

APPLICATION FOR FEDERAL ASSISTANCE

OMB Approval No. 2342-0043

1. DATE SUBMITTED		Applicant Identifier (Optional)	
2. DATE RECEIVED BY STATE		State Application Identifier Center for Integrated Science Education	
3. DATE RECEIVED BY FEDERAL AGENCY		Federal Identifier	
1. TYPE OF SUBMISSION <input checked="" type="checkbox"/> Construction <input type="checkbox"/> Non-Construction <input type="checkbox"/> Construction <input checked="" type="checkbox"/> Non-Construction			
2. APPLICANT INFORMATION		Organizational Unit	
Legal Name of Organization University of Utah		Name and Telephone Number of the Person to be Contacted on Matters Relating to this Application (Give Area Code) Joseph D. Andrade, Professor & Director 801-581-4379 801-581-8692-FAX	
Address (Give City, County, State and ZIP Code) Office of Sponsored Projects Salt Lake City, Utah 84112 (Salt Lake County)		1. TYPE OF APPLICANT (Enter appropriate letter in box) <input checked="" type="checkbox"/> A. State <input type="checkbox"/> H. Independent School Dist. B. County <input type="checkbox"/> I. State Controlled Institution of Higher Education C. Municipal <input type="checkbox"/> J. Private University D. Township <input type="checkbox"/> K. Indian Tribe E. Interstate <input type="checkbox"/> L. Individual F. Intramunicipal <input type="checkbox"/> M. Profit Organization G. Special District <input type="checkbox"/> N. Other (Specify) _____	
3. EMPLOYER IDENTIFICATION NUMBER (EIN)		2. NAME OF FEDERAL AGENCY U.S. Environmental Protection Agency	
4. TYPE OF APPLICATION <input checked="" type="checkbox"/> New <input type="checkbox"/> Continuation <input type="checkbox"/> Revision 5. Revision enter appropriate letter(s) in box(es) A. Increase Award B. Decrease Award C. Increase Duration D. Decrease Duration Other (Specify) _____		11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT Environmental Awareness & Education in Utah Elementary Schools.	
6. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER 66-951		12. AREAS AFFECTED BY PROJECT (Include County, State and ZIP) State of Utah	
13. PROPOSED PROJECT Start Date: 6/1/92 Ending Date: 5/30/93 14. CONGRESSIONAL DISTRICTS OF A. AGENCY: District #2 B. PROJECT: Districts 1-3		15. ESTIMATED FUNDING a. Federal \$ 24,772 .00 b. Applicant \$ 11,353 .00 c. State \$ 0 .00 d. Local \$ 0 .00 e. Other \$ 0 .00 f. Program Income \$ 0 .00 g. TOTAL \$ 36,125 .00	
16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS? a. YES. THIS PREAPPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON DATE _____ b. NO. <input checked="" type="checkbox"/> PROGRAM IS NOT COVERED BY E.O. 12372 <input type="checkbox"/> OR PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW		17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> "Yes" status of delinquency <input type="checkbox"/> No	
18. TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION PREAPPLICATION ARE TRUE AND CORRECT. THE DOCUMENT HAS BEEN SWORN AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES IF THE ASSISTANCE IS AWARDED.			
19. Name of Authorized Representative: ROBERT G. OLABE, Director, Research Project		20. Signature of Authorized Representative: Acting for Ronald J. Pugmire, Acting Vice Pres. for Research	
21. Telephone Number: 801-581-3003		22. Date Signed: 3-6-92	

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460
PROCUREMENT SYSTEM CERTIFICATION

