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# **HOWARD HUGHES MEDICAL INSTITUTE**

**Office of Grants and Special Programs**

**Precollege and Undergraduate Science Education Program**

**The Hughes Science Pipeline Project at**

**BARNARD COLLEGE**

**2009-2010 ANNUAL REPORT**

**(Grant No. 52006281)**

Section I. Program Summary  
Current Progress Report Synopsis:

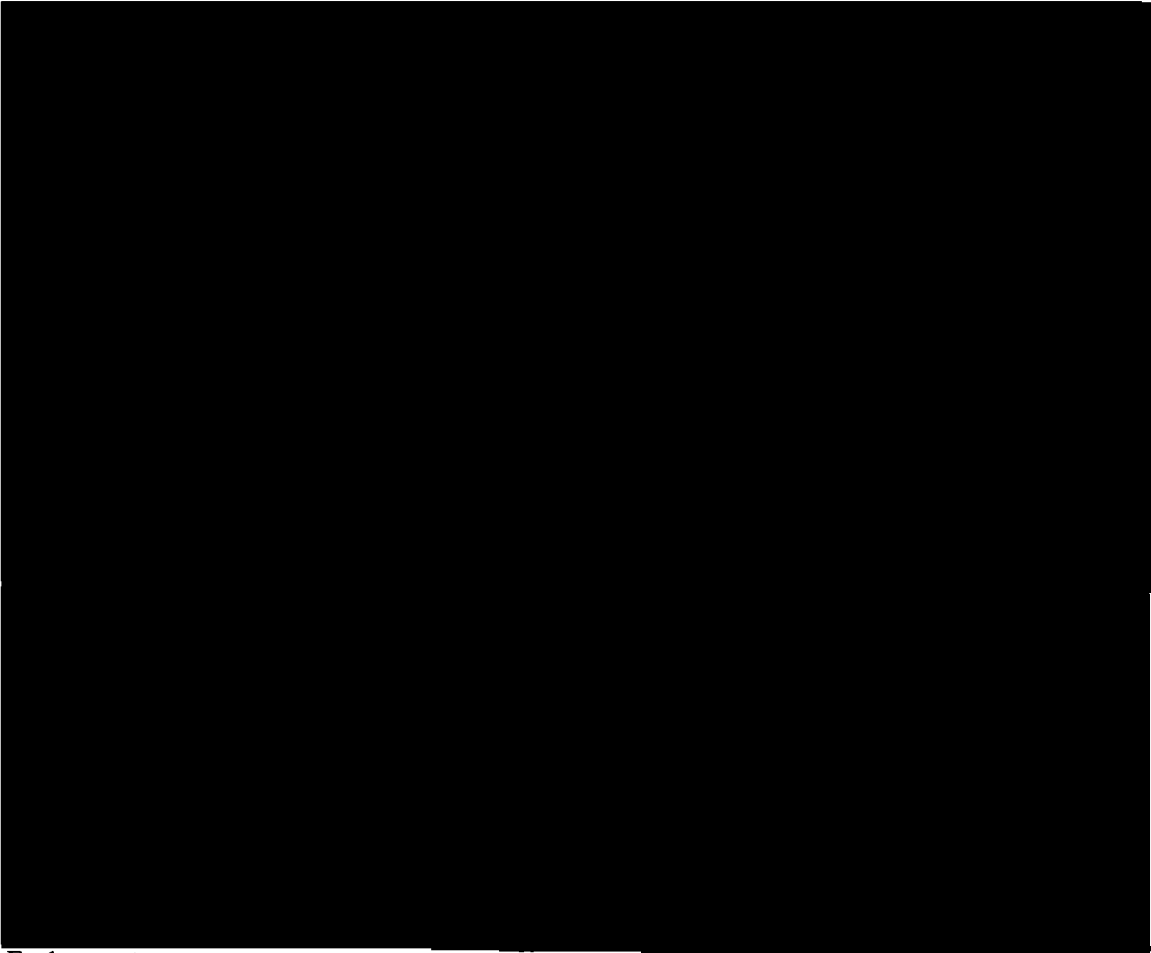
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[REDACTED]

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Each year, HEOP participants complete a written evaluation of the program. A majority of the 2010 cohort found that the program met its objectives: at the end of the program they felt better prepared for the academic year. Most identified time management as the most valuable skill they acquired; many noted improvements in their basic academic skills (e.g., writing, reading, mathematics, study habits) and felt more confident as they embarked on their college experience.



