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STUDENT PORTFOLIO

An Interactive Qualifying Project Report

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by

Gary Woo

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Approved:

Professor Judith Miller, Major Advisor

1. portfolio
2. IQP
3. rubric

Professor Art Heinricher, Co-Advisor

Abstract

The objective of this project was to determine if student portfolios could be logistically feasible and able to document measurable growth in certain skills that occur during the off-campus IQP experience. Three groups of three WPI students completing their IQPs in Washington D.C., during B term of 2000 were asked to produce portfolio entries that contain self-reflective essays concerning their teamwork, confidence, and IQP goals. Student portfolios were shown to be logistically feasible however weren't able to show measurable growth.

Executive summary

The objective of this IQP was to determine whether or not student portfolio could be logistically feasible and also used to measure growth in certain skills that takes place during the off-campus IQP experience.

Of five groups, each which had three students, three groups that were being advised by Professor Heinricher and that went to Washington to do their IQP B term 2000 were asked to submit portfolio entries. These selected students were given assignments approximately every week. In each assignment, the students were asked to write about their teamwork skills, confidence during meetings, or IQP goals. In order to be able to measure growth, the topics of teamwork skills and IQP goals were given at two time points. These two time points were approximately three weeks apart.

Many student entries focused on teamwork whether or not the assignment originally was targeted toward teamwork skills. Since this was the case, a teamwork skills rubric was generated in order to measure the author's performance in different outcomes of teamwork.

The rubric was generated by using the guiding questions from the assignments. A three-point scale was used and each level had a descriptive statement specifying what it meant. If an entry did not touch on a particular outcome, an NA was given.

The results of the usage of the rubric on the students' entries showed that the rubric could produce numerical results on teamwork skills. After asking the groups' advisor, Professor Heinricher, it seemed that the results the rubric produced did closely correlate to the team's performance. The groups that received high scores tended to be groups that were working well, while groups that received low scores tended to have

some team related problems. While the scores of the students' entries seemed to be able to document teamwork skills, they did not show measurable growth.

In order to determine whether student portfolio can be logically feasible, the students were asked to complete a final questionnaire that asked approximately the length of time it took to complete the assignments. Of the four students that returned the final questionnaire, they all responded that it took an hour to complete the portfolio assignments. The advisor was also asked if he believed student portfolios were logistically feasible in his part, he responded that it was.

In the future there are several recommendations that can be taken in order for student portfolios to work better. Many entries related to teamwork regardless of the topic the assignment was intended to target. A more specifically worded assignment may work better. Since none of the students completed all the entries, it was hard to measure growth. Some way of making students finish their entries may be required; making the assignments mandatory could be a solution. Also it was hard to measure growth because the assignments were so close together, if more time was given between assignments, the measurement of growth may be more likely. In order to have more time in between the assignments, student portfolios could span the PQP and IQP time periods.

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1. Introduction

Portfolios are generally used to collect and document achievement. They can measure or document change, or both. Depending on the user and the usage, portfolios can be geared toward many different audience groups. For example, an artist may create a portfolio containing all of his or her works. This type of portfolio can both document change over time and show the artist's quality of work. This person can also choose to narrow the range down to either include only selected works that show improvement, or can include his or her best works. However, portfolios are not only for artists. Like an artist, an engineer or a computer scientist can use a portfolio to document his or her work. A portfolio need not only describe the final product, but can also describe the process. A computer scientist may use a portfolio to show how he or she improved upon his or her design or algorithms. A student can use a portfolio to show what he or she has learned or accomplished in school.

Employers, employees, and even students are using portfolios. The academic community is the newest of these groups. A small number of colleges have begun to require the use of a portfolio in order to graduate. Many schools that use portfolios are using them for particular classes, rather than instituting it as graduation requirement. At WPI, all students must complete three projects, a Sufficiency, an Interactive Qualifying Project, and a Major Qualifying Project. WPI has not experimented with having students who are working on their projects complete portfolios. Some portfolios used in classes may focus on the outcome of the class and determine if the student has accomplished the course's objectives. Projects completed at WPI, however, have outcomes that vary with the project. Depending on the project that is done, the objectives may be different. Off-

campus projects may focus some of their objectives on getting to know the new environment or culture.

WPI students completing a project such as their IQP could benefit from building portfolios. For example, students could document their teamwork abilities or their relationship with their advisor and could allow both others and themselves to determine if their communication skills are working well. By comparing students' entries, readers of the portfolio can determine whether the students have improved, or can get a better understanding of what is needed in order for improvement to occur. The advisor could also benefit if he or she found that the students were not receiving the correct guidance. Students who create portfolios while working on an IQP could include essays of self-reflection, and any proof that they have achieved what they claim. In an ideal situation, both advisor and students could benefit from such a portfolio system.

Currently, students who are working on their Interactive Qualifying Projects are not creating portfolios. One of the reasons for doing Interactive Qualifying Projects is "to enable WPI graduates to understand, as citizens and as professionals, how their careers will affect the larger society of which they are a part."[1] This understandably cannot be assessed by any simple test. Portfolios may be used to assess learning in an IQP that cannot be measured in other ways. Students working on portfolios while completing a project may gain an overall view of how their skills are being tested in real world situations. After the completion of their IQPs, the self-reflection process of creating the portfolios can help the students discover how they may affect society after they graduate, or how they have affected society already by completing their IQPs.

Students that do document their progress in portfolios will also gain the skill of writing status reports.

Documentation of skills in portfolios serves the student not only in school, but also in the student's future career. Teamwork skills and communication skills are important when employers are searching for potential employees. Students who complete portfolios will be able to show after graduating from WPI, that they have acquired skills that even WPI does not have classes for.

Analyzing portfolios for growth provides a few benefits. Showing students their ability to develop and learn new skills will increase a student's self esteem. Students that have a chance to reflect back on their progress during their IQPs will be encouraged to be better rounded, as they may find certain new skills useful. Also growth of students' skills shows how WPI's IQP requirement is a success.

I hypothesize that portfolios can be used to help supplement learning during a WPI Interactive Qualifying Project (IQP) through self-reflection. The objective of this project is to see if student portfolios could be logistically feasible while also able to document measurable growth in certain skills that takes place during the off-campus IQP experience.

2. Literature Review

2.1. Portfolios

A portfolio is used to hold evidence that shows a person's skills. There are many different uses for a portfolio. An artist can use a portfolio to show off a certain talent by selecting his or her best works of a particular type. However, portfolios are not just for artists. Boy scouts collect their merit badges as evidence they have achieved a certain skill, and investment brokers can use history of gains to show their skill. Portfolios hold not only pieces of work or history, but also reflection pieces. These pieces can be essays providing information on the person's thinking, understanding, and future direction. Learning can be provided by the discussion of the portfolio by the producer, the producer's peers, and the instructors. Portfolios promote creativity and allow the user to reflect upon their learning. A portfolio also helps support self-confidence, as the user gets to visualize the material being learned[2].

2.2. Student Portfolios

When used by students, portfolios allow for a different learning experience. Portfolios can be used to show a student's progress, effort, and completed works[3]. Portfolios contain both a self-reflective statement as well as the evidence of learning[4]. Depending on the desired goal of the portfolio, instructors can provide guidance on the range of works the student should place in the portfolio. A student's work that is difficult or that shows that the student is learning new things can be placed in the portfolio. Work that the student is proud of can also be used. A student portfolio may contain anything the student wishes to learn more about by discussion, or by self-reflection[5]. Student

portfolios encourage production of products that the student is proud to share with others[6]. Useful items to place in the portfolio are shown below.

- Writing samples
- Exams
- Computer exercises
- Simulation exercises
- Video of class activities
- Photographs of class work
- Research products
- Other experiences not included in a résumé
- Documents of achievement
- Programs from participated in events
- Previous or current job evaluations
- Career goals
- Teacher evaluations and notes
- Products from previous employment

Reflective pieces of some portfolios allow the educator to learn more about the student's learning process. Multiple-choice tests, for example, generally cannot show if a student understands how, when, and why to apply different skills. On the other hand, a student's self-reflection piece has a greater chance to show what the student was thinking when he or she chose a specific way of doing something. This does not mean that one should replace the other; rather they should be used for different purposes.

Portfolios used by engineers are geared toward students in an engineering field. They work just like student portfolios, but their objectives have a link to the engineering field. One of the portfolio's objectives is the engineering design method that typically includes abilities shown below:

- identify the problem
- gather the required information
- search for a solution
- create preliminary designs from the given information
- evaluate and pick the preferred solution
- document plans and specifications
- implementation of the design

However, even engineering portfolios can have different topic focuses, since they can contain materials from any engineering curriculum[7].

2.2.1. Examples of Student Portfolios

In most cases the student prepares and places the documents in the portfolio. However, in some cases such as at the Colorado School of Mines, the faculty maintains the portfolios. Colorado School of Mines uses the portfolio to assess the curriculum, and does not require the reflective part of the portfolio that is placed in many student portfolios[8].

Some student portfolios, such as the ones created by some physics students at Pittsburg State University, are used to get a better understanding of the students'

achievement in the class. In this experimental portfolio system, the professor came up with 24 important course objectives. The students were told to include in their portfolios work that they believe would show that they have mastered all the course objectives and a statement of self-reflection that indicated how well they had mastered the course objectives, how this objective may be useful in the future, and how the student mastered the objective. These student portfolios encourage teachers to assign real-life problems, which require the students to apply, synthesize, and evaluate different problem solving methods, instead of multiple-choice tests that do not require the same depth of thinking[9]. The teachers get encouraged because these portfolios can now be used to show that the students really understand the process instead of just the end result.

Student portfolios can be used for the whole duration of a student's career in a school. Graduate students entering the educational or school psychology programs in the University of Alabama after August 1995 are required to complete portfolios. In this example, the goals of the student portfolio are to allow the student to monitor his or her progress, show his or her skills and achievements, allow reflection on under par areas, and relate the student's knowledge and skills to their individual professional goals[10]. For students belonging to the class of 2000 and beyond at Kalamazoo College, student portfolios are a must. The portfolio helps the students make informed decisions on career paths. Academic advisors are given the job of evaluating the portfolios. There are specific levels to be reached at the end of every year. Specific topics to be addressed include lifelong learning, intercultural understanding, social responsibility, career readiness, and leadership. The skills that are to be shown with the portfolio are written expression, oral expression, quantitative reasoning, and computer and information

literacy[11]. In this example, the goals of the student portfolio are to clearly show and monitor the progress and accomplishments of the student, relate the student's experiences, increase the student's self confidence, and allow the student to get a better understanding of his or her area of interest[12].

Student portfolios do not always include all work completed in the period of the student's attendance at a school. A single class can have a student portfolio. In an experiment given to the students attending Louisiana State University in the BE 1252, Biology in Engineering class, students were told which assignments to place in the portfolio. The students had the choice of how to organize and present the work. This allowed the students to focus on the self-assessment part, in which students reflected on experiences of the class material. Students attending Ohio State University in the class AE 625, Modeling and Design of Biological Systems, also were required to complete a portfolio. This portfolio consisted of work from the class that the students chose. Accompanying the students' work was an essay reflecting on learning and experiences that the student encountered. Overall, the portfolios were a success. 80% of the BE 1252 students, and 78% of the AE 625 students, said that the portfolios enhanced their learning[13].

2.2.2. Electronic Portfolios

More and more portfolios are being put in electronic form. Electronic portfolios require much less space than non-electronic forms of portfolios. Portfolios that are in electronic form can be placed on the Internet unlike their physical counterparts. This

allows students to have potential employers view their web-based portfolio from virtually anywhere[14].

The Rose-Hulman Institute of Technology (R-HIT) is a technical school that requires all students to have a standard laptop computer with specific software installed[15]. All students at this school have the same software, and hand in homework in the same format. Since students are already completing assignments in electronic form, creating a repository for the work is not hard to do. R-HIT created RosE-Portfolios, which are web based repositories for the students. Students can submit and view their electronic student portfolio from almost any computer that has a connection to the Internet. Just like many other regular portfolios, RosE-Portfolios requires a reflective piece to go along side the student's work.

