# Group Projects in an Introductory Statistics Course

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## Abstract

*The primary goal of a group project in an introductory statistics class was to teach students how to resolve real life problems using statistical analysis. Research identifies that group projects increase student learning experience in introductory statistics course. But, in reality, majority of the students mentioned that projects did not increase their overall learning experience. Our experience and students' reaction to the group projects are evaluated and discussed in this article. To better understand the gap between our expectations and student findings we analyze the current status of group project using a popular quality control tool-house of quality.*

## 1. Introduction

Research identifies that many students learn statistical techniques without knowing how these techniques can be applied [1]. After teaching applied business statistics designed for second year undergraduate students for a few years, a group project was added. Group projects were designed to meet the following goals established for statistics education [2]:

- Learn to apply statistical theory to real data set
- Acquire training in the use of both statistical analysis and word processing software
- Develop communication and problem solving skills by working in collaborative groups
- Improve organizational and writing skills

To make projects authentic [3], students were asked to define a research question, select variables, collect and/ access relevant data, make conclusion after relevant analysis. Carrying out group projects in large classes did not go without multiple setbacks. In the following sections, we discuss the way group project was carried out, the difficulties related to the project, necessary changes to be made in future projects to tackle current challenges, and also application of House of Quality [4] to better analyze the current form of the project.

## 2. Beginning of Group Project

Initial plan was to find answer(s) to the research question(s), students could use one of the following methods:

- collect primary data by designing and implementing survey techniques discussed in class
- use secondary data that are available in authentic databases

Before preparing the project outline, an application was made to the research ethics board (REB) for clearance. This is necessary to allow students to gather primary data for their projects. The board asked for examples of projects that students might be doing. But, at that moment there were no examples to show because that was the first time projects were introduced in the introductory business statistics class. So, in the project outline students were asked to use *only* secondary data for their projects.

The project outline and rubric were prepared in detail to eliminate as much confusions as possible. Teaching assistants (TAs) were consulted in the process of preparing project outline to make sure that we did not miss any confusion that might arise later. But, later we found that we could not totally achieve the goal.

Project outline clearly stated time line of different steps to finish the project. Students were asked to form a group of 3 to 4 within 3rd week of class. The next task was to come up with a research question. Students had freedom in selecting research question. Students also had to figure out what data to access and where to get them to find answer to the research question. To help them become familiar with available data sources, the experts from the library were invited to give a talk in class about the authentic data sources that can be accessed through the library website.

Project outline did not have detail information about what statistical techniques to use to analyze data. The assumption was to identify right techniques to analyze data, students might *think* about the statistical techniques they learn in class. In other word, it could be a source of deep learning. In the project outline, students were asked to use at least three statistical methods in their projects. They also had to learn how to use Excel to analyze data. Teaching team had office hours to help students with project related questions. The actual data analysis is

only one step of the entire process. The plan was to evaluate steps taken to finish the project in addition to the result of data analysis.

## 3. Execution of Group Project: Gap between Our Assumptions and Student Experience

We assumed that students would love doing group projects as opposed to solving problems with given data. In this section, some of the setbacks that indicate gaps between our assumptions and student experience related to group project are discussed. Some of the proposed actions to tackle difficulties in coming semester are also identified.

### 3.1. Too much freedom caused frustrations

After reviewing numerous articles written by expert teachers regarding group projects in introductory statistics classes [5, 6, 7, 8], we believed that by doing projects students could learn that statistics is more than just summarizing data. To maximize the benefit of group project, students were given lots of freedom from the beginning to the end of the project. Unfortunately, at the very beginning of the semester, students started showing frustrations for not having definite project themes or ideas given in the course outline. Some of the students became clueless just to come up with a research question for the project. This setback made us realize that the future project guideline should contain some steps to help students selecting a topic. For example, a group must meet a teaching staff by the second week of class to discuss about tentative project topic(s). If a point or two are allocated for having this meeting on time, students might be motivated to sit down as a group to come up with ideas before this mandatory scheduled meeting. Weblinks to previous student projects will also be part of the future project guideline.

### 3.2. This much work for *what* percentage of grade

A huge chunk of grades was not allocated to group project. We thought that less grade was equal to less worries! We wanted students to appreciate steps like exploring different ideas, looking for relevant data, etc. without fearing of losing lots of marks. But course evaluation at the end of the semester showed that students had complaints about not allocating a big chunk of grade to project. They identified that the assigned grade was not enough to compensate their time and efforts. After discussing this issue with colleagues, we have decided to increase the marks allocated for future projects.

