Evaluation of University of California Irvine
National Science Foundation
Partnerships for International Research and Education Project
Low Energy Options for Making Water from Wastewater

Quarter 3 Evaluation Report
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Section 1. Executive Summary

1.1 Overview

In the summer of 2012, the University of California, Irvine (UCI) Departments of Civil and Environmental Engineering and Chemical Engineering and Materials Science received a National Science Foundation (NSF) grant to establish a Partnerships for International Research and Education (PIRE) program. The NSF PIRE program seeks to catalyze a higher level of international engagement in the U.S. science and engineering community by supporting innovative, international research and education collaborations. The UCI Water-PIRE project supports the NSF PIRE mission with four goals addressing knowledge, education and workforce development, partnerships, and institutional capacity. UCI will address these goals by establishing collaborative relationships with worldwide academic institutions and organizations that conduct urban water sustainability research and conducting student and faculty exchange programs with these institutions. Project components include national and international workshops, research abroad opportunities, and ongoing collaborative research.

The focus of this evaluation is to provide an informed analysis based on the data to improve project implementation and increase decision-making capacity to ensure the project's success in meeting established goals and objectives. Two types of evaluation are being conducted for this project: a formative evaluation to monitor project implementation and give ongoing feedback to the principal investigators, and a summative evaluation to assess the quality and impact of the project in reaching its stated goals and objectives. Both types of evaluation use a combination of qualitative and quantitative indicators. Guiding evaluation questions of this PIRE project are based on project goals.

In the spring of 2014, participants lead a video program for high school students engaged in a class project focused on the environmental impact of human development. The video program is called PIREwolf Productions. At the end of the program, the UCI instructor and high school students completed a reflective survey about the program.

1.2 Summary of findings

Key findings and recommendations are shown in Figure 1 for demographics, program components, and program impacts for the UCI PIREwolf Productions Video Program. A complete discussion of key findings and recommendations can be found in Section 4 of this report.

Figure 1. Summary of key findings and recommendations

Key Findings	Recommendations
UCI PIREwolf Productions Video Program	
Demographics • A large percentage of under-represented minority students were served by this program. • Male and female students were equally represented.	• Continue to assure the representation of women and under-represented students in future projects. • Increase the variety of speakers who present in videos. • Make sure video and sound quality are high enough that students' can understand video content. • Increase the degree to which the videos are directed to the class' needs. • Include visual aids in videos to engage students and help them understand that material. • Assure videos will assist students in their intended class activities. • Expand the program to additional classes and additional schools.
Satisfaction with elements of the program • Student satisfaction with the usefulness of the videos was very high • Student satisfaction with the personalization of the videos was very high • Student satisfaction with how friendly and personable the scientists were was extremely high • Student satisfaction with how interested the scientists were in their class was extremely high • Student satisfaction with how interested the scientists were in whether the students learned the information they presented was extremely high	
Program impacts • Objective 1 – Students' perceptions of scientists as an outside resource • Objective 2 – Student's knowledge of the environmental impact of human development • Objective 3 – Students' ecofriendly behaviors • Objective 4 – Student's preparedness to participate in classroom activities All program objectives were met. Students were positively impacted by program participation in all areas and gains were statistically significant.	

Section 2. Introduction

2.1 Background of the project

In the summer of 2012, the University of California, Irvine (UCI) Departments of Civil and Environmental Engineering and Chemical Engineering and Materials Science received a National Science Foundation (NSF) grant to establish a Partnership for International Research and Education (PIRE) program. The mission of the NSF PIRE program is to "catalyze a higher level of international engagement in the U.S. science and engineering community by supporting innovative, international research and education collaborations. The program will enable U.S. scientists and engineers to establish collaborative relationships with international colleagues in order to advance new knowledge and discoveries at the frontiers of science and engineering and to promote the development of a diverse, globally-engaged U.S. scientific and engineering workforce… It is also intended to facilitate greater student preparation for and participation in international research collaboration, and to contribute to the development of a diverse, globally-engaged U.S. science and engineering workforce. The program aims to support partnerships that will strengthen the capacity of institutions, multi-institutional consortia, and networks to engage in and benefit from international research and education collaborations."[1]

Project mission, goals and objectives

The focus of the UCI Water-PIRE project is to develop and install low-energy options (LEOs) for the sustainability and production of water resources. In partnership with universities in water-stressed regions of the United States and Australia, UCI conducts research on water sustainability and the use of LEOs while also educating and training students in sustainability options that will protect the health of humans and ecosystems. The UCI Water-PIRE project supports the NSF PIRE program with the following mission, four goals and corresponding objectives:

Mission: Working together with Australian and local partners, the PIRE will foster changes in the way the U.S. designs its urban water infrastructure, toward a paradigm in which lower-quality water is viewed as a resource and higher-quality water is used more efficiently.

GOAL 1: KNOWLEDGE/RESEARCH/DISCOVERY

Increase knowledge and understanding of sustainable urban water systems, and in the process equip a new generation of engineers, natural, physical, and social scientists, policy makers, and educators with multi-disciplinary skills and sensitivities.

Objective 1 (Layer 1): Work with our Australian partners to improve the engineering science associated with low-energy approaches for removing pollutants from urban and peri-urban runoff in streams and biofilters.

Objective 2 (Layer 2): Work with our Australian partners to improve understanding of the benefits and risks associated with adoption of low-energy treatment technology, such as biofilters, relative to public health, energy consumption, and greenhouse gas production/emission.

Objective 3 (Layer 3): Analyze economic, regulatory, institutional, regional planning, and public acceptance factors that could hinder the adoption of low energy options (LEOs) based on

[1] NSF PIRE Program Solicitation 09-505: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12819

the Australian experience; identify economic incentives, innovative regulations, institutional changes, and planning practices that could foster the adoption of LEOs in the Southwestern U.S.
Objective 4 (Layer 4): Work with Australian partners to improve understanding of the impacts of distributed approaches for capturing and reusing runoff in urban and peri-urban settings, relative to improving water productivity (for example, as measured by declines in per capita use of drinking water), and returning downstream rivers and riparian zones to more natural hydrological and ecological states.
Objective 5 (Cross-cutting): Work with Australian partners to improve understanding of urban water supply challenges and solutions that require an interdisciplinary (cross-layer) research approach, including elements of climate science, ecosystem science, engineering, and water supply and water demand modeling.