[REDACTED]

[REDACTED] During the current reporting period, all 14 participants completed an online evaluation of the Research Apprenticeship Seminar and 12 of them completed a separate course valuation. All respondents said that the seminar increased their understanding of scientific research and fortified their interest in conducting research in the future. They appreciated the instructor's knowledge of science research as well as his ability to facilitate classroom discussion. Although all students found the discussions interesting, some cited an occasional lack of focus in classroom discussions, while others wanted more consistent participation by all members of the seminar. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] Student evaluations indicated that the format was not very popular: students felt overwhelmed and too pressured to lead discussions, particularly because this was a new experience for most. [REDACTED]

[REDACTED]

[REDACTED] The revised format received better, though still mixed, reviews. Most students found the readings and classroom discussions to be interesting. They all found the instructor's responsiveness to their participation and her effectiveness in communicating the subject matter to be excellent.

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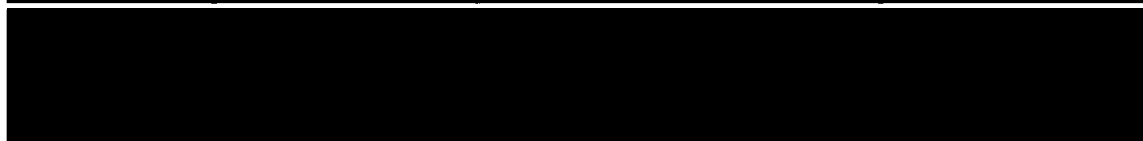
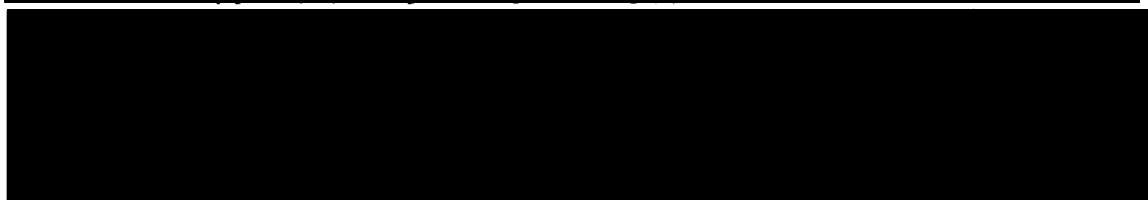
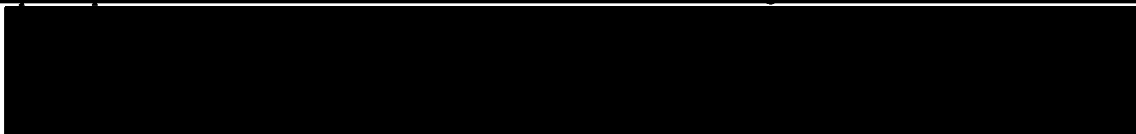
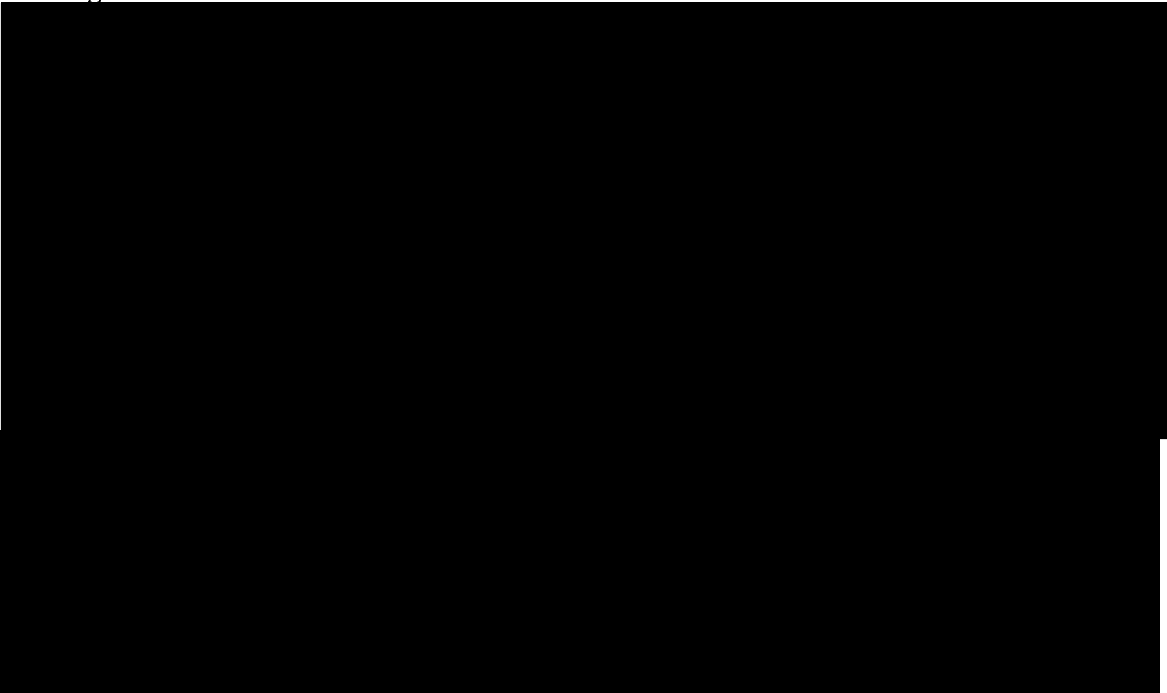
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Each of the 2009–2010 Research Interns completed a written evaluation of the program. All noted that they acquired new technical and analytical skills and, perhaps most importantly, they learned how to develop research plans, organize data, and collaborate with a team while work somewhat independently. The research experience either confirmed or fortified their interest in pursuing a research career. Research Interns commented that their mentors were very supportive and offered a lot of guidance while allowing them space for individual exploration; only one of the 14 students wished that she had received more guidance from her mentor. Many Research Interns also gained confidence in their ability to contribute to the body of scientific knowledge. Many learned the importance of being diligent and thorough in their work, and several interns were surprised at their ability to overcome obstacles and solve problems. Generally, interns noted that these hands-on laboratory experiences changed their view of scientific research.