Kalamazoo College also requires students to complete electronic portfolios[16]. "K portfolios" contain students' works and reflections[17]. These portfolios are a series of web pages stored in the students' e-mail account[18]. The series of web pages resembles a web page of a college; each page has to be linked, or else it will not be accessible[19]. Students must understand the relationships among the content in their portfolio in order to link the web pages together.

2.3. Assessment of portfolios

Portfolios have both strengths and weaknesses with respect to student assessment. Portfolios can be used to view learning and development overall, instead of in just one area. The reviewers and graders also gain from reviewing a student's portfolio, because they get to exchange and develop new ideas. Portfolios also increase students' interest in

participating in the assessment process. The drawbacks of using portfolios are that portfolio assessment is expensive in time and effort, it is hard to grade a portfolio, and storing a portfolio is a concern[20].

In order to assess portfolios, a plan must be created first. Creators of the portfolio system for the Chemical Engineering Department at Colorado School of Mines identified three primary goals that should be satisfied by the Chemical Engineering Department's educational program. These goals are linked to the ABET criteria I.C.3.a – I.C.3.k that lists some basic learning objectives the program must promote in its student in order to qualify for being accredited[21]. The first goal was to provide chemical engineering students a high quality education in chemical engineering fundamentals. The second goal was to develop the students' skills in applying their chemical engineering fundamental knowledge to analysis, synthesis, and evaluation of chemical engineering processes and systems. The third goal was to promote personal development in chemical engineering students to guarantee that the students will practice in a professional manner, and understand the ethical and societal responsibilities of being a chemical engineer. In order to judge whether the program was successful in having the students satisfied these three objectives, the planners must indicate what assignments would test these goals. The students whose work will be collected for portfolios are chosen at when the students enter Colorado School of Mines. After the students' work is collected, the reviewers have to decide if the evidence showed that the students accomplished the stated objectives. In order for the reviewers to judge the portfolios, rubrics describing how a score relates to the level of performance the student shows in the portfolio are required. Each year the assessment committee convenes to examine the language of the rubrics and to evaluate

the portfolios using the rubrics[22]. The information from the assessment and evaluation process is given to both the chemical engineering department students and faculty. This provides the faculty with feedback about the curriculum, in order for the courses to improve outcomes.

Lessons are learned from experimenters of portfolio assessment as time goes on. After going through the portfolio creation and assessment process, the Colorado School of Mines has learned from some mistakes. Collecting portfolio materials without clear objectives and an assessment process is not a good idea. A good lesson is to figure out what questions to ask and what will be analyzed, then collect the materials. Collect pieces that are most valuable in providing evidence that will improving the learning and teaching process, instead of collecting a mass of information that spans many learning objectives[23].

2.4. Rubrics

In order to assess portfolios, a rating scale must be generated. Rubrics are usually scales with well-worded levels specifying how a portfolio ranks. Different types of rubrics can be created.

Analytic rubrics are used when there are specific types of actions or responses to be measured. Each action or response should be reviewed one at a time, and assessed with a rating system that may not be consistent across different actions, but should be consistent under the same action. Analytic rubrics provide specific information about the student's strengths and weaknesses of a type of responses or actions. Each response or action can also include outcomes or other areas of interest. For example an analytical

rubric can be used to measure how a student's level of understanding in algebra, and which areas of algebra this student is strong in.

Holistic rubrics are used to assign a single score to a student overall. If the overall skill is what you are after, assess the student holistically to determine if the student has learned most if not all of the parts of the action. Holistic rubrics do not provide information in a particular area; rather they usually provide a scoring of general knowledge. For example an holistic rubric can be used to measure how a student's level of understanding in all subjects such as English, math, science, and other classes. The holistic rubric can be used to measure the student's overall knowledge of his or her classes.

2.5. WPI Projects Program

In the early 1970's, WPI introduced a new approach to undergraduate engineering education by creating the WPI Plan. One part of the WPI Plan consists of the Interactive Qualifying Project (IQP). The IQP component of the WPI plan is a project that is supposed to promote learning through actual project work, and allow students to demonstrate that they can not only complete classes satisfactorily but are also capable of completing work in a professional manner[24].

WPI's IQP requirement helps satisfy ABET's Engineering Criteria 2000. An IQP provides the student with an interdisciplinary viewpoint, allowing students to practice dealing with unstructured, open-ended, and interdisciplinary problems. Since IQPs are not major-specific, an IQP group can bring together students that come from different

backgrounds[25]. This creates an environment for students to interact and teach each other new skills.

Many IQPs completed off campus deal with environmental, societal or technological interactions that are easier to deal with when the student is in the affected geographical area[26]. Having students closer to the area of experimentation is a benefit to both their project and their cultural knowledge. Students are exposed to different areas of the world, and see the world from different perspectives.

3. Methodology

The objective of this IQP was to test whether or not it was possible to use portfolios to measure growth in certain areas that was normally not documented during an off-campus IQP. In order to test if portfolios were useful and feasible, three groups of three students completed portfolios during B term of 2000 at Washington D.C. The three groups of students were all advised by Professor Heinricher and were asked to complete portfolio entries as their project progressed. The students were given one assignment approximately every week with a total of five. Their advisor handed out the assignments, and the students were told the due date. The students were also told that their advisor would read their entries; however not grade them on their content. When the students completed their entries they were given back to Professor Heinricher. Professor Heinricher then placed group and student codes on each entry before the entries were provided for the use of this project, this way the students remained anonymous.

Of the five assignments, two topics were given at two different time points during the term and one topic given only once. The topics included teamwork, confidence, and the IQP objectives. In order to get students to write about their teamwork skills, the assignment had several guiding questions for the student to write about. The questions related to how the student interacted with the group, and how the group made its decisions, and also how the student believed that they could improve their group.

The confidence topic focused mainly on the student's handling of a discussion. The assignment asked the student to write about how they handled a discussion with either other members or their advisors and liaisons. Again the assignment asked what the student could do in the future to improve.

The IQP objectives assignment listed a few IQP objectives that came from a list given to the students before their IQP started, and allowed the student to either write about those shown or another goal that he or she wished to talk about. The assignment asks the student to write about how the student is progressing and plans to improve in the IQP objective that they selected. Some IQP goals focused upon are shown below:

- Strive to achieve as much balance possible between the technical and social humanistic aspects of the project topic.
- Demonstrate knowledge of the relevant literature and other background sources; evaluate this material critically and apply it appropriately to the project work.
- Take initiative: students should make the project their own, and pursue its completion independently.
- Work smoothly with each other and with advisors, meeting deadlines and conducting work in a timely fashion.
- Lead meetings with advisors and sponsors. It is your responsibility to make sure they are productive.

After the students completed their entries, the entries were reviewed using a generated rubric. This rubric contained goals and outcomes targeted by the assignments and minor adjustments were made by reading the student's entries. The rubric that was generated contained a numerical score and description of what that number should mean. The same rubric was used throughout the assignments, and the outcome received an NA if the assignment did not talk about the outcome. Since each of the assignments was

measured with the same rubric, change would be apparent by putting the assignment results next to each other in a chart.

4. Results and Discussion

The objective of this project was to determine if student portfolios could be logistically feasible and also able to document measurable growth in certain skills that should take place during the off-campus IQP experience. Some students completing their IQP off-campus at Washington DC during B term 2000 were asked by their advisor, but not required, to complete five assignments over a seven-week IQP. These students were given about one week for each assignment.

The original plan (Table 1) was that six assignments would be given. There would be three different topics and for each topic, two assignments would provide two different time points during the IQP to document growth. The original plan included the following assignments:

- Teamwork – Assignments 1, 4
- Meetings and student confidence levels – Assignments 2, 5
- IQP goals – Assignments 3, 6

Table 1: Original plan

10-18-2000	Assignment 1 (Teamwork) assigned
10-29-2000	Assignment 1 (Teamwork) due
10-30-2000	Assignment 2 (Meetings and student confidence levels) assigned
11-3-2000	Assignment 2 (Meetings and student confidence levels) due Assignment 3 (IQP goals) assigned
11-10-2000	Assignment 3 (IQP goals) due Assignment 4 (Teamwork) assigned
11-17-2000	Assignment 4 (Teamwork) due Assignment 5 (Meetings and student confidence levels) assigned
12-1-2000	Assignment 5 (Meetings and student confidence levels) due Assignment 6 (IQP goals) assigned
12-8-2000	Assignment 6 (IQP goals) due

The main focus of the first assignment was on teamwork skills. Four main areas were emphasized in teamwork skills: *meeting work content*, *meeting process*, *division and sharing of labor*, and *conflict resolution skills*. A brief list of questions that targeted these four areas was given with the assignment as a guide for the student to follow. The list included questions in the following areas:

Team dynamics

Descriptions and predictions of change

Suggestions for future improvement

The complete text of the first assignment is shown in Figure 1.

Figure 1: Assignment #1 given to students

Assigned: 10-18-2000
Due: 10-29-2000

Portfolio Assignment #1: How Does Your Team Grow?

One of the most important educational goals of the IQP is the development of the ability to work well in a team. I am asking you to take a little time to reflect on your abilities in this area. Are you better able to work on a team now than you were 7 weeks ago?

Write a few paragraphs (one or two pages) describing how your team worked together to prepare for the project in Washington. The following are some areas* to focus on:

- The current state of your team:
  - Does the team work well together?
  - Is everyone involved with the team?
  - Is your team productive?
  - Is the work divided fairly?
- How has your team changed over the *past* seven weeks?
- How do you expect your team to change over the *next* seven weeks?
- If you do not believe your team is ideal
  - How can it be better?
  - What could you do to change your team?
  - How will you go about changing your team?

Please have your entry ready when you arrive in Washington.

Note:

This is part of an IQP being done to study new ways to assess and improve the IQP. Only at WPI!

*** These are only guidelines; if you wish to expand on a certain category or add others of your own, do it!**

The second assignment focused on meeting discussions and communication with advisors. This assignment was intended to help the writer describe and examine an experience they had during a meeting, and how their confidence (or lack thereof) in a particular area manifested itself in an argument. The point of this topic was to have students discuss how their confidence level affected their ability to stand up even against their advisor in a meeting. A list of questions was given as a guideline to the student to steer the discussion into the area of interest. The following are some categories of guiding statements given with assignment two:

- Description of the event
- Outcome of event
- Suggestions for future improvement

The complete text of the second assignment is shown in Figure 2.

Figure 2: Assignment #2 given to students

Assigned: 10-30-2000
Due: 11-6-2000

Portfolio Assignment #2: Argue or Discuss?

One of the key steps in a good IQP occurs when the students take ownership of the project. That sounds good, but do you have any idea what that means? Your confidence in your knowledge of the project, and all of its aspects, is one measure of ownership and it should grow as the project progresses.

Write a few paragraphs describing your confidence level during an argument with an advisor or liaison or team member that has occurred either during the PQP or in Washington DC. The following are some guidelines* to help you.

- Describe your interaction with this person.
  - Who is the person?
  - What did you disagree about?
  - Did you have a good background on the material covered in the argument?
- Did the argument have a positive outcome?
  - Was there a winner in the argument? Was there a loser?
  - How did each person "handle" the argument?
- If you do not believe your argument was handled well:
  - How could it have been handled better?
  - What can you do to improve the outcome in similar situations in the future?

You can either e-mail your paragraphs to me or give me a disk on Monday.

*** Note: these are only guidelines. You can and should emphasize very different points in your discussion.**

The third assignment focused on IQP goals. The purpose of this assignment was to determine which IQP goals were actually being achieved by the students and to see if student portfolios would be able to document growth. An excerpt from the list of fourteen IQP goals given to the students during the PQP phase of the project was also given with the assignment. The following were some categories of guiding statements given with this assignment:

- Description of how you are progressing toward the goal
- Description of the steps you will take.
- Description of how this goal will be useful in the future.