Form Approved
OMB No. 2030-0020
Approval Expires 12/31/92

APPLICANT'S NAME UNIVERSITY OF UTAH		ASSISTANCE APPLICATION NUMBER	
APPLICANT'S ADDRESS Office of Sponsored Projects University of Utah Salt Lake City, UT 84112			
SECTION I - INSTRUCTIONS			
The applicant must complete and submit a copy of this form with each application for EPA Assistance. If the applicant has certified its procurement system to EPA within the past 2 years and the system has not been substantially revised, complete Part A in Section II, then sign and date the form. If the system has not been certified within the past 2 years, complete Part B, then sign and date the form.			
SECTION II - CERTIFICATION			
A. I affirm that the applicant has within the past 2 years certified to EPA that its procurement system complies with 40 CFR Part 33 and that the system meets the requirements in 40 CFR Part 33. The date of the applicant's latest certification is:		MONTH/YEAR	
B. Based upon my evaluation of the applicant's procurement system, I, as authorized representative of the applicant: (Check one of the following.)			
<input checked="" type="checkbox"/> 1. CERTIFY that the applicant's procurement system will meet all of the requirements of 40 CFR Part 33 before undertaking any procurement action with EPA assistance.			
Please furnish citations to applicable procurement ordinances and regulations:			
The procurement system of the University of Utah is in compliance with the Federal Acquisition Regulations (FAR) and the State of Utah Procurement Code. These laws and regulations are to the best of our knowledge, in material compliance with the provisions specified in 40CFR Part 33. Competitive bids on proposals are required for purchases in excess of \$1,000. The public solicitation of sealed bids or proposals is required for all purchases anticipated to be \$20,000 or higher.			
<input type="checkbox"/> 2. DO NOT CERTIFY THE APPLICANT'S PROCUREMENT SYSTEM. The applicant agrees to follow the requirements of 40 CFR Part 33, including the procedures in Appendix A, and allow EPA preaward review of proposed procurement actions that will use EPA assistance.			
TYPED NAME AND TITLE Arnold Combe, Director of Finance		SIGNATURE Arnold B. Combe	DATE June 7, 1991

PA Form 5700-48 (Rev. 11-90) Previous edition is obsolete

EPA Proposal
Environmental Awareness and Education
in Utah Elementary Schools
ABSTRACT

The average elementary teacher often has difficulty incorporating environmental and science concepts and activities into his/her classes. This is due to their concern that these topics do not "fit" typical lesson plans and available materials and do not easily match state curriculum guidelines. In addition the teachers are often overburdened. Class sizes are too large. There is simply not enough time to incorporate many such topics in an average classroom setting. (S. Loucks - Horsley, et al., Elem. School Science for the 90's, The Network, Andover, Mass., 1992.)

The Center for Integrated Science Education at the University of Utah has a number of projects and activities to work directly with elementary teachers to minimize their science anxieties and to incorporate such topics in their everyday curriculum.

This project will set up a FAX network throughout the state. Each of the 400 elementary schools in the state would receive a brief FAX newsletter once a week from CISE focused mainly on local and national environmental issues which are reported in the press. In addition to the press clipping, the story will contain suggestions as to topics and activities for the class. Emphasis will be placed on how such topics fit into the state curriculum guidelines.

Thus each elementary teacher in the state will receive environmental education ideas and resources every week. Every teacher will immediately become aware of environmental issues and be encouraged and motivated to incorporate these issues in their classroom environment.

Background:

The Center for Integrated Science Education at the University of Utah was established to educate and stimulate elementary teachers and elementary teacher candidates in environmental science and technological areas. The Center's key objective is to minimize and hopefully eliminate the science anxieties which most elementary teachers and teacher candidates experience. This is being accomplished by a series of integrated science courses at the University level, designed specifically for elementary teacher candidates, and by a variety of projects for existing teachers, including novel inservice courses, science fair projects, interactions with practicing scientists and engineers, experiences with hands on science museums, opportunities to meet and interact with scientists on a personal level in social situations, and a variety of other novel and innovative projects.

The Center is particularly interested in environmental issues, as most environmental topics serve as ideal case studies with which to integrate scientific, technological, medical, and societal topics and concerns.

Environmental topics can be used to help the students and their teachers discover the principles of chemistry, physics, geology, biology, and health sciences, as well as mathematics, decision making, and public policy.

The Center is particularly interested in utilizing environmental issues and topics as vehicles to not only teach environmental awareness and responsibility, but to encourage students and their teachers to learn the requisite science, engineering, and

technology necessary in order to participate as part of the informed citizenry of the nation.

