EDUC 607 Winter 2017

Final Exam Methodology

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**Introduction**

The plan for this idea is to implement an extracurricular activity with my college class, that will actively engage these students in an educational project, that also is a meaningful community project, to promote the use of renewable energy. The capstone electronics printed circuit board design, fabrication and assembly class, will be helping the renewable energy college class, create a more effective design for installing a photovoltaic (PV) array on the parking structure roof at the local public park, located at Fairmont and Main. The energy that the array generates will be tied back into the city’s grid, and offset the cost of the lighting that is used at night, for sports games. The materials for the array are being donated by numerous large corporations in town. The labor installation is being done as part of the joint internship with the local International Brotherhood of Electrical Workers (IBEW), and our community college electrician students.

There will be two classrooms involved in this project, since both classes meet at the same time. Since we have the materials being acquired through corporate donations there are no costs. The research on this project will consist of reading peer-reviewed journal articles, and talking to 5 to 10 experts. To complete this first phase of this project, the students understand that they must devote many extra hours (from 10 to 30 hours to do research), and have only 10 weeks to complete this initial vital work, outside of their normal class hours. They also realize that this project could be a stepping stone, to a career, in the renewable energy arena.

**Goal:**

What measures can I take to significantly improve the quality of my community project?

To answer this question, is to create a way to make these college students eager to do this project. Have them break up into small teams of no more than four, to a group. The challenge is that they are to come up with workable and creative ideas, that will solve the problems of installing this PV array economically, without losing functionality. The entire project does not have to be installed within the 10 weeks. Yet, the problems on how to install it, must be resolved.

**METHODOLOGY**

**Step 1: Literature Review**

**Rationale –** To research renewable energy, and photovoltaic arrays on ERIC, data-base through the online library, there were 78 journal articles on photovoltaic solar energy alone. When you researched under renewable energy, there was a choice of 441 articles. Therefore, the researcher would have to eliminate those articles, that were not suited for this project. To narrow down the quantity, use key terms, and phrases to help select which articles to look at first. The abstracts are a quick way to get a glimpse into what the article is covering. The articles of interest should pertain to the construction and installations of PV arrays. Will this array be stationary or move with the sun? Is the positioning of the array important? Will they have one big inverter, or use the mini inverters? These are the types of questions that need to be researched.

Since this field is exploding, it is better to limit our research to the last 5 to 10 years. The more current the better. Review of literature is a no budget cost item. Students have free access to the school online library via the computers in the classroom, in the school library, in the student success center within the Applied Technical Building on campus, and their home computers, tablets and cell phones.

**Step 2: Draft of Guidelines**

The guidelines will help the students and their teams get started on their quest for discovery.

As the teacher, I will take more of a facilitator role on this project. I want the students to take the lead in each of their groups. I will direct them back on course, if I see that they are going astray. I will answer questions when they ask me. I will be constantly wandering the classroom to monitor their team’s progress. I will have them give we quick progress reports, every week, or at every milestone. This will determine the team’s progress. It will also show where they are in respect to the time remaining on the project. If necessary, I will remind them of the timeline requirements.

Each team will present at least two peer-review journal articles that they felt were relevant to this project. To make it easier, all the students have agreed to share the research that the various teams have discovered. It will be placed in a central location, and available for all students to view when all articles are presented to the class. Therefore, all will have the same advantage if they choose to read all the articles. The information from these articles will help guide the students to a better understanding of what is required to complete this project.

The hope is to make this project an ongoing curricula assignment in future semesters. The idea is to teach students to work in team. Be responsible to meet deadlines that they will face in industry. To encounter bumps in the road, where they must use critical thinking and problem solving skills to address the issues that occur without relying on someone else to bail them out.

1. Will these students be able to complete this project on time?
2. Will these students work well with the teams they put together, themselves?
3. Will everyone on each team due his/her own share of the work?
4. Should we have teams rate the performance of contributions from each member, with the work they submit each week?
5. Will the teams be balanced between novices and advanced students?
6. Should the project work be kept quiet until presented to the class-at-large?
7. Does there need to be incentives along the way to keep the competition moving quickly along?
8. To keep students engaged and on-track, should we limit maximum time-on-task to keep them focused?

As the instructor, I wish to incorporate what the experts will contribute about the implementing of this project. I will continue to validate, or modify the guidelines. Later, I will integrate these ideas into the guidelines, as I gain valuable insight from the experts, and my students’ feedback information, as well.

**Step 3: Data from Experts**

I arranged to have 6 experts to come into the class one day, to be interviewed by the different teams. To insure privacy, we have several unoccupied classrooms within the building. So, this day, we will be spread out just during our normal class period. Since our class is 2.5 hours long, this will allow for 6, 20-minute sessions, with a 5-minute break in between for passing. The experts are: a PV installer with 20 years’ experience, an electrical engineer who designs PV arrays, two journeyman electricians with C-10 licenses, from the IBEW, a college professor who teaches renewable energy, and Leadership in Energy and Environmental Design-Accredited Professional (LEED-AP) architect who designs energy efficient buildings.

