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Putting Individual Learning Responsibility Back into the Team Experience – An Application of the Design Experience

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Introduction

For years engineering programs have focused on the importance of students participating in team experiences within subject and capstone classes. This team experience need was emphasized by ABET in its Criteria 3 – Student Outcomes, specifically outcome d (for years 2000 to 2019) and outcome 5 (for years 2019 to present) and emphatically adopted by most engineering programs [1] [2].

The need for teamwork is also emphasized by industry. Industry, especially those associated with the development of new or improved products, benefit from interdisciplinary teams which can represent various specialized fields and address the needs of a quickly evolving environment [3]. Research regarding these interdisciplinary product teams found that they can improve project performance especially regarding meeting budget costs and developing a quality product [4]. In addition, when individuals face challenges in a team environment when trying to produce a successful output, they have opportunities to improve their project management skills, develop a broad perspective on problem solving, expand their social and business networks, and build resilience [3]. These qualities to manage a team are coveted by many in industry, especially at the management level [8].

However, having students participate in academic teams to solve a problem or complete a project does not necessarily result in all students completing the required activities. Some students take on little responsibility for the team activity and depend on their peers to complete the work. Since it is a team activity, these students benefit academically from their peers' efforts though their new knowledge is limited. Thus, assessing the outcomes of team projects may not effectively measure individual student learning.

This study addresses one means to increase the responsibility, and thus learning, of individual team members when completing a team-based project. It reports on an intervention the course instructor made to increase individual contribution to a team design project and the intervention's result on student learning and contribution ownership. In addition, the study reports on the ability of the intervention to (1) effectively reward those students who contribute more to the activity and (2) reliably recognize those students who choose to minimize their activity effort. This study meets IRB Exempt Category I.

Background

The outcomes of academic team projects and individual contributions have been studied much over the years. Some faculty found that, due to this large emphasis on completing team-based projects, individual student project experiences and contributions have decreased. Some believe this decrease is due to (1) social loafing – when a team member exerts less effort to a team assignment than when working on an individual assignment or task – or (2) free riding - when a team member benefits from the results of a team activity without participating in the activity [14] [15]. When students participate in social loafing or free riding much of the technical work on team-based projects is completed by a subset of the team members [5] [6] [7] [8] [9]. The academic result of both free riding and social loafing is the possibility that some students are completing courses or course requirements without practicing or illustrating competence in a technical area.

There are practices an instructor can take to train student project teams and help them develop a working and collaborative relationship and minimize dysfunctional team practices such as social loafing and free riding [8]. But even with these practices some students may still participate in social loafing and free riding. This is because individual team members prioritize their contributions to the group based on work style, apathy, and feeling of ownership [13]. The result is often frustrating to contributing students since grades for team assignments are often assigned to all team members, including those who may not have contributed appropriately to the team's activities.

Strategies to Minimize Free Riding and Social Loafing

Research identifies various strategies an instructor can take to minimize the desire for team members to participate in free riding or social loafing. Some of these strategies are:

- Conduct student team building activities [8]
- Ensure teams understand the relevance of the project in relation to real-world situations [8]
- Teach teamwork skills [8]
- Assign a reasonable workload [8]
- Establish clear team goals and expectations [7] [8]
- Require identification of team member roles [7] [8]
- Provide class time for team meetings [8]
- Request interim reports or other feedback from teams [8]
- Require individual team members notebooks of personal contributions [8]
- Use detailed peer evaluations [7] [8]

It is recognized that these strategies may require classroom time and instructor contribution that may not be realistic.

The Intervention

The author incorporated most of the mentioned strategies in the course associated with this study, but the existence of free riding and social loafing students remained. The author reconciled that the lack of equality in work contribution will occur but continued concerned that less productive students may complete the course and receive a reasonable grade without illustrating subject competence. Thus, the instructor made a change to the team experience (the *intervention*) to ensure students complete several individual activities – those that require prototyping and testing functional operation of a proposed solution - to support the overall outcome of the project.

The goals of this intervention are to ensure individual students (1) illustrate competency in at least a few of the project design activities and (2) recognize the role of the activities in the overall project design solution. It is hoped that if students recognize this role, they will minimize their social loafing and free riding leaning and take on ownership of the project.

Another intervention goal is to ensure students who contribute most to the outcome of the project are recognized for their contribution via the grade. It is hypothesized that students who contribute most to a project will also perform well on the individual assignments.

The Course and Intervention Overview

Since the mid-2000s first-year level engineering students at the University of Tennessee at Chattanooga have participated in a course (ENME 1850 Introduction to Engineering Design) that introduces them to the engineering design process, customer interaction, technical communication, and project management. The course evolved over time but has always required a customer-supported service-based team project as its design and experiential learning experience. Presently the course provides each team of 4 to 6 students a customer for which they develop a deliverable physical device. Most projects aid customers or users, who may have one or more disabilities, to be independent in their life and/or learning. Student teams are multidisciplinary. They consist of mechanical and computer engineering, mechatronics technology, and environmental science students.

During the semester project, students work through the engineering design process of identifying the project, understanding the project needs and criteria, developing conceptual designs, analyzing, and testing design appropriateness and capabilities, determining final solution, building and testing solutions, and delivering a final solution. Prior to Fall 2021, student teams, through a guided process, determined among themselves how they would work within their teams to meet the goal of producing and delivering the final product. Prototyping and testing prior to delivery were required though at times difficult to ensure. Since Fall 2021, however, individual team members are now required to prototype and test functional concepts of the possible final design solution prior to final build. This is done to ensure that all students participate in the prototyping and testing phases of the design process and that prototyping of concepts occurs. The goals are that each student will experience the learning that comes from hands on testing and each team will ensure testing of concepts prior to solidifying final designs.