The complete text of the third assignment is included in Figure 3.

Figure 3: Assignment #3 given to students

Assigned: 11-6-2000
Due: 11-13-2000

Portfolio Assignment #3: Choose your own Goal

There is a long list of educational goals for the IQP but not all goals are created equal (or achieved equally). Here are a few of the goals:

1. Achieve a balance between the technical and social/humanistic aspects of the project.
2. Develop knowledge of the relevant literature; evaluate this material and apply it appropriately to the project.
3. Take initiative: students should make the project their own, and pursue its completion independently.
4. Work effectively with advisors and sponsors: learn to lead meetings and to make sure they are productive.

Pick one of these four goals and write a few paragraphs describing how you are addressing it in your work on the IQP. Here are some of guidelines to get you started:

- Describe an event or piece of work that shows how you are progressing toward the goal.
    - If no such event exists, go on to the next point.
- Do you expect to make further progress toward the goal during the project?
    - Describe some specific steps you will take.
- Describe how achieving the goal may help you in the future.

You can either e-mail your paragraphs to me or give me a disk on Monday.

* Note: these are only guidelines. If you wish, you can and should emphasize very different points in your work.

The first goal is "achieve a balance between the technical and social/humanistic aspects of the project." This goal should get students to think about how their project is not too focused on either the technical or the humanistic side of things. Since most students doing their IQP are majoring in some technical field, thinking about how their project focuses on the social and humanistic side gives them a chance to look at their project from a different point of view.

Another IQP goal is "develop knowledge of the relevant literature; evaluate this material and apply it appropriately to the project." This IQP goal requires students to be able to gain an understanding of the project field, so that they can gain confidence in arguing in favor of their viewpoint.

The next IQP goal is "take initiative: students should make the project their own, and pursue its completion independently." This IQP goal makes the students think about the direction in which they wish to steer their project. The students can choose to go more in depth in particular areas of their project that they are especially interested in.

The last IQP goal is "work effectively with advisors and sponsors: learn to lead meetings and to make sure they are productive." This goal supports the previous goal, as the students should be the bosses of their own project, however they should also learn to critically evaluate and accept input from others.

4.1. Timing adjustments

As the term went on, it became clear that the students could not finish their entries as fast as expected, and a week was no longer sufficient time to complete these entries as finishing their IQP was their top priority. It was decided that one assignment needed to

be dropped. Since many of the students' entries focused on teamwork skills instead of meeting discussions in assignment 2, the second time point for this assignment would not be as useful as the second time point for team work and IQP goals topics. If students did write about their confidence level in their entry for the second time point for meeting discussions, it would not really be a second time point since the first time point did not get many responses about confidence levels. If students wrote about teamwork again, it would not be useful since assignment 1 and 4 already cover this. The plan (Table 2) now changed so that only the teamwork and IQP goal assignments had two time points.

Table 2: Actual plan

10-18-2000	Assignment 1 (Teamwork) assigned
10-29-2000	Assignment 1 (Teamwork) due
10-30-2000	Assignment 2 (Meetings and student confidence levels) assigned
11-6-2000	Assignment 2 (Meetings and student confidence levels) due Assignment 3 (IQP goals) assigned
11-10-2000	Assignment 4 (Teamwork) assigned
11-13-2000	Assignment 3 (IQP goals) due
11-17-2000	Assignment 4 (Teamwork) due
12-1-2000	Assignment 5 (IQP goals) assigned
12-8-2000	Assignment 5 (IQP goals) due

The fourth assignment, shown in Figure 4, was a repeat of the first, providing the second time point for teamwork. In the revised plan, the fifth assignment shown in Figure 5 focused on the IQP goals topic and was similar to the third assignment.

Figure 4: Assignment #4 given to students

Assigned: 11-10-2000
Due: 11-17-2000

Portfolio Assignment #4: How Does Your Team Grow?

One of the most important educational goals of the IQP is the development of the ability to work well in a team. I am asking you to take a little time to reflect on your abilities in this area. Are you better able to work on a team now than you were 7 weeks ago?

Write a few paragraphs (one or two pages) describing how your team worked together to prepare for the project in Washington. The following are some areas* to focus on:

- The current state of your team:
  - Does the team work well together?
  - Is everyone involved with the team?
  - Is your team productive?
  - Is the work divided fairly?
- How has your team changed since you have been in Washington?
- How do you expect your team to change in the remainder of this term?
- If you do not believe your team is ideal
  - How can it be better?
  - What could you do to change your team?
  - How will you go about changing your team?

* These are only guidelines; if you wish to expand on a certain category or add others of your own, do it!

Figure 5: Assignment #5 given to students

Assigned: 12-1-2000
Due: 12-8-2000

Assignment #5

In assignment #3, you selected one IQP expectation from the list below. If you believe that you have improved greatly in the same IQP expectation please focus on that goal. However, if you feel that there has not been very much change, please select an IQP expectation that you believe to be important.

1. Achieve a balance between the technical and social/humanistic aspects of the project.
2. Develop knowledge of the relevant literature; evaluate this material and apply it appropriately to the project.
3. Take initiative: students should make the project their own, and pursue its completion independently.
4. Work effectively with advisors and sponsors: learn to lead meetings and to make sure they are productive.

Write that expectation at the top of the page. Then write up to a page describing how you are currently addressing that expectation. The following are some areas to focus upon:

- Think of a recent (within the past week) event that shows how you are addressing this IQP project expectation.
    - Describe the event.
    - How does this event relate to your learning with respect to this project expectation?
- How can you improve your learning with respect to this project expectation?

Describe how achieving this project expectation may help you in the future.

4.2. Rubric development

After the assignments were returned, a rubric was developed so that the portfolio entries could be evaluated on a consistent scale and a numerical score given. The rubric was generated to quantify the skill in each areas of the author of the entry.

In order to generate a rubric, there are three stages to go through. When all the stages are completed, they form a hierarchical design with each goal having a number of outcomes, and each outcome having a number of performance measures. At the top of the hierarchy, each goal is a broad topic that is to be rated. As the hierarchy branches off into outcomes, the topic gets more precise. The performance measures are specific levels that have been achieved.

In order to form the goals, the general overriding topic of each assignment was used. The rubric allows the entries to be given a numerical score for each different outcome. For the first and fourth assignments, teamwork would be a good choice. The second assignment dealt with confidence level during meetings, so this would be a good goal. The third and fifth assignments dealt with IQP goals, and progress toward an IQP goal would be the last goal. In general, most of the students' entries for each of the five assignments dealt with teamwork whether or not the assignment's goal was teamwork. The goal for all the assignments then became teamwork, since this was the main theme in almost all the entries.

The second stage in rubric construction is to identify outcomes for each goal that has been decided upon. A wide selection of outcomes should be picked, and then later narrowed down. This allows brainstorming and less chance of an outcome being overlooked. Outcomes were generated from the guiding questions that were given with

each assignment. The outcomes that were not addressed in the entries were disregarded so that data analysis would be manageable. An example of this stage would be making an outcome from the question "Is the work divided fairly?" taken from the first assignment. The outcome that this guiding question suggests is the division and sharing of labor. The team skills goal and its outcomes are shown in Figure 6.

Figure 6: Outcomes that were measured in the team skills goal

Goal: Team Skills

Outcome: Meeting work content

Deals with the sharing of information, and whether the meetings contain useful discussion of ideas.

Outcome: Meeting process

Deals with whether everyone participates in the meetings. Also whether focus wanders from project, and whether members encourage others to voice their opinions or not.

Outcome: Division and sharing of labor

Deals with how work is shared within the team.

Outcome: Conflict resolution skills

Deals with how members deal with group problems; also deals with who is in charge all the time.

Outcome: Leadership

Deals with how this member takes charge of a discussions

Outcome: Communication with advisors

Deals with whether the member listens as well as voices his opinions to advisors.

Outcome: Fulfill responsibilities

Deals with whether this member is responsible to the group.

Outcome: Balance technical and social/humanistic aspects

Deals with the member's ability to keep the team's view on both technical and humanistic aspects of their project.

Outcome: Knowledge on project's field

Deals with this member's use of relevant literature knowledge for the team.

Outcome: Group agreement

Deals with the group's agreement in all the outcomes.

The third stage of forming a rubric is to generate performance measures. In order to form the performance measures, a three-point scale was used because more levels would make rating decisions difficult. On the scale, 1 denoted poor or lack of skill in the outcome, 2 denoted average skill in the outcome, and 3 denoted excellent skill in the outcome. For each outcome, a descriptive statement was written for each numerical level. The wording for each scale was generated and then revised by rereading the entries. Rereading the entries made sure that the scale worked and the entries could be rated with the scale. In the case that an entry didn't discuss certain outcomes an NA score would be given. This NA choice meant that the entry did not talk about the topic. In the example given before, the division and sharing of labor outcome required performance measures. These performance measures were created by wording descriptions of situations of lack of skill, average in skill, and excellent show of skill for the three-point scale. Shown below is how this outcome now looked:

Outcome: Division and sharing of labor
NA = Unable to tell from content of entry.
1 = No team member voluntarily accepts tasks, and at least one person may not be doing as much work as the rest of the group.
2 = Tasks are assigned randomly, but all members participates in doing the work.
3 = Work is assigned taking into account the strengths and weaknesses of the member related to the task.

The rubric that was generated and used to evaluate the student portfolios is shown in Figure 7.

Figure 7: Rubric used for rating entries

Goal: Team Skills

Outcome: Meeting work content

NA = Unable to tell from content of entry.

1 = Discussions waste time and the group generally does not spend time effectively in meetings.

2 = Discussions are not always on topic but sometimes helpful; but the group generally share data.

3 = Excellent sharing of information, and meetings contain useful discussion of ideas.

Outcome: Meeting process

NA = Unable to tell from content of entry.

1 = Not everyone is involved during meetings.

2 = Everyone participates in the meetings, sometimes focus wanders from project, one member may share opinions more often than others.

3 = Everyone participates in the meetings, are focused on the project, and encourages other members to share their thoughts.

Outcome: Division and sharing of labor

NA = Unable to tell from content of entry.

1 = No team member voluntarily accepts tasks, and at least one person may not be doing as much work as the rest of the group.

2 = Tasks are assigned randomly, but all members participates in doing the work.

3 = Work is assigned taking into account the strengths and weaknesses of the member related to the task.

Outcome: Conflict resolution skills

NA = Unable to tell from content of entry.

1 = Members have problems dealing with the group, and either can't find solutions to the problems, or their solutions are not used; members do not rotate roles.

2 = Members may come up with solutions to group problems, however do not implement them; members may not get to experience certain roles they want to.

3 = Members talk to each other about problems and their solutions and they also try to implement these solutions; also roles are rotated among group members.

Outcome: Leadership

NA = Unable to tell from content of entry.
1 = The author always waits for others to take charge.
2 = The author takes charge of a discussion with the group, however does not help the group take charge of a discussion with advisors.
3 = The author takes charge of a discussion with the group and helps the group take charge of a discussion with advisors.

Outcome: Communication with advisors

NA = Unable to tell from content of entry.
1 = 0 way communication between the group and advisors.
2 = 1 way communication, the group is only able to have effective communication in listening to the advisor or speaking to the advisor.
3 = 2 way communication, the group is both able to listen and speak to the advisor.

Outcome: Fulfill responsibilities

NA = Unable to tell from content of entry.
1 = The author is not reliable to partners, sponsors, advisors, and other team members.
2 = The author meets appointments or due dates most of the time.
3 = The author is fully responsible to partners, sponsors, advisors, and other team members.

Outcome: Balance technical and social/humanistic aspects

NA = Unable to tell from content of entry
1 = Member allowed the project either to be very focused on the technical details with very little consideration of the social parts or is very focused on the social parts of the project and leaves out the technical details.
2 = Member allowed the project to be slightly lopsided to one side.
3 = Member allowed the project to achieves a balance between the technical and social/humanistic aspects of the project.

