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When Students Keep Timesheets during a First-Year Engineering Project: Assignment Evolution and Student Perceptions

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Work-in-Progress – When Students Keep Timesheets during a First-Year Engineering Project: Assignment Evolution and Student Perceptions

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***Abstract* – Using timesheets to keep track of work is a common task for engineers. In a first-year engineering course, students were asked to track the time spent on their design and build robot project. Students had different category choices to select. Based on these timesheets the students were to use this data when reporting on their project. The results from the timesheet tracking were valuable for instructors to provide real-time feedback to the teams about workload. Students were then asked to provide feedback about the timesheet process. Students were generally positive in the survey results about the timesheets. The survey indicated that the timesheets met the components of the MUSIC Model of Motivation. Improvements to the process were made for a second year implementation, which included a more streamlined reporting process. Results of this work-in-progress will help inform areas for future investigations.**

Index Terms – timesheet, design, work distribution, teams

INTRODUCTION

In many engineering fields, keeping track of billable and non-billable hours worked through the use of timesheets is a part of an engineer's workday. Timesheets are often completed and submitted electronically through company software on a weekly basis. Translating this to the classroom has also become a practice with engineering students acting as consultants and tracking their hours working on a project [1] or tracking time to help inform curriculum [2]. In a first-year engineering course, the second semester includes a design and build robot project. Students work in teams of four to design, build and code an autonomous robot which must complete a set of tasks [3]. Throughout the process students must document and manage the project appropriately. Students began keeping track of their time via timesheets. These timesheets tracked: (1) the activities each group member worked on, and (2) the self-reported time spent on each activity. Activity choices included: Documentation, Project Management, Coding, Testing, Building/ Constructing, CAD, and Other. These timesheets served as a talking point for faculty during regular progress meetings with the teams to discuss the distribution of work. Some of the trends faculty are interested in include how gender factors into the distribution of work, how the workload relates to credit hours and learning objectives, and how time spent on this project may be impacting students in other areas of life and school. One specific example that could be investigated is in teams with males and females are females disproportionately working on tasks like documentation rather than the other areas of the project

This work-in-progress paper investigates students' responses from a survey about completing the timesheets and includes a discussion of the history of the timesheet assignment in this course and how it has evolved. Finally, the paper highlights some key areas for future data analysis from the full timesheet dataset. While a limitation of this study is that the student hours are self-reported and self-reported time is not always accurate, the hope is that the student perceptions and data trends will determine areas for future investigations.

PILOT YEAR IMPLEMENTATION

During the pilot year implementation, students completed timesheets using a template in Microsoft Excel. Student teams were provided a template for each week they worked on the project and were expected to complete the timesheet on a weekly basis. Instructors had access to the timesheet data for each team and could monitor progress and hours worked.

A MATLAB script was created to aid in the analysis of the data. As part of the analysis the MATLAB script created a variety of plots. All of this information was made available to the teams. For example, teams were able to graphically see the number of hours each teammate spent working on the project, the number of hours devoted to specific activities, and the hours the team devoted to the project for any given week. The MATLAB program produced eleven different plots based on the data.

Figures 1-3 show three sample plots that a team would have obtained and these could have been used by faculty to have conversations with the team about work distribution. For example, in Figure 1 it is clear that Students A, B and D are contributing a similar percentage of time toward the project. An instructor may want to determine what is happening with Student C. Figure 2 shows helpful trends of the timing and spikes in certain categories of the project. With substantial data in future years, trends can be computed that will be helpful when planning the course for subsequent years. Figure 3 is useful when meeting with teams to discuss distribution of work from a category perspective. If Student A is spending most of his/her time on documentation but would really like experience coding, having a conversation

about that early in the process is helpful to making sure students gain the appropriate experiences during the project.

While the timesheet submission process seemed simple initially, difficulties were observed throughout the semester. One problem was that one teammate could accidentally overwrite another teammate's data when updating the Excel document. A second was that it was possible to upload duplicates of the timesheet. Each of these issues made analysis with the MATLAB script difficult. The survey administered at the end of the pilot year implementation allowed students to provide open-ended responses regarding the timesheets. One student stated:

> *"I think that the time sheets were a good thing for keeping track of the time spent on the assignment. The only problem I had with them was that in my group, some people would upload duplicates of the time sheets, and then the entire team's time sheet would be split in two. In the future, maybe it would be better to give each student their own folder and their own time sheets so that everyone is responsible for their own, and nobody can overwrite anyone else's time sheet."*

Another problem encountered had to do with the consistency with which the Excel documents were completed by students. In order for the MATLAB script to run properly, the students had to enter their names on the timesheet in the same order every week. The MATLAB code assumed students would follow the directions and use the same order. Additionally, student names had to be the same from week to week. Sometimes students would use only their first name when entering their data and other times they would use their first and last name. Both of these issues affected the usefulness and impact of the timesheets and MATLAB script and were addressed prior to second year implementation.

STUDENT PERCEPTIONS

The survey was developed based on the MUSIC Model of Motivation [4] with empowerment, usefulness, success, interest and caring as the key areas. Questions were developed around these key characteristics of motivation. The survey was administered in SP 2016 to the three course sections that completed the timesheets. There were 104 complete responses recorded out of 105 possible participants. The results are shown in Table 1 with the results for Item 7 being reverse coded before the average was calculated.

Since all questions in this survey were designed to assess motivation related to the timesheets, a Chronbach's alpha was computed to determine if the questions were measuring similar constructs. The Chronbach's alpha was 0.782. Only the removal of Item 7 resulted in a higher Chronbach's alpha (0.837). This high Chronbach's alpha indicates that the remainder of the questions are measuring the motivation characteristics. Item 7, which asked students if they wanted to fill out the timesheets, was the answer that had the lowest average score. It is interesting that students did not want to fill out the timesheets yet they found value in them in other ways since the remaining questions all had averages between 3.75-4.19 indicating agreement with the statements.