As part of this process, each team member is required to report – in memorandum format and in an oral presentation – their prototype design, device, test procedure, and test results. They submit their work to the instructor and share their results with their team members. At the end of the semester the students reflect, using an online survey, on the role the individual prototyping and testing experience played in their (1) contribution to the team, (2) learning of technical matter, and (3) confidence in working a design project in the future.

This paper reports on the student responses to this reflection. It also reports on the evaluation, by the instructor using individual memorandum and team final report assessments, of the ability of each team member to (1) complete an effective prototype build and test and (2) to contribute to the final product design. Through this analysis, the paper addresses one means to increase the responsibility of individual team members and more appropriately assess student contribution when project-based learning is employed.

Intervention Details

Following the brainstorming stage of the design process, students work through a decision process that uses design constraints, functions, and objectives, to determine the best one or two solutions for meeting their clients' needs. Once the solution is identified, they are asked to identify the functions of that solution, at the lowest level possible, and update their function tree. The function tree in Figure 1.0 is for a device that holds and positions a probe for measuring air flow in various locations of an air duct in an upper-level mechanical engineering laboratory.

Students use the function tree to select one or more functions to test to help the final design solution be successful. Since the project teams are only 4 to 6 students each, many of the functions are not tested. However, the students are advised to pick for testing those functions that have the most impact on the final design.

Once the functions are selected, the students have two weeks to build and test the prototype. Most prototypes can be built from scrap materials since the students should only be testing the concept of the function. They may also buy items to test the ability of simple devices to perform as expected if necessary. Many of the scrap materials and small devices are available to the students in the course design shop.

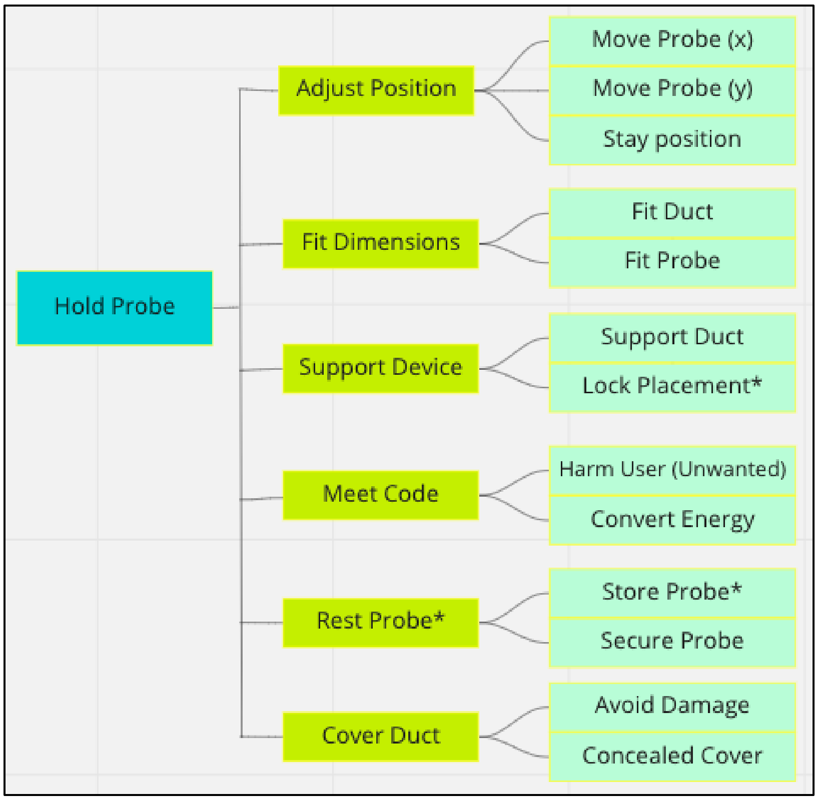

Figure 1.0: Example Student Team Generated Function Tree

Following the two-week prototyping and testing period, students must submit to their teammates (and cc the instructor) a memorandum reporting on the results of the prototyping and testing activity. This is an individual grade for the student. Each student is also required to complete an oral presentation that communicates their tests and findings to the class, another individual grade for the student. These assignments are evaluated on a 5-point scale where 5 is excellent, 4 is above average, 3 is average, 2.25 is below average, and 1.5 is unacceptable. Each student must complete both assignments to get a grade for the course.

Methods

The study desires to answer the following questions.

1. What is the effectiveness of an individual student team project activity in identifying highly contributing and poorly contributing students?
2. How effective is a required assessed individual student team project activity in (a) rewarding highly contributing students and (b) identifying poorly contributing student learning?
3. To what extent does the participation of individuals in the individual student team project activity influence individual student perception of their (a) project responsibility and (b) learning of and using elements of engineering design?

Three data sets are used to support this study: student assignment and final course grades, peer evaluations, and student reflections. The student grades on the required individual assignments aid in assessing learning and project contribution. Course grades are used to evaluate the benefit of the individual assignments. The final course grades and the final project grades are based on the 5-point scale.

An end of the semester anonymous reflection helps assess student reaction to the prototyping and testing assignment. The probes on the reflection survey include:

- Describe the role the individual prototyping and testing experience played in your contribution to the team solution.
- Describe the role the individual prototyping and testing played in your individual learning of technical functional operation.
- For each of the following, rate your level of confidence on a scale of 1-5 with 5 being high confidence and 1 being little to no confidence.
    - Ability to independently test a functional concept of a design.
    - Ability to use various brainstorming techniques to develop problem solutions.
    - Ability to, in the future, complete a design project to support customer/user needs.

