	Mentors, role models through Internet.	
3.60	Public awareness of structural soundness of homes and public buildings; include all impacts and mitigation information.	1
3.40	Make informal education more fun and active	
3.10	Present ideas so can be understood by general public, all backgrounds (e.g.: videos)	

GROUP 1		
Score (1-5)	1.2 What are three potential barriers to meeting these needs?	Hitch-Hiked # of Times
5.00	Budgetary constraints (money)	
5.00	Ongoing administrative support / staff development in curricular training	1
5.00	New activities displace existing activities -- how to integrate the two? Lack of time in a test-driven classroom is a factor.	1
5.00	Sustainability for all implemented programs	
5.00	Difficulty in drawing underrepresented groups into STEM education and careers	
4.80	Scalability for broad impact	
4.60	Assessment and evaluation and money to do it	
4.60	Dissemination	
4.60	Critical thinking as part of the learning process	
4.50	Technology problems: hardware, software and someone to act as a systems administrator.	
4.40	Competing priorities within NEES -- need buy-in from NEES Consortium, researchers and NSF	
4.40	How to integrate NEES into pre-service curriculum at colleges of education and other college departments preparing future teachers.	
4.20	Identifying appropriate people to carry out mentoring, curriculum development, professional development.	
4.20	How to affect policymaking processes	
4.20	Lack of time for teacher training	
3.20	How to integrate pedagogy into NEES	
GROUP 2		
Score (1-5)	1.2 What are three potential barriers to meeting these needs?	Hitch-Hiked # of Times
4.90	Inadequate time for educators (preparation and training). Curriculum is full!	1
4.90	Matching needs of K-12 and informal science with the goals of the faculty designing the NEES experiments	
4.70	Delivering data analysis and visualization at right level for intended audience	
4.30	Inadequate basic skills	
4.20	Lack of resources within the school districts	1
4.00	Explaining relevance to students against competing priorities for youth. \$\$/work=small	
4.00	No management of available information	
4.00	Lack of adoption / use of materials that are developed.	
3.80	Costly to develop wide spectrum of educational materials	
3.80	Information Technology (IT) Training for teachers in "real" classrooms.	
3.70	University / academia doesn't reward for E/O efforts; responsibility for outreach goes down chain of command (e.g., graduate students)	1
3.60	Address social aspects of schools (e.g. negative perception of learning; women and minorities don't see themselves as scientists or engineers.)	1

3.60	Lack of parental motivation, interest and involvement.	
3.30	Once disaster is over (post-earthquake environment) it is hard to engage public and decision-makers in current science and technology research.	
3.30	Prejudices of adults about technology capabilities and significance	
3.20	Focus placed on language and math skills (standardized test scores)	
3.00	Reinventing the wheel / not created here	
2.30	Lack of science / technology across US Society.	

GROUP 1		
Score (1-5)	1.3 What are three potential benefits to meeting these needs?	Hitch-Hiked # of Times
5.00	Increased number of underrepresented groups exposed to careers in STEM	
5.00	Significantly reduced loss of life and property	
5.00	Better-prepared students go into careers in engineering and come back to improve engineering infrastructure (assumes a 10-year turn-around during life of NEES)	
5.00	Improve knowledge transfer process - via train-the-trainer programs; raise interest about engineering among precollege educators and students (motivation improves retention and reduces isolation)	1
4.80	Increased number of students going into careers in engineering	
4.80	Better informed citizenry of seismic phenomena	
4.80	Advances NSF mission and positive payback to Congress and taxpayers	
4.80	Continuity / long-term connection to area of study through time	
4.80	Increases teacher confidence and ability in inquiry-based STEM topics	
4.60	Methods for learning (inquiry-based) as model for other subjects	
4.50	Provides opportunities for multidisciplinary use of materials and data	
4.20	Positive attitudes toward STEM and broader understanding of STEM issues	1
4.00	Growing the community of practice through collaborations	
3.80	Assessment / evaluation process a learning tool / incentive	
3.80	Increased use of technology in classroom	
GROUP 2		
Score (1-5)	1.3 What are three potential benefits to meeting these needs?	Hitch-Hiked # of Times
5.00	Increased number of minorities entering earthquake engineering fields / careers	
5.00	Increase excitement, motivation for continued education, technical literacy, and increase performance.	1
5.00	Students consider science and engineering as a potential career.	
4.83	Better prepared students would be entering universities and majoring in math, science, social science and engineering	1
4.80	Students from all backgrounds feel more comfortable with math, science, engineering.	
4.50	New partnerships between university researcher and K-12 educators could lead to long term evolution and compatibility	
4.50	More well rounded students grow up to be more well rounded adults. Includes ways of thinking, problem-solving skills.	1
4.50	NEES opportunities will inspire teachers.	
4.00	Transfer of knowledge from student to parent	
4.00	Students prepared for future careers in technical work force.	
3.83	Better educated domestic work force	
3.83	Increase public awareness and better decision making	2
3.50	"Real" research live for classroom applications	