GOAL 2: EDUCATION/WORKFORCE DEVELOPMENT
Accelerate education and training in the area of urban water sustainability, and diffuse knowledge about sustainability options to U.S. middle-school and high-school students, undergraduate STEM majors, graduate students, post-doctoral researchers, and practitioners. Contribute to the development of a workforce in urban sustainability science, engineering, and policy that will thrive in the face of transdisciplinary problems.
Objective 1: Foster an interdisciplinary approach to urban water sustainability that informs undergraduates, graduate students, post-docs and faculty.
Objective 2: Foster a cross-cultural approach to urban water sustainability that informs undergraduates, graduate students, post-docs and faculty.
Objective 3: Leverage the PIRE research findings into curriculum tools and teacher training programs that increase the quality and depth of understanding about urban sustainability issues for K-12 students.
Objective 4: Place students associated with the PIRE in internships, graduate school, post-doctoral positions, and professional positions related to urban water sustainability science, engineering, and policy.

GOAL 3: PARTNERSHIPS
Improve urban water sustainability research and application through the establishment of new partnerships between university researchers, non-university researchers, and urban water managers.
Objective 1: Foster new relationships between the PIRE research team and Australian researchers at the University of Melbourne and Monash University.
Objective 2: Foster new relationships between the PIRE research team and non-university researchers at the Southern California Coastal Water Research Project (SCCWRP) and its affiliated governmental and non-governmental agencies.
Objective 3: Participate in practice-oriented professional meetings organized through SCCWRP and its affiliated governmental and non-governmental agencies.
Objective 4: Public outreach.

GOAL 4: INSTITUTIONAL CAPACITY
Increase the capacity of UCI's Henry Samueli School of Engineering (HSSoE) to lead research and educational exchange programs with other units on campus, other universities, non-university research programs, and international partners.
Objective 1: Increase HSSoE's engagement in research with other schools, departments, and programs at UCI.
Objective 2: Increase HSSoE's engagement in research with other universities in Southern California.
Objective 3: Improve HSSoE's engagement in effective international research and educational exchange programs, including the development of new linkages with existing education abroad programs administered through UCI.

Project participants

As shown in Figure 2, the UCI PIRE project currently has four national and two international institutional affiliations.

Figure 2. Institutional affiliations of Water-PIRE participants by country

United States	Australia
California Stormwater Quality Association (CASQA) Southern California Coastal Water Research Project, CA (SCCWRP) University of California, Irvine, CA (UCI) University of California, Los Angeles, CA (UCLA) University of California, San Diego, CA (UCSD)	University of Melbourne, Melbourne, Australia (UM) Monash University, Monash, Australia (MU)

Project components and activities

Project leaders propose to conduct the following activities during the five years of this project:

- Research experiences and training for UCI, UCLA, UCSD-SIO Sustainable Water Environmental Engineering Team (SWEET) Post-docs and graduate students
- Weekly SWEET meetings, introductory SWEET class, create SWEET e-book SWEET-SURF (Summer Undergraduate Research Fellowship) program, SWEET meetings – Replaced by the UPP Down Under UCI/Australia program
- Summer program through Mathematics, Engineering, Science Achievement (MESA) to develop K-12 modules in water sustainability, attend SWEET-student led classes and workshop on biofilter design, participate in BioFilter Frenzy Week – Being replaced by the PIREwolf program
- Summer program for Native American HS students who visit UCI through American Indian Resource Program Center for Educational Partnerships (AISESS) program.
- SCCWRP meetings between potential end-users and PIRE staff.
- SCCWRP workshop about the PIRE project at annual California Stormwater Quality Association Conference
- Networking between US/Foreign colleagues
- Hold virtual and face-to-face scientific conferences with US/Foreign colleagues
- Management meetings (weekly layer lead lab meetings, bi-monthly US management meetings, monthly international meetings)
- Meetings with the UCI PIRE Advisory Board

2.2 Background of the evaluation

The focus of this evaluation is to provide an informed analysis based on the data to improve project implementation and increase decision-making capacity to ensure the project's success in meeting established goals and objectives. Two types of evaluation are being conducted for this PIRE project: (1) a formative evaluation to monitor project implementation and give ongoing feedback to the principal investigators, and (2) a summative evaluation to assess the impact of the project and progress made toward reaching stated goals and objectives. Both types of evaluation use a combination of qualitative and quantitative indicators (Frechtling, 2010; Patton, 1990).

Formative evaluation monitors the effectiveness of project implementation with ongoing feedback to the leadership team, including assessment of satisfaction with project activities, progress toward goals, and recommendations for project improvement. The external evaluator works collaboratively with the project leadership team to evaluate effectiveness and improve implementation of project activities. All project activities are evaluated using activity evaluation forms, on-site interviews, discussion groups, and annual post-surveys. Evaluation forms will use Likert scale and free response questions to assess each activity, perceived benefit to participants, and how they plan to use what they have learned. Analyses of response frequencies identify strengths and areas for improvement, with timely feedback to the leadership team. The formative evaluation results should be used by project leaders to identify potential problems and seek solutions early during the implementation.

The summative evaluation examines the project's overall success and benefit to participating students, faculty, researchers, universities, and the scientific community. Summative procedures include conducting a project baseline and post-survey of all project participants when they enter the PIRE project and at the end of each project year. The evaluation measures participants' gains in the advancement of knowledge and understanding of sustainable urban water systems, the acceleration of education and training in urban water sustainability and the diffusion of knowledge of sustainability options to students, the establishment of partnerships between researchers and urban water managers, and increase in capacity of HSSoE to lead research and educational exchange programs. At the end of each project year, the evaluator interviews key personnel at each participating university to assess growth in institutional capacity to participate in and benefit from international collaborations. Growth in workforce development is indicated by the number of new people who join the PIRE project and continue in STEM studies and careers. After several years of grant implementation, the evaluation will examine the broader impact of this PIRE project on developing a diverse, globally-engaged science and engineering workforce by assessing the number of high school, undergraduate, and graduate students who participated in the PIRE project and choose to pursue a STEM academic path and career. Progress made towards achievement of project goals is also assessed using the Activity and Milestone tables to track the number of activities under each objective that have been met. The evaluator disaggregates data by gender, ethnicity, academic position, citizenship, and university affiliation when possible. The evaluation also tracks expansion of participation in water sustainability training to additional universities and countries.