  For each of the three questions it is hypothesized that there is no difference in the student average response between evaluated semesters.

The intervention began in fall 2021. Student reflections, peer evaluations, and individual project design activity grades and final grades from the Fall 2021 (39 students), Spring 2022 (35 students), and Fall 2022 (41 students) semesters were used for this study. For comparison, final project grades from Spring 2018 (35 students), Fall 2018 (34 students), and Spring 2019 (32 students) were used. Students in the course during the semesters prior to Fall 2021 did not participate in the individual prototyping and testing assignments; so, there are no such activity assignment grades. The comparison classes occurred prior to the Covid19 pandemic and thus control regarding online learning is not necessary. Data from Fall 2019 was not included in the study because the instructor of the course was on sabbatical that semester.

Minitab Statistical Software was used to analyze quantitative data. A very high-level text analysis was used to evaluate the reflection responses. A study using a text analysis tool is planned for the near future. It is expected that this analysis will provide a more comprehensive review of the student perceptions (Question 3).

Results

The end of the semester reflection survey, using both essay and determinate questions addresses study Question 3. The individual student project assignments and final grades were used to address study Questions 1 and 2.

Reflection Survey Results - quantitative

Three quantitative questions on the reflection survey address student confidence in testing a functional concept, brainstorming problem solutions, and completing a design project in the future. These were assessed by the students using a 5-point scale where 5 indicates high confidence and 1 indicates little to no confidence. The first question addressed the quantitative assessment of student confidence in independently testing a functional concept of a design. The per semester average assessment scores for this question are 4.26 (fall 21), 4.26 (spring 22), and 4.17 (fall 22) indicating that students have above average confidence that they can test a functional concept of a design. The minimum evaluation was a 3 (average) for all three sections.

It was hypothesized that there is no difference between the mean values of the responses for this question for each of the three semesters. Based on the Analysis of Variance, this hypothesis cannot be rejected (p-value =.78) at a significance level of .05. Equal variances were assumed for this test. Thus, student perceptions are equivalent across the three sections regarding their ability to test a functional concept.

The numerical student responses to the remaining two quantitative questions ("ability to use various brainstorming techniques to develop possible problem solutions" and "ability to, in the future, complete a design project to support customer/user needs") are like those of the first question. The students have strong confidence (above 4.0) in their abilities and there is consistency in the responses between the three sections.

However, when the average responses for the three questions (across the three semesters) are compared, there is statistical evidence that the students have a higher degree of confidence with their ability to "… complete a design project…: than "...brainstorm…" or "…test a functional concept…". This is interesting since completing a project involving customer needs requires both brainstorming solutions and testing functional concepts. This relationship can be more fully assessed by comparing these student perceptions of confidence with their actual abilities as illustrated by the assessment of their final exams. This analysis is not yet completed but may be insightful.

Reflection Survey Results - qualitative

One reflective essay question prompt was "describe the role the individual prototyping and testing played in your individual learning of technical function operation." This was addressed to determine the students' perceptions of their learning. Most student responses are positive. Many of the responses discuss how important this activity was to their understanding of the role individual design functions play in the operation of a device's primary function. Below are sample responses.

> *"I feel like individual prototyping and testing played a huge part in understanding it because it's easy to go into something and just jump straight into a solution. By separating that solution into its functions, it lets you take a step back and*

understand the importance of why it needs to do a certain thing. It keeps you from brute forcing your way into a solution that might not even work since some functions of it weren't tested separately".

"I learned that sometimes your original ideas, while seemingly good, don't actually work. Without doing the individual testing and prototyping I wouldn't have been able to accurately pick a weight that would have suited our needs, nor would I have been able to choose a material that was able to achieve our goal while also being cost effective."

"This helped me learn just how in-depth a function can go whether it be finding that right solution to fix it or even finding the right key words to use during research. This also helped me understand that writing out all of your problems and picking the most important ones is a lot easier through the function process instead of just trying to think of them as you go."

There were some negative responses to the activity, though few. These negative responses mention that the activity was a waste of time or that their time could have been used to benefit the project in a better way. Some of these poor experiences are a result of the student not selecting an appropriate function to prototype and test. For example, one student reflected this:

"I do not think it did much for me personally. It was more of a pain to have to do than something that would improve our project. Again, I can see it being useful but for me it was not. I saw some individuals who did do very well and I'm sure some did benefit from it."

The second reflective essay question asked students to "describe the role the individual prototyping and testing experience played in your contribution to the team solution". This question was asked to identify the level of responsibility students took on during and after the activity. However, upon taking a high-level look at the responses, it is difficult to determine any measurement of responsibility.

Even though the quantitative analysis indicates students have much confidence in their ability to complete similar projects in the future, the analysis of the qualitative data is incomplete. Thus, Question 3 cannot be thoroughly answered. A more exhaustive analysis using translation methods is necessary to adequately identify student perception of learning and responsibility. Of specific interest is whether the reflective prompts adequately address the study questions.

Grade Assessment Results

To assess how well the individual prototyping assignment helped differentiate between highly contributing and poorly contributing students, the grades associated with the prototyping activity were compared with the final individual grades. Figure 2 illustrates a correlation between a student's overall individual course grade and their prototyping assignment grade with $r = .936$ and $p=0$. (The prototyping assignment grade includes the memorandum and oral presentation grades). This is expected since the prototyping assignments have a considerable influence on an individual student's course grade.