### 3.3. Really, an entire project needs to be done just to get familiarize with data analysis software

Ledolter [6] identified that project is a good way to motivate students to know at least one statistical software. But in reality some of the students in the course evaluation mentioned that it was not worth to spend so much time for learning some features of statistical software. Their argument was that that goal could have been achieved with one or two small assignments instead of a project. But, we are still not very convinced to change anything about the use of data analysis software for project.

### 3.4. Project as an important tool to improve writing

When we started preparing project outline, we thought that project could serve as a writing tool. But in reality most of the teaching assistants just came from foreign countries to start their graduate studies. After having a discussion with the TAs, I realized that they were not comfortable to give weight on assessment of writing skills. They wanted to give emphasis on how students put quantitative information into a written framework to communicate to an audience. So, we did not give emphasis on checking grammar or writing skills in project rubric. This will be same in coming years.

## 4. The House of Project Review: Analyzing Connections between Different Parts and the Learning Goals of the Project

As we mentioned earlier that we would continue using projects to help students see the application of statistical analysis in real life issues. We would like to evaluate whether we need to change things in our project outline to make better use of project in student learning before the coming semester. So, we analyze the relationships between important parts of projects that are evaluated and/ graded and required objectives of the project. A commonly used tool in the area of quality control is the house of quality. See any text on quality control, e.g., Summers [4]. Many organizations use the house of quality to determine successfully whether their products meet the preferences and expectations. The tool may be adapted for finding the required actions necessary to take to fulfill the objectives of project requirements and also to enhance student learning. In this section, we are going to outline some issues related to project. We call it House of Project Review.

### 4.1 Different parts of the project

There are different parts of the project including brief explanation of the entire project – executive summary (P1), detail explanation of the importance of the project in introduction (P2), literature review related to the selected topic (P3), access to authentic and relevant data (P4), use of statistical software for analyzing data to answer the research question/ topic (P5), preparing powerpoint slides to summarize project findings (P6). We have chosen a handful of the parts that are included in the rubric as must have components of the project. This list can be written in detail, if necessary.

## 4.2. Skill areas

The house of project review indicates that the skill areas to be developed in different parts of the project including learn to apply statistical theory to real data set (S1), acquire training in the use of statistical analysis software (S2), have some training in the use of word processing software (S3), develop communication and problem solving skills by working in collaborative groups (S4), improve organizational and writing skills (S5).

## 4.3. The contribution of each part of the project to skill areas

The house of project review uses ratings to identify the contribution of **each** part to each skills area. The ratings used in Figure 1 are:

B: Basic, the part provides basic preparation in the stated skill area
I: Intermediate, the part provides an intermediate level of knowledge in the stated skill area
A: Advanced, the part uses advanced level of skill area

## 4.4. The status of each part within the entire project

The house of project review identifies the following status for each part of the project:

R: Required, the part is required for the project
E: Elective, the part is not required for the project.

Elective part can add value to the entire project but there is no specific grade is given to complete that part.

## 4.5 Assessment and evaluation techniques

The house of project evaluation identifies the primary assessment technique(s) used in evaluating student performance in different parts. We identified that in our situation we only use two types of evaluation and/ assessment techniques:

W: Written submission
E: Excel output submission

## 4.6 Importance of skill areas to stakeholders: on a 5-point scale

House of project review allows us to identify how significant the skills areas are to stakeholders:

B: Accreditation board requirements
P: Professional society requirements
E: Employer expectation
A: Alumni experience

## 4.7 Student opinion: on a 5-point scale

The house of project review includes ratings that reflect student opinion of each part of the project. To arrive at these ratings, we informally consulted students about different parts of the project. We summarize student responses to the following questions:

- How effective was the project outline in communicating goals and requirements of the project?
- How consistently did the stated project goals match what was being taught in the course?
- How appropriate was the project format for the subject matter?
- How well did the methods of evaluation (e.g., drop box submission of excel files, submission of written report, submission of power point slides, etc.) reflect the subject matter?

