ILLINOIS INSTITUTE OF TECHNOLOGY

FINAL REPORT

IPRO 332

Our Energy Future: Creating Multimedia Education Modules for the Classroom and the Community Center

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Everyday, millions of people worldwide receive information regarding their energy consumption from less than reliable sources. Often this information comes from companies with an interest in convey only part of the story to their potential customers. Whatever the reason, balanced, non-biased information is rare, making it difficult for consumers to understand how simple choices effect their larger environment. A team of undergraduate students at Illinois Institute of Technology sought to create a positive change in this cycle, starting with consumers who are just starting to ask these questions; high school students.

Initial research was conducted to select an energy topic suitable for this context. The field of choices was narrowed using a system of filtering criteria and a final topic was selected: the Ecological Footprint. The Ecological Footprint is a model used to represent the area of ecologically-productive land needed to sustain an individual or group of individuals. The calculated area includes land and water areas needed to produce resources, support use, and assimilate waste. The Ecological Footprint is especially useful as a tool for comparative analysis, allowing users to quickly and easily understand the effect of consumer choices.

Supplemental research was conducted to determine which methods and tools would be best for teaching the Ecological Footprint model to a group of students. Emerging and conventional methods were surveyed and a system of filtering criteria were applied. This process resulted in the decision to pursue a multi-media, interactive module consisting of the following; a video featuring interviews (produced by the IPRO team), a Power Point Presentation, white-board graphical analysis and group discussion.

Based on this research, an education module was constructed and tested a high school classroom. The host for this test was Robert Chrupka who volunteered his De La Salle High School class of Honors Physics students. The test was conducted over two consecutive days with one homework assignment. Student surveys were administered as a way of gauging the effectiveness of the prototype. In addition, Mr. Chrupka was interviewed personally to get further feedback concerning the effectiveness of the teaching method and material.

The result of the semester's work is a transportable energy education module available to schools throughout the region. Should the team's application for the BP A+ for Energy Grant be accepted, the program will continue in Fall 2007 with a wind module and will be supplemented by the actual installation and tracking of a wind turbine on the roof of De La Salle High School. The Ecological Footprint module is fully ready to serve as a foundation for any number of energy education modules to be pursued by future teams.

Table of Contents

0.0 Executive Summary…………………………………………………………… 2
0.1 Introduction…………………………………………………………………. 3
0.2 Background …………………………………………………………………. 3
0.3 Purpose ………………………………………………………………………. 4
0.4 Research Methodology ……………………………………………………. 5
0.5 Assignments …………………………………………………………………. 0
0.6 Obstacles ……………………………………………………………………… 0
0.7 Results ………………………………………………………………………… 0
0.8 Recommemdations …………………………………………………………. 0
0.9 References ……………………………………………………………………. 0
1.0 Acknowledgements…………………………………………………………….0
1.1 Appendix ……………………………………………………………………….0

0.1 Introduction

If every person in the world were to consume at the rate of the average American, we would 5.3 earths to sustain ourselves. Today, consumers have available to them a seemingly infinite numbers of choices. For years this has been considered the hallmark of a healthy economy and society. Recently, however, we have become globally aware that those infinite choices have consequences, sometimes disastrous ones. IPRO 332 proposes to introduce an education module into area public schools that would begin to offer a balanced perspective on the effects of these consumer choices.

0.2 Background

Energy is indispensable to nearly every action in the modern world but there is no single or simple portrait of energy, its unintended consequences or its unimagined possibilities. Energy choices and challenges will become increasingly complicated as the nation and the world balance the expanding need for energy supply with the importance of increasing energy efficiency and conservation. The world energy market grows daily with new stakeholders, new limitations, new resources, and new challenges. As greater numbers of stakeholders appear, so do the means and reasons for presenting a complicated image from a singular perspective. Because multi-sided information is difficult to locate, lessons focused on the indispensable "total energy picture" get excluded from the curriculum of public schools and other teaching institutions, leaving a regrettable deficit in public knowledge.

In spite of stifling odds, organizations are currently working to bring balance back: organizations like NEED (the National Energy Education and Development Project). NEED brings together students, educators, business, government and community leaders to design and deliver objective energy education programs. Through this balanced network, NEED is able to teach the scientific concepts of energy and provide objective information about conventional and emerging energy sources—their use and impact on the environment, economy, and society. The program also educates students about energy efficiency and conservation while providing tools to help educators, energy managers, and consumers use energy wisely. By following precedent organizations, like NEED, this IPRO hopes to create the conditions for an objective, balanced, voice to be heard by those with the power to affect our energy future.