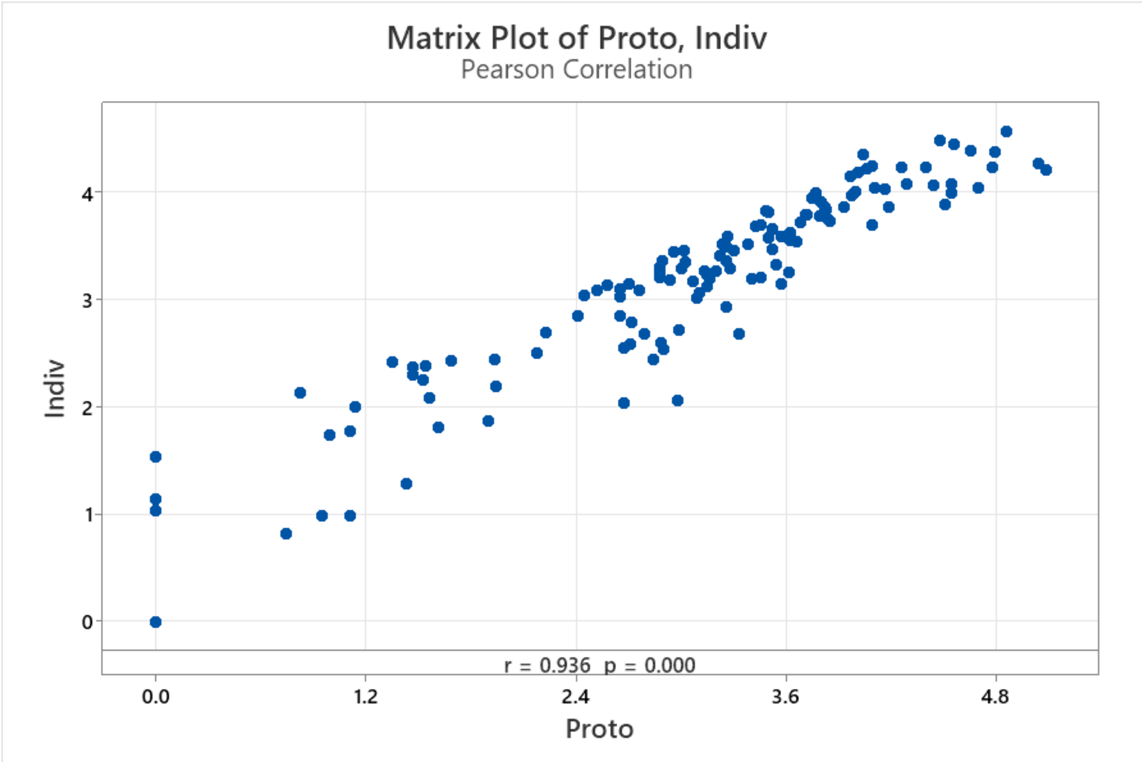

Figure 2.0: Correlation Between Individual's Overall Course Grade and Prototype Assignment Grade

This relationship, however, does not provide an indication that students who are more involved in the course and assignments are being rewarded for their contribution. Nor does it indicate that the grades of those not contributing are being negatively impacted. To address this, the final individual course grades of the pre 2021 students (pre) and the post 2021 students (post) were compared to determine if there is a difference in the average grade or grade distribution prior to and after the intervention. Using a two-sample t-test, at a 95% CI, the hypothesis that the mean grades of the pre and post individual assignment grades are equal cannot be rejected (p=0.175). However, when the two variances of the pre and post final grades are compared, there is an indication of a difference. At a significance level of .05, the hypothesis that the two variances are equivalent can be rejected since the p-value = 0 and Figure 3, 2nd graph, shows no overlap in the plot of the variances.

Of note is that this analysis includes other course assignment grades - such as the final exam and peer evaluations - in the final grade. If only the individual course assignments are evaluated and end of semester assessments are not included (the pre-intervention course included individual assignments, but they did not pertain to the project), the result is similar – as shown in Figure 4.0 (p-value = .006).

