The Integrated Environmental Health Middle School Project

A Summary Report

IEHMSP

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Introduction and Background

This report provides a summary of the accomplishments of the **Integrated Environmental Health Middle School (IEHMS) Project**, a seven-year initiative that demonstrated how environmental health (EH) topics invigorate and enhance the teaching of middle school science, social studies, language arts, math and health. The project was one of nine such efforts around the country that received funding in 2000 through an initiative sponsored by the National Institute for Environmental Health Sciences (NIEHS). This initiative, entitled **Environmental Health Sciences as an Integrative Context for Learning (EHSIC)**, fostered partnerships among EH scientists, educators, and state departments of education. The centerpiece of the EHSIC initiative was the development of a collection of standards-based classroom materials that integrate EH topics into a broad range of subject areas (e.g. math, science, language arts, and social studies).

The IEHMS Project was unique among EHSIC-funded projects in that it was a collaborative effort between two universities - the University of Washington (UW) in Seattle and the University of New Mexico (UNM) in Albuquerque. Participating middle school teachers in Washington State and New Mexico attended summer professional development workshops in order to gain the expertise needed to introduce their students to the core concepts of EH. During this training, they were given the skills and resources they needed to help their students identify and research EH issues in their communities. They were also encouraged to team up with their colleagues to plan and implement an integrated EH unit that was relevant to their students' interests and that addressed state academic standards. To ensure success, the teachers were given specialized curricula and on-going training and support throughout their participation in the project. The timeline below provides an overview of the project life cycle.

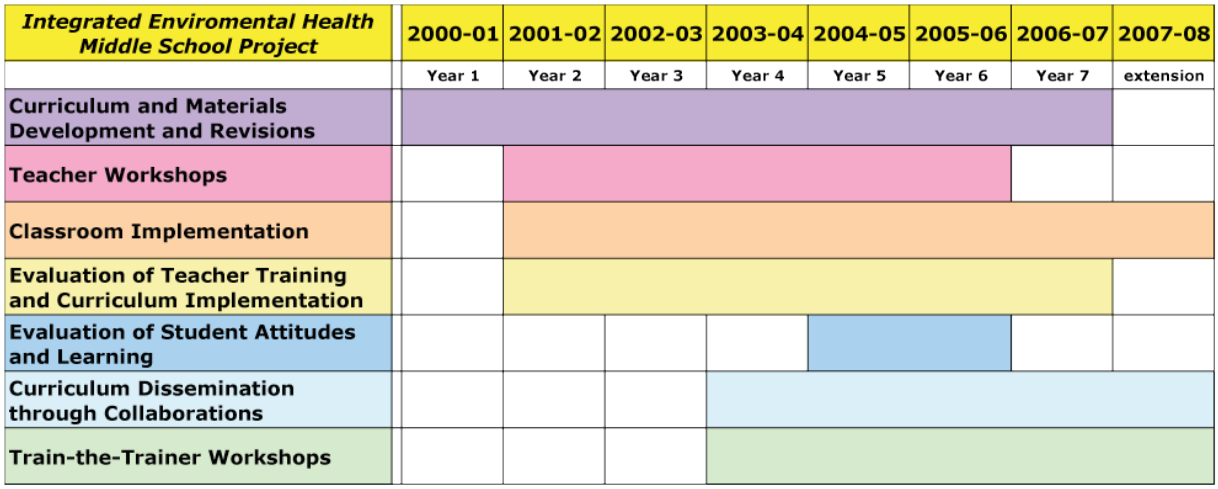

Figure 1. This timeline summarizes the IEHMS Project's phased approach to curriculum development, teacher training, implementation, dissemination, and sustainability.

The IEHMS Project was successful in a variety of ways. For example, the project resulted in the creation of a rich collection of scientifically accurate, accessible, and innovative classroom materials. **During the course of the project, a total of 286 educators were trained in the core concepts of EH and how to incorporate those concepts into their teaching. These teachers reached a total of at least 15,080 students during the five year period of the grant for which such data are available** (*figure 2*), although that figure is likely an underestimate due to the challenges of capturing such data. The project also included an evaluation component that looked at student attitudes and knowledge related to EH, resulting in some valuable findings with implications for future EH education efforts. Finally, classroom materials designed for the project attracted the attention of state departments of education in both Washington State and New Mexico. The adoption of portions of these materials by a wide range of stakeholders will ensure that the IEHMS Project continues to impact middle school education in the years ahead.

This summary report provides a brief overview of the IEHMS Project's accomplishments by describing how each of the five originally specified aims was addressed.