Guiding evaluation questions

Guiding evaluation questions are based on and aligned with UCI Water-PIRE goals. Has the PIRE project:

Goal 1: Scientific knowledge/research/discovery – Increased knowledge and understanding of sustainable urban water systems, and equipped participants with multi-disciplinary skills and sensitivities?
Goal 2: Education/workforce development – Accelerated education and training in the area of urban water sustainability, diffused knowledge about sustainability options, and contribute to the development of a workforce in urban sustainability science, engineering, and policy that will thrive in the face of transdisciplinary problems?
Goal 3: Partnerships – Improved urban water sustainability research and application through the establishment of new partnerships?
Goal 4: Institutional capacity – Increased the capacity of UCI's Henry Samueli School of Engineering to lead research and educational exchange programs?

Assessment development

SmartStart has or will develop the following assessment instruments for this PIRE project:

- Evaluation forms for UPP Down Under, PIREwolf, AIWISS, CASQA, retreat.
- Project baseline/post-survey
- Research abroad post-survey
- Partnership matrix survey
- Mentor interview protocol
- Student focus group protocols
- Senior personnel interview protocol
- Intercultural Development Inventory (IDI) (Developed by the IDI)

Evaluation forms are based on seminar, workshop, and meeting agendas, and other program objectives. Forms include rating scales of usefulness of agenda items and/or satisfaction with program elements, as well as open-ended questions so participants can comment on the activity. Baseline/post and reflective post surveys' Likert scale, open-ended, and perceived gains questions are adapted from validated surveys[2] where available. Instrument development is guided by a systematic, iterative process of construct identification, creation, and instrument review or validation (Wilson, 2005). To develop the surveys, the evaluator discussed the project goals, program objectives, and the impact principal investigators would like participation to have on participants. Next, the evaluator generated questions that address key constructs identified in the goals and/or objectives. Survey drafts were sent to principal investigators. Feedback and suggestions were incorporated into the surveys and the surveys were finalized. Questions are repeated on baseline and post-surveys to measure changes in outcome areas, or in some instance reflective post surveys are used. Principal investigators provide feedback to better align all evaluation forms to the project goals and/or program objectives.

Data collection methods and analyses

Survey instruments are posted online at www.surveygizmo.com and individualized links are sent to participants' email addresses or a general link is sent to all participants in certain cases to preserve the anonymity of participants. Quantitative results of all evaluations are analyzed using SPSS or STATA software. Results of workshop, meeting, and program evaluations are analyzed using means and response frequencies. Likert scale results of project impacts are analyzed using paired t-tests to measure gains that can be attributed to participation. All responses to open-ended questions are included in reports.

[2] List of surveys is in the References section.

Section 3. Evaluation Findings

3.1 Evaluation of UCI PIREwolf Productions Video Program

Background

The UCI PIRE program proposed to work with K-12 teachers who participate in the UCI summer Mathematics, Engineering, Science Achievement (MESA) program to develop K-12 modules in water sustainability. Teachers would also attend SWEET-student led classes on water sustainability and a workshop on biofilter design and they would participate in Biofilter Frenzy Week. This program is being replaced by the PIREwolf Productions Video Program.

The PIREwolf Productions Video Program was piloted with one teacher and his Earth Science students (n=125) from The Academy High School in Santa Ana, California during the spring of 2014. This program consisted of four videos created by one UCI PIRE professor and one graduate student. The high school students were preparing for a classroom debate on whether or not the O'Shaughnessy Dam, which creates the Hetch Hetchy Reservoir in Yosemite National Park, should be removed. These videos supplemented that curriculum. The teacher's lesson plans included the following project based learning activities:

- Listing information required to prepare a debate
- Reviewing informational worksheets and articles
- Researching relevant topics
- Watching debates
- Watching videos produced by PIREwolf Productions
- Interacting with UCI PIREwolf Productions faculty member and graduate student

PIREwolf Productions videos were developed to provide balanced information to the students regarding the environmental impact of human development and infrastructure demolition. Students used this information to prepare for their debate. Students generated questions for the UCI professor who addressed them via video. Ffive class debates were held over two days at The Academy, and a member from PIREwolf Productions attended all of them. The UCI professor attended one and after hearing reports on the others, addressed the students in a wrap-up video, complementing their hard work and critical thinking skills. Students demonstrated gratitude online and in person for the videos customized to their learning.

Program objectives

This program contributes to Goal 2 (Education and workforce development) of the UCI Water PIRE Project. The PIREwolf video program objectives are:

1. Increase students' positive perceptions of outside experts as valuable resources.
2. Increase students' knowledge and interest in the topic (i.e. environmental impact of human development).
3. Increase students' ecofriendly behaviors as a result of learning more about the topic.
4. Increase students' preparedness to participate in class activities related to the topic.

Evaluation participants

A link to the online evaluation form was emailed to the teacher at the end of the PIREwolf program. Students completed the evaluation form during class. Of the 125 students, 119 completed the entire evaluation form (95%). As shown in Figure 3, students were evenly divided between males (49%) and females (51%). A very high percentage of students are from under-represented minority (URM) groups[3], with 68% identifying as Hispanic or Latino and 3% as Native American or Alaska Native. Additionally, of the 12 of students who selected more than one racial/ethnic category, 10 selected one or more under-represented group. Therefore a total of 79% of student respondents are from underrepresented groups.

Figure 3. Demographic description The Academy PIREwolf evaluation participants

	Completed reflective survey (n=119)	
	#	(%)
Gender		
Male	58	49
Female	61	51
Ethnicity		
African American or Black	0	0
Asian American or Asian	2	2
Caucasian	19	16
Hispanic or Latino	81	68
Native American or Alaskan Native	3	3
Native Hawaiian or Pacific Islander	0	0
Multi-Racial/Other	14	12

Evaluation findings

Student satisfaction

Students rated their satisfaction with aspects of the PIREwolf Video Program on a scale from 1-5, 1=*not at all* to 5=*extremely*. Mean ratings can be considered to trend towards positive or negative based on the following scale:

Extremely satisfied	4.21 – 5.00
Very satisfied	3.41 – 4.20
Somewhat satisfied	2.61 – 3.40
A little satisfied	1.81 – 2.60
Not at all satisfied	1.00 – 1.80

As shown in Figure 4, students were *very* or *extremely satisfied* with all program aspects.