Utah has the largest class sizes in the nation. Utah spends a high proportion of its state budget for education, and its taxes on a per tax payer/head of household basis are in the nations top 1/3. The demographics of the state result in the largest average family sizes in the nation. The result is very low per student expenditures and very large class sizes, compared to most other states. This provides Utah teachers with an unusual set of challenges.

These facts, coupled with the general fact that elementary teachers in general do not feel very comfortable in science and related topics, it is not surprising that in the United States the typical elementary school student experiences less than 30 minutes per day of science related activities and instruction, whereas their counterparts in other advanced nations have nearly 3 times the exposure and the opportunity to learn science. (Science and Math Education Briefing Book, Horizon Research, Chapel Hill, NC, 1990)

The situation can be dramatically improved if elementary teachers are shown that it is relatively easy to incorporate environmental and science topics into the everyday classroom. Given their relatively low confidence with respect to science and related topics and given the unusually large classroom sizes in Utah, teachers need to be nearly constantly encouraged to involve science topics and reminded as to how such activities fit into their curriculum and classroom routine.

Proposal:

The Center for Integrated Science Education will produce a very brief newsletter, tentatively titled Environmental and Science Education Tips. The newsletter would be produced by CISE staff including affiliated faculty and students. The tips would be derived by scanning local and national newspapers as well as national publications involved with science and environmental education, particularly the publications of the National Science Teachers Association.

We anticipate no more than 3 or 4 major suggestions or tips in each weekly issue. In the case of a suggestion derived from a newspaper account, the appropriate paragraphs of the actual newspaper story would be reproduced in the newsletter (by scanning the story into the computer - the newsletter would be computer composed and FAX - modem transmitted).

The newsletter would be ready on a Tuesday and then directly faxed to each of the 400 elementary schools in the state on Tuesday and Wednesday evenings. The fax would be available in the schools on Wednesday and Thursday mornings. It would be duplicated by the Principal's office and a copy delivered to each elementary teacher in the school that same morning. In this way the teachers have the tips available, at the latest, by noon on Thursday. They can use it during their class preparation time on Friday afternoon and of course over the weekend, in preparation for their classes the following week. Tips and suggestions are provided for stories and topics which are being discussed in the media and are of strong, current interest.

We will attempt to balance the treatment of local environmental issues with national and international topics.

In the first month of the project, we will assess elementary teachers actions and impressions relating to science and environmental issues in the classroom via a brief questionnaire as well as by telephone interviews.

At the conclusion of the project, the assessment will again be performed to see if the newsletter activity has had the expected effect. We will also encourage the teachers to submit their criticisms, suggestions, and ideas to the project staff on a regular basis. The staff would also contact a random group of teachers weekly to assess their needs and obtain their suggestions.

We also expect to work closely with the state Department of Education and with the local districts to develop more complete and effective collections of resource materials, including science kits and demonstrations, in each of the schools.

A typical item in the newsletter would consist of a topic of current interest which has appeared in the press or in the mass media. Hopefully the teacher will already have at least some awareness of the topic. There would then be several sentences as to why this topic is important and relevant to the city, state, nation, and world, and why it is important for the students to know something about it. The key scientific and technical issues involved and key questions or uncertainties would be briefly noted.

One of the objectives of CISE is to illustrate scientific concepts and questions in very simple, graphical terms and to treat science as a set of integrated concepts and questions by showing how different environmental issues involve the same general integrated concepts. (see, for example F.J. Rutherford and A. Ahlgren, Science for All Americans - Project 2061, Oxford University Press, 1990) The teacher will begin to obtain a feeling and appreciation for the commonality and applicability of general science topics. These would be illustrated as simply as possible and presented using common analogies and metaphors relevant to the elementary grades. We would then show how this fits into the state curriculum and, in the case of the large urban school districts, into the district curriculum. In this way, the teacher sees that the topic is not only relevant socially, but relevant in the practical sense of meeting the requirements and testing expectations of the state and local district. The Newsletter item concludes with several very simple discovery experiments, which the student and teacher can perform using readily available materials.

We will endeavor to develop analogies and experiments which the student can take home and thereby interact with their parents. There is the real opportunity of educating the parents on environmental issues through the environmental awareness and activities of their children.