Outcome: Knowledge on project's field

NA = Unable to tell from content of entry
1 = The author has very little knowledge about the project's field to use for the team.
2 = The author has gained a good sense of the project's field, however does not always help the team apply relevant literature appropriately to the project.
3 = The author developed knowledge of the relevant literature and aided the team in evaluating and applying it appropriately to the project.

Outcome: Group agreement

NA = Unable to tell from data; less than 2 people have values for this outcome.

1 = The highest value for this outcome in the group is a 3, and the lowest is a 1.

2 = The highest and lowest value for this outcome differ by 1, for example if the lowest score is 2, the highest is a 3.

3 = The highest and lowest value are the same; the group agreed.

4.3. Rubric usage

To form numerical results, the student's entries were read one at a time. For each entry, a score corresponding to the achieved performance measure was given. For example student A of group 2 received a 1 in "Meeting work content" for assignment #1 because the entry stated that "Productivity has been a little on the low side due to the mass amount of time we assigned to each group meeting procrastination is bad." While student A of group 4 received a 3 in "Meeting work content" for assignment #1 because the entry stated that "we felt more at ease to criticize each other, and in a more constructive manner."

The results of using the rubric on the student entries, which are shown in their entirety in appendix 4, were summarized in a chart. Two views were created, one was a "Results of the rubric used on the students' entries, shown by assignment" (Table 3) and the other was a "Results of the rubric used on the students' entries, shown by group" (Table 4). The charts show the different outcomes along with the score each assignment and student received.

In Table 3 each chart represents an assignment, and holds data for all the student's entries for an assignment. The first row of each chart shows the assignment number. The second row shows the group numbers. Each of the columns holds data from a different student entry. In each column, there is a student A, B, or C listed in the row labeled student. The row listed Group shows which group the student is in. Each column represents data from the use of the rubric on the student's entry. For example the first column of student data holds the results of the rubric on group 2's student A's entry for

assignment 1. If the student received an NA in a given outcome, the chart has a blank field.

Table 4 shows the same data as Table 3, but each chart represents the responses for all the assignments of a group. The first row of each chart shows the group number that these students were in. The next row shows which student's entries are below. In each column the responses are the results from after the rubric was used on the student's entries. Again if the student received an NA in a given outcome, the chart has a blank field.

In the "Results of the rubric used on the students' entries, shown by group" (Table 4) chart a "group agreement" field was added that showed how the students in the same group viewed their group. This "group agreement" field shows whether all the students in the group gave consistent reports about group dynamics. Since each member worked from the same assignment, if one member reports that the group is doing well with respect to a specific team skill, while another member reports that their group is doing poorly, group agreement would be low, meaning that there may be a problem of communication or perception. A cause for low group agreement could be a lack of communication, or maybe just that one member's standards were not as high as another's.

Table 3: Results of the rubric used on the students' entries, shown by assignment

Assignment:		1							
Group:		2			3		4		
Student:		A	B	C	B	C	A	B	C
Team skills:									
	Meeting work content	1	2	1		1	3		3
	Meeting process	3			1		3	2	2
	Division and sharing of labor	2		2	1	1	2		2
	Conflict resolution skills	3	2	3	1	1		2	
	Leadership		2	2	3	2	2		2
	Communication with advisors		2	2					
	Fulfill responsibilities								
	Balance technical and social/humanistic aspects								
	Knowledge on project's field								

Table 3: Results of the rubric used on the students' entries, shown by assignment (continued)

Assignment:		2							
Group:		2		3			4		
Student:		A	C	A	B	C	A	B	C
Team skills:									
	Meeting work content	2							
	Meeting process								
	Division and sharing of labor					1			
	Conflict resolution skills	2	3	3		1			2
	Leadership	2	2	2			3	3	2
	Communication with advisors		3				3	3	
	Fulfill responsibilities								
	Balance technical and social/humanistic aspects								
	Knowledge on project's field								

Table 3: Results of the rubric used on the students' entries, shown by assignment (continued)

Assignment:		3						
Group:		2			3		4	
Student:		A	B	C	A	B	C	B
Team skills:								
	Meeting work content							
	Meeting process	3						
	Division and sharing of labor				2			
	Conflict resolution skills	3						
	Leadership	2			3			
	Communication with advisors		2		3	2	2	
	Fulfill responsibilities							
	Balance technical and social/humanistic aspects							
	Knowledge on project's field		3	3				

Table 3: Results of the rubric used on the students' entries, shown by assignment (continued)

Assignment:		4			
Group:		2	3		
Student:		C	A	B	C
Team skills:					
	Meeting work content	2	3	1	
	Meeting process	3	3	1	
	Division and sharing of labor	3	2	1	1
	Conflict resolution skills	3	3	1	1
	Leadership	2	2	3	
	Communication with advisors	3		3	
	Fulfill responsibilities				
	Balance technical and social/humanistic aspects				
	Knowledge on project's field				

Table 4: Results of the rubric used on the students' entries, shown by group

Group:		2												
Student:		A			B		C				Agreement			
Assignment:		1	2	3	1	3	1	2	3	4	1	2	3	4
Team skills:														
	Meeting work content	1	2		2		1			2	2			
	Meeting process	3		3						3				
	Division and sharing of labor	2					2			3	3			
	Conflict resolution skills	3	2	3	2		3	3		3	2	2		
	Leadership		2	2	2		2	2		2	3	3		
	Communication with advisors				2	2	2	3		3	2			
	Fulfill responsibilities													
	Balance technical and social/humanistic aspects													
	Knowledge on project's field					3			3				3	

Table 4: Results of the rubric used on the students' entries, shown by group (continued)

Group:		3															
Student:		A			B				C				Agreement				
Assignment:		2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
Team skills:																	
	Meeting work content			3				1	1				1			1	
	Meeting process			3	1			1								1	
	Division and sharing of labor		2	2	1			1	1	1		1	3			2	
	Conflict resolution skills	3		3	1			1	1	1		1	3	1		1	
	Leadership	2	3	2	3			3	2				2			2	
	Communication with advisors		3				2	3			2				2		
	Fulfill responsibilities																
	Balance technical and social/humanistic aspects																
	Knowledge on project's field																

Table 4: Results of the rubric used on the students' entries, shown by group (continued)

Group:		4									
Student:		A		B			C		Agreement		
Assignment:		1	2	1	2	3	1	2	1	2	3
Team skills:											
	Meeting work content	3					3		3		
	Meeting process	3		2			2		2		
	Division and sharing of labor	2					2		3		
	Conflict resolution skills			2				2			
	Leadership	2	3		3		2	2	3	2	
	Communication with advisors		3		3					3	
	Fulfill responsibilities										
	Balance technical and social/humanistic aspects										
	Knowledge on project's field										

4.4. Feasibility for students

One of the objectives of this project was to see if the implementation of student portfolios during an off campus IQP was feasible. At the end of the IQP, the students were asked to fill out final questionnaire. There were two different versions of the final questionnaire, one version (appendix 1) to be given to students that had completed all the assignments, and one version (appendix 2) to be given to students who had not completed all the assignments. The version given to the students that did not complete the assignments asked why the student didn't complete the assignments. Since none of the students completed all the assignments, only the version shown in appendix 2 was given. Of the nine questionnaires given, four were returned and a summary of their responses is included in appendix 3. These four final questionnaires that were returned stated that each assignment took about an hour to do. They also reported that they barely had time to finish the last few assignments because of they were working on their IQP too. Also the students that returned the questionnaires stated that they did not find the student portfolios helpful. The students may need to be told more about how self-reflective essays work in the future.

In the results of the rubric used on the student's entries charts (Tables 3 and 4) it can be seen that none of the students completed assignment five. In the final questionnaire two students said that they were doing their IQP instead of doing these assignments. Given all this information, it appears that six assignments given one per week, covering the span of the students' IQP, is not feasible. Even five assignments given over seven weeks was a challenge. One way of allowing the students more time to complete the assignments would be to extend the span of the assignments, and begin

assigning the assignments during their PQP phase. Having fourteen weeks would allow students much more leeway in completing the assignments.

4.5. Feasibility for faculty

Having the students complete all these assignments would be useless without having someone process these entries. The advisor for these three groups was Professor Heinricher. He also read through the students' entries. Professor Heinricher did not use these entries for grading purposes; however he found them useful in understanding progress and spotting developing problems. Having the advisor read through the entries was successful and not overly time consuming. However, this time around the advisor did not produce the scoring, and this job must be done in order to produce results such as Tables 3 and 4. Reading and scoring all the entries would not be an impossible task, and could even be done by someone on campus such as a PLA or a grad student. This person could be hired especially for this job or could be the advisor, or the staff that reviews IQPs. Reading and scoring these entries should not take very much time once the rubric has been set up and the evaluators understand the scales. It would take approximately five to ten minutes per student entry. The number of off-campus IQPs done per year is approximately 60% of 600 juniors, which means around 360 students per year. If student portfolios are done for all off-campus IQPs and an even number of students go off-campus each term (A-E), then approximately 72 students complete entries each term. If students complete five assignments, the scoring of all the entries per term would take approximately 30-60 hours.

4.6. Measurable growth

Extending the time span of the assignments and increasing the number of time points would increase the chances of documenting measurable growth in teamwork skills. The time points for this experiment may have been too close together, as the data tables at different time points (Table 4) showed that the students' teamwork skills did not change much. Table 4 shows that the only students to show measurable growth were student C of group 2 in the division and sharing of labor and student A of group 4 in the area of leadership.

4.7. Summary of Results

Three groups of three students totaling nine students that were completing off campus IQPs in Washington B term 2000 were asked to complete portfolios entries. These students were assigned 5 assignments. The students' entries are shown in their entirety in appendix 4. The rubric was generated using the assignments and by reading the returned entries made minor adjustments. Tables 3 and 4 show the results of the rubric on the student's entries. Tables 3 and 4 also show that this rubric is able to produce numerical results.

In order to attempt to see if the numerical results listed in tables 3 and 4, then groups' advisor, Professor Heinricher, was asked how each team was doing. Professor Heinricher stated "Team 2 seemed to have significant problems working as a real team during the preparation phase of the project (A term at WPI). This group worked hard, starting in A term and continuing through the term in Washington, to overcome these difficulties." Table 4 shows that overall the students in group 2 did show an average or

excellent display of skill in their entries. Professor Heinricher stated "During their time in Washington, Team 3 had the most significant problems with teamwork of any of the groups. One member of the team was the clear "leader" and the most interested and engaged in the project. The other two members, while willing to work on the project, were never involved to the same level. This team had the additional challenge of working on the most technically demanding project of all nine groups in Washington. This fact placed significant additional stress on this group." Table 4 shows that student A believed that his or her team skills was excellent, however the other two students reported that they did not believe in the same thing. For group 4, Professor Heinricher stated "Team 4 seemed to work very well together, from the start of the project in A term through the work in Washington." Each student in group 4 seem to believe that they had average to excellent team skills. With the results of Table 4 and Professor Heinricher's perspective on the groups, it seems that the rubric is able to measure if the group is doing well or if the group is doing poorly.

5. Conclusions and Recommendations

The results of this project show that the use of student portfolios during an off campus IQP is feasible. Table 3 and Table 4 shows that the rubric is able to document certain numerical values that seem to correlate to levels of skills in teamwork areas for students, however it was not able to document growth in these areas. However with some improvements next time the process can work much better.

The process of using student portfolio on students completing off-campus IQPs can be improved. There were several different problems that occurred pertaining to the timing of when the assignments were given.

5.1. Timing related recommendations

The reason for students not completing the last assignment was different from the reason of students who did not complete many of the other assignments. Students wrote in the final questionnaire that the assignments were given too close to the end of the students' IQP, which was a very busy time for them. This problem could be fixed by not assigning assignments near the end of the term. This however creates an even smaller time span, five to six weeks instead of the previous seven.

If the assignments were spread out between the PQP phase and the actual off-campus IQP, there would be around thirteen to fourteen weeks. This would allow for more time points to get a better measure of students' growth in the targeted areas. This also alleviates the problem of the smaller time span that would be caused if assignments were not given to the students during the last week or two of their IQP.