## 4.8. Recommendation

The house of project review provides enough information to make recommendation for future. We check to see that there is a match between the skill areas and assessment/evaluation techniques for each part of the project. From this example, we can conclude that such match exists for each part. Students' opinion shows that some parts are not very effective or well received. But these opinions were collected informally. Number of students who gave informal opinion was very small compared to the entire student body. We identify that before changing the parts of the project based on student opinion, we need to evaluate student formal opinion regarding project in detail. To improve the learning goal, we also believe that the way projects are done in similar courses in other universities also need to be

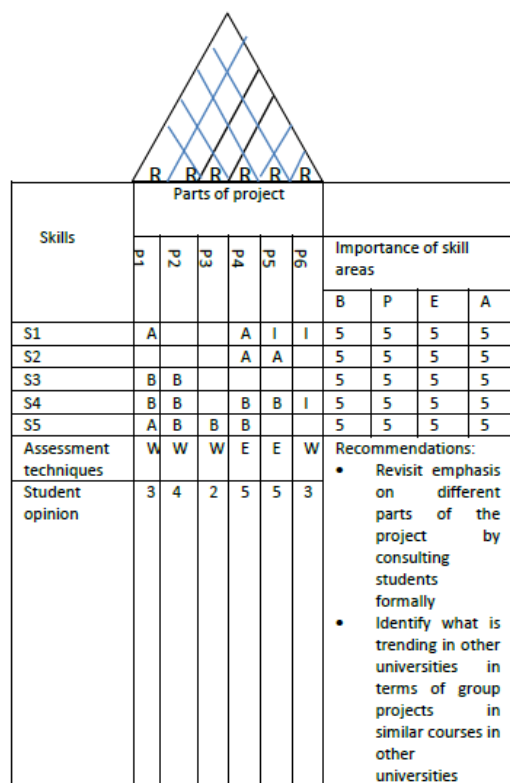evaluated. Please find the visual description of house of project review in Figure 1.



Figure 1. House of Project Review

## 5. Conclusions

In this article, we discussed our one time experience related to the introduction of projects in introductory statistics course. We found that authors of the research papers written on similar topic felt very good [6, 7, 8] about projects, but our experience was not quite similar. As the semester went on we started regretting the idea of introducing projects in statistics course. Our overall teaching evaluation took a hit. Students commented that with projects their lives became complicated. They also mentioned that previous years' students did not have this much pain in the course because they had midterm instead of the project. Next time, to make this effort worthwhile, we need to have mandatory scheduled meetings between groups and teaching staffs throughout the semester as opposed to leave it to the students to schedule meetings as necessary. Meeting with teaching staffs will make students feel that they are not alone in the process. Before changing the parts of the project, we need to collect student opinion formally about different parts of the project. We also did not see find the connection between each part of the project. House of project review can easily handle that information.

## 6. References

[1] Zhang, J., "Preparing Students to Solve Practical Problems: An Elementary Statistics Course with a Group Final project Requirement", *Primus*, Taylor and Francis, Volume VIII, Number 1, March 1998, pp. 67-83.

[2] Holcomb, Jr., J.P., and R.L. Ruffer, Using a Term-Long Project Sequence in Introductory Statistics, *American Statistical Association*, Volume 54, Number 1, February 2000, pp. 49-53.

[3] Spence, D.J., J.L. Sharp, and R. Sinn, "Investigation of Factors Mediating the Effectiveness of Authentic Projects in the Teaching of Elementary Statistics, *The Journal Of Mathematical Behavior,* Elsevier, Volume 30, 2011, pp. 319-332.

[4] Summers, D.C.S., *Quality*, 5th edition, Prentice Hall, New York.

[5] Roseth, C.J., J.B. Garfield, and D. Ben-Zvi, Collaboration in Learning and Teaching Statistics, *Journal of Statistics Education*, Volume 16, Number 1, 2008, Retrieved from www.amstat.org/publications/jse/v16n1/roseth.html.

[6] Ledolter, J., Projects in Introductory Statistics Courses, *The American Statistician*, Volume 49, Number 4, November 1995, pp. 364-367.

[7] Chervany, N.L., R. O. Collier, Jr. S.E. Fienberg, P.E. Johnson, and J. Neter, A Framework for the Development of Measurement Instruments for Evaluating the Introductory Statistics Course, *The American Statistician,* Volume 31, Number 1, February 1977, pp. 17-23.

[8] Reese, M., A Multi-Class, Interdisciplinary Project Using Elementary Statistics, *PRIMUS*, Taylor & Francis, Volume 22, Number 6, 2012, pp. 474 -481.