Benefits:

- 1)-Every elementary teacher and principal in each of the 400 elementary schools in Utah will become much better informed and aware of environmental and related technical issues.
- 2)-Every elementary teacher in the state will receive every week a very brief, practical, and helpful Environmental and Science Education Tips, which will encourage him/her to involve their students in environmental and science projects.
- 3)-The projects suggested for the teachers will be of relevance and interest to parents and will encourage students to take the topics and activities home to share with their parents.

- 4)-The newsletter will include a variety of tips and suggestions relating to the development of science projects and the development and enhancement of science fairs, which are not now common in elementary schools in Utah.
- 5)-The newsletter and its FAX distribution network will encourage teachers to communicate with each other and with the University staff and faculty associated with the Center for Integrated Science Education. The teachers will develop a network of individuals who can support and aid them in their environmental and science education endeavors.

The Center would also work closely with local environmental groups and with the Utah Society for Environmental Education in obtaining their participation and input in the project.

Personnel:

This project was conceived and will be directed by J.D. Andrade, Director of the Center for Integrated Science Education.

Dr. Andrade will be assisted by faculty on campus who have strong environmental interests and science and elementary education experience (see Table 1).

Table 1: Faculty with Interests in Environmental Topics and Public Education.

Nathan Winters	Art
Sam Ghosh	Civil and Environmental Engineering
Lynn Alvord	Communication Disorder
Joe Andrade	Materials Science
Calvin Giddings	Chemistry
Mc Donald Wrenn	Environmental Radiation
Joseph Lyon	Family and Preventive Medicine
Robert Mayer	Family and Consumer Studies
Slava Lubomirov	Political Science
Christine Oravec	Communications
Fred Hillyard	Continuing Education
Thomas Richmond	Chemistry
Craig Feibel	Geology and Geophysics
Irene Fisher	Community Service Center
Don Tucker	Mathematics
Hugo Rossi	Mathematics
Don Boswick	Mechanical Engineering
Carlton deTar	Physics
Sid Rudolph	Physics
John Crossley	Recreation and Leisure
Frank deCourten	Utah Museum of Natural History
Noel deNevers	Chemical Engineering
Zig Peacock	Physics
Ron Ragsdale	Chemistry
Rick Steiner	Chemistry

This group together with elementary education professionals from the Graduate School of Education will meet informally during the summer of 1992 to develop a mechanism for selecting issues and topics and for developing the general format of the newsletter.

One graduate student in science education would be selected for the day to day management and conduct of the project.

Dr. Trish Stoddart and Julie Gess-Newsome, co-directors of CISE, with J. Andrade, will also be closely involved. Their brief biographical sketches are attached.

Time Plan and Milestones:

- 1)-Assemble task force to administer project (5/92); developed a detailed action plan for Project (6/92).
- 2)-Monthly luncheon meetings of the environmental education faculty and other project participants (starting May 1992).
- 3)-Select student manager and editor (7/92).
- 4)-Purchase necessary equipment and supplies (8/92).
- 5)-Develop prototype newsletter and set of topics for first 3-4 issues (9/92).
- 6)-Assessment of environmental and science education activities and attitudes in Utah elementary classrooms (early September 1992).
- 7)-Post project assessment including environmental and science education attitudes and activities (late May 1993).
- 8)-Submit final report to EPA (June 1993).

Justification:

A FAX Network is practical and appropriate. Although many elementary schools in Utah do not have a FAX, we expect to rapidly establish FAX equipment in every elementary school in the state. Funds are requested in the project for FAX awards. We would work with the principals to encourage them to obtain appropriate FAX equipment for their schools. Given the FAX "award" from this project, the state has funded a Utah technology initiative for education, so every school has funds for computers and related equipment, which would include FAX and other forms of electronic communications.

A FAX network, we feel, is more effective than an electronic mail network. Electronic mail would require a computer in each school. It would require somebody having to physically log on and would still require printing and duplicating. The FAX comes in through the existing phone line, has the sense of urgency and importance, comes in directly through the principal's office, so the principal becomes aware and involved, and becomes immediately duplicated by the principal's secretary and distributed to the teacher's mailboxes.