5.2. Requirement related recommendations

As noted in the results and discussion section, certain students did not submit entries and none of the students submitted all five completed entries. In order to avoid this problem, several different options could be used. In order to produce more useful results, students may be either required to complete these assignments, or be very highly encouraged. This would produce more student entries and allow for more complete data.

5.3. Focus related recommendations

A more narrow focus for the assignments may also be a good idea. Many students' submitted entries concerning teamwork, whether the assignment was originally intended for it or not. There are two options to solve this problem. The first is to narrow down the topics being assigned. Since many students did answer with teamwork related responses, it seems that teamwork may be a good area to focus on. The second option is to reword the assignments so as to try to get more on-topic responses.

The rubric used may be modified as was done in the rubric development process if the advisor or students provide feedback. If assignments dealing only with teamwork were assigned, a rubric similar to the one used this time around could be used again with a few modifications. A sample of a modified rubric is shown in Figure 8.

Figure 8: Suggested rubric for rating teamwork (removed text marked by text strike through and additions marked by italics)

Goal: Team Skills

Outcome: Meeting work content

NA = Unable to tell from content of entry.

1 = Discussions waste time and the group generally does not spend time effectively in meetings.

2 = Discussions are not always on topic but sometimes helpful; but the group generally share data.

3 = Excellent sharing of information, and meetings contain useful discussion of ideas.

Outcome: Meeting process

NA = Unable to tell from content of entry.

1 = Not everyone is involved during meetings.

2 = Everyone participates in the meetings, sometimes focus wanders from project, one member may share opinions more often than others.

3 = Everyone participates in the meetings, are focused on the project, and encourages other members to share their thoughts.

Outcome: Division and sharing of labor

NA = Unable to tell from content of entry.

1 = No team member voluntarily accepts tasks, and at least one person may not be doing as much work as the rest of the group.

2 = Tasks are assigned randomly, but all members participates in doing the work.

3 = Work is assigned taking into account the strengths and weaknesses of the member related to the task.

Outcome: Conflict resolution skills

NA = Unable to tell from content of entry.

1 = Members have problems dealing with the group, and either can't find solutions to the problems, or their solutions are not used~~; members do not rotate roles~~.

2 = Members may come up with solutions to group problems, however do not implement them~~; members may not get to experience certain roles they want to~~.

3 = Members talk to each other about problems and their solutions and they also try to implement these solutions~~; also roles are rotated among group members~~.

Outcome: *Role rotation*

NA = Unable to tell from content of entry.

1 = Members do not rotate roles.

2 = Members rotate roles, however they may not get to experience certain roles they want to.

3 = Members rotate roles among group members, so all members get a chance to experience all roles they want to.

Outcome: Leadership

NA = Unable to tell from content of entry.

1 = The author always waits for others to take charge.

2 = The author takes charge of a discussion with the group, however does not help the group take charge of a discussion with advisors.

3 = The author takes charge of a discussion with the group and helps the group take charge of a discussion with advisors.

Outcome: Communication with advisors

NA = Unable to tell from content of entry.

1 = 0 way communication between the group and advisors.

2 = 1 way communication, the group is only able to have effective communication in listening to the advisor or speaking to the advisor.

3 = 2 way communication, the group is both able to listen and speak to the advisor.

Outcome: Fulfill responsibilities

NA = Unable to tell from content of entry.

1 = The author is not reliable to partners, sponsors, advisors, and other team members.

2 = The author meets appointments or due dates most of the time.

3 = The author is fully responsible to partners, sponsors, advisors, and other team members.

~~**Outcome:** Balance technical and social/humanistic aspects~~

~~NA = Unable to tell from content of entry~~

~~1 = Member allowed the project either to be very focused on the technical details with very little consideration of the social parts or is very focused on the social parts of the project and leaves out the technical details.~~

~~2 = Member allowed the project to be slightly lopsided to one side.~~

~~3 = Member allowed the project to achieves a balance between the technical and social/humanistic aspects of the project.~~

~~**Outcome:** Knowledge on project's field~~

~~NA = Unable to tell from content of entry~~
~~1 = The author has very little knowledge about the project's field to use for the team.~~
~~2 = The author has gained a good sense of the project's field, however does not always help the team apply relevant literature appropriately to the project.~~
~~3 = The author developed knowledge of the relevant literature and aided the team in evaluating and applying it appropriately to the project.~~

Outcome: Group agreement

NA = Unable to tell from data; less than 2 people have values for this outcome.
1 = The highest value for this outcome in the group is a 3, and the lowest is a 1.
2 = The highest and lowest value for this outcome differ by 1, for example if the lowest score is 2, the highest is a 3.
3 = The highest and lowest value are the same; the group agreed.

If these recommendations are taken into account when doing this project next time, the results should be much better. The student portfolios are able to document skill in an outcome, and were feasible.

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Appendix 1: Final Portfolio Questionnaire given to students that completed all the entries

We would like to understand how students viewed the portfolio assignments. Your responses will be kept confidential in the same manner as your portfolio entries. Please circle the number that is closest to what you feel is true.

1. How much time did you spend working on the portfolio assignments?

Very little	-	1
A few hours total	-	2
A few hours per week	-	3

2. How did you feel about the amount of time spent on the portfolio assignments?

Too little	-	1
About right	-	2
Too much	-	3

3. How helpful to your learning do you believe completing these portfolios was?

Not helpful, no point in doing them	-	1
Somewhat helpful	-	2
Very helpful	-	3

4. Do you believe that the portfolio assignments were assigned too close together?

Not enough time	-	1
Enough time	-	2
Plenty of time in between	-	3

Do you have any other comments or suggestions on specific assignments or on the portfolios as a whole?

Appendix 2: Final Portfolio Questionnaire given to students that did not complete all the entries

Name_____

This form is used to try to get a better understanding of how students felt about the portfolio assignments. Your responses will be kept confidential in the same manner as your portfolio entries.

1. How much time did you spend working on these portfolio assignments?

Very little - 1

A few hours total - 2

A few hours per week - 3

2. How helpful to your learning do you believe completing these portfolios were?

Not helpful, no point in doing them - 1

Very little - 2

Very helpful, but no time to do them - 3

3. What were the main reasons that you didn't complete the portfolio assignments?

_____

_____

_____

_____

Please use the back of the form for any additional comments you have regarding the portfolio experiment.

Thanks!

Appendix 3: Summary of Responses to the final questionnaire

Final Portfolio Questionnaire

Name_____

This form is used to try to get a better understanding of how students felt about the portfolio assignments. Your responses will be kept confidential in the same manner as your portfolio entries.

1. How much time did you spend working on these portfolio assignments?

Very little	-	1	
About one hour	-	2	4 of 4 people responded with a 2
A few hours per week	-	3	

2. How helpful to your learning do you believe completing these portfolios were?

Not helpful, no point in doing them	-	1	2 of 4 people responded with a 1
Somewhat helpful	-	2	2 of 4 people responded with a 2
Very helpful	-	3	

One person that responded with a 1 commented "There was some satisfaction to doing them"

3. What were the main reasons that you didn't complete the portfolio assignments?

- Too busy doing my IQP work. Sorry! Think about the Social Exchange Theory + Total Design Method: What are my benefits: NONE What are my costs: Time, effort……. Good Luck!
- I thought I completed them.
- Too much work especially when trying to complete an IQP of our own.
- I believe I did hand all of them in but not on time. I would just forget about them

Please use the back of the form for any additional comments you have regarding the portfolio experiment.

Thanks!

Appendix 4: Portfolio Entries

Appendix 4.1. Assignment #1 Group 2, student A

Our team will be working for the Research Evaluation and Communication (REC), which is a division within the National Science Foundation (NSF). My partners are ######### and #########.

The preparation work for our project was one with many obstacles, but as a team, we accomplished it with success. I'd be lying if I said that my team is perfect, because it's not. Then again, nothing is perfect. It's the imperfections that make us so unique. The current state of my team is one filled with friendship. We get alone with each other very well; RESPECT would be a good word to describe our relationships. Everyone is involved with the team. Whenever there was a team meeting, all three of us would be at the meeting place on time and really to work. Productivity has been a little on the low side due to the mass amount of time we assigned to each group meeting procrastination is bad). Also, during the first few weeks, it took quite a bit of time for us to really understand what our project was about and for everyone to be able to explain the topic everyone else. But after the initial struggle, we were able to do a lot more in the same amount of time. The work has been divided fairly equal. All of us had parts in the background information where we had to research and summarize. But we later realized that some of the parts had more sub-parts than others. To correct this, whomever had the "shorter" part had to help out the member with the "longer" part after his/her part was completed.

Our team has changed dramatically during the past seven weeks. We understand each other a lot better now and have grow used to the company. There was a focus group conducted within our group during the hardest time, when the term "Group Dynamic Problem" was used to describe our team. This focus group really helped us, I believe, it brought us closer as a group than ever before. During the session, we discussed our cultural and racial backgrounds, and also our views on how the group is doing and what each member needed to do in order for everyone else to see us more as a

Collective. I am positive that the group is going to go through another stage of change over the next seven week because of the close living arrangements and the lack of friend/family influences. Since there are no classes other than the IQP, we will be able to work more efficiently as a group.

Like I said before, I don't think we have a perfect group; it's far from perfect. The biggest weakness that is present in our group right now is the fact all three of us have VERY DIFFERENT writing styles due to that our native languages were not English but rather, Chinese, Russian and Spanish. Nevertheless, the write has been improving. It will improve even further when we actually have the time to carefully read over what we have written (all three of us). We should do the writing in parallel like before, but proof read it individually and bring in our own corrections on what the other two wrote. Corrections from the advisors are welcome, in fact, very welcome. We have to stop procrastinate and use the time we have wisely. And if we can think as one, then there is no reason why we cannot do a kick-ass project and get an "A" as the final grade.

Appendix 4.2. Assignment #1 Group 2, student B

I am a member of the Washington, DC team that is working on a project at Research, Evaluation, and Communication (REC) division of the National Science Foundation (NSF). The goal of our project is to survey Western European organizations and pro-grams that perform or sponsor research on learning and education. REC is interested in a ways these organizations can work together with REC's new Research On Learning and Education (ROLE) Program. Other members of our team are ########## and ##########.

When we started our PQP we were told that one of the objectives of PQP is to improve our team dynamics. This turned out to be not as straightforward as I initially thought. One week into the project we had to submit the first draft of the background chapter. None of us had a clear understanding of what our project was. Complex organizational hierarchy and the language of the project description were the major contributers to our confusion. Conversation with our liaison have helped significantly, nevertheless we were still confused about what is the background for our project: is it education research, or is it information on international collaboration. At this stage we already had three common team dynamics problems:

• Different members had different (sometimes almost opposite) understanding of the project

• Meetings were ineffective. Although all members were always present and were active, idle brainstorming and procrastination were not uncommon.

• Meetings were hard to schedule due to high load on some members of the team in other classes.

• I subconsciously assumed the responsibility for the project and paid little attention to the progress and participation of other team members. After talking to our advisors, we decided to organize a few meetings dedicated to the discussion and improvement of our team dynamics. One of our advisors, Professor Hein-richer, helped to bring all the members to more or less common understanding of the project goals. All team members now were letting others know about their actions that can be harmful to the team. Personally, I had to try to keep everyone on track and to distribute workload

fairly. I was and still am watching out for my tendency to look down on the opinions that do not make sense to me. After some practice we achived significant improvement. Nevertheless, our writing was not up to the expected level, since none of us were/are good writers. We came from rather different backgrounds and cultures. For each member of the team the first language was not English.

Appendix 4.3. Assignment #1 Group 2, student C

I was chosen to go to D.C. for my group project, along with two other people that I did not know. ######### had some difficulties. First, we all have different personalities/characteristics. We have a person who is very vocal, semi vocal, and one who is quiet. Second, we write papers differently, hence we need to become unified, in terms of our writing skills. Thirdly, we had different schedules, so we needed to adjust our time so that we could work together. These were problems in the beginning, but we worked through them.