We have identified the following as the most pressing issues regarding the current state of energy: bio-remediation, climate change, endangered environments, energy conservation in the home, energy conservation in vehicles, non-renewable energy sources, renewable energy sources, political influence, recycling, and waste. These ten items begin to paint the full energy picture but fail to describe the complicated checks-and-balances at work within each category. For instance, an educator interested in conveying balanced information about wind power (a renewable resource) to his or her students would be obliged to discuss its history, basic science, potential for production as well as its land requirements, operating expense, lifespan, and threat to local fauna, etc. When charged with presenting each of these items thoroughly and without bias, the task at hand becomes overwhelming. This is why our IPRO has chosen to spend the semester developing a segment of a model teaching tool which will focus on one of these important categories. It is by researching and implementing both the information and the means required to produce this tool, that we hope to acquire all the knowledge necessary for another team (perhaps a future IPRO) to implement a complete, well-grounded product.

0.3 Purpose

Given the problem of lack of consumer awareness of the consequences of their energy choices the team recognized the desire on the part of the sponsor (and advisor) Prof. Jim Braband to pursue a solution to be implemented as an energy education module for high school students. We planned our activities for the semester around determining the characteristics and content of this tool.

The team's original objectives were as follows:

1. Develop the groundwork for an energy education module to be implemented inside of the Chicago Public School system
2. Build relationships with partner companies and organizations with whom we can ally to distribute the tool upon completion

The team's original objective was to develop the groundwork for a tool, to be implemented either in Chicago Public School classrooms or community centers that delivers balanced, non-biased information to its student constituents about energy issues that affect their daily lives. We anticipated, when authoring the project plan, that research would constitute a significant portion of this semester's effort. Therefore, we committed ourselves for laying the groundwork for this program (research and recommendations) while leaving the development of the actual tool as an optimistic goal. Our research yielded confident findings however and our objectives expanded to include not only designing and assembling the tool but also testing it and making changes based on the feedback.

The objectives developed at the beginning of the semester were expanded in several other ways. One of the most significant was the addition of a grant application mid-semester. Our research early in the semester produced the BP A+ for Energy Grant, which seemed purposed for programs much like ours. The grant application required us to select a high school teacher and submit on his or her behalf. Because of its proximity to the campus and an affiliation through the mother of a team member, De La Salle High School was chosen and Robert Chrupka, the school's Environmental Science teacher was identified as the most suitable applicant. While the grant application process was helpful in forcing our team to solidify early plans and plan for consecutive semesters of the project, it did require the project plan to be revised and time had to be allocated from other tasks.

One of our initial objectives was to work within the educational standards of the Chicago Public Schools. We assumed that their standards would be the strictest and that an education module which was valid according to CPS criteria was likely to be valid for other classrooms. However, the relationship we developed with Robert Chrupka during the grant-writing phase was too fruitful to abandon for the purpose of the implementation of the project. The requirements for the education module were then restructured to respond to De La Salle standards. (A meeting much later in the semester with Kevin Hall, director of a regional science program of Chicago Public Schools, revealed that our module not only meets the standards of CPS but would be warmly welcomed into the classrooms of several teachers. Plans have been developed to implement the module in some of these classrooms in the Fall, 2007.)

Revised Objectives:

1. Create, test and refine an energy education module for implementation in local high school classrooms
2. Apply for the BP A+ for Energy grant on behalf of Robert Chrupka and De La Salle High School
3. Build relationships with partner companies and organizations with whom we can ally to distribute the tool upon completion
4. Plan for continuation of the project in future semesters, both in and outside of the IPRO Program framework

0.4 Research Methodology

The team's objective was to develop an energy education module for implementation in local high school classrooms or community centers, which will deliver balanced, non-biased information to its constituents about energy issues that affect their daily lives. The team first decided to divide the semester by phases. Phase one would include background research and determination of appropriate research methodologies which would produce recommendations for actual development of the tool. Phase two would include development, assimilation of the research, and actual construction of the tool. Phase two would end with trial testing and revisions based on feedback. (See appendix)

Subject Matter Subteam: Objectives

The subteam's objective was to come up with a target topic related to energy that we would use as the base content of the education module. The subteam began by researching all issues related to energy, including but not limited to web resources, books, journals, and further resources made available to us by our advisor and other faculty. Next, the subteam compiled all issues into a list, then refined this to a list of only the best topics, for further analysis. The issues were first categorized into themes and sub-themes (see appendix). Filters were then applied to these topics which were arrived at through a team brainstorming session (see attached document for filters used). From this process it was concluded that the Ecological Footprint was the most relevant issue. Although the Ecological Footprint was not included in our original list, it none the less arose from a team effort and passed all the applied filters.

Once the subject matter topic was selected, work began on assembling research. All sides of the issue were researched to ensure a complete, non-biased picture that could be developed into a solid lesson tool. Methods of recognizing credible sources, such as high school text standards, were researched and discussed as a team. Components of the Ecological Footprint that may be seen as biased were identified and the objectivity criteria were used to determine whether or not to include these points in the final module. Because this topic is the groundwork for the IPRO project, the team felt that it was important to provide a guideline for subsequent semesters based on the concept of the Ecological Footprint. To do this, the team created an outline that demonstrate the various topics that can be investigated and then related back to the Ecological Footprint keeping in mind the fundamental process of how energy relates to our everyday lives.