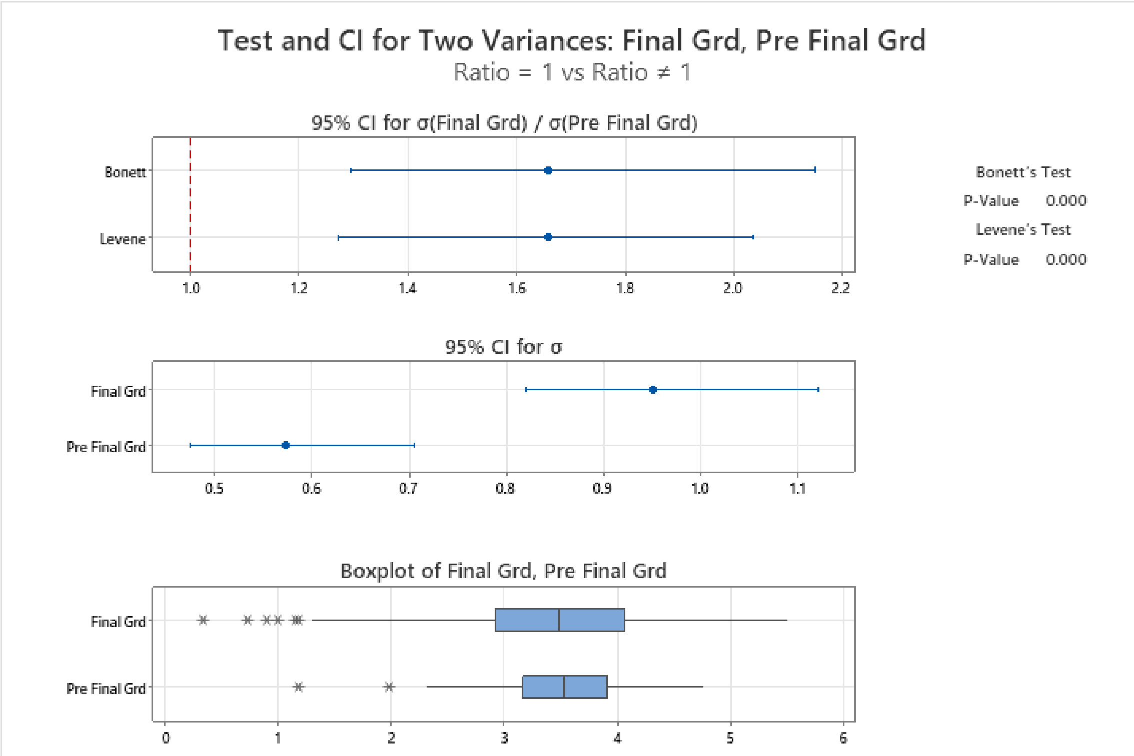

Figure 3.0: Variance Test for Pre and Post Student Final Grades

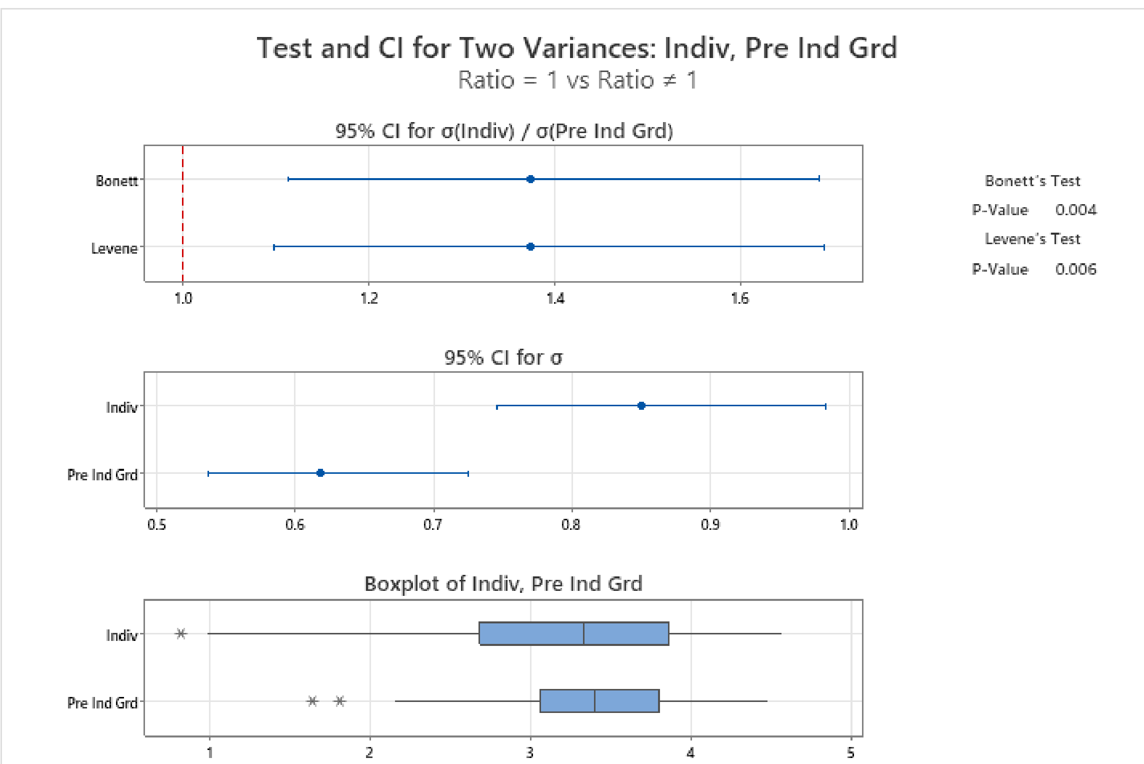

Figure 4.0: Variance Test for Pre and Post Student Individual Grades

Also of interest is whether students performed at the expected "grade" level when completing the prototyping assignments. The instructor uses an assessment rubric that specifically addresses student attainment of assignment requirements. The desire is that students receive a 3 (lowest B) or above on the assignment. (This is using the 5-point grading scale). The mean individual prototyping assignments grade for the three post intervention semesters is 3.18 and the median grade is 3.26. These meet the instructor's goal. The variance, however, is high at .99. The variance is illustrated in Figures 5.0 (boxplot) and 6.0 (histogram). Figure 5 indicates that 50% of the students receive individual prototyping grades between approximately 2.8 and 3.9. However, almost 25% of the students receive grades at 4 or above and another 25% of students receive a grade below 2.8. which is performing below expectations. These students are possibly those who desire to free ride using the course team activities and assignments.