Since 2006, Research Interns have participated in both the summer and academic year *Surveys of Undergraduate Research Experiences (SURE III)* directed by Dr. David Lopatto of Grinnell College. The results of both surveys largely confirm the internal evaluations. Unfortunately, only 4 of the 2009-2010 Research Interns completed the SURE academic year survey, perhaps because it was available only near the end of the academic year when students were concerned about writing papers and taking final exams. These four students had a positive and valuable experience overall. Indeed, when asked to measure the benefits of their academic year research experience, 16 of the 21 learning gains rated by our 2009-2010 Research Interns were significantly higher than the overall mean tabulated across all participating institutions. The only gain that was lower at Barnard than at other institutions was "Learning ethical conduct." The results of the 2010 SURE III summer survey show that the 2010-2011 cohort experienced

learning gains that were above average for 12 (out of 21) measures; the most notable of these were learning lab techniques, understanding real problems, integrating theory and practice, readiness for more research, and understanding knowledge constructs. No gain was rated below the means tabulated across all participating institutions. Both surveys reveal a shift in career goals. Before their HSPP research internships, more students planned to pursue a medical degree than a Ph.D. in Science. After the project, the opposite was true. These results indicate that the program is effective in accomplishing its primary objective.

The Internship/Assessment Coordinator and Program Director also poll the faculty mentors about the internship program. They report that HHMI funding has allowed them to work with more student researchers and on more projects than they might otherwise be able to complete. The extended summer research helps students to become comfortable in the lab environment, establish a project, and begin to grapple with the relevant scientific literature. Support from HHMI has also been instrumental in building strong student-faculty research teams and it enables them to attend scientific meetings as a team. Some have also note that the year-long experience is developmentally appropriate, especially for rising juniors with less experience reading scientific literature.