Program Subteam: Objectives

Andy, here's where you insert your work.

Phase 1

To solve this problem the team first looked at precedent endeavors in this field and examined products, methodologies and relative successes and failures. From the research, we then narrowed our scope to one subject of the greater energy picture to be the focus of a carefully constructed educational tool. In this phase, it was important to develop criteria for determining the objectivity of the acquired material relating to a single energy topic. The criteria functioned to identify missing information that must be included in order to achieve objectivity. Our research and development process was documented in presentations and diagrams which were stored for team reference on iGroups. By thoroughly recording our process, present members of the IPRO, as well as those interested in learning about or continuing our work, will be able to access and understand our methodology. Phase one methodology:

1. Formed two subgroups: subject matter and program
2. Surveyed issues comprising the broad topic, "energy"
3. Surveyed organizations presently working on the problem of energy education

4. Surveyed current and potential teaching methods and materials with an emphasis on emerging and “best practice” options
5. Identified deficits in the energy focus of the State of Illinois and Chicago Public Schools’ science curriculum
6. Identified a single problem that is appropriate in scale and scope to be the focus of a prototype tool
7. Identified the issues comprising this acute topic
8. Established a set of qualitative requirements for “balanced” information
9. Established a set of qualitative requirements for objective sources of information
10. Created a list of information sources with our criteria applied
11. Uploaded our research onto iGroups

Research mid-semester uncovered the BP A+ for Energy grant which the team decided would be well-suited to the purpose of this project. For the grant application, the team proposed a Fall 2007 education module as a continuation of this semester’s work. Using funds provided by the grant, students would install a vertical-axis wind turbine on the roof of de La sale high school. Students from the school would form an extra-curricular organization to work with IIT students in tracking the energy produced by the turbine and putting it to use in their classroom. The project would conclude with a presentation to the class on the reduced Ecological Footprint after implementation of the turbine.

12. Compiled budget for grant application
13. Made contact with wind turbine manufacturer for grant application
14. Met with Robert Chrupka and made presentation to De La Salle science department
15. Submitted grant application

In order to ensure the education module we developed was appropriate and effective for use in the classroom, up-to-date multimedia technology was considered with regard to the opportunities and constraints of the classroom environment. Special consideration was given to the effectiveness of these tools to engage the students and retain their attention. For this reason, a deliberate effort was made to engage methods and technologies break from traditional teaching methodologies. Phase one continuation:

16. Conducted studies of effective teaching methods and materials
17. Conducted a video, literature, and software research

Phase 2

With the end of Phase one the team disassembled the subgroups to reassign roles according to the myriad tasks required for the completion of the project. Many students worked to develop components of the education module (video, presentation, pre and post test, evaluation, Ecological Footprint quiz, etc.) while a small portion of the team began work on assembling IPRO program deliverables. Our final product was a prototype tool that conveys the findings of our research.

18. Disassembled subgroups
19. Compiled and organized all research
20. Developed the prototype tool and supplementary material
21. Conducted a two-day classroom test of the tool
22. Acquired feedback from the students and teachers
23. Reconfigured the tool according to feedback
24. Produced IPRO deliverables and uploaded them to iKnow

0.5 Assignments

Team Organization

I. Subject Matter Subteam

Sarah Leingang
- 4th yr architecture major
- Strengths: communication, teamwork, graphic design, video production, public speaking

Tony Osborn
- 5th yr architecture major
- Strengths: communication, teamwork, organization, project management

Sara Pfau (Subteam leader)
- 4th yr architecture major
- Strengths: organizational skills, teamwork, communication

II. Program Subteam

Andrew Martin (Subteam leader)
- 2nd yr chemistry major
- Strengths: communication, teamwork, project management, being positive concerning just about anything

Michael Lagiglio
- 3rd yr computer science major
- Strengths: teamwork, website design, critical thinking, communication

Sasha Romanova Smith
- 4th yr architecture major
- Strengths: communication, website design, teamwork, public speaking, graphic design