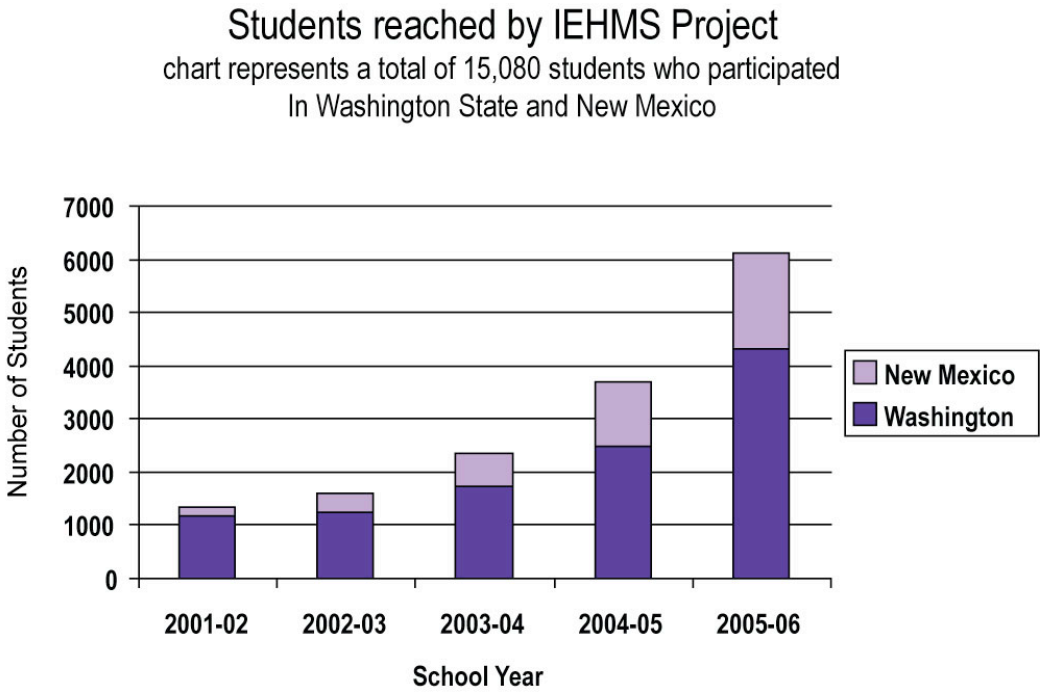

Figure 2. Teachers participating in the IEHMS reached at least 15,080 students during the project period in which such data was collected (years 2-6).

Materials Development

Specific Aim 1 ⇒ *Adapt existing instructional materials and create new ones that facilitate the use of environmental health sciences as an integrative context for learning in grades 6 – 8.*

Prior to being awarded the EHSIC grant, IEHMS Project staff had been working for several years to ensure that EH-related content was included in the primary and secondary school curriculum. These earlier efforts included the creation of electronic and print classroom materials, as well as a hands-on activity kit for use by EH professionals when presenting in K-12 classrooms (Tox-in-a-Box). Between 1996 and 1998, a series of in-depth teacher workshops was also developed and implemented. This extensive experience in designing and disseminating curricula, as well as creating robust professional development opportunities for teachers was invaluable in laying the groundwork for an undertaking as ambitious as the IEHMS Project.

The first stated aim of the project was to create a powerful toolkit of classroom resources that would provide teachers and their students with access to up-to-date and accurate information about EH. This was done both by adapting materials that had previously been developed and creating new ones that were designed specifically to address the unique goals of the project. In particular, given the project's interdisciplinary nature, there was a recognized need for new print and electronic materials that were readily accessible to non-science teachers.

In addition to being easily integrated across disciplines, all project materials were expected to be standards-based and to support a problem-based approach to learning. Given the diverse nature of the student populations we expected to reach, it was also critical that as many materials as possible be adapted to be culturally appropriate and relevant for specific communities of learners involved in the project. For example, several schools located in pueblos in rural New Mexico participated, requiring project staff to adapt the content of both print and electronic materials to be relevant to the interests and concerns of students in these predominantly Native American and Hispanic communities. All materials were reviewed by teachers from the four main disciplines (science, math, social studies, and language arts) and were evaluated by EH scientists for accuracy and bias. Most materials were also translated into Spanish by the New Mexico project team.

Early in the life of the project a set of "EH core concepts" common to all materials was developed. A set of icons was created to represent these concepts, in order to draw students' attention to them as they occurred across topics and lessons (*figure 3*).

The materials development phase of the project was not without its challenges. Teachers are already famously overburdened with topics they are mandated to teach. Even those who clearly recognize the importance of teaching students about the connections between human health and the environment are sometimes unable to make room for an EH unit in their curriculum. The enactment of the federal *No Child Left Behind* (NCLB) policy in January of 2002 placed new requirements on states to implement high stakes testing in order to maintain federal funding. This

unexpected development early in the life of the project made it even harder for participating teachers to find class time for non-required topics, as preparing for and administering these new tests carved ever-increasing time out of an already overcrowded teaching schedule. With the specter of lost funding hanging over their heads, many schools quickly shifted their resources to improving reading and math skills at the expense of "add-on" topics like health and environmental education.

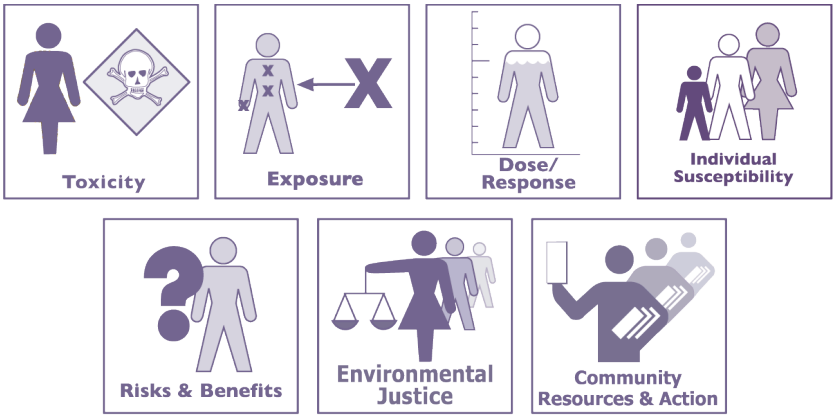

Figure 3. These icons were developed to provide continuity across project materials and help reinforce the core concepts of EH for students and teachers.

The IEHMS Project was able to overcome these challenges, however, in part by ensuring that the materials development process was flexible and responsive to teachers' real world needs and constraints. A prime example of this was the development of the *Environment Health Fact Files* series, the format and design of which came directly from teacher feedback early in the project. These short, stand-alone lessons are discipline specific and aligned with standards that teachers are already expected to teach. They provide an easy, less daunting entrée into EH for teachers who are not yet able to commit to team teaching or to requiring their students to do extended research projects. For teachers who are able to commit to a more extended EH unit, they also provide an excellent set of introductory lessons.