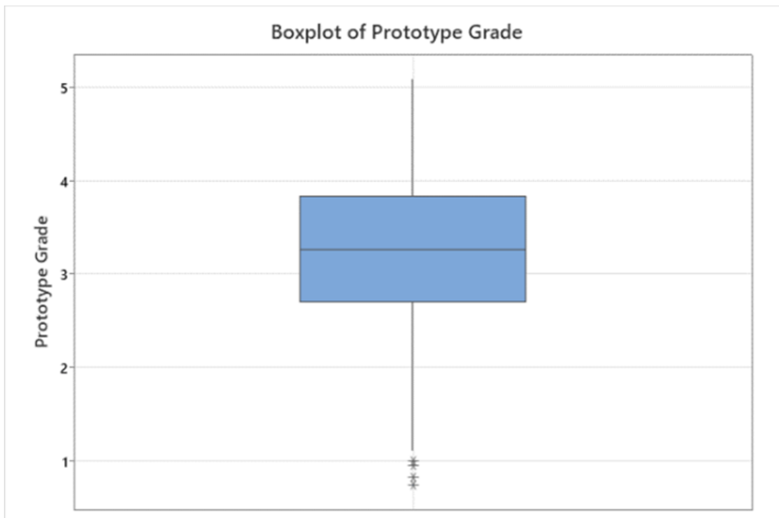

Figure 5.0: Boxplot of Prototyping Grade

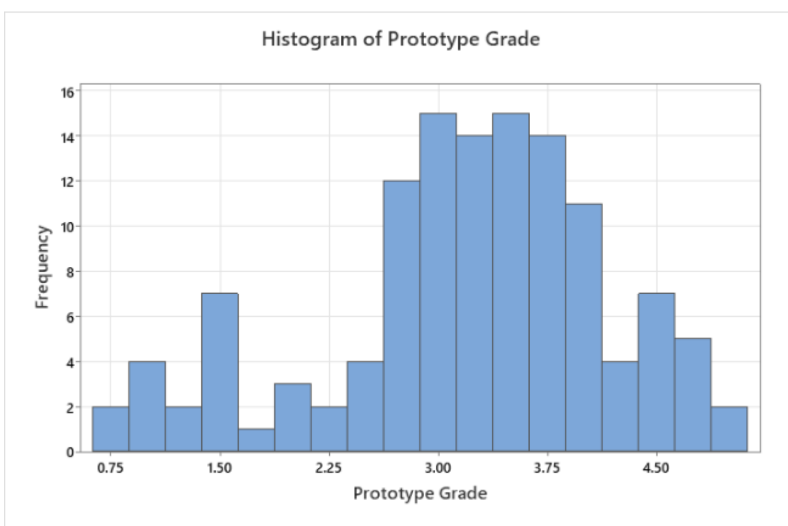

Figure 6.0: Histogram of Prototyping Grade

Finally, it is interesting to look at the correlation between the individual prototype assignment grades and the peer evaluation grade the students receive from their team members. Figure 7.0 indicates there is a moderate association (r=.542) between the two assessments. Thus, only some students recognize and communicate that their peers do not contribute sufficiently to the project.

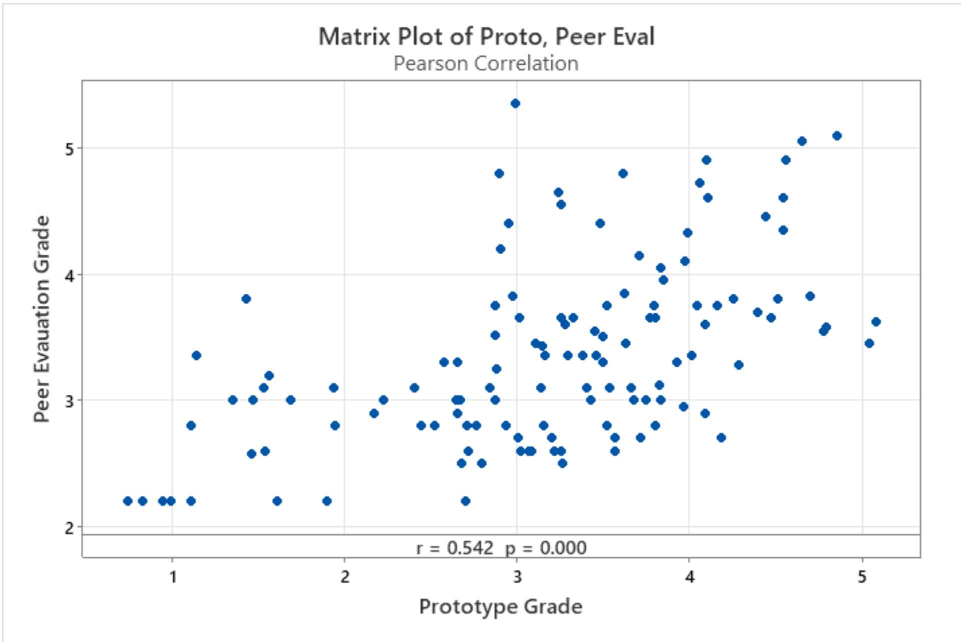

Figure 7.0: Correlation Between Prototype Grade and Peer Evaluation Grade

Discussion

The results indicate that the prototyping assignments influence the students' final course grades – if the student does not participate in this individual learning exercise their individual overall course grade is negatively affected. The difference in the spread of final grades between the pre and post intervention (Figure 3.0) illustrates that students cannot free ride their way through the prototyping assignment. Figure 4.0 illustrates that the new prototyping assignments are more effective at identifying those students not performing as individual contributors to the project than the previous pre-intervention assignments were. The results also indicate that the new assignments are better at identifying loafing students than peer evaluations. Thus, the intervention is helping to diminish the benefit students receive from social loafing or free riding. This is further illustrated *in Figures 8.0 and 9.0 below where the final grade is compared to the team project grade – the correlation coefficient has decreased from 0.666 (pre intervention) to 0.460 (post intervention).*