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] OCD staff attends each event to collect student evaluations, which reveal positive responses: the panels encourage them to pursue internships, provide a preview of specific careers, and help them focus on possible future careers.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] Even before the final tweaks to the manuals, students described them as clear, and they noted that the analyses helped them to understand better the theories that the experiments were testing. One student noted in response to a question on the course evaluation that asked about which aspects of the lab were most valuable, "The hands-on lab work, and the data analysis. I really learned to apply statistical tests and technical skills that I had previously only learned about shallowly. The amount of independence expected from us made me learn much more than I had in previous (intro bio and psych) lab courses."

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Many students are thrilled about the opportunity to become directly involved in an interdisciplinary research program.

[REDACTED]

After students are introduced to *Manduca* in the introductory biology courses, many become so excited about the prospect of doing more sophisticated research projects that they approach faculty during their sophomore year to start engaging in research.

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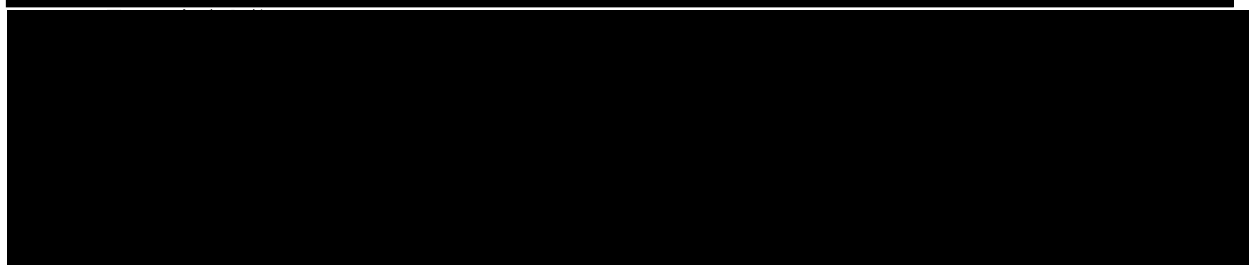
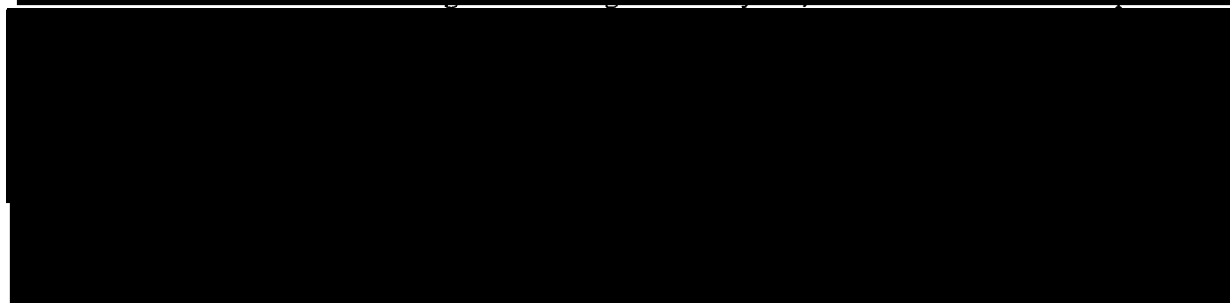
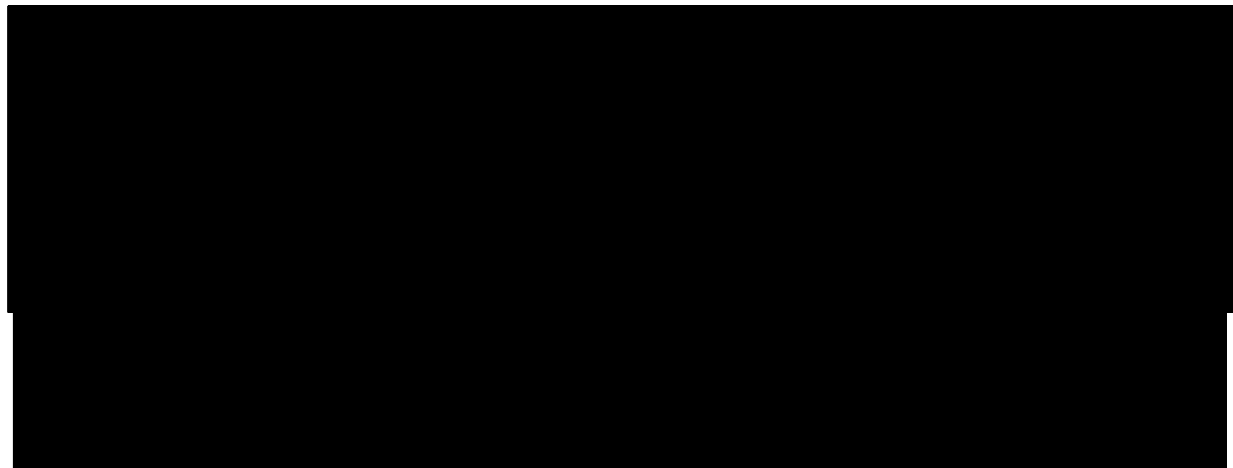
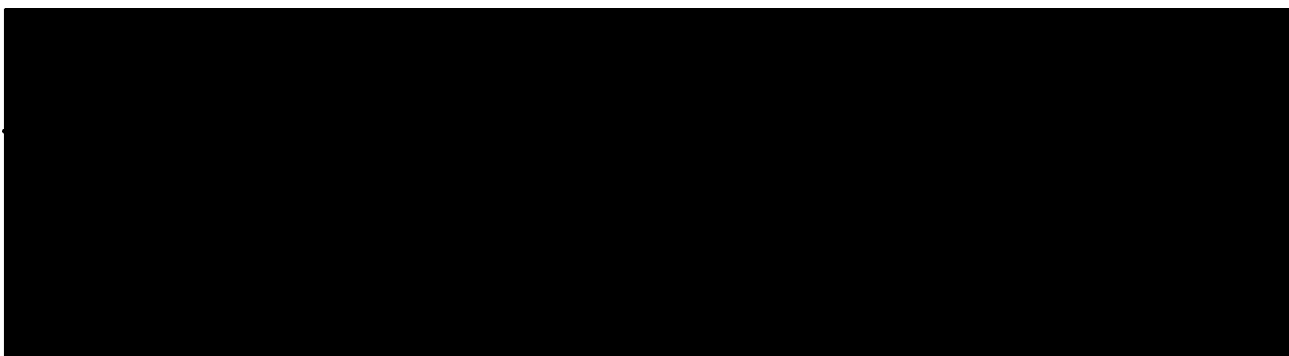
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[REDACTED]