This flexible approach to curriculum development also allowed us to align our efforts with a variety of state mandates as they emerged and to "piggyback" on these new requirements. In Washington State, for example, a new assessment tool was developed for social studies teachers as part of the state's requirement for classroom accountability. These "Classroom Based Assessments," or CBAs, were designed to allow teachers to take existing classroom materials and adapt them to conform to a generic template for assessment. We were able to quickly respond to this need by creating a series of resources for the CBAs based on portions of our already developed materials. These were then made available on the state's Office of the Superintendent for Public Instruction website. This kind of real-time adaptation to the changing landscape of education ensured that we were still able to meet project goals, even if we did so in ways that could not have been envisioned in the original proposal.

The following is a description of the materials that were either modified or developed for the project. All materials are suitable for grades 6-8 and include content specifically tailored to teachers of science, language arts, social studies, math and health. Electronic versions of all IEHMS Project materials are available free of charge through the project web site.

Figure 4. A broad range of classroom materials was developed in order to provide teachers with a range of choices of how to best integrate EH into their teaching. Many materials are also available in Spanish.

Student Introduction to Environmental Health (*Print materials and PowerPoint presentation*)

This short, stand-alone lesson introduces students in any subject area to the seven core concepts of EH that will be reinforced in other IEHMS Project materials. This lesson is an excellent opening activity, giving students the confidence and foundational knowledge to move on to other, more in-depth assignments. Based on teacher feedback, a PowerPoint presentation was developed to accompany the print lesson plan. This presentation brings the core concepts to life through graphics and simple animations, and provides a more interactive way for teachers to introduce the information. *Print materials are available in Spanish*.

Environmental Health Fact Files (*Print materials*)

As described above, the development of the *Environment Health Fact Files* series was inspired by feedback received from teachers early in the project. These topic-based collections of short lessons were designed to provide an easy entry point for teachers wishing to include EH topics in their teaching, but unsure how best to do so while still meeting existing subject area requirements. The EH Fact Files are especially useful for non-science teachers, as they include lessons specifically designed for math, social studies, language arts, as well as science. They were designed to provide an 'à la carte' resource that allows teachers to mix and match lessons across disciplines according to the constraints and opportunities particular to their teaching situation. Other features of the EH Fact File series include a list of resources for school librarians, a matrix of state standards addressed by each lesson, and suggestions for incorporating the materials into a health and fitness curriculum. They also provide a valuable resource for school nurses, after school programs, and parents.

EH Fact Files are available on the following topics**: lead, asthma, and diabetes**. *Both English and Spanish language versions are available.*

The Quicksilver Question (*Web module and print materials*)

One of the primary curriculum development goals of the project was to adapt *Project Greenskate*, a previously developed web-based module, in order to make it work in an interdisciplinary middle school context. *Project Greenskate* was launched in 1997 as part of an earlier curriculum development effort. It invited high school students to explore a fictional situation in which a contaminated former industrial site is being considered as the site of a new skateboard park. In order to decide whether or not to build the park, students explore the virtual town and collect key documents that provide them with a broad range of information and opinions about the situation. This innovative, scenario-based module had been well received by teachers and popular with students, but the content and programming were outdated and in need of revision by the time the IEHMS Project was launched. Based on conversations with teachers, we chose to retain the basic game-like format of the existing module, but created an entirely new storyline. We also moved from HTML to Flash programming in order to add more sophisticated functionality, as well as consistency across platforms and applications.

The Quicksilver Question story introduces middle school students to the connections between historic gold mining, mercury contamination, fish consumption and human health. Students explore the fictional town of Quicksilver, meeting people and gathering information along the way that will help them decide if fish from the local lake are safe to eat. The module models problem-based learning for students, engaging them in a guided exploration of an issue similar to one they might encounter in the real world. A number of in-class extension activities are available for teachers across a variety of subject areas. In order to ensure cultural and regional relevancy for teachers and students participating in the project, both a New Mexico and a Washington State version of the module were

created, each reflecting the unique terrain and history of these very different regions, while maintaining the basic content of the storyline.

The Health & Environment Activities Research Tool (HEART) (*Print materials*)

In many ways, the *HEART* manual is the centerpiece of the IEHMS Project. This collection of worksheets and resources is designed to help teachers engage their students in extended, locally relevant EH research projects. It provides solid scaffolding for both teachers and students who are unfamiliar with undertaking open-ended, student-driven research. A series of worksheets breaks down the process into seven manageable steps. From problem identification, to formation of a research question, to presentation of research findings, the materials provide students with the tools required to successfully investigate how the environment impacts their health and the health of their community. *Both English and Spanish language versions are available.*

Social Studies Classroom Based Assessment (CBA) Bridging Documents (*Print materials*)

As described above, these materials were created as a direct response to changes in the educational landscape that occurred after the project was funded. When the CBA was introduced in Washington State as a new way to assess student learning in Social Studies, teachers and curriculum developers were invited to take existing classroom materials and adapt them to conform to a generic template for embedded assessment. The IEHMS Project responded by creating the following "bridging documents," which were adopted by the state Office of the Superintendent of Public Instruction (OSPI) and made available to teachers throughout the state:

Constitutional Issues and Environmental Justice (*CBA Bridging Document)* asks students to take a stand on whether everyone has an equal right to a healthy environment. Students explore how environmental justice relates to our nation's constitutional principles and democratic ideals.

Why History? - The Quicksilver Question Web Module (*CBA Bridging Document)* asks students to develop a position on how the knowledge of history helps them understand a current issue by analyzing related historical events. By exploring multiple resources from *the Quicksilver Question Web Module*, students unravel the legacy of mercury use through history and develop an understanding of its impact on human health today.

Why History? - Looking at Lead's Legacy (*CBA Bridging Document)* asks students to develop a position on how the knowledge of history helps them understand a current issue by analyzing related historical events. By exploring multiple resources, students unravel the legacy of lead use through history and develop an understanding of its impact on human health today.