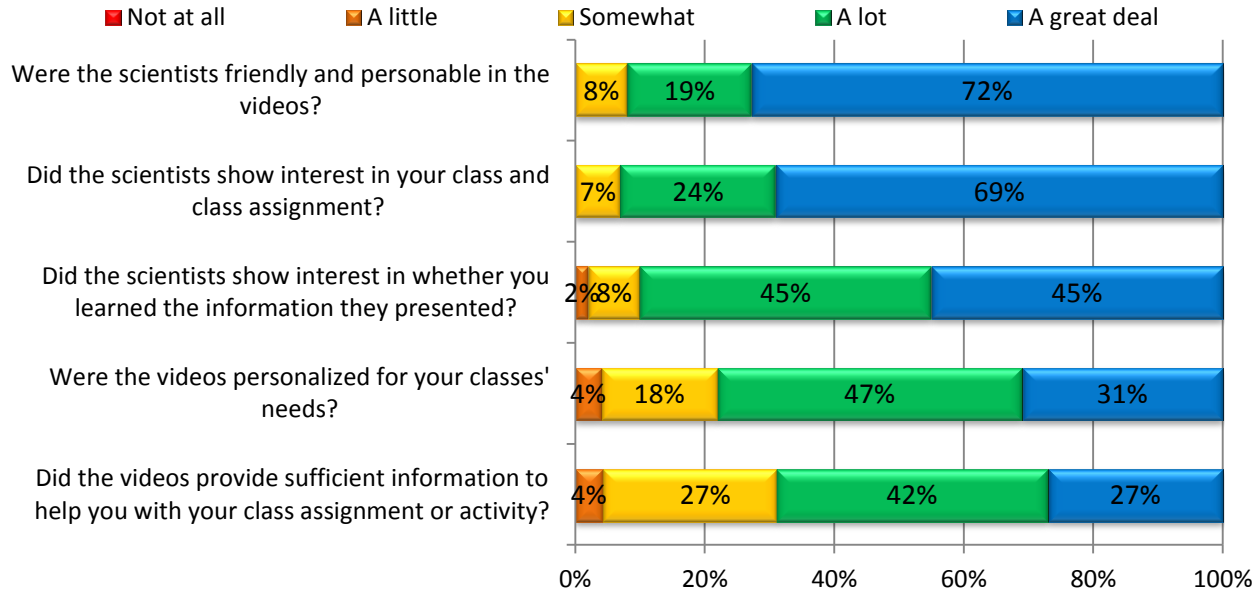
Figure 4. Mean satisfaction ratings for elements of the PIREwolf Productions

Program Element	Mean
Did the videos provide satisfied information to help you with your class assignment or activity?	3.92
Were the videos personalized for your classes' needs?	4.05
Were the scientists friendly and personable in the videos?	4.64
Did the scientists show interest in your class and class assignment?	4.62
Did the scientists show interest in whether you learned the information they presented?	4.34

[3] African American, Hispanic, Native American, Pacific Islander

Ratings were further broken down to show the percentage of students who assigned each rating to each aspect. For three of the five aspects, more than 90% of students were highly satisfied. The two aspects with slightly lower satisfaction ratings were the level of personalization and sufficient information to help with the classroom assignment.

Figure 5. Attendees' ratings of satisfaction with aspects of the PIREwolf Productions



Student suggestions to improve future videos

Sixty-three of 119 students provided suggestions to improve the videos. Responses were coded and grouped into themes. The six themes are presented in Figure 6. One characteristic comment for each theme is provided and the number of students making a similar comment is listed in parentheses. All student responses are included in Appendix B.

Figure 6. Student suggestions to improve videos

Theme	Comments (n = 63)
Improve Sound quality (8)	*They were very funny. I loved the intro growl. I suggest you invest in a boom microphone to get better audio. The wind seemed to pick up which slightly made it a little difficult to hear. The videos were great overall and I would be very thrilled to hear whenever Mr. Jones would say you made a video for us.*
Add visuals (7)	*I suggest you add effects and visuals to make them more entertaining, rather than just speaking in front of a camera for like 5 minutes.*
More informative (7)	*Add more background on who's in the video*
Production *(6)*	*The video could have used better lighting because the harsh afternoon sunlight washed the video out a bit*
Increase speaker variety (4)	*Seeing more students and/or professor in future videos would be helpful because of the different opinions they will have to offer.*
More interesting (3)	*A little more excitement throughout the whole video*

Teacher and facilitator satisfaction

The high school teacher and two UCI speakers who facilitated the PIREwolf Productions Video Program commented on their experience with the program. They were asked to describe what worked well and areas for improvement. All statements were positive, with a few suggestions. The areas that worked well include:

- The students being able to ask the professor questions and seeing him respond via video.
- The professor visiting the school to watch the debate.
- The quality of the videos to provide appropriate student discussions.
- The advanced language, vocabulary, and sentence structure used in the videos.
- The professor's enthusiasm for the subject matter and his support of the students.
- The scientific knowledge that students gained from the videos.
- The student questions were well formulated.
- The cinematographer was well prepared and adapted to filming in the field.
- An effective way to interact and connect students with the field experience.

Areas that could be improved include:

- More short videos.
- More representatives with varying opinions on the issue.
- Better audio equipment for filming the videos.
- Add Skype interaction with the students, from the field to their classroom.