Kurt Zeigel

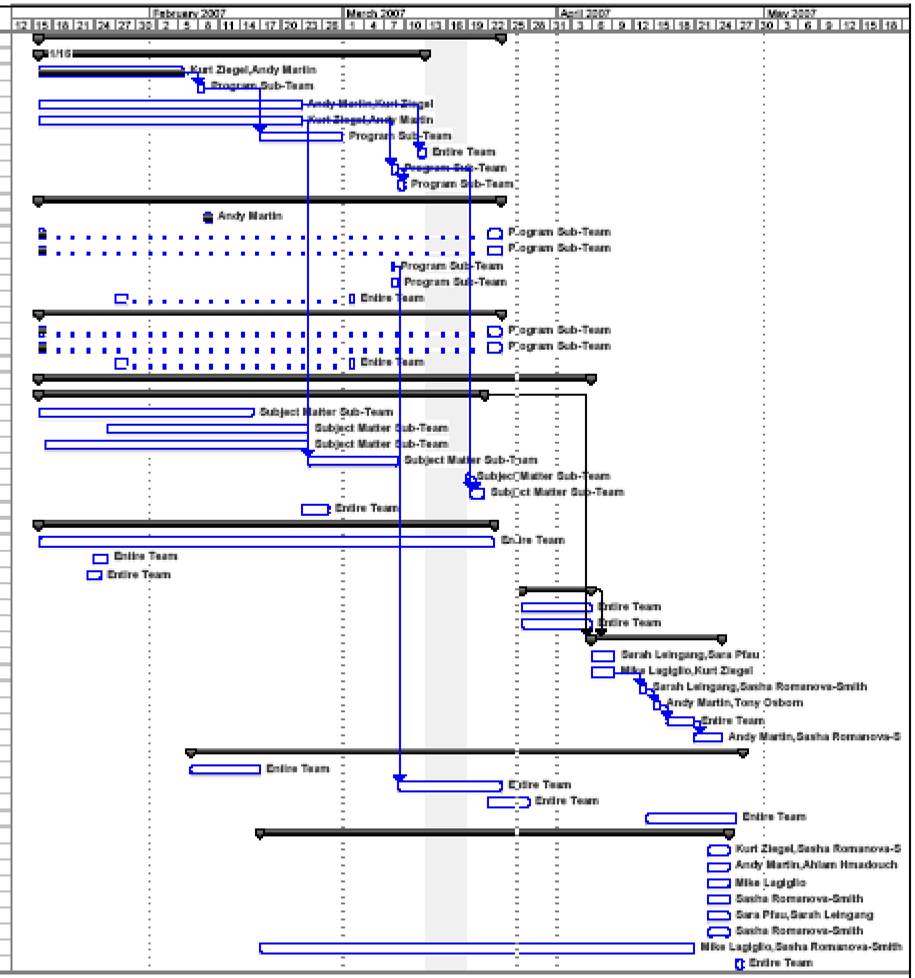
- 4^{th} yr architecture major
- Strengths: teamwork, organization, time management, graphic design

Team Roles

Team Leader – Andy Martin
Agendas – Andy Martin
Time Keeper – Tony Osborn
Meeting Minutes – Sasha Romanova Smith
Time Sheet Management – Tony Osborn
Report Layouts – Mike Lagiglio
PowerPoint Layouts - Kurt Ziegel
Presentation Boards - Kurt Ziegel & Sasha Romanova-Smith
Websmaster - Mike Lagiglio & Sahsa Romanova-Smith
Schedule Monitor - Tony Osborn

Gantt Chart

ID	Task Name	Resource Names
1	Phase 1 Research <Program sub-team>	Program Sub-Team
2	Research curriculum at CPS	
3	obtain curriculum	Kurt Ziegel,Andy Martin
4	find gaps in curriculum	Program Sub-Team
5	contact a De LaSalle curr. Director	Andy Martin,Kurt Ziegel
6	contact a LaSalle science teacher	Kurt Ziegel,Andy Martin
7	Prepare for teacher interview	Program Sub-Team
8	attend staff meeting	Entire Team
9	interview a teacher	Program Sub-Team
10	record findings	Program Sub-Team
11	Research other sources	
12	museum visit	Andy Martin
13	internet	Program Sub-Team
14	publications	Program Sub-Team
15	interviews with De La Salle science teacher	Program Sub-Team
16	record findings	Program Sub-Team
17	review videos on the subject	Entire Team
18	Research new methods	
19	internet	Program Sub-Team
20	publications	Program Sub-Team
21	review videos on the subject	Entire Team
22	Phase 1 Research<Subject Matter sub-team>	
23	Research	
24	define issues	Subject Matter Sub-Team
25	categorize issues	Subject Matter Sub-Team
26	locate associated organizations	Subject Matter Sub-Team
27	prepare student survey	Subject Matter Sub-Team
28	survey students	Subject Matter Sub-Team
29	record findings	Subject Matter Sub-Team
30	refine to one issue	Entire Team
31	Define Objectivity Criteria	
32	research precedent organizations	Entire Team
33	determine criteria	Entire Team
34	define "balanced"	Entire Team
35	Final Research	
36	compile objective information	Entire Team
37	write research paper on chosen topics	Entire Team
38	Phase 2 Implementation <Entire Team>	
39	format research for delivery	Sarah Leingang,Sara Pfau
40	design prototype module	Mike Lagiglio,Kurt Ziegel
41	insert research in module	Sarah Leingang,Sasha Romanova-Smith
42	edit for delivery	Andy Martin,Tony Osborn
43	test in classroom	Entire Team
44	interpolate results	Andy Martin,Sasha Romanova-Smith
45	Deliverables	
46	Project Plan	Entire Team
47	BP A+ Grant Proposal	Entire Team
48	Midterm Presentation and Report	Entire Team
49	Final Report	Entire Team
50	IPRO Day deliverables	
51	poster	Kurt Ziegel,Sasha Romanova-Smith
52	abstract	Andy Martin,Ahlam Hmadouch
53	CD-Rom	Mike Lagiglio
54	iKnow submissions	Sasha Romanova-Smith
55	PowerPoint presentation	Sara Pfau,Sarah Leingang
56	meeting minutes submission	Sasha Romanova-Smith
57	website	Mike Lagiglio,Sasha Romanova-Smith
58	IPRO DAY	Entire Team