Teacher Training and Classroom Support

Specific Aim 2 ⇒ *Provide training and follow-up support to participating teachers and their students in the use of project curriculum materials.*

Prior to being awarded the EHSIC grant, IEHMS Project staff had gained valuable experience in professional development for secondary teachers through the NIEHS-funded *Environmental Health for Educators* project. This project, supported by an R25 grant from the NIEHS, brought together a group of dedicated high school teachers and asked them to design the ideal professional development experience. The result was a two-part workshop series that provided teachers in a variety of disciplines with in-depth training in a range of EH topics. Teachers received three days of content training in summer, then were asked to return to their classrooms and create and implement their own EH lesson plans. Finally, they were asked to return the following spring for a two-day follow-up session in which they shared the materials they had created and piloted in their classrooms.

While this experience contributed greatly to the success of the teacher-training component of the IEHMS Project, the budgetary constraints and scope of the project required a different approach to training than the one developed for *Environmental Health for Educators*. Instead of five days of training delivered across two workshop sessions, participants in the IEHMS Project received one day of initial content training and introduction to the goals of the project during the summer, followed by on-going support throughout the school year. In Washington State, this support was provided in part by a "resource teacher" who offered classroom instruction, attended school science fairs, arranged field trips to university labs, and helped locate and provide additional teaching materials upon request. In New Mexico, project staff provided on-going support to teachers in a variety of ways, including helping with grant writing, arranging for scientists to visit classrooms and school fairs, and providing tours of the UNM Health Science Center. At both sites, additional funds were also allocated to support optional planning sessions for teachers upon request. Participating teachers and administrators were also given access to a broad range of unique professional development opportunities as a result of their participation in the project. These included attending and presenting at professional meetings hosted by organizations such as the National Science Teachers Association, The Northwest Association of Environmental Educators, and the American Public Health Association. All of these components taken together allowed for a flexible and dynamic approach to professional development that could easily be tailored to the particular needs and constraints of the individual participants.

The original vision of the grant was that teachers could only participate if they agreed to work in interdisciplinary teams, representing science and at least two other non-science disciplines (e.g. math and language arts). They were also expected to collaborate on an extended student research project. At the time that the grant proposal was being developed, a handful of committed school districts in the two states agreed to participate, and a goal was set of reaching 350 teachers from these districts over the seven-year grant cycle. The expectation was that participating districts would encourage teachers to attend workshops and require the use of project-generated materials in the classroom.

This initial vision of teacher training and expectations, however, had to be modified early on in the project. As described above, the passage of No Child Left Behind had many repercussions for both teachers and administrators, effectively curtailing their willingness to include extended student research projects in an already overcrowded curriculum. In addition, unforeseen turnover in district personnel and a lack of consistent follow-through on the part of district administrators made it impossible to meet training goals as originally envisioned. Project staff recognized early on that the intended project implementation model requiring a district-wide curriculum adoption and top-down mandate was not feasible. As a result, the decision was made to move away from a model in which full participation was expected from a small number of districts towards a more organic approach in which a school or district's participation could be initiated by an individual teacher's enthusiasm and commitment. Workshops were opened up to individuals as well as teams, and teachers from districts other than those originally included in the grant were encouraged to attend. As a result of this shift, **the IEHMS Project ended up having a presence in twenty school districts**, and arguably influenced a wider array of educators than originally envisioned. In New Mexico, participating schools were located in both urban and rural areas, as well as on Tribal lands. In both states, teachers in the project worked with a diverse population of students representing a broad range of socio-economic and ethnic populations.

In terms of numbers of individual teachers reached, this flexibility and willingness to adapt when faced with unforeseen challenges allowed the IEHMS Project to reach nearly as many educators as projected in the original proposal**. Over the course of the project, 286 teachers participated – 91 in New Mexico and 195 in Washington State.** Each of these participants received an introduction to the field of Environmental Health Sciences, as well as training in some or all of the IEHMS Project materials. Many of these teachers participated over a period of several years, and many also took advantage of the follow-up support and additional resources that were made available to them. By adapting our criteria for participation as a result of changing conditions, we were also to attract participants from disciplines that weren't originally envisioned in the grant, such as health and fitness, library media and technology, and special education (*figure 5*).

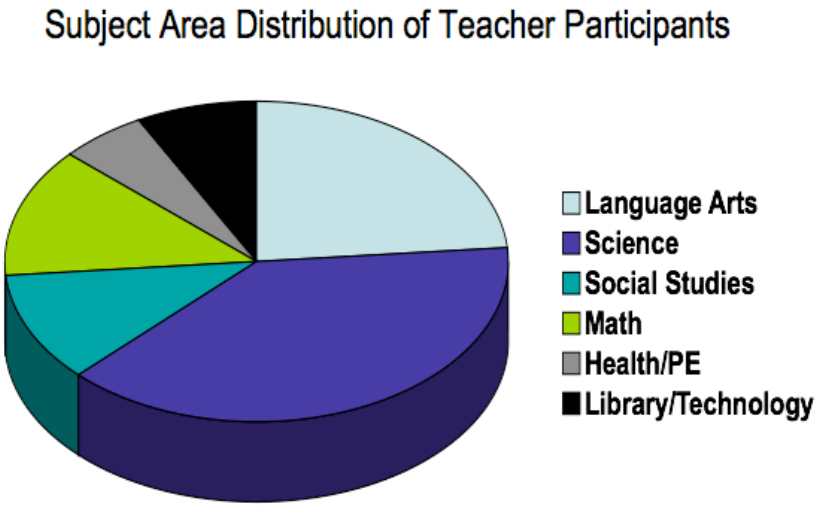

Figure 5. Teachers participating in the IEHMS Project represented a broad range of subject areas. This chart includes teacher participants from both WA and NM.

The fact that the IEHMS Project was able to remain flexible and adapt its curriculum development and teacher training goals to rapidly changing conditions is, in part, a testament to the original vision of the EHSIC program. The willingness of NIEHS to award funding over a seven-year period was truly unprecedented. This long-term commitment allowed the IEHMS Project to change over time, identifying and pursuing the unforeseen opportunities that inevitably appear in the wake of unforeseen challenges.