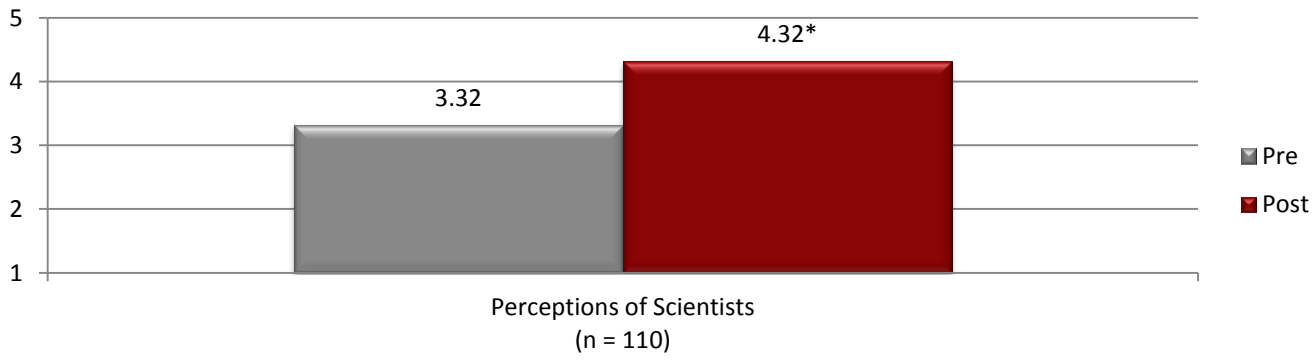
Program impacts

Achievement of the four program objectives was evaluated using Likert scale items on which students rated impact of participation from *minimal* to *extensive*. In the reflective post survey design, students indicate the level of their knowledge or understanding of each item before and after project participation. Paired sample t-tests are used to determine the statistical significance of project impacts. All significant results ($p < .01$) are indicated with an asterisk (*).

Objective 1: Increase students' positive perceptions of outside experts as valuable resources.

To evaluate program participation on students' perception of scientists as a valuable resource to help them learn new information, a composite of two survey items was created and the mean was taken for each student. Figure 7 shows a positive shift in students' perceptions of scientists, as their mean score on the composite measure increased significantly due to project participation. The mean increased one full point from 3.32 to 4.32.

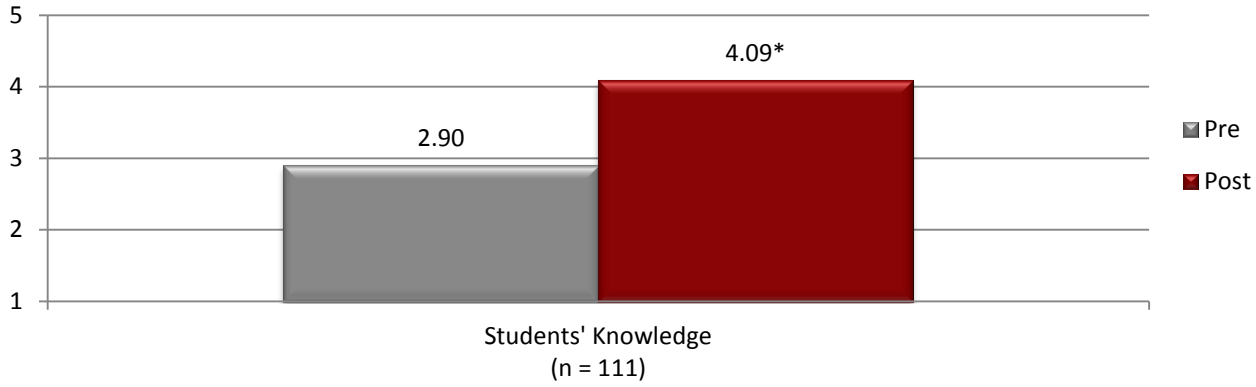
Figure 7. Students' perceptions of outside experts as valuable resources



Objective 2: Increase students' knowledge and interest in the topic (i.e. environmental impact of human development).

A composite of two items measuring students' knowledge and interest in the topic addressed by the videos, the environmental impact of human development, was also analyzed. Figure 8 shows that student's mean rating increased by almost 1.2 points, from 2.90 to 4.09, which is a statistically significant gain.

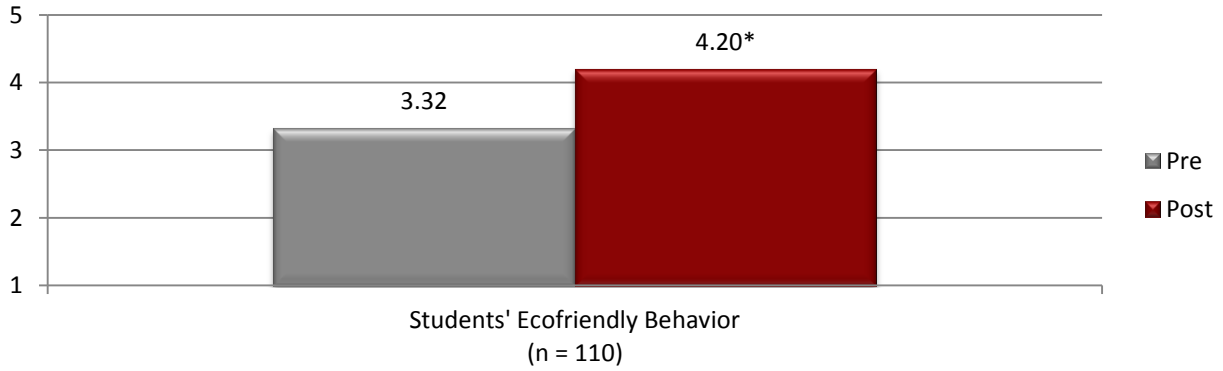
Figure 8. Students' knowledge and interest in the topic



Objective 3: Increase students' ecofriendly behaviors as a result of learning more about the topic.

Students' ecofriendly behaviors, or their intent to change their behaviors, were also addressed in the evaluation form by two items. Figure 9 shows that students' rating of their behavior as measured by a composite increased from 3.32 to 4.20. This difference in means from before project participation to after is statistically significant.

Figure 9. Students' ecofriendly behaviors as a result of learning more about the topic



Objective 4: Increase students' preparedness to participate in class activities related to the topic.

One item measured students' preparedness to participate in class activities as a result of participation in the program. Students' mean rating of their preparedness increased by about .90 points, from 3.31 to 4.22. Again, this is a statistically significant change. Results are presented in Figure 10.