3.16	Schools as Information Technology (IT) Centers with staff prepared for a range of technical careers	
3.00	Less teacher "burnout"; teaching = more desirable career	
2.60	NEES / EPSCOR	

GROUP 1		
Score (1-5)	2.1 How can your school or community use NEES as a resource? Please suggest three specific NEES Consortium Education & Outreach programs.	Hitch-Hiked # of Times
5.00	Partnership with University Consortium on Instructional Shake Tables (UCIST)	
5.00	Classroom activities that focus on sensor technology (as part of traveling instructional kits)	
5.00	Extend NEES Resources and the collaboration experience to teachers via an "Educators Workbench"	
5.00	Establish traveling Earthquake kit with models, posters, activities, etc.	
5.00	Sustainable workshops for teachers: tools, concepts, pedagogy and activities; help teachers link NEES to appropriate points in the curriculum.	1
5.00	Research Experience for Teachers (RET) opportunities at NEES Institutions	
5.00	NEES should produce education-friendly database organized around topics in science curricula (I.e., "Data and Story Library" project at Carnegie Mellon; see http://lib.stat.cmu.edu/DASL/). Extend to National Digital Library project.	
5.00	Conduct classroom projects that parallel research projects; students can use tools to experiment and manipulate data. Students can go online with researchers to share predictions and outcomes for the projects.	1
4.80	Discovery Channel programs to highlight NEES and its university sites: Assignment Discovery for teachers and students, Discovery Education, Science Channel, and Discovery International.	
4.80	Provide existing research data via WWW so students can use it to conduct similar experiments and analyze data.	
4.80	Challenge or competition among schools; submit results for judging by NEES undergraduates, grad students, post docs, faculty.	1
4.60	Develop exhibits and activities specifically for science centers and museums (hands-on, interactive)	
4.60	Teleobservation / video conferencing access for students and teachers	
4.20	Create "National Month" with researchers participation to highlight NEES on a national level. Could be a month-long Internet-based "Ask an Expert" campaign; could develop into curriculum enhancements.	1
3.80	Raise awareness of earthquake engineering -- especially on national level	
3.80	Training engineers to talk to school groups	
3.60	Create activities that capitalize on national conferences such as EERI.	
3.20	Site-specific clubs (for students) for purpose of learning / explaining research conducted at site. Can host on-site events for younger students.	
GROUP 2		
Score (1-5)	2.1 How can your school or community use NEES as a resource? Please suggest three specific NEES Consortium Education & Outreach programs.	Hitch-Hiked # of Times
5.00	Develop concepts and instructions for simple, inexpensive models to demonstrate structural engineering principles that can easily be put together in the classroom.	
4.80	"Hollywood Squares" type game or science bowl	

4.80	Interactive web-based modules.	
4.70	Create lesson plans and accompanying materials that are aligned with standards (hands-on activities)	1
4.50	Creation of digital labs (role playing scenarios, digital and non-digital) that could be used nationwide.	1
4.50	Training in curriculum (K-12) with concentration on grades 6-12.	
4.50	Develop a strong Research experiences for Teachers (RET) program at all NEES equipment sites.	
4.30	Mobile laboratories dedicated professional staffing, such as an outreach professional.	1
4.20	One-week training camp at NEES sites (with science teachers, math teachers, counselors) for hands-on experience and courseware.	
4.10	Work with Southern California Earthquake Center (SCEC), Incorporated Research Institutions in Seismology (IRIS), EarthScope and others in development of informal science educational products.	
4.10	Digital library of NEES materials.	
4.00	Sustained professional development using NEES scientists and technology integration and applying local field investigations (research experiences).	1
3.80	Oral history: talk to people in the community that have experienced earthquakes; tie in to "Did You Feel It?" website, http://pasadena.wr.usgs.gov/shake/	1
3.70	Provide a student competition that uses a NEES site -- a 21st Century adaptation. Add the coursework to prepare them for the competition (via after school programs, clubs, etc.)	1
3.70	"Ask an Expert" teleconference setting (scientists walks through the experiment). Age specific.	
3.70	Provide competition for student to predict the result of a NEES experiment.	
3.50	NEES should serve as a liaison for student internships.	
3.30	Development of telepresence laboratories	
3.20	College visits / seminars for parents, students, teachers.	