Project Evaluation and Assessment

Specific Aim 3 ⇒ *Evaluate the implementation of project materials in the classrooms and schools.*

Specific Aim 4 ⇒ *Evaluate student outcomes in terms of achievement and attitudes* **.**

Effective project evaluation was a key requirement of the EHSIC request for proposals. In order to successfully fulfill this requirement, the IEHMS Project worked with independent outside evaluators throughout the life of the project. The UW's Office of Educational Assessment (OEA) assisted in the initial phase of the project, helping staff design instruments to evaluate teacher workshops and assess classroom implementation of EH content. During year 2 of the project, the OEA team was replaced by an independent evaluator whose expertise was better suited to the program's needs. This evaluator oversaw work at both sites and assisted the project throughout the remainder of the grant. In addition, project staff in New Mexico engaged an on-site evaluator during the period in which student data were being collected.

Evaluation for the project focused on both process and outcomes measurements. Process evaluation helped ensure that classroom materials were effective and relevant, workshops were tailored to address teacher needs and concerns, and that follow-up support provided to teachers was timely and sufficient. Outcome evaluation sought to measure changes in student knowledge and attitudes as a result of having participated in the project. The original requirements in the grant RFA expected that student scores on standardized tests would be used to measure changes in student learning, along with information about attendance and disciplinary actions to measure attitudinal changes. This approach, however, had to be abandoned early in the project for a variety of reasons, such as school district restrictions, privacy issues surrounding student information and the virtual impossibility of designing a randomized control trial in an educational setting. Instead, a pre/post survey was administered to students during years 5 and 6 of the project. This survey included both an attitude and knowledge component. The results of an initial analysis of data from year 5 (2004-05) were presented at the Hawaii International Conference on Education in 2006 and published in the conference proceedings. A manuscript presenting the results of a comparison study conducted on a subset of the data from the same year is currently being prepared for submission to a peer-reviewed environmental education journal.

For the purposes of this report, the various components of project evaluation have been divided into three basic strands, with the relevant methods used and highlighted findings for each strand presented below.

1. Evaluation of teacher training and support

Methods used:

- Anticipation surveys administered to teachers at the beginning of their participation in the project
- Post-workshop evaluations administered to teachers
- End of year reflection surveys administered to teachers
- End of year interviews with teachers

Selected highlights from findings:

- **Workshop evaluations over the time period of the grant were consistently, overwhelmingly positive; speakers were well received and the EH content was found to be relevant and useful.**
- Teachers particularly valued the fact that time was set aside during the workshop to plan their EH units with colleagues.
- In the two summer workshops that took place before the full range of project materials was available, participating teachers reported concerns both about curriculum alignment and access to resources. This was less of an issue later in the project as more curricula came online and matrices showing alignment with standards were included in project materials.
- The greatest concern expressed by teachers related to issues of time management, especially a lack of time for planning units with partner teachers. This remained true throughout the life of the project.
- When asked what aspects of follow-up support were most effective, teachers particularly appreciated the availability of the resource teacher (in Washington State) and *EH Headlines*, a weekly email update compiled by project staff that provided links to EH related stories in the news.

2. Evaluation of project materials

Methods used:

- Formal review of materials by teachers representing four disciplines (science, math, language arts, social studies), as well as by science curriculum directors from three school districts in Washington State
- Formal review of materials by scientists with relevant expertise
- Formal testing and review of web module by students

- End of year reflection surveys administered to teachers (included questions about the implementation of classroom materials)
- End of year interviews with teachers (included questions about the implementation of classroom materials)

Selected highlights from findings:

- **80% of teachers surveyed in year 5 said that the project materials were highly relevant to their curriculum.**
- 78% said that the seven core concepts of EH were easily incorporated into their subject area.
- When asked what the major obstacles were to integrating EH into their teaching, 48% of teachers cited insufficient planning time with other teachers, while 25% cited time constraints given existing curriculum requirements.
- Teachers reported that use of the materials contributed to student skill development in areas such as community awareness, current events, research skills, and presentation skills.
- Feedback from teachers during the evaluation process resulted in the creation of a PowerPoint presentation to accompany the *Student Introduction to Environmental Health* lesson plan.

3. Evaluation of student outcomes

In terms of evaluating student outcomes, the project team chose to wait until all classroom materials had been developed and implemented before collecting data. As a result, student data was collected in years 5 (2004-05) and 6 (2005-06) of the project. Student outcome evaluation focused on answering the following knowledge-related questions:

- *How well can students identify EH issues in their communities?*
- *How well do students understand the core concepts of EH as presented in the materials?*
- *How robust are students' problem-solving skills in the domain of EH?*

In addition, we were interested in answering the following attitude-related questions:

- *How much of a connection do students perceive between human health and the environment?*
- *How interested are students in learning about EH?*
- *How empowered do students feel to positively influence how the environment affects their health?*

Methods used:

- Pre/Post student knowledge survey
- Pre/Post student attitude survey

In order to increase teacher participation and district buy-in, the knowledge survey was designed to closely mimic the format of the recently developed Washington State Assessment of Student Learning (WASL) in science. This allowed teachers to more easily justify the use of precious class time for the survey, as it could be seen as an additional way to prepare students for this new, high stakes test. The criterion-referenced survey consisted of multiple choice and short answer questions, as well as a single extended response question. Project staff spent several months developing a detailed scoring rubric, inviting input from EH experts and participating teachers throughout the process. Inter-rater reliability scores were tested until agreement ratings were consistently above 80%.

The attitude survey was less class time intensive, consisting of four short questions with Likert scale responses.