[REDACTED]

Student responses on course evaluations indicated that they had greater confidence in their interpretations of data after using these analyses.

[REDACTED]



In their narrative evaluations of the program, most of the 16 summer participants commented that the program taught them a lot about science and the ways in which scientists learn about the world. Most participants said that the program reinforced their goals, prepared them for the challenges of a four-year college, boosted their confidence in pursuing a career in science, and inspired them to challenge themselves. Only one left the program completely unsure about his goals. Despite the heavy workload and time constraints, the courses were a positive experience for the students. While many found the courses to be challenging and fast-paced, the vast majority agree that they helped students consolidate and expand their knowledge significantly. They were able to learn easily from the professors and that any

questions they had were answered in class or after class. Most students found the Teaching Assistants to be approachable and helpful, although several felt that they were a little too demanding.

Evaluations of the half-hour weekly individual counseling sessions were extremely positive, boosting students' confidence and helping them stay focused on their goals. Some students said that the sessions were not long enough. When asked to rank the hour-long group counseling sessions, the most useful sessions were: *Health Professions*, *Study Skills & Time Management*, *Transfer Process*, and *Financial Aid*. The participants said that the writing tutors provided helpful advice on their weekly essays, focusing on issues that students wanted to discuss, particularly grammar and organizing their ideas.