GROUP 1		
Score (1-5)	2.2 What are three potential barriers to implementing these programs?	Hitch-Hiked # of Times
5.00	Availability of funds	
5.00	Time involved in developing tutorial materials, curriculum, etc.	
5.00	Administrative cooperation and buy-in at school sites	
4.80	Absence of physical models for experiments at schools	
4.80	Quality control of products	
4.60	Maintenance of technology tools	
4.60	Finding willing / able engineers to host teachers in summer	
4.20	Firewalls, access to hardware, software	
4.20	Timing in relationship to research projects	
3.20	Ability of NEES participants to organize a club	
2.80	Willingness to share pre-published data	
GROUP 2		
Score (1-5)	2.2 What are three potential barriers to implementing these programs?	Hitch-Hiked # of Times
4.70	Lack of current technology in classroom or homes	
4.60	Money, time, energy of staff conducting the workshops (burnout); materials, student prep, money for student competitions; money to staff mobile lab; funding for development of modules; etc.	4
4.50	Public understanding of technology is limited.	
4.40	Hard to keep interest (from public policy to classroom) between disasters. People forget!	
4.40	Integrating NEES concepts into standards / curriculum.	
4.40	Anything that relates to IT needs -- supervision and maintenance	
4.10	Lack of student interest and/or participation (time)	
4.00	Educators' attitudes (buy-in)	1
3.80	Marketing of services	
3.80	Lack of university faculty participation and lack of teacher training; unwillingness of NEES researchers to mentor teachers	1
3.60	How to form a team with K-12 expertise AND NEES experiments	
3.60	Partnerships -- are they equal? Equity issues	
3.60	Multi-lingual participants / language barriers	
3.30	Well-designed games take time to design and implement in the classroom; students capable of solving problems	
3.00	Hard to reach everybody	

GROUP 1		
Score (1-5)	2.3 What are three potential benefits to implementing these programs?	Hitch-Hiked # of Times
5.00	Increased appreciation for research and student involvement -- fostering growth of students toward STEM careers	
4.60	Opportunity to collaborate with EarthScope on variety of products, programs	
4.40	Students get clear, meaningful feedback on their work	
4.00	More engineers engaged in education	
3.60	Better appreciation for unpredictability and uncertainty in research	
3.60	Leveraged resources via public TV and films and NEES videoconferencing infrastructure	
GROUP 2		
Score (1-5)	2.3 What are three potential benefits to implementing these programs?	Hitch-Hiked # of Times
5.00	Presentation of exciting materials will inspire and motivate students; more interesting science and math classes.	1
5.00	Interdisciplinary learning allows students to develop life skills; competition develops teamwork; role-playing is a particularly effective educational tool.	2
5.00	A community of teachers: supported, comfortable, successful role models, collaboration with scientists and engineers	
4.80	Competitions will allow students to use math and science skills	
4.60	Curriculum development will increase likelihood that topics in earthquake engineering will be covered in K-12 education (especially physics). Align to standards!	
4.50	Students building models translates to "buy-in"	
4.30	Exposure (show public process of science and engineering, etc)	
4.10	Internships and workshops give students experience.	
4.10	Mobile labs can reach all school districts - an equalizer	
4.00	Participants will gain first hand experience with capabilities of one NEES site and an overview of all NEES sites. Applications can be taken back to the classroom.	2
3.50	Interested minority public results in an education society	
3.30	Materials that are developed may be applicable to freshmen, non-science majors at university level.	
3.30	Increased number of students entering engineering fields.	
3.00	Public will be more aware	