Both the knowledge and attitude pre-surveys were administered to students within the first month of the school year, before any EH instruction had begun. The post-surveys were administered as soon as possible following completion of EH instruction. All surveys were administered by teachers, and submitted to project staff for scoring. Due to insurmountable challenges in data standardization and collection, only data collected in Washington State was ultimately analyzed.

Selected highlights from findings in Year 5:

- 934 matched student knowledge surveys were analyzed**. This analysis showed a significant improvement in student understanding in most classrooms pre to post test in all three knowledge areas** (ability to identify EH issues, knowledge of EH core concepts, and EH problem solving).
- In terms of the core concepts, students generally showed the greatest understanding of dose/response and risk reduction. Students showed the greatest improvement in their understanding of the concept of routes of exposure.
- In addition to the analysis carried out on the entire data set from year 5, a further analysis was conducted on a subset of eighth grade classrooms as part of a comparison study. This study sought to evaluate the effects of including a project-based learning (PBL) component in instruction. One group of students conducted community-based EH research projects. The other group of students received similar instruction but without the research project component. Student post-survey scores were compared using an analysis of covariance (ANCOVA) with pre-survey scores as the covariate. **Results from this comparison study showed significantly greater understanding of EH issues and EH problem solving among students who had been asked to conduct an EH research project.** Student understanding of EH core concepts varied between these two groups and was not consistent across all core concepts. These differences in core concept

understanding may be accounted for by the different emphasis teachers gave to the various concepts during their instruction.

- Nearly 2000 unmatched student attitude surveys were analyzed**. After receiving EH instruction, more students perceived a great deal of connection between human health and the environment, believed they knew a fair amount about how their surroundings influenced their health, and believed they had the power to change how the environment influenced their health.** Slightly fewer students, however, expressed interest in learning about EH following the project intervention. This finding might be attributable to student fatigue. It is hoped that interest levels would increase if the same question could be asked several weeks or months after completion of the unit.

Project Sustainability and Collaborations

Specific Aim 5 ⇒ *Disseminate project results and collaborate with other grantees to encourage the nationwide dissemination of project results and the creation of new EHSIC programs.*

The ultimate goal of any educational project is to ensure long-term, sustainable, and systemic change that ultimately leads to measurable improvements in student learning. The original vision of the EHSIC program included a goal of increasing the number of EHSIC funded projects around the nation. Presumably, this was to be done by offering opportunities over time for new projects to be funded beyond the original nine grants awarded in 2000. These new programs would benefit from the experience previous grantees had accumulated and the resources they had developed, allowing the program to impact an ever-increasing number of students around the country. Mid-way through the funding period, however, changes in direction at NIEHS resulted in a move away from providing dedicated funding opportunities for K-12 education and outreach. In response to this shift, the IEHMS Project developed a different model for ensuring that project materials were disseminated as widely as possible and that their use would continue beyond the life cycle of the grant.

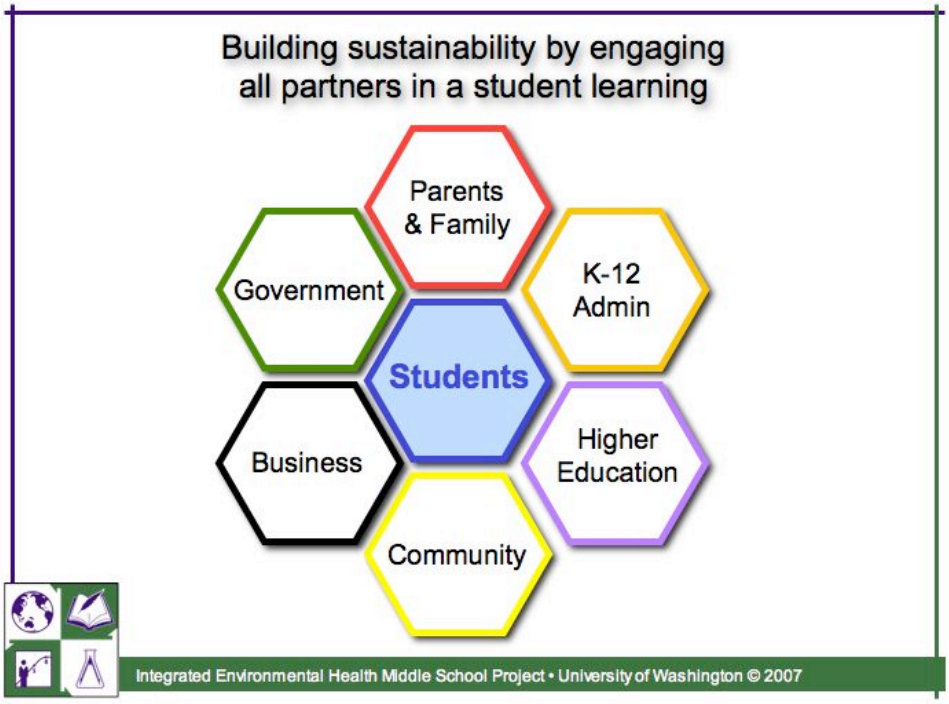

*Figure 6. This graphic represents the various stakeholders in a middle school student's education. The IEHMS Project worked to engage representatives from every domain in order to provide ensure the greatest likelihood of long-term sustainability and continued use of the project materials. *graphic model adapted from OSPI Science System Plan*

The model shown above is a way of conceptualizing the domain of education. It identifies the various stakeholder groups who have both an interest in and an influence upon the quality of student learning. As an organization and planning tool, the model served as a useful reminder that working to influence state departments of education, school districts, schools, and individual teachers would not necessarily be enough to guarantee that EH content was included in the middle school curriculum. Instead, a holistic approach was needed in which all stakeholders were considered as possible allies for the project. This section highlights some of the ways in which the IEHMS Project partnered with each of these stakeholder groups to build and extend support for including EH content in the curriculum.