For most students, the primary challenges of the summer program were the heavy workload and time management; several said that they enjoyed being challenged in this way. One described the ICP Program as a "science boot camp." The most rewarding and enjoyable aspects of the program were the subject material learned and the experience of living on campus. Overall, students found the program to be "fine the way it is," offering few suggestions for changing its core structure. All respondents said they would recommend the program to others—as long as they were receptive to challenges and hard work.

[REDACTED]

Most of the students find the regular academic year courses to be exceptionally challenging; during the semester, we direct the students to various sources of help and arrange individual tutoring at the students' request. Although the students often express their dismay about how hard they have to work in these courses, they are usually grateful for the experience. They report that the training they get here makes the courses they take at community college or another CUNY campus seem easy by comparison.

[REDACTED]

describe the experience as fantastic.

[REDACTED]

All of the teachers noted specific things they wanted to change about their teaching (e.g., 4<sup>th</sup> grade, dual language teacher: "I was ... able to catch two things that I am working on changing ..... I am always pressed for time... I found that I speak quickly and that needs to change because I have a lot of second-language learners.... Also ...I want to make [my tone] softer...and it's changed...and I speak slower now."

[REDACTED]

Most noticed that their use of the PDR model incorporated too much teacher direction and guidance. They also reflected on changes they would make to the lesson and the value of the PDR and scaling models for student learning. Space constraints allow the inclusion of just a few of the many written comments made by pre-service teachers. "... next time, I would [have] students measure the earthworms [rather] than just observing them. I would frame the debriefing questions differently to make it more about their observations." "I think [that] play in teaching and learning science is incredibly important because it provides children with hands-on experiences of concepts that may be difficult to grasp. I like how the play-debrief-replay model allows students to interact with materials and share ideas with other students. Without [the teacher's] guidance and previous teaching, I don't know if students would have done as well as they did." "This model worked beautifully...However, our lesson incorporated more direction and guidance than a normal PDR model asks for and therefore didn't follow the lesson as planned. For example, there were a few occasions in which Mr. G. would play off the experimentation and observations of the students and either direct them or ask questions to further challenge their thinking." "Our lesson did not proceed in strict accordance with the scaling lesson...The largest difference was the order: instead of going from the activation stage to the actualization stage to the application stage, we first had actualization, then activation, and finally application. However, I think that the lesson was quite successful. The students seemed more responsive in this lesson than in the play-debrief-replay lesson---there was more participation, better behavior, and more signs of student excitement."

[REDACTED]

[REDACTED] Teacher journals documented the seminar's impact on teachers' actual classroom practices and their beliefs. Impacts on teachers' beliefs included questioning the types of experiences that were influencing their students' beliefs about science, recognizing the value of interviewing students in subjects other than reading, noticing the value of play in engaging students who typically had behavior problems, appreciating the ways in which the scaling model helped to teach linguistically diverse students, and allowing students' interests to drive classroom instruction following a museum trip.

Pre-service teacher portfolios consistently documented what they were learning and the impact it had on their beliefs about or goals for science teaching. For example, one pre-service teacher wrote, "One of the most essential learning experiences from the course was doing science to teach science. Participants engaged in science investigations of their own and became learners in order to enhance their teaching. I discovered which approaches to science teaching were most effective for me and possibly for my students. I was able to use what I learned from the seminar in the classroom and I reflected on those practices." Another noted, "Working alongside [the teacher] helped me to improve my own skills. The course also made me aware of the stereotypes that persist in children's ideas of science, and how science is related to discrimination and the privileging of ideas. A teacher who is conscious of these issues in science education is better prepared to teach her students."

[REDACTED] Participating teachers cited evidence of student learning throughout the semester. For example, one team noted that students were able to develop concept maps of the major forces and motions on earth. Student reflections on their learning (in drawings and words) indicated their awareness of what they had learned. For example, one student drew a picture of herself and her partner shaking their desk with their model city on top of it. Another student reflected on the earthquake simulation activity, "I was making a world of my own but then an Earthquake happened. It was horrible. The place was damaged. The homes were damaged. I could not believe it."

[REDACTED]

[REDACTED]

[REDACTED]