In the beginning of the term we were struggling to work together. We didn't get over these problems until the third week. After that, we began to work well with each other. In the start, everyone was involved and the work was divided fairly. The main thing after we started to work well with each other was how productive we were. Our weakness was that our writing skills are poor, so we needed help on how to write our paper, along with getting advise on what to write on the paper. At the end, we finished the paper better than we.

For the next seven weeks, we will improve. The reason why is because we won't have any other classes to take and we know each other better. We also will improve because our communication skills are improving. I can help by speaking more and voicing my opinion verses just going along with my partners. We also need to communicate with our advisors, so that we are on the same page as them. I believe that this term will be better than our last term.

Appendix 4.4. Assignment #1 Group 3, student B

Group dynamics has been an integral part of our project development. From the start there were problems in defining the project. This only increased the problem that was occurring between the members of our group.

With three people in the project group, it is essential that all members of our group be involved at the same level with the same goal in mind. This became a problem when we encountered it. I became the leader almost immediately. This included speaking to our advisors, to our liaison, and planning group meetings. Another member of our group was willing to do work but was reluctant to do anything extra. He took the project much less seriously from the start and was less willing to present (or maybe develop) his own thoughts. The third member of our group was also willing to do work, and tried to present his own ideas. This became a problem when his ideas were not in line with the project goals and his work was unfinished and less than acceptable for presentation to anyone.

Our group began to severely change once the middle of the third week came around. The group member who was reluctant to take the project seriously became very involved in the project. I think the realization of where we were in the project became apparent to him and began to almost scare him. This was worsened by the third partners inability to comprehend the actual project and his inability to produce a finished product.

The partner that began to change and I was writing the entire paper. The only tasks that could be performed by the third partner were menial tasks. He could copy and do tasks that didn't make him put in his ideas about the project into his work. If I needed him to do anything, I would go through step by step what I would need him to do.

The project came together through the effort of I an the second partner, with virtually all work that was done by the third partner having to be redone by I and the other partner.

In order to change this I have talked to each of my partners about what the difficulties I am seeing in our performance is. This has been able to help many aspects of our team. The only difficulties that still remain are the previously mentioned problems of

the third parents misunderstandings. The only way that I see I can deal with this from now on is on a case to case basis as I have had to in the past.

Overall, I am unhappy with the situation, but have to accept and deal with it as I have done for the last seven weeks. I feel I have exercised all alternatives to this situation and now must accept what I have to do and deal with..

Appendix 4.5. Assignment #1 Group 3, student C

In preparation for going to Washington, all groups were faced with writing a proposal based on the guidelines of their project. The proposal was to include a background to the problem and methods as to how the group was going to solve their problem. The proposal had to be competently put together and organized in order for people to know exactly what we were trying to accomplish. This would involve a group understanding and effort.

At the beginning of the PQP our group struggled to grasp the objectives and goals of our project. We were really lost and it took us longer than all the other groups to make significant progress in collecting information and writing the actual parts of the proposal. Once we got things straight, we were able to make better progress, but the work did not seem evenly distributed. The three of us would meet and not much would get done at these meetings. Things we said we were going to do on our own time were completed, but putting the information together was difficult. Passages written by one member of the group had to be constantly revised and done over. It was as if only two were doing the writing. This was discouraging and made things more time consuming and difficult.

As the term moved along our group was making progress slowly. Our literature review was thrown out and our methodology was completely rearranged. Everyone was involved in some aspect of this, but the actual writing fell on two of the members. The other mainly looked up things on the Internet and searched for more areas relative to the project. This is one of the ways our group improved. We realized that two of us had to do research as well as writing so we had the other just concentrate on research. Most tasks required us to help him get going, but he tried hard. The amount of work he was trying to get done was good, but the quality of it could have been better.

Over the seven-week span in Washington D.C., we hope to adapt to situations like these faster. We will have to find ways for the work to get done evenly, but more importantly done thoroughly. Also, we will have to have each of the members do what they are good at. If one cannot write well, then we will have to find other things for him

to do that will make a positive impact on the group and the project. This is an issue that will be dealt with immediately upon arrival in Washington D.C.

Appendix 4.6. Assignment #1 Group 4, student A

Group dynamics are the key to success in the pre-qualifying project. If one member in the group is not in sync with the rest of the group, problems will arise immediately. Team members working together, however, will result in a very well done project.

The team for my PQP was fortunate enough to start off with very good group dynamics. From the beginning of the project, work was done equally by all members. With the exception of the literature review, each and every aspect of the proposal was written with all three members present. The literature review was broken up into equal parts, each of us writing a section. Afterwards, each part was reviewed by all three members so that we could all critique what was written. While conflicts arouse on occasion, there was always some common ground that could be reached.

Throughout the course of the PQP, the only change that may have occurred was that we became more comfortable with each other. This was a benefit to the team because we felt more at ease to criticize each other, and in a more constructive manner. Ideally, this level of comfort will continue to increase throughout the course of our IQP allowing us to criticize each other without offending one another. After these seven weeks, we will be the only ones who can control the outcome our project. Effective group dynamics will help our final project to be as successful as we want it to be.

Appendix 4.7. Assignment #1 Group 4, student B

Currently my team works well together as a team. We have learned how to argue points well and come to a conclusion without offending one another. Everyone is a productive member of the team; there isn't one person who does the most work. We divided the lit review into three parts, so each member wrote one part.

My team hasn't changed much over the past 7 weeks. We worked well together from the start. The major point of change was that we grew to know each other's capabilities, and when we met, we would know at the start of a meeting what would happen before we began.

Over the next 7 weeks I think it will be a little more difficult towards the end. People tend to get more edgy when a deadline is close in front of them. We will have to learn better how to deal with each other's conflicts and disagreements.

I feel fortunate to be a member of this team because we work well together. I don't think that any team can be ideal; people almost always disagree about something. The best teams just find a way to work out the disagreements positively. One of the most useful things we learned about in ID 2050 was that people have different ways of dealing with conflicts. Understanding that the people of my group deal with conflicts in different ways will help when confronted with a major problem.

Appendix 4.8. Assignment #1 Group 4, student C

I believe that the biggest advantage that our group had this project was our group dynamics. From the moment we had our first meeting, we knew that we would get along well. We were laughing and joking as well as getting work done. In our group it seemed that everybody was trying to contribute and was able to do so. We all put in ideas and voted upon them as a group. I feel that our team was very productive. Since we worked so well together, every idea was discussed thoroughly to determine if it was good. We would argue over it until everybody felt satisfied. However, in some cases this did affect our productivity because we would end up arguing over little things for several minutes. Many of the things we wrote were written completely as a group, however, when it was possible, work was divided up evenly.

I don't feel that our group changed very much over the last few weeks. From the moment we started we knew that we would have to pull together and get work done and that's what we did. I don't foresee many changes in the coming weeks. We have been strong as a team and I hope that this will continue.

I do not feel that any team is ideal. I feel that our team needs a little work on listening completely to each other's ideas. There were sometimes when we would be arguing a point and one of us would play the role of the placater and would give in. I think it will be beneficial if for the next seven weeks our team ensures that everybody is in full agreement. This can only lead to improved results.

Appendix 4.9. Assignment #2 Group 2, student A

To argue or not to argue, that is the question Ever since I could remember, I was taught to listen to everything people have to say. After the person is done talking, that's when you express your opinions. I truly believe that everyone deserves a chance to express him or herself, and I respect that. Even though I do not find an argument as amusing as some people, I could still hold my own. To me, an argument is the last resort. It should only be used after everything else fails and not before.

I really can't recall an instance when an argument was needed in order to prove my point, so here's a hypothetical situation to show what I would have said and done during the argument.

The person whom I might have had the argument could be #########. The reason for the argument might be whether or not to use LaTex as the word processor. The reason why I would not like to use LaTex is simply because I do not know how to use it. It's true that the program allows the user to format the document to exactly what he or she wants but I don't know the commands to do that. I had a good quite a few of reasons to back up my arguments. First off, what is LaTex? Where's the GUI I've gotten so accustomed to? Why should ######### and I use a program that we have never even seen or heard of before?

There would not be a winner in this argument, but rather both sides would win. The key here is to compromise. ######### and I would still use Microsoft Word as our word processor. After all the typing is done, everything would be converted into LaTex, and be formatted into the professional looking document that we want. Every one handled the situation with grace and respect. There would not be any fist in the air nor will there be bloodstain on the carpet. Each side gives their view first, and then comment on what the other had just said.

I believe I am a good handler of arguments because I do not always assume my opinion is 100% right; maybe 99.9%. That gives me room to listen to what others have to say without getting frustrated and a better chance of resolve the problem.

Appendix 4.10. Assignment #2 Group 2, student C

One of the main arguments among the group and our advisors is that we have poor group dynamics. This disagreement have gone on for almost the whole term. It did not get solved until five weeks into the term.

#########, #########, and I are different. ######### is quiet, but he gets his work done. ######### like to argue with everyone one, including the advisors. I don't mind to argue, but when small arguments were going no where, I would shut my mouth and go along with the person arguing, mainly #########. The things that the team would argue over would be small things, like how to word a sentence, or if something should be worded in the paper or not. The arguments that I was getting into seemed to be pointless. I did want to get the paper finished; I also had two other classes to study for. The more, deeper into the term, the more I found myself going along with ######### and ######### once an arguments begins. This went on for about three weeks. Even though we were different, we did get our work done together.

Later, we got our midterm reports, and it said that our group dynamics was poor. We tried to fix that immediately after we received the reports. ######### agreed that he would speak more. ######### agreed that he would argue less with everyone, and I agreed that I would argue my point, because it could be good for the paper. We didn't think that our group dynamics was bad, but making this agreement made our group stronger.

Towards the end of the term, we were still getting the same feed back form our advisors. They actually sent us an email that said that if we did not work well together and pass in all our stuff, we would get an NR. This email discouraged the whole team. We did not understand because we knew that we were getting along well, we got a C+ on our midterm report, and we averaged a B in the class. My partners did not even feel like taking the midterm test. Their attitudes were, if we did pass the PQP, we would probably fail or get a C in D.C. I wanted to encourage them and guarantee that we will pass, and probably get a B, because we have been improving.

After this email, we had a meeting with our advisors. We found out that the problem was not our group dynamics anymore, but a lack of communication between the advisors and the team. They said that ######### was quiet, the thought there was tension between #########, and me and they felt like ######### wrote the whole paper. We had to tell them that we had no problems with each other. We actually sit down together and write the parts of the paper together. They then realize that they said that our writing was poor, so they thought that we did not agree on things in the paper, but we did. Our advisors also felt that they gave us advice, but we just ignored them. We had three different corrections, so we tried to correct the paper the best way that we could. We also felt that this was our paper, so we decided what we wanted to put in the paper or didn't want to put. We were told that we could do whatever that we wanted, just as long as we argued our point (######### did that pretty well). We did what we thought was right, and when we got corrections it seemed that we just had to accept it without questioning it.

There were no winners or losers in this misunderstanding. It could have been better if we discussed this within the first two weeks of the term verses the last two weeks. We are doing better this term.

Appendix 4.11. Assignment #2 Group 3, student A

One afternoon while working on the project, I finished typing up a section of the literature review, and I decided to have someone review it to see if any corrections were necessary. So I asked #########, since he was the only other person there at the moment.

He thought the entire section was bad. He didn't understand anything I wrote. So I tried to explain every sentence to him. Apparently, what I thought was clear and understandable seemed like jargon to him. I asked him exactly what was wrong with it, and he said it wasn't organized well and the sentences jump from one idea to another. He even read one my sentences aloud and it sounded fine to me. For example, "The data chosen to evaluate research and development trends require careful selection because there are factors that could cause some unforeseen difficulties" is a completely understandable sentence to me, but my team member had difficulties with it. Then I realized that my train of thought is very differently from his.