Collaborations with K-12 administration:

From its inception, the IEHMS Project worked at all three administrative levels of K-12 public education – state, district, and school – to encourage support for the use of EH-related materials in as many classrooms as possible. These collaborations were time and resource intensive, requiring project staff to invest many hours in partnership building activities, such as serving on advisory committees, attending planning meetings, or networking at professional conferences. Ultimately, however, these efforts paid off by creating new allies and opening doors to innovative approaches to reaching teachers and students. Some examples of these collaborative efforts and their outcomes include:

- The IEHMS Project was profiled as a model project in the publication *Environmental Education Report - Empirical Evidence, Exemplary Models, and Recommendations on the Impact of Environmental Education on K-12 Students*. The report was written at the request of the Washington State legislature and was submitted in December of 2007.
- Project representatives worked to ensure that language about environmental impacts on human health was included in the Washington State Governor's Executive Order on Environmental Education.
- Project representatives served as test item writers and reviewers during the development of the Washington Assessment of Student Learning (WASL) in science, working to ensure that EH content was included in the test.
- In Washington State, project materials were adapted for use by the OSPI sponsored *Education for Environment and Sustainability* initiative and will be included in a *Sustainable Design Project Teacher Manual*. IEHMS Project staff have also been invited to several of their teacher workshops and asked to present and share materials.
- OSPI makes project materials available to social studies teachers in Washington State through its Classroom Based Assessment workshops and related web pages.
- OSPI has links to project materials on its web pages for health and fitness instructors.
- Project representatives in New Mexico collaborated with the Health Services Division of the New Mexico Public Education Department to train staff in the use and dissemination of project materials through a variety of statewide mechanisms.

Collaborations with higher education (beyond those described in the original grant proposal):

- IEHMS Project staff were invited to provide an overview of EH and introduce project materials in several UW College of Education pre-service classes, such as a science methods course taught at UW's Bothell campus.
- New Mexico project staff were invited to present materials to teacher pre-service classes at the College of Santa Fe, San Juan College, and New Mexico Highlands University.
- A train-the-trainer presentation was provided at the 2007 annual meeting of the Teachers of Teachers of Science (TOTOS). This professional organization brings together science methods faculty from each of the teacher preparation programs in Washington State. Feedback after the event was overwhelmingly positive and many participants expressed interest in including EH issues in their science methods instruction.
- IEHMS Project concepts and materials have been presented to teachers participating in the QuILS (Quarterly Institute in Life Sciences for K-8 teachers) continuing education program at the UW. This program provides experienced teachers with hands-on opportunities to explore inquiry and problem-solving in the context of life sciences education. Program organizers and participants have consistently expressed enthusiasm for the potential of EH concepts and IEHMS Project materials to support inquiry-based instruction.
- Project staff at UNM received supplemental financial support for additional EH curriculum development from La Tierra Sagrada Society, a member-driven organization housed in the UNM Medical School that is dedicated to medical education, research, and healing.

Collaborations with community and professional organizations:

- Project staff shared information about the project and classroom materials with EH professionals at several annual meetings of the Society of Toxicology.
- Collaborative relationships were developed with a variety of community groups and NGOs working on issues related to EH. In Washington State, these included organizations such as the American Lung Association, The Community Coalition for Environmental Justice, and the Duwamish River Cleanup Coalition. Project staff in New Mexico collaborated with groups such as the Southern Area Health Education Center and the Border Health Education Training Center.
- In 2007, lessons from *EH Fact File: Asthma* were adapted and included in a curriculum unit published and distributed by the St. Louis Regional Asthma Consortium.

Collaborations with business and industry:

- In Washington State, additional teacher planning time was supported through a small grant from the Seattle Biotech Legacy Foundation (now the Sustainable Path Foundation). This association of professionals working in the biotech industry supports projects that emphasize the role of science in creating a healthy, sustainable future.
- In New Mexico, project staff partnered with a local Walgreen drugstore and received funds for additional teacher support events.
- Project staff from UW participated in a series of meetings of the Life Science Education Advancement Partnership (LEAP), a consortium of over 65 life science education organizations sponsored in part by the Northwest Association for Biomedical Research and Amgen.

Collaborations with government (other than departments of education and higher education):

- In 2006-07, Health Observances and Public Education Partnership (HOPE), a federally funded SEPA project, presented IEHMSP materials both at team trainings for project partners as well as at train-the-trainer sessions for teachers in New Jersey, North Carolina and Oregon.
- The Pierce County Health Department (WA) invited IEHMS Project staff to share materials at a series of community meetings sponsored by the Pierce County Coalition for Environmental Health Priorities.
- Collaborations with the NM Department of Utilities resulted in grant awards to two teams of teachers participating in the project. One grant enabled the teachers to research illegal dumping around schools, while the other supported testing for the presence of lead on school grounds.
- A collaboration with the NM Public Health Association resulted in a team of teachers being awarded support to record one edition of an environmental health radio show called "Healthy Voices Radio: Smoke, Trash and Trout: Writings from the Rio Grande Valley."
- A lesson entitled "Toxic Candies and Dangerous Cures" from the *EH Fact File: Lead* was adapted by the Los Angeles County Department of Public Health's Childhood Lead Poisoning Prevention Program and included in a curriculum guide distributed throughout LA county in 2008.

Collaborations with parents and families:

- Project staff have collaborated with The Home School Network in New Mexico and shared EH materials with their membership.
- One of the hallmarks of many of the classrooms participating the IEHMS Project was that students would select and research locally relevant EH issues. This research often

culminated in a presentation that took place as part of a grade-wide or school-wide science fair or community event. These events included parents and other family members, many of whom were being educated about EH concepts and issues for the first time. This opportunity for family to actively participate in and benefit from student learning was a particularly effective aspect of the project. The value of community engagement was perhaps best demonstrated at Olympic View Middle School in Washington where family member involvement at the *Environmental Health Fair* was considered important enough to be a requirement for students. The fair was the year-end capstone event for graduating eighth graders; students presented scientific posters or PowerPoint presentations on their research about an environmental health topic. Throughout the life of the IEHMS Project the eighth grade classes at this school had substantive exposure to environmental health sciences by teaching teams in all core subject areas.