Figure 10. Students' preparedness to participate in class activities related to the topic

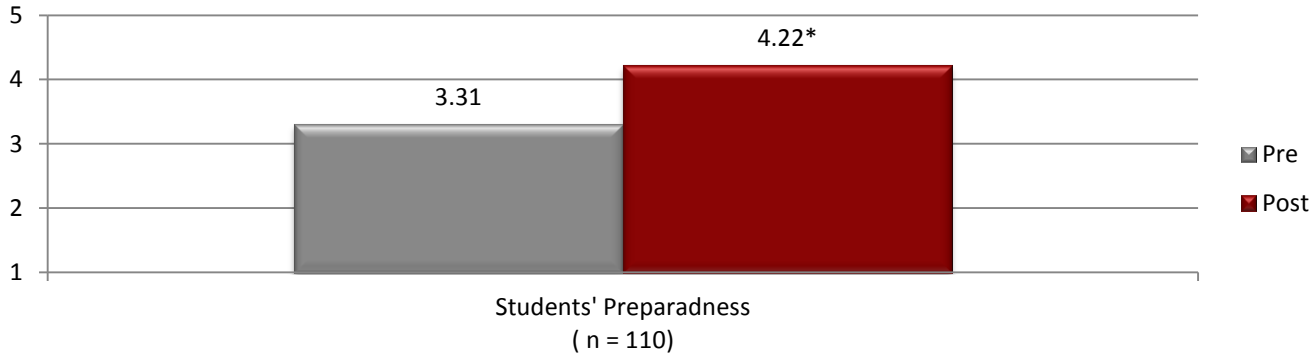


Figure 11 shows the results for the individual items that make up the composites for the objectives. All of these items showed significant gains.

Figure 11. Individual item analysis for achievement of program objectives

Survey Item	Mean		Sig.
Question	**Pre**	**Post**	
My perception of scientists as a valuable resource to help me learn new information.	3.24	4.18	< .01
My belief that scientists would want to help me learn.	3.42	4.46	< .01
My knowledge about the topic the scientists taught us.	2.89	4.10	< .01
My belief that the topic is important to the general public.	2.90	4.08	< .01
My knowledge of how to change my behavior to help the environment.	3.35	4.19	< .01
The likelihood that I will change my behavior to help the environment.	3.29	4.22	< .01
My preparedness to participate in the class activity related to this topic.	3.31	4.22	< .01

Students' explanation of how they will use what they have learned

One-hundred five of 119 students explained how they will use what they learned. Responses were coded and grouped into themes. The five top themes are presented in Figure 12. One characteristic comment for each theme is provided and the number of students making a similar comment is listed in parentheses. All student responses are included in Appendix B.

Figure 12. Student explanations of how they will use what they have learned

Theme	Comments (n=119)
Environmental outreach (27)	*I will use it to teach my cousins about what dams do to rivers it's also a perfect example on how humans do things that kill environment without us thinking its harming anything.*
Share information (18)	*Well I had already talked to my family and friends about this project and about UCI making videos for us. I talked to them about the City and the dam and they seemed really interested in everything especially on the videos*
Use in debate (18)	*I will use this information to my advantage if a debate on the same topic is brought up again.*
Improved habits (13)	*I am going to start being more conscious of what I do to the environment. Now that Dr. Bowler and Mr. Jones have shed some new light, I want to start helping the environment instead of killing it.*
More knowledgeable (12)	*I will consider to myself that Dams and Reservoirs are nice inventions, they really do help us in a way but then there's a bad side to it. I used to be all for Reservoirs and now I am not*

Students also wanted to share the following with program directors.

Thank You so much for the videos! I really enjoyed and found them interesting. I honestly didn't care about the project or the environment, specifically Hetch Hetchy, but after seeing the videos and learning more after, I am seeing the environment in a different way. I will pay attention more to what is happening in our environment. Thank you once again UCI.

Just that I am so thankful that you all take time to get videos and come into our class to make sure that we have a good learning experience. I thank Mr. Jones for also creating such amazing and creative projects that I am so excited to work on making Science my favorite class. (besides photography)

This project was by far, one of my favorite. I loved the debate and wished Dr. Bowler attended, as it was intense. Thank you soooooooo very much for taking the time to create these series of videos.

The videos were really good and very helpful for our debate. I learned a lot about things I didn't consider to bring up during the debate but then I realized how useful they would be.

The videos seemed biased towards one side of the argument, leaving a disadvantage towards the opposite side. I really like the enthusiasm that was shown within the video.

Having the support of scientist and our teacher in our project made it so much more important to us students than it should have.

Thank you! Dr. Bowler your videos were amazing and I absolutely love those firewolf mimics! Thank you so much!

I would like to thank all of the scientists for the videos and thank my teacher for making a very interactive project.

I'm glad you want to help us and make videos to help us understand what we are learning in class.

I appreciated all the videos we received. It helped me stay on track with what I was learning.

The information you gave us was really helpful in our project

That the project was very fun and i just wish we could do more projects like this one.

I was glad so many scientist and teachers helped us in our debate project.

You Are Helping Others To Do Something Great For The Environment

I would just say thank you for all the new knowledge that I now have.

You guys did a good job at helping me learn about these topics.

The scientists are amazing and awesome and very friendly

Thank you for taking the time to film the videos for us.

I feel as if I should have participated in the debate.

I love scientist more now that I did this project.

Thank you for the videos! We all enjoyed them.

The videos from the Dr. Bowler were hilarious!

That UCI has helped us a lot in this thank you

Thanks for the videos they were very useful.

I really enjoyed the project and the videos.

This was such a great project!

Thank You for being involved in this project

Thank you for all your support

They are really nice and friendly and awesome

Great video, Dr. Bowler! Thanks Mr. Jones!

I think these videos were fun and cool.

Thank you for the amazing help

That these videos helped us

Thank you for the videos.

This was great

Section 4. Key Findings and Recommendations

Key findings and recommendations are listed below for the PIREwolf Productions Video Program activities from the spring of 2014.

Demographics

Program participants included high school science students from The Academy High School, in Santa Ana, California. A large percentage of under-represented minority students (79%) were served by this program. Male and female students were equally represented.
Continue to select schools with high female and URM populations to assure representation of female and under-represented students in future projects.