I didn't really want to argue over what I think is right because I wanted everyone to be able to understand my writing. He just kept criticizing my sentences and the overall organization of the paper, and I thought that maybe my writing does need some work. So I asked him what type of corrections did I need to make. He gave some suggestions and everything was resolved.

There really wasn't much of an argument because I really didn't try to defend my view. I tried to see things from his point of view and I thought that maybe I did need to work on my writing. So because of this there was no clear winner or loser. We both benefited from this conflict. He won with his arguments, and I learned something about my writing and how to improve on my section of the literature review.

Appendix 4.12. Assignment #2 Group 3, student B

Grasp of Project

I definitely feel like as soon as we got down here I had a definite explosion in terms of my knowledge of the project. I was very blind up in Worcester. It became much more clear once down here, what our role was. Some of the problems that we are having in terms of taking ownership, are advisors who don't really grasp the aspects of our project. This is through no fault of the advisor. I believe this comes from the fact that while we are in the office, every conversation and little meeting you have helps you to really grasp what people are looking for. I feel that this grasp cannot be gotten without constant exposure to the project.

Confidence Level

The confidence level I have with this project is extremely high. I feel that I know what they want. My confidence level drops when the one who I am talking with does not realize the amount of effort being exerted. That gets me very frustrated, and I withdraw from trying to argue my point, because there is no way to change that mindset with a conversation, and therefore becomes pointless for me to continue. I as a student realize how powerless I am if I am unable to influence the professor's thoughts.

My confidence in dealing with the project comes from the fact that I know more of what is going on down here and I know of the research I have done. The professors could not possible have done the research I have done and put in the same amount of effort I have. This is where my confidence level comes from when talking about the project.

Arguments

Learning how to deal with group dynamics is or should be basic knowledge of any management major. So at this point I really have no answer to this question in terms of the group because we have had no real problematic arguments. Here's something though.

Arguments haven't really been a problem. I tend to pick my fights carefully. If the setting is right for an heated, nonproductive argument and differences of

opinions come up, the usual way that I deal with it is to say to everyone that they write what they think they should write. Then next time we meet we will have an argument about it that is productive in the right settings. Most of the time when everyone is fresh and we first meet is when the arguments result in the best outcome. Arguments towards the end of a meeting tend to be unproductive and people just go home mad. That is all.

Appendix 4.13. Assignment #2 Group 3, student C

Over the course of the PQP and through the IQP so far, I have not had any huge arguments. If there were any disagreements within our group, we did not talk about them. I think that the three in our group kept most things to themselves. This was because our group was having a tough time with the project as it was and we did not need any more distractions. As a group we just dealt with it and tried our best to complete the project.

In our group, there seemed to be one person who was the weak link. Myself and the other member of the group would talk about what we could do to help this third member make a better contribution. Of the things we discussed, we did not actually do anything. We told our advisors what was happening, but this situation is out of their hands. They suggested that we visit the group counselor, but that did not accomplish anything either.

The bottom line is that our third member could not write complete passages, which we could include into our project proposal. After reading things he wrote, I was confused and not sure what he was trying to do. Sentence placement did not make sense and there was no organization or paragraph form. We would take his writings and try to turn them into paragraphs that made sense, but it was a waste of time. It was just easier to start from scratch rather than reading and correcting his contributions.

We did not ever say anything to him about this. We went through the PQP like this, but finally mentioned it to him during the first week into our IQP. He understood what we were talking about and we told him that we need more complete things from him. He thought that all we wanted were rough drafts from him. Now he says he will make more quality drafts which may be able to be put directly into the IQP. Whether his work improves is yet to be seen, but at least now he knows how we feel about his work. This shows that a line of communication must be open at all times.

Appendix 4.14. Assignment #2 Group 4, student A

So far with this project, there have not been any arguments with our liaison. So far, she has been very friendly, and very easy to get along with. Arguments with our advisors, while not frequent, do come about every so often. The best way to handle any argument, but especially one with advisors, is to know the subject; knowledge is power. Since in most IQPs, the students know more about the topic than the advisors do, the students therefore have more power in the argument. The key aspect to these arguments is to remain professional. Do not take advisor comments as personal attacks, even if they are presented in such a way. Argue your point but be sure to back it up with facts, not just opinions. Don't back down to your advisor comments if you truly disagree with them. Use your knowledge of the project to argue why they are wrong.

As for our group, we do have arguments on occasion, but few have lasted more than just a minute. Most of these are arguments simply about a word choice. Those that have been longer disagreements occur initially by everyone yelling their opinion, without listening to the other group members. This, however, accomplishes nothing but more arguments. The way that we have overcome these disputes is by all of us stopping, thinking, and then one at a time explaining our views. We all obviously have similar knowledge of the project, so it is more difficult to overcome these arguments than those with out advisors. For this reason, we take slightly more time reviewing each side, and may have to compromise in order to progress. Again, when in doubt, remember to remain professional, do no resort to personal attacks, and back up any argument with your knowledge of the subject.

Appendix 4.15. Assignment #2 Group 4, student B

As of yet, my group has not had any arguments with out liaison, or amongst us. For the most part, when there is something that we do not agree on, we will talk about it and rationalize it until we either compromise or decide on one point of view or another. All of these discussions have a positive outcome, because they help our project.

I don't think that it will come the point where my group has an argument as opposed to a discussion. To the outside person, it might appear we are having an argument, but we have worked together long enough to know how to work out issues about our project.

No one wins or loses, because if someone lost, then the project would suffer.

We discuss our points with out advisors about our project because we are confident in our research and conclusions. What good would it do if we didn't argue out points and just redid what our advisors thought was wrong all the time. We wouldn't have progressed as much as we did because we would have been concentrating on redoing as opposed to going forward.

Appendix 4.16. Assignment #2 Group 4, student C

To date we have not had a fight with our liaison. She is a very friendly person and we seem to be able to discuss any problems that we have and come up with a solution. Most of the arguments that we have are within the group. There are times when we are discussing some part of our project and we all disagree. Most of the arguments are about word choice or sentenced structure. However, some of the arguments are on the subject of the proposal. We all feel we understand the necessary background for the project, but no one actually knows the correct answer. It all comes down to proving to the other group members that your opinion is correct.

In a group argument it doesn't necessarily come down to a winner or a loser. The intention of the argument is to improve the product the group is working on. Hopefully the outcome will be a refined paper, which will benefit all the members of the group and will leave no losers.

Many times when we would argue the group would eventually agree on the same thing. However, there have been certain times when there was no changing somebody's mind. The person who would disagreed would give in and say "fine, whatever, your right!" and give up. This wasn't very helpful so we tried to discourage it

In the future we will try to pay more attention to understanding each other. We will try to look at each person's point of view and try to be objective before we move on. It is our hope that this will lead to improved projects and better group work.

Commentary: I feel that this second assignment seems to be provoking the same responses as the week before. Maybe some more thought should be put into rewording the questions so they provide the right answers.

Appendix 4.17. Assignment #3 Group 2, student A

It's always been hard for me to take the initiative or to stand out and be the leader in most situations. But during the past ten weeks, I've really learned something "If I don't take the initiative, who will?" This IPQ has to be one of the toughest projects I have ever worked on, and it's challenging enough to be a member of the team not to mention the "initiator."

I cannot really describe an event that shows how I am progressing towards the goal but rather, a series of events. Think back to A-term, when we first got our project and group assignments, I had no clue whatsoever on what the project was about. I had assumed that my partners knew what they were doing, so I just followed along. A couple of weeks had passed, and there was still no clear understanding of what we had to do. One day, out of the blue, ######### took over the role as leader of the group. I was relieved. To me, it's easier to be told what to do rather than telling some else what to do, but that was soon to be changed. During one of our group dynamics meeting A-term I realized something, I realized that my partners do not know any more about this project than I do. If I don't start to express my ideas on the subject matter, the project will collapse very soon and very fast. That moment marks the beginning of my big "I."

From then on, group meeting and meeting topics were both organized by me. At the meetings, I was the mediator trying to let everyone voice out their opinion before being shut down. When it comes to writing the report, I volunteered to write as much as possible - I not sure if that was a good thing. Near the end of A-term, I arranged for studies sessions for the ID2050 final and presentation rehearsals, which was quite helpful. Ever since we came to Washington, my initiative to lead the team is more than ever; arranging interviews, designing interview questions, group dynamics meetings, weekly progress meetings every Monday mornings etc. And because of my big "I," we are working better as a team too - the arguments are not always with ######### anymore, but rather, directed at me (I am a easier person to talk to than #########, at least I think so).

There will defiantly be further progress towards this goal during the project. My leadership skills are close but not up to par with the project we are trying to accomplish. This will be worked on. I will also encourage my other partner ######### to lead more often, so all three of us will be leaders, but in a way that we won't fight over every single little detail.

Achieving the goal will definitely help me in the future. I am an Electrical and Computer Engineering major. Being able to take the initiative in a project and become the leader is a must if I am to be a successful engineer.

Appendix 4.18. Assignment #3 Group 2, student B

Goal:

Develop knowledge of the relevant literature; evaluate this material and apply it appropriately to the project.

I am a member of the Washington, DC team that is working on a project at Research, Evaluation, and Communication (REC) division of the National Science Foundation (NSF). The goal of our project is to survey Western European organizations and programs that perform or sponsor research on learning and education. REC is interested in a ways these organizations can work together with REC's new Research On Learning and Education (ROLE) Program. Other members of our team are ######### and ######### . The major part of our project is information collection. The ultimate goal of the work, our project is laying the foundations for, is establishment of the "big picture" (comprehensive view) of educational research around the world. Thus the major component (importance-wise and time-wise) of our work is collection of knowledge on what the education research is as well as on where and how it is performed.

Our investigation into what education research is required surveying a wide variety of topics: neuroscience, psychology (primarily cognitive psychology), scientific inquiry (in context of psychological and social sciences), research on teaching and earning methods, educational policy, history of education in U.S. and abroad. This development of our knowledge base started during our PQP and now continues through the IQP itself.

Second component of our research is establishment of who is conducting educational research, how they do it, and what their future plans are. There are two levels of such research: organizational (concentrating on organizations performing, sponsoring, or organizing [in some other way] educational research) and individual (concentrating on individual researchers). The two are certainly interrelated. However, we limited the scope of our project to organizations (nevertheless we have surveyed a number of U.S. researchers; we also consider talking to individual foreign researchers).

Ideally, our background chapter should include overview of all the areas specified above. This task, if done right, requires some level of proficiency in each area. For me personally

Appendix 4.19. Assignment #3 Group 2, student C

One of the goals for this IQP is for us to develop knowledge of the relevant literature, evaluate this material, and apply it appropriately to the project. The way that we will achieve this is first to state the project goal. That was accomplished during our PQP class; our project goal is to identify international programs and organizations that have similar interests as the program that we are working with. This program is called the Research On Learning and Education program, also known as ROLE. The reason why we are doing this is because ROLE seeks to collaborate with these organizations and programs that we identify and analyze.

We have already started to evaluate this material by going through proposals and books relating to the project. We had to find out why ROLE was started, what it does, what areas does it concentrate on, and why does it desire to collaborate with other programs and organizations. We also had to find information relating to the program. This involved topics on learning, educations, and other programs that dealt with international studies. In addition we had to find the organizations and analyze what they do. All this information was obtained through books, articles, websites, and material, we go through the people working with ROLE.

After getting all this information, we have to evaluate it and put it together in the final project. We already know what ROLE is about, so now we have to relate the other organizations or programs to it. They might relate, but at the same time we may find organizations and programs that do not relate to ROLE. This is fine because ROLE can learn from them and they can learn from ROLE.

Appendix 4.20. Assignment #3 Group 3, student A

Our group frequently has meetings during our IQP to discuss what needs to be done, and to determine who gets assigned what task because we realize that this project is our project. We understand how our group needs to take the initiative, work independently on this project, and not to rely on anyone for direction.