Lessons Learned and Next Steps

The EHSIC program was a bold and visionary effort to integrate EH teaching into K-12 education by demonstrating its relevance across a wide range of disciplines and grade levels. The program sought to accomplish this in a way that would show the effectiveness of such interventions not only in terms of their ability to increase student understanding of the connections between human health and the environment, but also in terms of their ability to improve students' overall academic performance. The collective hope was that, armed with data showing that using EH as a context for learning improved student outcomes across a variety of core subject areas, EH proponents would be better positioned to convince legislators, administrators, and teachers to make EH topics a standard part of the K-12 curriculum.

In the end, the program was able to reach or exceed many of its goals, but several unforeseen events and national policy changes during the seven-year life cycle of the program resulted in some difficult lessons learned. The advent of NCLB early in the life of the program resulted in a shift 'back to basics' in most schools that precluded the introduction of 'non-essential' topics and materials. In addition, EHSIC grantees discovered that obtaining access to student data and test scores was increasingly difficult as privacy concerns resulted in new and more stringent school policies. Finally, conducting truly randomized control trials in an educational setting is virtually impossible, making it difficult to design and implement studies that would allow one to draw conclusive statements about the reproducible effects of any single, limited educational intervention.

These changes in the educational landscape and realities of doing research in the public schools led IEHMS Project staff to develop new strategies as the project evolved, many of which are described above. These strategies influenced teacher recruitment, materials development, and project approaches to partnerships and collaborations. Other lessons learned that might be useful to organizations wishing to pursue similar projects in the future include:

- Build in an adequate amount of time early in the project to conduct a needs assessment with teachers and administrators in order to make sure project goals are relevant and realistic.
- Work at the highest administrative levels possible (e.g. state departments of education) to leverage existing or emerging top down mandates.
- Be explicit about what you expect from districts, schools and teachers from the onset, making sure that all parties understand how the project helps meets their needs. This might involve having all parties sign a written agreement, such as a memorandum of understanding, prior to beginning work.
- Identify outstanding strategies developed by participating teachers and seek to celebrate, describe, and replicate these wherever possible.
- Be sure to build in adequate staff time to cultivate and support ongoing relationships with teachers, administrators, and other stakeholder organizations (e.g. government agencies, tribes, NGOs).

- Be realistic about the time and resources involved in meaningful evaluation of student outcomes. Be sure to have the appropriate expertise on your team and ensure that all the required evaluation elements are in place early in the project.
- Financially remunerate participating teachers whenever possible, recognizing that the time they invest in your project is your greatest asset.

In the end, the IEHMS Project was able to achieve the lion's share of its originally stated goals. Despite a variety of challenges encountered along the way, project staff trained an impressive number of teachers who in turn impacted a great many students. Process evaluation contributed to the development of highly successful teacher workshops and relevant classroom materials. In addition, analysis of student outcome data resulted in findings with significant implications for those wishing to better prepare middle school students to solve the EH-related problems that society will no doubt face in the future.

Although the EHSIC program was not renewed and the IEHMS Project has formally ended, the partnerships and collaborations that were established under its auspices are still going strong. Key project staff at both UNM and UW have been fortunate enough to continue work in EH or health sciences related outreach programs. Project materials are still available for free from the project's web site, with plans underway to build a more permanent virtual home for them on the newly redesigned site of the NIEHS Center for Ecogenetics and Environmental Health at the UW. In addition, IEHMS Project materials will soon gain greater national visibility when they are listed as a reviewed and recommended resource on *ScienceNetLinks*, a popular teacher internet curriculum resources site sponsored by the American Academy of Arts and Sciences (AAAS). *ScienceNetLinks* provides standards-based resources for K-12 science educators and partners with *Thinkfinity*, a site aimed at educators across all subject areas. This will ensure that teachers from a variety of disciplines will have easy access to project materials for years to come.

Selected Publications

Fiege, G. (2004). Mock disaster challenges students to solve problems. *Skagit Valley Herald, February 4, 2004*.

Frevert, K., Nicoll, A., Acharya, C., Rudensey, L., Burbacher, T., & Eaton, D. L. (2006). *Environmental Health Curriculum in Washington State Middle Schools: A Tiered Model of Integration*. Paper presented at the Hawaiian International Conference on Education.

Frevert, K., & Tchakirides, D. (2004). Spotlight on UW Web Sites: Integrated EH Middle School Project. *OnTech News, February 4, 2004*.

Gilbert, S., & Frevert, K. (2008, in press). Special Topics: Public Education. In *Information Resources in Toxicology* (Fourth ed.): Elsevier.

Hall, K. (2006). Engaging Middle School Students Through Environmental Health. *Environmental Heatlh News, Winter*.

Hines, S. D. (2006). Diabetes, A Protein Puzzle. In *Earth, Life, Physcial Science in New Mexico* (pp. 17-21): McDougal Littell.

Miller, E., & Sharpe, J. F. (2003). When Youth Lead. *Yes! A Journal of Positive Futures, Spring*.

Rudensey, L., & Whidden, J. (2005). Spill Sleuths - An Interdisciplinary Environmental Health Investigation. *Science Scope, February*.

Sedlacek, N., Young, J., Acharya, C., Botta, D., & Burbacher, T. (2005). Linking the Classroom to the Community. *The Science Teacher, April/May*.

Sharpe, J. F. (2007). Eighth-graders get hands-on environmental health lessons. *University Week, May 3, 2007*.

Sharpe, J. F., Eaton, D. L., & Marcus, C. B. (2001). Digital Toxicology Education Tools: Education, Training, Case Studies, and Tutorials. *Toxicology, 157*(1-2), 141-152.