Evaluation findings

Key findings

Student Satisfaction

Student satisfaction with the usefulness of the videos was very high. The largest percentages of students praised the videos as helpful and commented on how they could use what they had learned to share with others, in class activities, or to change their personal behavior. Students believe the scientists were friendly, personable, interested in them and their class.
Future videos may benefit from increased alignment with class assignments, activities, and science standards.

Program Impacts

All four program objectives were met and gains for all areas were statistically significant.
The evaluator makes the following recommendations based on students' suggestions for improvement:

- *Increase the variety of speakers who present in videos.*
- *Make sure video and sound quality are high enough that students' can understand video content.*
- *Increase the degree to which the videos are directed to the class' needs.*
- *Include visual aids in videos to engage students and help them understand that material.*
- *Assure videos will assist students in their intended class activities.*
- *Expand the program to additional classes and schools.*

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Appendix A: UCI PIREwolf Productions Video Evaluation

UCI PIREwolf Productions - Video (4-14)
Hetch Hetchy Dam Removal Project: UCI Video Contribution

Thank you for participating in the evaluation of UCI's contribution to your recent Hetch Hetchy project.

Your responses are very important. Please answer each question honestly and thoroughly. Your response to any of the questions is completely voluntary. However, the information you provide will help improve UCI's video program and make it more valuable for students and teachers. All responses are confidential.

Please feel free to ask your teachers if you have questions about this survey.

About You

1) With which gender do you identify?*
( ) Male
( ) Female

2) With which ethnicity and/or racial background do you identify? Check all that apply.*
[ ] African American or Black
[ ] Asian-American or Asian
[ ] Caucasian or White (non-Hispanic)
[ ] Hispanic or Latino
[ ] American Indian or Alaska Native
[ ] Native Hawaiian or other Pacific Islander
[ ] Other (please specify): _____

Satisfaction with the Project

3) About the Videos: In each of these areas, please indicate how satisfied you are with the videos shared in your classroom.*

	Not at all	A little	Somewhat	Very	Extremely
Did the videos provide sufficient information to help you with your class assignment or activity?	( )	( )	( )	( )	( )
Were the videos personalized for your classes' needs?	( )	( )	( )	( )	( )
Were the scientists friendly and personable in the videos?	( )	( )	( )	( )	( )
Did the scientists show interest in your class and class assignment?	( )	( )	( )	( )	( )
Did the scientists show interest in whether you learned the information they presented?	( )	( )	( )	( )	( )

4) What suggestions do you have to help improve future videos?
_____
_____

Impact of Project - Objectives

5) Achievement of Project Objectives: Select the number that best represents your knowledge and understanding in each of the following areas before and after watching the videos.

RATING SCALE 1= MINIMAL 3=SOMEWHAT 5=EXTENSIVE

	BEFORE					AFTER				
	1*	2*	3*	4*	5*	1*	2*	3*	4*	5*
My perception of scientists as a valuable resource to help me learn new information.	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My belief that scientists would want to help me learn.	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My knowledge about the topic the scientists taught us.	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My belief that the topic is important to the general public.	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My knowledge of how to change my behavior to help the environment.	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
The likelihood that I will change my behavior to help the environment.	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My preparedness to participate in the class activity related to this topic.	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

6) How will you use what you have learned?*

_____

_____

7) Is there anything else you would like to share with the scientists or your teacher?*

_____

_____

We appreciate the time you have taken to complete this survey. All of your responses are anonymous and will be reported as an average of students' responses. If you have any questions, please ask your teacher.

Appendix B. Student Responses to Open-Ended Questions

Suggestions for improvement

Students made the following suggestions to improve future videos.

Improving sound quality (n = 98

- *They were very funny. I loved the intro growl. I suggest you invest in a boom microphone to get better audio. The wind seemed to pick up which slightly made it a little difficult to hear. The videos were great overall and I would be very thrilled to hear whenever Mr. Jones would say you made a video for us.*
- *The only problem was that there was a video they filmed out during the wind so we couldn't really hear.*
- *I think you should get a muffle for the mic because it was a little hard to understand them when you shot outside because of the wind.*
- *In a video there was a bit of a wind and it was difficult to understand what Dr. Bowler was saying.*
- *To have better quality next time other than that the videos were great!*
- *Record in a room that way the sound of the air won't be as distracting*
- *I think you should add special effect and better sound quality.*
- *Less wind sound and speak louder*

More visualization of film topics (n = 7)

- *The videos were a little boring after a few minutes. I suggest you add effects and visuals to make them more entertaining, rather than just speaking in front of a camera for like 5 minutes.*
- *More creativity and maybe a few labs or experiments to help us visualize what you're saying*
- *Have little diagrams, not just filming somebody speaking!*
- *More props or examples but it was good overall.*
- *Have a demonstration of some sort.*
- *Make show pictures*
- *Show videos*

More informative (n = 7)

- *Add more background on who's in the video.*
- *I would maybe take more questions from us students to help us with things we needed help in.*
- *Give a little more information.*
- *Show a little more detailed*
- *Say more about how the park would turn out if we actually moved instead of just talking about how its good just by keeping it*
- *Talk about how to fix the problem.*
- *More learning.*

Production (n = 6)

- *Try to find the perfect weather to film*
- *The video could have used better lighting because the harsh afternoon sunlight washed the video out a bit.*
- *I think the editing could be a bit better but the people and the knowledge is perfect*
- *Make the videos specific right to the topic.*
- *Background music :)*
- *Better camera.*

Increasing variety of speakers/viewpoints (n = 4)

- *Seeing more students and/or professors in future videos would be helpful because of the different opinions they will have to offer.*
- *If there is a debate get a good reason from both sides to in both perspectives of the industries.*
- *Have more people like different people not just Mr. Bowler present*
- *Maybe have other people or students talking in the video*

More interesting (n = 3)

- *A little more excitement throughout the whole video*
- *Make them more interesting*
- *Be more specific and use 9th grade vocabulary.*

Students' plans for use of information

Students noted how they plan to use what they had learned.