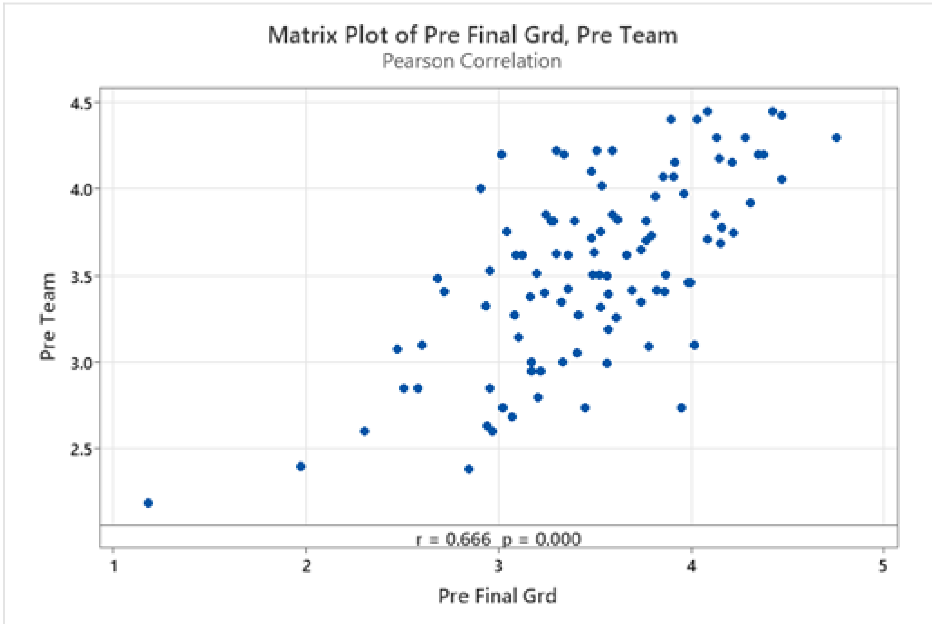

Figure 8.0: Pre-Intervention Final Grade vs. Pre-Intervention Team Grade

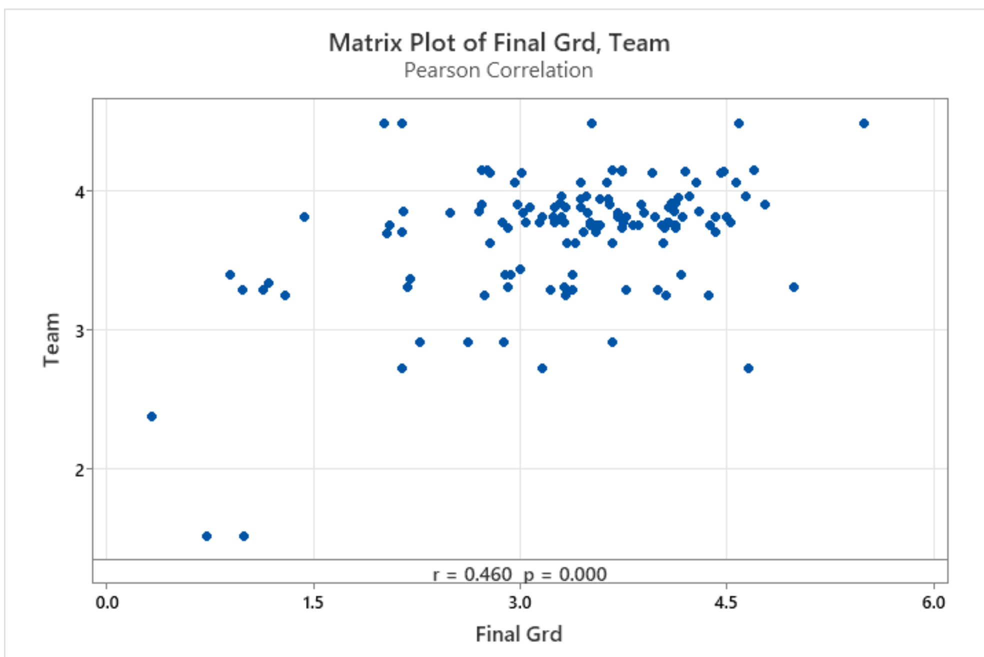

Figure 9.0: Post Intervention Final Grad vs. Team Grade

But are the students learning by participating in the prototyping assignment? The student reflections indicate that they believe they are learning. The comments they relay include terms that signal they recognize the relevance of the activity and how to use the design criteria as a part of the prototyping and testing process. For example, students comment that:

- *'I **felt a responsibility** to make sure I tested everything correctly since it would be a critical part of the build."*
- *"The individual prototyping and testing **were crucial to my learning** of functional operations."*
- *"The individual prototyping process **allowed me to learn** how difficult it can be to take ideas and designs that I have created and drawn on* paper *and turn them into functional prototypes."*
- *"I worked on these processes on my own and **was able to learn** more about each of them. It helped me learn a lot about the overall design process."*

There are many more comments like these. Some comments indicate students appreciated the opportunity to work for a short term outside of the project team. Students also learned how much knowledge can be acquired from a test that fails. This realization and learning did not occur prior to adding the prototyping and testing assignments. This analysis, however, is incomplete. As stated previously, a study using a text analysis tool is planned for the near future to investigate more fully the reflections and provide a more thorough response to study Question 3.