Project: Project1
Date: Mon 3/26/07

Task · Split · Progress · Milestone · Summary · Project Summary · External Tasks · External MileTask · Split

Page 1

Individual Tasks

Team Member	Original Tasks	Updated (Mid-term)	Updated (Final)
Sarah Leingang	- Research energy issues - Apply filters - Administer surveys	- Background research EF - Wind turbine and viability research - Grant proposal budget development - IPRO day presentation	- Video for education module - Day 2 script - Abstract & poster layout - Guest list - Project references
Tony Osborn	- Timesheet manager & timekeeper - Schedule monitor - Precedent surveys	- Background research EF - Project plan writing - Mid-term report presentation - Grant proposal writing - Design and construction of EF module - Objectivity criteria	- Final Report writing - Final Presentation construction
Sara Pfau	- Research energy issues - Apply filters - Construct surveys	- Background research EF - Summarize energy big picture - Compose “project evaluation” in grant proposal - Designed layout for IPRO day presentation	- Day one script - Student & teacher evaluation forms - EF module pre/ post test - Subject matter report
Andrew Martin	-	-	-
Michael Lagiglio	-	-	-
Sasha Romanova Smith	-	-	-

Kurt Zeigel - - -

Semester Timesheet Tracking

NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
	HOURS BY WEEK															
Lagiglio, M	5	4	3.3	9.5	8.5	10	7.3	5.5	1.5	12	10	0	18	6		99.75
Leingang, S	2	5.5	7.2	9	10	5.5	8.5	6.5	1.5	7.5	8.5	11	10	7.5		99.7
Osborn, T	0	0	4	4	4	3.5	7	13	1	6.5	4	8.5	7.5	8		63
Martin, A	9.5	4.5	8	8	8.5	6	7	6.5	5	5.5	6	11	8	11		104.5
Pfau, S	6.5	4.5	5	4	17	6.5	7	6.5	2	5	6.5	12	6	5		93
Smith, S	0	3.3	2	4.3	2.5	4.8	6	2	0	8	8.8	7.5	6	8		63
Zeigel, K	3	5.5	3.5	5	9.5	6.5	6	4.5	2	8	6	5.5	9	11		85
sum	26	27	33	44	60	43	49	45	13	52	50	55	64	49		607.95
ave.	3.7	3.9	4.7	6.3	8.6	6.1	7.0	6.4	1.9	7.4	7.1	7.8	9.1	8.1		

0.6 Obstacles

Obstacles faced by the team this semester can be grouped into three categories; team management, project management, and ethics.

Team Management

The first obstacle faced by the team was in the loss of a team member. Due to lack of communication on the part of this former team member, the Subject Matter subteam lost time while it waited for her input. In addition, materials generously donated to the team by a non-for profit researcher and speaker were in her possession at the time of her withdrawal and were not recovered. This problem was resolved once the team confirmed her withdrawal (several weeks after her disappearance) by reassigning her tasks to other members of her subgroup. Deviation from the schedule caused by this problem was negligible.

The team was also volunteered to test the Beta version of an iGroups system update (iGroups 3.0). The entire team complied for approximately two weeks before confusion and frustration led the team to abandon the test system for the old system, which retained the team's information. Even the team's advisor was unable to use iGroups 3.0 for his team management purposes. Comments were submitted to the developers for use in correcting the issues but the team never went back to using the beta system.

Project Management

The team also faced some issues with the structure it established for the project early in the semester. As illustrated above, the team was divided into two subteams that were to periodically report their work to the entire team until the subteams were reassembled for development of the education module. Phase one of this structure worked well with only minor problems occurring as a result of the subteams' non-concurrent schedules. However, the deadline for reassembling the team in Phase Two did not happen cleanly because of work still being done by both subteams. As a result of this, tasks were still being assigned to former subteams to be carried out, preventing the transparency and communication that was required of the prototype production process. The problem was brought to the team's attention by its advisor and tasks were reassigned according to division of labor needed to complete the remaining work.