Use in environmental outreach efforts (n = 27)

- *I will use it to teach my cousins about what dams do to rivers it's also a perfect example on how humans do things that kill environment without us thinking its harming anything.*
- *I will use my knowledge to tell other people about what I've learned. For example (my family, friends, and neighbors, etc).*
- *I will share it with my family, friends, and neighbors so that they become aware of what's going on with the environment. I will also teach them how it not only affects our surroundings, but us as well.*
- *I have always wanted the environment to be a clean place, and when I see someone toss trash on the floor I pick it up or I tell them to not do that.*
- *Nature is something very precious. I would probably make sure that were being environmentally friendly and bring my knowledge home.*
- *Make sure our earth doesn't do global warming and tell people to please take care of their water and earth.*
- *I will now be able to educate those around me about the dam that is causing all of these arguments.*
- *I will use it to show to the people what they should do to keep the environment eco-friendly.*
- *I will talk about the situation with my family and friends and advocate in restoring nature.*
- *I will use the stuff that I learned to help educate more people to help the environment*
- *Being able to compare other dams that are in use and are harming the environment.*
- *I will use it to help persuade others into working towards helping the environment.*
- *I will use it to change my community to a healthier place for our health.*
- *To support the environment against the anti-environment people.*
- *I can use it to help protect my local and global environment!*
- *I can help the community be more aware of the environment.*
- *I can inform others around me to help the environment.*
- *I will use this knowledge and share it with the public.*
- *I will spread what I've heard to raise awareness!*
- *I will use this to spread it out to people that don't realize what is going on.*
- *Convincing people to help the environment*
- *To get people aware of what is happening.*
- *I will tell people about Hetch Hetchy.*
- *I will use it to help the environment. (3)*

Share the learned information with others (n = 18)

- *Well I had already talked to my family and friends about this project and about UCI making videos for us. I talked to them about the City and the dam and they seemed really interested in everything especially on the videos*
- *I will use it through discussion among others and maybe in a future career.*
- *To help others become more knowledgeable about the topics I now know*
- *I will use what I have learned by just by sharing it to my family.*
- *I will use it to help the next year ninth grader on this project.*
- *Explain it to people that don't know a lot about this topic.*
- *To help out future generations who get this project*
- *By informing my friends and family members.*
- *I would share it with people if they need it.*
- *I will use it for next year's new freshmen*
- *Teaching other students*
- *I'll tell it to my friends.*
- *Teach others about it*
- *Tell people*
- *To teach my younger teacher when they need help*
- *I will use it to start conversations*

Use in debate (n = 18)

- *I will use this information to my advantage if a debate on the same topic is brought up again.*
- *It's great to know how people actually debate about these things. I didn't even know Hetch Hetchy existed before this project!! Now I know a little bit about Hetch Hetchy and I can now add on to a conversation about Hetch Hetchy, rather than just hearing about it and not knowing what it is!*
- *I am now aware of how informed and willing to help scientists are. I used it in the debate and it was very exciting to debate against a topic this important.*
- *We've learned how to debate and that is way of getting your ways fairly, to prove you r points.*
- *I will learn how to debate more and how to come up with good come backs in future debates*
- *I will use the information to think about the cons and the pros from different perspective.*
- *I will use what I learned in my future on how to debate and how some laws function.*
- *I did use what I learned during the debate and when I did my debate paper.*
- *I will use it for when it is needed and use it for defense or oppose*
- *With my debates and show teach others what I learned*
- *I used the information to perform a debate and win.*
- *I will make the debate better and stronger.*
- *The debate and general knowledge*
- *I used information for my debate.*
- *Create a Debate Club. Protest.*
- *I learned how a debate works*
- *By being a better debater.*
- *I used it for my debate.*

Improved habits regarding treatment of water and the environment (n = 13)

- *I am going to start being more conscious of what I do to the environment. Now that Dr. Bowler and Mr. Jones have shed some new light, I want to start helping the environment instead of killing it.*
- *The way I would use everything I learned about the environment would be by taking care of the public parks because not everyone is able to see the beauty of nature.*
- *I Will Learn To Help The Environment By Throwing Away My Trash And Recycle What Can Be Recycled.*
- *I would use it in so many ways and now I know how important water is and how important the environment*
- *I think I will use it to be prepared more and to take care of our planet more.*
- *I have respected nature more and have learned acknowledged it a lot more.*
- *I will use it in how I think about all the environment problems we have*
- *I will use it to help & respect the environment.*
- *Apply it to my everyday life as much as I can.*
- *I will help the environment improve.*
- *I will apply it to my everyday life.*
- *I will become more Eco-friendly*
- *I would be able to use it in the water I drink*

More knowledgeable (n = 12)

- *I will consider to myself that Dams and Reservoirs are nice inventions, they really do help us in a way but then there's a bad side to it. I used to be all for Reservoirs and now I am not.*
- *I now know where the city of San Francisco gets their water.*
- *I really learned a lot like of all the thing in the your opinion*
- *I will think twice about things I would normally not give second thought too like the Hetch Hetchy Dam.*
- *I will ask people question about it and see if there right or wrong*
- *I would use it for or as an example*
- *Add it to the many things I now know*
- *I will use all my skills throughout life, and maybe pursue a career in a science or engineering field.*
- *I will use what I have learned to learn about more issues related to the subject*
- *I will use what I learned to help my knowledge of the environment*
- *I will be more aware of what is happening to local areas.*
- *I will probably put in more interest to the topic*

Use for class assignments/projects/exams (n = 11)

- *I will use it if I ever need it in school, if I want to impress somebody, or if I need to answer a question for a game show.*
- *Maybe in the future I might do this project again then I can remember what I learned in science class*
- *Teach it to other people and use it for a quiz if I am going to be given one.*
- *I can use this in maybe a future presentation or for the future 9th graders*
- *I would use it in my science class and sometimes in my everyday life.*
- *I would use it to study for tests*
- *To create an awesome project*
- *I will use to put on my resume.*
- *I used it for my paper.*
- *In my future projects*
- *The test*

Won't use or not sure (n = 6)

- *I will use it in the future and make sure I could use it.(3)*
- *It's hard to make decisions*.
- *I don't know what I will use the information given for.*
- *I honestly probably won't use any of it.*
- *I don't know it depends on what (4)*