Conclusion

This research included only three post intervention semesters of the revised course, including data associated with only 115 students. This sample size, however, is adequate to illustrate the results noted. Of significance is the difference of variance in pre and post final grades that indicates an ability of the intervention to identify high and low project contributors. Also of significance is the decrease of the correlation between a student's course final grade and the team grade from pre-intervention to post intervention. This illustrates less opportunity for a student to free ride and more opportunity for those students who work hard, contribute much to the project, and excel in assignment response to receive a grade that represents their performance.

The moderate association of correlation of team and individual student grades seen post intervention may be appropriate in a course that is team project-based for the entire semester. This needs further investigation. However, the strong association correlation prior to the addition of the prototyping activities (pre-intervention) was not acceptable. Students were not being appropriately assessed regarding their contribution to the course requirements.

There is much data in the student comments yet to be mined. Students honestly share their thoughts, but evaluating their contribution to the study requires translating methods that have yet been completed. Thus, Question 3 has not been adequately addressed. In addition, student comments are anonymous. There may be some benefit to connecting the qualitative contributions to the quantitative student assessments. This connection may help identify if social loafing students bond with the individual prototyping and testing assignments and produce at a higher level. However, it is recognized that not having anonymous comments may limit the candid and honest comments the students provide.

References

[1] A. Akera, S. Appelhans, A. Cheville, T. De Pree, S. Fatehiboroujeni, J. Karlin, D. M. Riley, "ABET & Engineering Accreditation—History, Theory, Practice: Initial Findings from a National Study on the Governance of Engineering Education". Proceedings of the ASEE 2019 Annual Conference. American Society for Engineering Education.

[2] ABET. *Self-Study Templates*. Engineering Accreditation Commission/ [Online]. Available: https://www.abet.org/accreditation/accreditation-criteria/self-study-templates/. [Accessed January 19,2023].

[3] A.C. Edmondson, I.M. Nembhard, "Product Development and Learning in Project Teams: The Challenges Are the Benefits". *The Journal of Product Innovation Management*. Vol. 26, pp. 123-138, 2009. [Online]. Available: https://doi.org/10.1111/j.1540-5885.2009.00341.x [Accessed February 27, 2023].

[4] E.F. McDonough III (2000), "Investigation of Factors Contributing to the Success of Cross-Functional Teams". *Journal of Product Innovation Management*, Vol. 17, pp. 221-235, 2000. [Online]. Available: https://doi.org/10.1111/1540-5885.1730221. [Accessed February 27, 2023].

[5] C, Gabelica, S. De Maeyer, M. C. Schippers, "Taking a Free Ride: How Team Learning Affects Social Loafing". *Journal of Educational Psychology*, American Psychological Association, Vol 114, No. 4, pp. 716-733, 2022. [Online]. Available: https://doi.org/10:1037/edu0000713. [Accessed January 20, 2023].

[6] J. Pabico, J. A. C. Hermocilla, J. P. C. Galang, C. C. De Sagun, "Perceived Social Loafing in Undergraduate Software Engineering Teams". [Online]. Available: https://doi.org/10.48550/arXiv.1507.08345 . [Accessed January 20, 2023].

[7] Y. Chang, P. Brickman, "When Group Work Doesn't Work: Insights from Students". *CBE—Life Sciences Education*, 17:ar52, pp 1-17, Fall 2018.

[8] R. S. Hansen, "Benefits and Problems with Student Teams: suggestions for Improving Team Projects". *Journal of Education for Business*, Vol 82, Issue 1, 2006.

[9] P. Aggarwal, C.L. O'Brien, "Social Loafing on Group Projects". *Journal of Marketing Education*, Vol. 30, No. 3, December 2008.

[10] N. Clark, "Evaluating Student Teams Developing Unique Industry Projects". *Proceedings of the Seventh Australasian Computing Education Conference (ACE) 2005*. [Online]. Available: https://www.researchgate.net/publication/220832269_Evaluating_Student_Teams_Developing_Unique_Industry_Projects . [Accessed January 21, 2023].

[11] L. Monzani, P. Ripoll, J. M. Peiro, R. Van Dick, "Loafing in the digital age: The role of computer mediated communication in the relation between perceived loafing and group affective outcomes". Computer in Human Behavior. Vol. 33, pp. 279-285, 2014. [Online]. Available: https://doi.org/10.1016/j.chb.2014.01.013. [Accessed January 23, 2023].

[12] U. Dong, K. M. Bartol, Z. Zhang, C. Li, "Enhancing employee creativity via individual skill development and team knowledge sharing: Influences of dual-focused transformational leadership". Journal of Organizational Behavior, Vol. 38, pp. 439-458, 2017. [Online]. Available: https://doi.org/10.1002/job.2134. [Accessed February 26, 2023].

[13] D. Hall, S. Buzwell, "The problem of free-riding in group projects: Looking beyond social loafing as reasons for non-contribution". *Active Learning in Higher Education*, Vol14:1, pp. 37-49, 2012. [Online]. Available: https://doi.org/10.1177/1469787412467123 . [Accessed February 28, 2023].

[14] “Social Loafing”. Oxford Reference. Oxford University Press, 2023. [Online]. Available: https://www.oxfordreference.com/display/10.1093/oi/authority.20110803100515291;jsessionid=98FE8556AD712DD9CA41A174556827F7. [Accessed February 28, 2023].

[15] H. Savigny, "free riding". *Encyclopedia Britannica*, June 3, 2016. [Online]. Available: https://www.britannica.com/topic/free-riding. [Accessed February 28, 2023].