**Rationale –** I selected these individuals because of my professional interaction with them for years. I have served on several national and international professional organizations. As a part of the Board of Directors for both organizations, I crossed paths with these people as they either served with me, or participated in events, that were being held by these organizations. These experts were chosen because of their years of experience, within the renewable energy field. They all have specialized in their area, and can advise the teams on how to succeed. Each person has at least 15 years’ experience to offer.

Here are some questions that the students may ask the experts:

1. Is it important that this array be stationary or should it move with the sun?
2. Is the positioning of the array important?
3. How big of an array do we need to calculate to cover the park’s needs?
4. Will the garage structure be able to hold this much weight?
5. Will the structure need any reinforcement work done prior to installation?
6. What kind of roof are we dealing with, flat, sloped, tiled, compo, etc.?
7. Do we have to worry about penetrating the roof when we install the array?
8. Should we have one big inverter, or should we use the mini inverters?
9. Is it good to tie the array back into the city’s electrical grid system?
10. Is it better to have our own battery back-up, therefore, have a stand-alone system?
11. Is there a place where these huge batteries can be stored, if we want or need to use

them?

1. Which is more cost effective, tying into the grid or stand-alone?
2. Do we have to plan for repairs?
3. Do we have to plan to replace parts?
4. Do we need to estimate how to maintain this array?
5. Do we need to worry about firemen access?

The experts and I have a passion for renewable energy. We have agreed that this project is a win-win for all concerned. We plan to come together after the interview sessions, to compare notes, and to see if anything may have been over looked by us. Or, if the students had some innovative ideas, that we should consider adding to our list. I also will be talking to the students at the next class session, to get their input and feedback on the interview process, and knowledge they gained.

**Step 4: Student Input**

**Rationale –** To elicit quick information from the students, about how much knowledge they personally had on renewable energy, prior to the project starting, I will create a short survey done in the Likert style for easy tallying. The questions will be very basic, and rather generic. The in-depth knowledge will surface as the students work on the project. The survey will be done on the computer.

The Likert-scale will be as follows: 5 = strongly agree; 4 = agree; 3 = neutral; 2 = disagree; 1 = strongly disagree. The questions are as follows:

1. You prefer to use renewable energy over fossil fuel
2. You prefer to use fossil fuel over renewable energy
3. You know that you can use renewable energy after dark
4. You know that some solar (photovoltaic array) systems are tied to the city’s electrical grid system
5. You know that some solar (photovoltaic array) systems are stand-alone, because they have battery back-up
6. You know that the solar (photovoltaic array) systems can work on cloudy days
7. You know the best exposure for the solar (photovoltaic array) systems is north or east
8. You know it is best to lay the solar (photovoltaic array) systems down flat when you install it

There is no need to have open-ended questions for this simple fact finding survey. Any other information will surface during the numerous class discussions.

**Step 5: Analysis of the Data**

**Rationale –** I will take thedata from experts, and the students, then, scrutinize it to see how it will work on this project. I will see if there is a consensus of opinions and what logic they are applying to the results. If I find that this information is workable and helpful, I will then add it to my guidelines as I make the necessary refinements.

The refinements to the guidelines should be done in the last several weeks of this 10-week project. Yet, it is an ongoing process, and should continue if the project is running. Like all projects clarification is always necessary. This hopefully, will discourage disagreements and misunderstandings among participants, or misinterpretations of the materials, also. It is my hope to have everything written out clearly, with no ambiguities or bias.

If the teams come up with creative and innovative suggestions, after the experts have left, then we have all their permissions, to get in touch with whichever expert may be needed to give more advice, on a given topic. These experts know that this work will generate more questions, and will need to be under some extra supervision, beyond that of the teacher. This is a very large and financially invested endeavor, and needs to be handled in a very professional manner. Even though the project will not be installed in these 10 weeks, this initial work is extremely important, to the overall success of the final outcome. These students will be passing on their efforts to the next class, to continue this project, on to the next phase.

**Step 6: Rewrite of Guidelines**

Based upon review of literature and the consensus of our experts, I will continue to rewrite these guidelines. I will include any modifications or additions, that are handed to me, that I determine are worth adding. Since this project is ongoing over several semesters, so should the guidelines be updated accordingly.

**Conclusion**

This is the beginning of the methodology phase of this project. The installation cannot be completed within a 10-week period. The next phase will lead into the implementation section. However, this first initial phase of this project will be finished. My class will show our community the significance of the effort that was spent in these 10 weeks. My class is answering this question **What measures can I take to significantly improve the quality of my community project?** The simple answer is our community college classes, along with the local IBEW, and some large corporations, will be installing a PV array on the parking garage roof at our local park. It is located at Fairmont and Main. The array will be large enough to generate electricity, to run the lights for the night sports, held at this park. Thus, saving our city those electricity fees, as well as the cost for the materials and labor for this project, which all are being donated. The estimated completion of the installation is two semesters from now, due to construction refit of the garage.