The advisors are here to provide guidance and advice on how to proceed, but not to tell us how to do our project. This was made clear to them when we told them our goals and the end result of the project. So we made it a point to make this our project. We are always progressing toward this goal by doing things our way. This doesn't mean we will complete isolate ourselves and not talk to anyone. We still rely on our advisors to make sure we are on the right track and other people to get information and data for our project. For example, we are always telling our advisors what we did, and what we are going to do to let them know if we are on the right track. We also write an agenda for every meeting we have so that we always go over what we want to go over during the meetings.

The first time we had this realization was after the meeting with the counselor. He discussed about how this was our project and we needed to take the initiative and not wait for the advisors to tell us what to do. It was as if a light bulb went off in my head and I realized that we needed to lead ourselves. So we came up with plans on what we needed to do such as making a working and we implement these plans into our project.

This project will help us when we do independent research or when we get a job in the future. No one is going to be there to tell us how to do our job. This IQP will get us situated to this concept of independent work.

Appendix 4.21. Assignment #3 Group 3, student B

Picking one of these goal is difficult because I feel that all have been greatly improved since our arrival to the project site.

One way that we have greatly improved is our meetings. We have made an effort to be more prepared and ready for the meetings with a specific agenda. The only thing that has been a problem concerning this is our liaison meeting with the advisors. We finish what we need to get accomplished for the meeting in under a half hour. The discussion then continues between advisors and liaison for another half hour.

Meetings should be short and to the point. We have let our advisors and liaison continue with what they want to talk about, but in the future we will try to avoid this. By keeping our points of concern short and to the point we can let the discussion wander after that. By stating that we are done, we let others know that this meeting is over for what needs to be accomplished. We may have to take a harsher approach of cutting the conversation that follows off. Maybe stating that we have work we would like to get back to.

Keeping our meeetings short allows us to control the meeting and keep everyone's interest. This helps us in terms of how others look upon us, letting the meeting drag on loses people's interest leaving an end feeling that the meeting was uncontrolled and unproductive. Also by keeping our meetings short, our control over them increases.

Appendix 4.22. Assignment #3 Group 3, student C

Working effectively with your advisors and liaison is very important. A successful group must know how to run meetings and keep high levels of productivity.

Meetings can work out two different ways. If your advisors control the meeting then they are more or less not allowing the group to decide where the project is going. The advisors did not make these projects. Sometimes they do not have as good a notion of what exactly is going on in the project as the group does. If this happens and the group does not speak up, a project may get off track due to the advisors wanting the group to look in one aspect of the project where the liaison does not want that result.

In effect, running good meetings is important when talking to your liaison. A group must display a good knowledge of what is going on in the project. Knowing exactly what you are doing and what you plan to gain towards the end product by doing it shows a commitment to the project. Liaison's look at the student project groups as free labor because that is exactly what it is. They can tell the group pretty much anything to do, but that is not what a project group is here for. Each group is here to complete a specific project and if the liaison start giving out different tasks it is necessary for the group to stay on task.

I am not describing specific things that have happened in our project experience thus far, but am describing how I see problems emerging.

As a group we have run meetings very well so far. In our weekly meetings of our advisors with the liaison, we have an outline of the week's goals prepared as a handout. We also have a rough agenda which we discuss for about twenty to twenty-five minutes. After this our advisors talk to our liaison for about another half-hour and we as a group just sit there. We are not getting anything done by sitting there, but we have not said anything to cut them short. We just sit there. We get what we want out of the meeting, but just waste the other time. Maybe next time we will not let them talk so much and get back to work.

Appendix 4.23. Assignment #3 Group 4, student B

I think on one of the goals for the IQP is to learn how to work in a team with people you've never worked with before on a project you know nothing about. In doing so, the group must develop knowledge about a subject they previously had little or no knowledge of.

In out case, we had to become experts about our project before we came down to DC. When we reached DC, we had to implement our knowledge as opposed to most other groups who are gathering research for their project. We are putting together a working system of surveys and a mystery shopper program. We did not have the luxury to continue to do lots of research down here, because that delay would have prevented us from completing a thorough test of our surveys.

The main focus of our research now will be to evaluate the surveys we produced at the beginning of our project. Once these are evaluated we will be using the knowledge we gained from our research in A term as well as our experience using these surveys to make finalized versions.

Comments

I would like to know what is going to come of these questions, because I do not see how they relate to one another. I would also appreciate some contact from the person who's IQP this is. After all the time we are taking to help him with his IQP, it would be nice if he took some time and let us know who he is and why he is doing this.

Appendix 4.24. Assignment #4 Group 2, student C

Does the team work well together?

I believe that the team is working well together. We see each other's differences and we are working with the differences so that we could best complete the project. For instance, we all write differently, so we have different opinions on the structure of the paper, yet at the same time, our writing is weak. When one of us proofreads the other's writing, the person feels like he/she needs to rewrite the section. At times, we need to work on the sections together. We also work best at different times of the day. I am a morning and late night person, The sections that we need to work on together, we agree to the time that best suits all of us. while my partners are afternoon and early evening people. We agree to work the hours that we are supposed to work at NSF. When we take our work home, we slit it and work on it at different times.

Is my team productive?

On a scale of 1-5, (1, not productive, 5 very productive) I would give us a 4. At times one of us needs to step up and encourage the team to pick up the pace and be more productive. We are doing a lot of work, but the main thing, which is writing the report, is going slow. We have the information, but we just need to make it look like a presentable report.

Is everyone involved with the team?

Yes, every one is involved in the project.

Is the work divided fairly?

This question can't be answered in a simple yes or no. We all divide up the work among ourselves, but the work divided has different amounts of value. Some of the work may not be as important as the other stuff but they need to be done and they may take a lot of time. For instance transcription, presentation slides, our weekly progress reports, and agendas for meetings. Other things may have more value, but usually one person is best fit for the task. For instance, ######### works well with the computer, so he compiles

the whole report, and did the survey on the web. It takes a lot of time to do that, but he's the only one who can do it and has offered to do it. I can communicate better with people than the other team members and can do more secretarial work, so I do all of the phone calls, weekly reports and goals. Since all of us have a task to do on the project, #########'s main task is to get more information off the web. This can be easy and hard, but it is essential to our project. Basically what I am trying to say is that the work is divided up fairly according to what each person can do, but it seems at times that some of the work may be more time consuming, or has greater value than the other pieces of work.

How has my team changed since I have been in Washington?
Since we have been in D.C., our team has not changed dramatically. Our team dynamics is improving and we are a lot different than when we started this project in A term.

How do you expect your team to change in the remainder of this term?
We just need to finish our findings and put it into a presentable report. The only change I hope that we make is to better our writing. We also need to organize the project more clearly so that it is a good piece of work.

How can the team be better?
We will defiantly make more trips to our advisors and our liaison. We need to identify what we have left to do and we need to just do it.

What could I do to change the team and how will I go about doing that?
I think that I can help the team by making sure we don't procrastinate. We can be more organized on what we need to do and when we are going to do it. I work better on deadlines while my team members are last minute people. We do have a time frame on what we are going to do, but it is not specific enough. We got a week and a half to hand in our first draft of our report; I want to make sure that we complete the project the best way that we can.

Appendix 4.25. Assignment #4 Group 3, student A

Our team works really well together. Everyone gets involved and contributes to the project. Everyone's opinion is heard and considered before making a decision. No one argues over task assignments. Each member usually volunteers for something and the others will take the leftover tasks.

When one member's view of the project is incorrect or is unclear of something, the other two quickly brings that third member up to speed on what's going on. If their view is different from the rest, then the topic is discussed among the group and is resolve through reasoning.

Our team has changed very little since our arrival in Washington. We've worked fairly well together during the PQP. Some minor conflicts have developed because we we're working longer hours together, but they're quickly resolved.

One reason for our team's success could be that I let the team member with the strongest views lead. That is why I let Steve lead the team, he usually has good reasons back up his views. If everyone was a leader and there were no followers in the group, the team would fall apart because everyone would want things done their way. The leaders would follow their own paths and kind of separate from the group. I only object when I strongly disagree about something or have my own ideas to contribute which happens occasionally. We also switch leadership positions occasionally, so that one person isn't the leader all the time.

I think our team will remain the same for the rest of this project because there is no reason for our team to change. We don't get each other's nerves or annoy each other. We enjoy working together. There are some conflicts, but they are minor and aren't the type that will escalate.

Even though we work well, I don't feel our team is ideal because we're not efficient. We are productive and get the project work done, but we end up writing the report very near the deadline. Maybe its because there's not enough motivation in writing the report because the project has changed so much. I feel this is one area our team needs to work on.

Appendix 4.26. Assignment #4 Group 3, student B

Let me tell you what I don't have time for. I don't have time for these reports. We are having too many meetings too close together. So we can continue to tell the same people the same things. This becomes very unproductive very quickly. Our group is not the most productive group in the first place.

This is because the basic common sense intelligence average is about fifty percent of a normal non-disabled person. I think one partner is actually mentally disabled and it pisses me off that the process of choosing people for this project lets this type of person slip through the holes. This is not uncommon either, as I have seen with other groups in Washington and heard from people who have already done their IQP. Now my grade depends on what the professors think that three people should have done when we really have one person who is contributing negatively to the project, which doesn't even allow for two people who are contributing to come out with the work of two people.

So to sum it up If we have two people working at full capacity, and one person working to a negative product we have a product that is less than two peoples work, but our grade will be given as if it were three people's work.

I have been forced to accept this fact. I know that I have done everything I can without the help of the advisors or anyone. During the PQP when I first noticed that this member was not producing anything useful. I first tried to deeal with it by going to him and showing him what needs to be done and what was wrong with his work that he handed me. Then when this didn't help I went to the advisor and told him of the problem. With examples of what I was trying to deal with. I don't think he was sure what the problem was until he had the group member do an assignment just for him. This was between the third and the fourth time that I had come to my advisor seeking help on this problem. After this I think my advisor understood the problem I was having trying to deal with this group member's work, but still nothing was done. At this point I went to my ID2050 professor, asking him for suggestions on how to deal with this problem.

After it was understood that I was looking for something I could do to better this problem, he suggested that I just go to my partner once again and tell him the problem that I see and that we can't afford to have that down in Washington. So I painfully did this. This only helped in the fact that once I had this discussion with him. It took him a full week of working to produce four pages of text that were good for our first deadline. But once the pressure started he was once again useless. This problem continues to be dealt with by our group…to no end.

Had this partner been pulled from the program due to incompetence, I feel we would have a better chance of getting a better grade on this report. We would not be graded on what three people should be doing, we also would not have his incompetence to deal with, which takes time that would be otherwise productive.

Appendix 4.27. Assignment #4 Group 3, Student C

Although our project has changed here in Washington, the group has not changed significantly. As a team we have our moments when everything is great, but for the most part we do our own parts. I would say that everyone is involved with the work, but the quality of that work is what I question. This leads to a somewhat undistributed workload and a lower productivity.

Here is a further explanation of what I mentioned above. In an attempt to split up all the work, certain tasks are taken and then other group members will check them over. One of the members of the group has a hard time functioning on his own. He tries to get things done, but when we look at what he has written for the report, it is need of a lot of help. It would be easier for us to write these parts completely over, but the time restraints and deadlines to meet make this difficult. We must write our own parts then go back and change his. This is a huge setback and makes me wonder how this project would go if there were three functioning people working on it. I am not saying that the work of my partner and myself is perfect, but it is incomparable to the third person's.

I do not believe we can do anything to fix this. We can try to tell him what he does wrong, but writing and forming complete thoughts should be known by now. It is way past the time when something could have been done about this. Therefore, nothing can be done now and as a team we will have to do the extra work necessary to get through this project.

I believe this is a knock to application and selection process to the IQP. It is hard to believe that this person wrote a competent application essay and it is even more amazing that he survived the interview. I have friends back at WPI that can do much better work that this person and they were denied to go away for any IQP project center. The grades you receive in your classes should not weigh so much when applying. There has to be a better way to sift out the weak links before they get to the IQP. That stage is called the PQP, when we mentioned to our advisors the problems we saw with writing and comprehension, but nothing was ever done.