A second obstacle faced in the "project management" vein was the addition of the BP A+ for Energy Grant to our objectives, mid-semester. The team's research early in the semester uncovered the grant, which seemed purposed for programs much like ours. The grant application required us to select a high school teacher and submit on his or her behalf. Because of its proximity to the campus and an affiliation through the mother of a team member, De La Salle High School was chosen and Robert Chrupka, the school's Environmental Science teacher, was identified as the most suitable applicant. The deadline (March 27) was extremely tight for producing the information needed to complete the application. Every team member was acquisitioned from his or her assigned tasks to work on the application for a period of about two weeks. While this was a major set-back in the project schedule determined earlier in the semester, the application process helped us to make decisions about the module that were previously vague, allowing us to work much more acutely when energy returned to developing the education module.

Each of the above-mentioned problems resulted in the team being behind on its schedule near the end of the semester. Because of this, development of the education module happened extremely quickly. Compounding this, communication with the host teacher at De La sale was cut off completely for the week prior to our testing goal date. The team was left with very little time (hours) for preparation before testing began in the classroom. This was caused not only by unanticipated obstacles but was exacerbated by a schedule that did not anticipate these obstacles. The problem was resolved by simply meeting the deadlines. Neither the module nor the testing was compromised by this obstacle.

Ethics

The chief ethical issue faced by this team was the ethical issue implied by the problem; consumers are making bad choices because of a lack of balanced energy information available to them. The team addressed this issue through the project itself. It chose to target high school students who are just begin to think about their global implications as consumers. In this way, the team was able to tip the scales (if even slightly) back to an objective balance.

The BP A+ for Energy grant also presented an ethical dilemma to the team. The grant authors wrote the application for high school teachers. In other words, the grant is awarded to a high school for a program proposed by a teacher. Because the grant seemed so well suited to our project, however, and because our team wanted to be sure a grant was submitted on behalf of our project, the team applied for the grant in Robert Chrupka's name. This issue was complicated further when Da La Salle's high school's entire science department (which had been searching with little excitement for a reason to apply for the grant) was approached by our team to be added to the project.

Although it's the team's belief that the intent of the grant was to foster exactly the kind of relationship our project proposes (between de La sale high school and IIT) it's unclear whether or not it was ethical for our team to complete the application on Mr. Chrupka's behalf.

A final ethical issue faced by the team this semester concerned permission to publish. The team conducted the testing of the module in the classrooms and documented this with photos and video. It wasn't until the team returned to tabulate what was learned that we realized we would be unable to publish the photos and video because we did not have the students' consent. Additionally, the students were asked to provide their names on the pre and post tests and many students returned their Ecological Footprint quizzes with their names on them. The team resolved this issue by writing permission forms and delivering them to the school to be signed by the students (or their parent, in the case of minors).

0.7 Results

The result of our research was a portable, balanced, engaging energy education module that is ready for implementation in local high school classrooms. The team has identified several partners who are interested in implementing this tool. Da La Salle High School will continue to work with IIT in the Fall of 2007. If Mr. Chrupka receives the BP A+ for Energy Grant, an IPRO team will be able to work with high school students to install and track a wind turbine, building on the Ecological Footprint concepts taught using this team's module.

In addition, Kevin Hall for the Chicago Public Schools has offered to introduce the tool to an Environmental Science van currently in circulation around Chicago. This van would make the Ecological Footprint module available to any CPS teacher who has completed a one-day training session and shows interest. As future IPRO teams continue to develop energy education modules, the Ecological Footprint module will provide the foundation for what could be an extensive education package.

The testing procedure implemented by the team allowed research to be conducted which benefited the quality and effectiveness of the actual tool. In addition, the team identified several useful resources which are accessible via the internet will be made available to students who are exposed to the Ecological Footprint module to share with friends and family, extending the reach of our program.

Conclusion

The team's research revealed that trying to combat the lack of balanced energy information by exposing consumers to all the information that is unavailable, is unrealistic for two reasons; (1) not even the best researchers know all there is to know about the effects of our consumption choices and (2) the information we do have is simply too extensive to teach even under ideal circumstances (a class devoted to the subject, for instance.

For these reasons, it is this team's belief that the chosen approach was most effective. Selecting students as the target audience for the module not only gave us a physical space to begin educating people.

0.8 Recommendations

For the current energy module it was found there were a great number of possible teaching methods, but there was no single source was suitable for the job. Rather, a multi-directional, multimedia experience was determined to be most effective. In this way, the scope and character of the ecological footprint can be appreciated by the audience, as well as holding their interest. Our team proposes the following methods to be included in the Ecological Footprint Module, following a two day format:

- A video (of interviews) to engage students at the beginning of the semester (Day 1).
- A short lecture, with material provided by the Subject Matter sub-group (Day 1, Day 2).
- An interactive activity that encourages students to use higher order thinking skills to analyze energy related issues (Day 1, Day 2).
- A homework assignment: taking some Ecological Footprint calculators home and getting results from others (Day 1).
- A Student Evaluation form to get feedback and make improvements on the module.