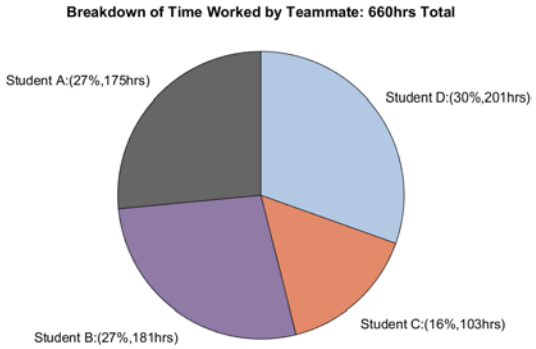

FIGURE 1
SAMPLE PLOT OF WORK BREAKDOWN BY TEAMMATE.

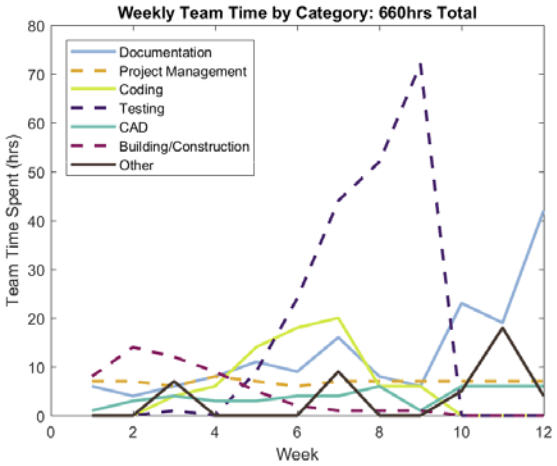

FIGURE 2
SAMPLE PLOT OF WORK OVER TIME BY CATEGORY.

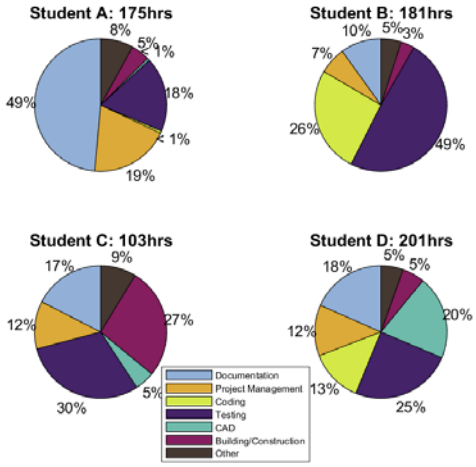

FIGURE 3
SAMPLE PLOT OF WORK BREAKDOWN BY TEAMMATE AND CATEGORY.

TABLE 1
RESULTS FROM SURVEY REGARDING TIMESHEETS

Item Number	Item Prompt	Average Score	Standard Deviation
1	The timesheets made me feel more confident in the amount of time I was spending on my robot project.	4.01	0.66
2	Completing the timesheets impacted how much time I spent on the robot project.	3.95	0.68
3	The timesheets were useful to analyzing the work put into the robot project.	4.17	0.70
4	The timesheets were beneficial to how we worked together as a robot team.	3.75	0.68
5	The timesheets and MATLAB analysis provided me with an opportunity to reflect on the work I've completed this semester.	4.00	0.72
6	The expectations for the timesheets were communicated clearly.	4.19	0.67
7	The timesheets were not something I wanted to fill out. (*R)	2.06	0.74
8	The MATLAB analysis of the timesheets was something I was interested in looking at.	4.00	0.77
9	The timesheets and MATLAB analysis demonstrated that the instructional staff cared about my team's time spent during the robot project.	3.91	0.75
10	The timesheets and MATLAB analysis demonstrated that the instructional staff cared about me as a student.	3.89	0.76

SECOND YEAR IMPLEMENTATION

Despite the generally positive feedback from students regarding the use of timesheets, changes were made based upon the data and feedback gathered after the pilot year with the goal of making the timesheet submittal process easier for students. The survey data from the pilot year implementation indicated that students found value in completing the timesheets, yet did not want to fill them out. This mentality is confirmed in the open-ended response provided by one student. The student stated:

> *"The timesheets were annoying to fill out, but I'm glad I did. They were beneficial when reflecting on how we spent our time and it made me proud to say I put in so much effort."*

Another student similarly stated:

> *"The time sheets were valuable but very inconvenient."*

To address this issue, students submitted their weekly timesheet through a Qualtrics survey during the second year implementation. The survey more closely resembled timesheet software students may see when they enter the workforce and minimized the effort required to submit a weekly timesheet. The Qualtrics survey helped address other difficulties encountered during the pilot year implementation. Not only did the survey alleviate the problem of overwriting teammates' data, it also created greater consistency in the format of the aggregate data delivered each week to the teams.

With a formalized timesheet process in place, all eleven sections (approximately 385 students) of the first-year engineering course participated in the second year implementation.

CONCLUSIONS AND FUTURE WORK

From these results we can see that students were generally positive about completing the timesheets. While valuable, timesheets are tedious to complete. Therefore, the simpler the process, the better. There could be more emphasis on what students should be looking for with the analysis. Many students stated that it did not change the number of hours they worked, but that was not the purpose of the timesheets. The next place to investigate is in the actual timesheet data to determine trends about the project. Looking at the scope of work and time spent on the project will be helpful when making future changes to the course. Determining how the time tracked corresponds to specific learning objectives may be able to point to areas of improvement in the course. Additionally looking at workload distribution by gender or by instructor may also result in some interesting findings.

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