We anticipate student FAX projects. We might have various contests as part of the project activity in which teachers and their students could FAX their entries back to the University.

There is a certain mystique associated with elementary students and their teachers having an involvement with the University, as well as the mystique and enhanced interest in using a technology which is still relatively rare for the everyday family i.e. the FAX. All of this can help build interest and insure participation.

Modern FAX equipment does not require a separate phone line so the existing school line can be used at no additional cost. The newsletter will be computer composed and will be sent by a computer FAX modem directly to the schools during the night. It requires about 40 seconds per page, thus sending a two page fax to each of Utah's 400 elementary schools requires a total time of 10 hours, which can easily be accommodated

in 2 evenings each week. As the computer, the phone lines, and the FAX machines are normally unused in the evening, this becomes a very cost effective way of transmitting information efficiently and effectively.

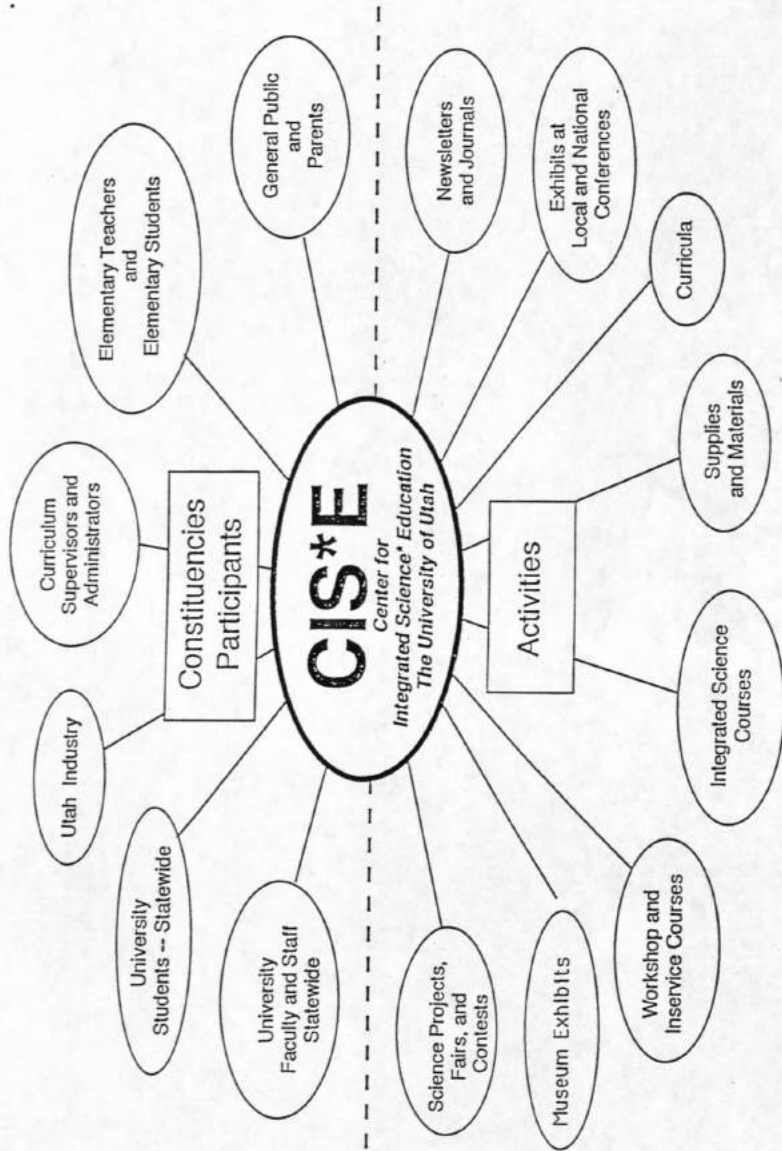
Collaboration: and Center for Integrated Science Education (CISE)

CISE is working very closely with the State Office of Education and with major school districts throughout the state. It is already involved in a variety of inservice courses, science fair project enhancements, and related topics and activities. A listing of CISE's current activities and those proposed for the next year are given in the table below.