The activity for Day 1 is a guided discussion where students explore the energy used in the production, use, and waste of each aspect of the Ecological Footprint. For shelter they will examine heating a house, for food they will examine making a steak, for mobility driving a car, and for goods and services buying a stereo. The activity encourages students to use higher-order thinking skills to apply what they have been introduced to in terms of the Ecological Footprint to new situations.

The Day 2 activity is one where students provide information they gathered from their homework assignments and discuss why there are differences in different age groups' Ecological Footprints. Their information is broken down into age groups 15-20, 21-30, 31-40, etc. This is also an open discussion that is guided by the facilitator.

The Program Team Sub-group also took into consideration teaching methods that could be applied to future energy modules, such as technologies that can be implemented. These include interactive, student-responding clickers, interactive whiteboards, and portable projectors.

0.9 References

Online Ecological Footprint Calcualtors

http://www.myfootprint.org/

http://www.powerhousemuseum.com/education/ecologic/bigfoot/mid/

http://www.ecologicalfootprint.org/

http://www.ecologicalfootprint.org/Global%20Footprint%20Calculator/GFPCalc.html

http://www.sustainenergy.org/

Aimed Toward Kids

http://www.islandwood.org/kids/impact/footprint/index.php

http://www.kidsfootprint.org/

Other Resources

http://www.earthday.net/

http://www.rprogress.org/

http://www.greenribbonpledge.org/pledge/index.html

http://ge.ecomagination.com/site/index.html#showcase

http://ge.ecomagination.com/site/index.html#arklow

http://www.teachers.ash.org.au/jmresources/energy/renewable.html

Books

http://www.need.org/

http://www.amazon.com/Our-Ecological-Footprint-Reducing-Bioregional/dp/086571312X/

http://www.amazon.com/Laugh-Learn-Effective-Teaching-Training/dp/0814407455/

1.0 Acknowledgements

The team would like, firstly, to thank professor Braband, our advisor, who sponsored the project and provided the team with a meaningful idea that we feel resulted in a meaningful project. Without his guidance and vision we would never have produced a different project than the one he intended the team to work on.

We would also like to thank Mr. Robert Chrupka and the entire De La Salle High School science department for their contribution and support. It is our hope that the relationship developed this semester will continue to grow and bear fruit in the near and far future.

Thanks to Kevin Hall for sharing with us the opinions and encouragement of the Chicago Public Schools. We look forward to introducing our tool to a wider audience with his help.

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1.0 Appendix

SUBJECT MATTER – THEMES + SUB-THEMES

Bio-Remediation / Phytoremediation The use of plants and organisms to cure the planet	• Emissions-eating algae • Nuclear Waste Clean-up • Billion Tree Campaign • Plant Based Clean-up
Climate Change The projected effects of continual damage to the planet and what these damages entail	• Global warming – polar ice caps melting • Increase of natural disasters & collateral damage • Rising sea levels • Ozone layer
Endangered Environments Current practices, their relative consequences and solutions	• Deforestation • Pollution – Air and Water (fresh, sea) • Over population – industrial spread, disease (cancer from proximity to power lines), landfills, food & water scarcity • Species extinction – invasive plants in natural habitats • Changing and disappearing ecosystems
Energy Conservation – home Steps to using less energy thereby saving money and earning money	• Low Embodied Energy Building Materials • Energy Star Change a Light Campaign • Programmable Thermostats • Clean Energy Buy-Back (ComEd Program) • Sun Tempered Superinsulated (STS) homes • Conservation steps within the home – recycling (full-circle), gray water recycling, rain gardens, etc.
Energy Conservation – transportation Reducing pollution and non-renewable energy consumption, and saving money	• Alternative modes of transportation – public (cleaner types), bicycle, walk, carpool, hybrids, etc. • Alternative fuels – biomass, bio-diesel, fuel cell, electric, hydrogen tank, ethanol, etc.
Non-Renewable Energy Resources Current uses, cost of production, % left and foreign dependency, emissions and effects on environment	• Oil (Petroleum) • Natural Gas • Coal • Uranium (nuclear-fission) • Electric Power Plants
Renewable Energy Resources Current uses and practices, benefits and detriments	• Geothermal – from the earth, heat pumps • Wind • Solar – photovoltaic, passive solar thermal • Hydropower (dams & waves) • Biomass
Political Influence Measures being taken by government to improve energy crisis / situation	• Iranian Nuclear Energy Production • Bush Energy Plan • Government subsidies for clean energy
Recycling Current uses and practices, benefits and detriments	• Cogeneration Power • Industrial Waste Fuel (recycled paper byproducts) • Everyday materials and their production • City & town closed loop (self-sufficiency)
Waste What is being thrown out and the consequences, ties in with Recycling	• Stockyards (meat embodied energy) • Field Crops (embodied energy, environment, etc.) • Construction

	• Food Packaging • Electricity – excess use (home & commercial)

FILTER (c): Difficulty to obtain expertise

RESULTS	DISCARDED	REASONS
Climate Change	Bio-Remediation	• Newer technology • Still researching + testing • Not many practical applications • Provides a little bit of background information but not a lot
Energy Conservation – home	Endangered Environments	• Future consequences unknown or not here yet, ie. more background information than current information
Energy Conservation – transportation	Political Influence	• A bulk of information is very bias
Non-Renewable Energy Resources	Waste	• Not much information about stockyards and field crops, but construction and food packaging could be tied in with Recycling theme
Renewable Energy Resources		
Recycling		

FILTER (d): "Bang for buck"

Energy Resources	Non-Renewable	Oil Natural gas Coal
	Renewable	Biomass Hydropower Wind Solar
Energy Consumption/ Conservation	Transportation	Alternative modes Alternative fuels
	Residential & Commercial	Clean energy buy back Recycling – everyday materials & production Waste – excess use of electricity & materials
	Industrial	
Effects of Energy	Climate & Environmental Change	Global warming & dimming Natural disasters Changes in current ecosystems

FILTER (e): Timeless

For the purpose of the filtering process, "timeless" is understood to mean, a process or system that has been scientifically substantiated and the cause or effect of which will remain relevant to global citizens for at least ten years.

Selected for Elaboration		
Issue		Reasoning
Bio-Remediation / Phytoremediation	• Nuclear Waste Clean-up	Slow rate of decay means we'll be dealing with it far into the future
	• Plant-Based Clean-up	Technique has been effective in the past and shows promise for continued effectiveness
Climate Change	• Global Warming	If steps were taken today, effects of carbon emissions would continue for centuries
Endangered Environments	• Deforestation	Global issue, long history
	• Pollution – air & water	Global issue, long history
	• Over population	Global issue, long history
	• Species extinction	Global issue, long history
	• Changing ecosystems	Global issue, long history
Energy Conservation – transportation	• Alternative modes	Change in this area is critical to many other energy issues and change is certain in the near future
	• Alternative fuels	Change in this area is critical to many other energy issues and change is certain in the near future
Non-Renewable Energy Resources	• Petroleum	Critical to understanding the current and historical energy picture
	• Natural Gas	Critical to understanding the current and historical energy picture
	• Coal	Critical to understanding the current and historical energy picture
	• Uranium	Critical to understanding the current and historical energy picture
	• Electric Power Plants	Critical to understanding the current and historical energy picture
Renewable Energy Resources	• Geothermal	Advances in technology have already reshaped the way power is generated globally, with expected growth
	• Wind	Advances in technology have already reshaped the way power is generated globally, with expected growth
	• Solar	Advances in technology have already reshaped the way power is generated globally, with expected growth
	• Hydropower	Advances in technology have already reshaped the way power is generated globally, with expected growth
	• Biomass	Advances in technology have already reshaped the way power is generated globally, with expected growth
Recycling	• Industrial Waste Fuel	Represents a critical change in conventional production
	• Everyday Materials	Understanding of this issue is critical to conservation and energy-use reduction
	• Eco-footprint	Critical to understanding the relevance of conservation
Waste	• Agricultural	Understanding of this issue is critical to conservation and energy-use reduction
	• Construction	Understanding of this issue is critical to conservation and energy-use reduction
	• Food Processing	Understanding of this issue is critical to conservation and energy-use reduction
	• Bio waste	Understanding of this issue is critical to conservation and energy-use reduction
	• Electricity	Understanding of this issue is critical to conservation and energy-use reduction

FILTER (f): BP A+ for Energy Grant

For the purpose of the filtering process, issues remaining are those for which the A+ for Energy Grant is well suited. Issues must be broad (scope of learning opportunity) with special emphasis given to energy use (current and future) and conservation.

Selected for Elaboration		
Issue		Reasoning
Energy Conservation – transportation	• Alternative modes	Kids think cars are fun. Could illustrate how much energy is wasted by cars in an experiment.
	• Alternative fuels	Kids think cars are fun. Could illustrate how much energy is wasted by cars in an experiment.
Non-Renewable Energy Resources	• Petroleum	Broad scope. Relates easily to energy use.
	• Natural Gas	Broad scope. Relates easily to energy use.
	• Coal	Broad scope. Relates easily to energy use.
	• Uranium	Broad scope. Relates easily to energy use.
	• Electric Power Plants	Broad scope. Relates easily to energy use.
Renewable Energy Resources	• Geothermal	Broad scope. Relates easily to energy use.
	• Wind	Broad scope. Relates easily to energy use.
	• Solar	Broad scope. Relates easily to energy use.
	• Hydropower	Broad scope. Relates easily to energy use.
	• Biomass	Broad scope. Relates easily to energy use.
Recycling	• Everyday Materials	Related to conservation. Opportunity for great experiments.
	• Eco-footprint	Related to conservation. Opportunity for great experiments.