Center for Integrated Science Education Current and Proposed Projects

Integrated Science Education Materials Based on Bioluminescence
Science Without Walls (S W/O W): Science Concepts and Skills for Undergraduates
NIGHT-WALK™: Discovery Exhibits Using Bioluminescence
Science Education and Experiences for the Utah Population
Elementary Teacher - Science Researcher Activities and Interactions
Environmental Awareness and Education in Utah Elementary Schools.

The graphic on the next page shows the Center, its participants, constituencies, and activities.



*The term "science" used here follows the common journalism/mass communications definition: science refers to issues and subjects involving science, mathematics, technology, engineering, and medicine. (Contact J.D. Andrade, University of Utah, 801-501-4379 for more information.)

Biographical Sketches:

Joe Andrade is Professor of Bioengineering, of Materials Science and Engineering, and of Pharmaceutics at the University of Utah and is the former Dean of the College of Engineering (1983-87). Several years ago Joe became increasingly interested in the issue of science education for the general population. He taught a course in the Department of Communications two years ago titled "Critical Science Communication, Separating Fact From Fantasy," which was stimulated by the University of Utah's press release dealing with cold fusion and the public interest which ensued.

While in graduate school Joe taught high school general science, biology, and chemistry in a parochial high school in Denver, where the "Science by Seduction" approach was practiced. Basically, his students had all been expelled from the public schools, and it appeared that the only thing that attracted their attention was sex. That became the underlying theme and concept of the life science and biology course, and he managed to find ways to tie a significant part of high school biology curriculum to the general theme of sex.

Joe was also in a cooperative elementary program when his two boys were in elementary school and taught 4-6 grade 6 hours a week for 3 years. His wife, Barbara, is a first grade teacher with some 12 years of teaching experience, and they have worked closely together in developing experiential modules for elementary students based on the phenomena of bioluminescence.

Joe recently decided to devote a significant portion of his time and career to the area of science education. He recently established the Center for Integrated Science Education of the University of Utah, and is working to involve all faculty, staff, and graduate students on campus with interests in science education. He has begun to give inservice courses to local school districts and is involved with the National Science Teachers Association and its local affiliate, the Utah Science Teachers Association. His bioluminescence inservice courses have been very popular with elementary and middle school teachers. His discovery demonstrations with 4-6 grade students are in great demand locally.

He is an accomplished scientist and engineer with 5 books, over 100 peer reviewed papers, and 5 patents. His research group focuses on proteins at interfaces and proteins as engineering machines and devices.

Dr. Julie Gess-Newsome is a science educator with a focus on the science understandings of preservice and inservice elementary teachers. Julie's interests in these topics have stimulated by her eight years of experience as a high school biology teacher. With this background, she was surprised at the poor quality of the science content courses she completed while working on her Ph.D. studies. This experience raised questions concerning the understandings which students, particularly preservice teachers, derive as a result of college and university science courses. IN particular, she is interested in the impact of university science courses on the conceptual understandings which teachers have of science, methods of enhancing these understandings, and the mediating variable which influence the translation of science understanding to classroom practice. She is also studying preservice biology teachers. Her dissertation specifically looks at inservice biology teachers' understanding of content as it influences their classroom practice.

Dr. Trish Stoddart is a cognitive and developmental psychologist with a focus on teacher learning and development, and teacher education. She is particularly interested in the development of subject-specific pedagogy and has conducted research in the areas of

Dr. Trish Stoddart is a cognitive and developmental psychologist with a focus on teacher learning and development, and teacher education. She is particularly interested in the development of subject-specific pedagogy and has conducted research in the areas of mathematics, science, and writing. As a Senior Researcher with the National Center for Research on Teacher Education, she was involved in a five year study on teacher' subject matter knowledge. She brings to this project her expertise in the development of teachers' content and pedagogical understandings for teaching science. Over the past two years with the assistance of a graduate student, Rene Stofflet, she has investigated the scientific conceptions of elementary education students and the use of conceptual change pedagogy to improve their science content knowledge. She has published extensively in the areas of teacher learning and development.