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Teaching Time standards in a practical way : How ET students were taught the importance of time standards in the real world

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Abstract

Standardization is all around us - traffic lights, weights, and measures to name a couple. However, time standards offer challenges in many ways. These are standards Industrial/Manufacturing engineers must establish all the time for workers/operators. Given the many factors that needs to be considered, this paper explores a holistic way of teaching students to appreciate, experience and develop skills to embrace time standard studies. A lot of what is discussed here comes from proven industrial practices and a developing student ability to get acquainted to real life work.

Keywords

ET, Time & Motion, Work design, Standardization, Lean

Introduction

In the business world the most famous saying is, "Time is money." This is an important and a vital statement to bring into the classroom. Engineering Technology (ET) is that field of applied sciences where knowledge is applied with a specific purpose/outcome. Time and Motion studies is one such course that helps lay foundation to the ET students about the importance of time as well as the practical use of it, in the industry. At the University of Memphis, this course is taught as a part of the Engineering Technology Major for both Undergraduate and Graduate degrees.

"Work design and measurement which is sometimes referred to as "Methods Engineering," is the systematic procedure for subjecting all direct and indirect operations in a manufacturing or service industry to scrutiny."[1] It includes introduction of improvements resulting in making work easier, to perform and allowing work to be done in less time and to improve workflow. In other words, the methods engineers increase productivity and throughput, reduce process, and cycle time and lower the costs of operations for products or services. To accomplish this task practitioners must have a working knowledge of work design and measurement.

Time studies have been done for many decades. They form the bedrock for many project proposals where effort estimation become the basis. All production-based industries use time studies as their platform to measure productivity. Software companies, Call centers, TSA etc., establish their people resources using time standards. They could be historical or current. Time studies in the industrial world have been done from around the 1930s. Frank and Lillian Gilbreths are known to be the pioneers of "one best way to complete a task" [2]. Frederick Taylor started the scientific management where his mantra was "a fair day's pay for a fair day's work" [3]

This paper presents, how I taught the real-life applications of time and motion studies using the textbook as a theoretical platform. There are various aspects of the teaching methodology that come from my work experiences. I had myself taken this course in this department in 2006 as a part of my master's degree. It helped lay the foundation about the fundamentals of production planning and workspace design that revolved around the human element. While it may seem that, this field of applied science is very practical and mathematical, it has the human effort aspect which makes it particularly challenging. I realized this in my very first job. My management would push for increased productivity while the operations team would ask for increased time for production. This was particularly challenging.

Successful completion of this course is expected to enable the student to:

- Effectively apply the principles of time and motion study, and concepts of Lean, ergonomics and industrial safety. Successful completion requires a familiarity with terminology, tools and techniques that are in use globally.
- Demonstrate a working knowledge of Stopwatch Time Study, Worker Rating (Leveling), Predetermined Time Standards, Standard Data and Work Sampling.
- Exhibit familiarity with current periodicals and sources of information pertaining to Work Design, Measurement and Improvement, thorough review, and critique of journal articles.
- Demonstrate the capability to use MS Excel, as well as other tools and techniques useful for quantitative analysis and presentation of findings.
- Ability to decipher the problems, critically think and analyze the problem, creative problem solving and present it effectively.

The students would attend this course are a blend of traditional and non-traditional students. Traditional students comprise a mix of those who wanted to get a degree in Engineering technology as their career goal. Another set of traditional students are also those first chose Engineering Sciences or other majors and decided to move into a more hands-on learning. Most of the non- traditional students are working professionals who want to get a degree to enhance their careers or using employer tuition contribution to grow within their organization. This blend of traditional and non- traditional students changes between the day classes and the night classes.

As seen above, the skills levels of these students significantly vary. They have their foundation courses completed but have not decided their field of study yet. The ideal time to complete this course is junior year of the first part of the senior year. The reason being, if they chose to complete their final project in the “Lean & Ops Strategy” field of study, this course is prerequisite. The final projects for all students are two semesters long. The first semester is where they propose their project and seek approval. The second semester is when they complete and present their projects.

This course was taught in the past by using the textbook as the foundation, some class exercises, and then online resources as a support. The evaluation for the grades was based on quizzes, exams, assignments, and research papers. This was quite effective is establishing the fundamentals and the concepts that were needed to complete the course. When I started this course the first semester, it was online due to the pandemic. There were many challenges, especially with the in-person

aspects of it. I had to get creative with my teaching and that was when I assigned a car parking exercise as a part of their course. Once we transitioned to in-person learning, I was able to see the challenges faced by the students in learning this course and had to make changes to achieve the following objectives

- Understanding the business value of this course
- Students should use the textbook as a theoretical guide and then the classroom lectures were aimed at discussing the concepts.
- Learning had to happen beyond the textbook – reference books, case studies, real life experiences had to be integrated.
- Learning to be resourceful – looking for avenues to solve problems
- Structured problem solving. Understanding and acknowledging that calculator and MS Excel were only tools and not solution providers.
- To emphasize the importance of effective communication and presentation of their research or project work.

The first change I implemented in my course was explaining the "Why" to the class. Many of the courses I learnt usually taught me the "How" and the details of it but somehow, they were not presenting the big picture. I take the class through the fundamentals of business – Mission/Vision, Strategic, Tactical and Operational layers of the company. Then they are introduced to the concept of value and its importance in the business and service world. We spend a class on this part because, it lays the foundation for the rest of the course. I share the general nature of their job in the industry. We also discuss the quantification and its relevance to the business world.

The second fundamental change introduced was using the textbook as a tool to understand the concept and not for memorization. Quizzes and assignments were originally based around the problems in the textbook. Grades were assigned solely based on the ability to demonstrate theoretical learning. In my class we used the textbook to discuss the concept but then take real life case studies to discuss about it and seek solutions. For example there is a concept called SMED (Single Minute Exchange of Dies) concept in the automotive industry. This concept is attributed to Toyota Production System where production lines were quickly able to change different models of production based on demand. Recently there was an article on BBC about how airlines spend a lot on airport fees due to the time planes stay at the airport. The changeover of passengers is a small percentage of this time but all other activities such as refueling, clearing trash, loading food etc. took the bulk of the time. We discussed how we could apply the SMED concept to solve the airline issue. Students were divided into groups to discuss and present solutions.

The third change introduced was using simulators as an effective tool to translate the text knowledge to hands on activity to learn this better. I designed and built simple simulators that I deployed as group activities. These simulators came from my work experiences and projects. These simulators had the technical, learning and business aspects in them. They were also very real life. For example, we did a mail campaign example where students were to send postal mails to potential donors as a part a fundraising effort. I introduced the quality aspect of it in this exercise such as address authentication. Labor time, efficiency and effectiveness were included too. This

was done over three classes with each iteration having a stepped improvement from the previous one. This experience received exceptionally good participation from the class.

The fourth change introduced was doing research and presenting to the class. Students were expected to find articles, videos from the internet study them and then create a presentation to the class. To leverage the experiences of non-traditional students, they were asked to bring their work projects and present to the class as well. We did not just discuss the technical aspects of it, we also discussed communication, challenge and how to overcome them. For example I had a student who took the learnings from my class and identified a significant cost savings opportunity at his job, but his supervisor was unwilling to buy-into the idea. So we discussed the concept of Cost of Doing Nothing (CODN) and how quantification would help break the barriers. Within a few weeks, the supervisor accepted, and the student was able to start his project successfully. This proved to be a big hit with the class about how the classroom learnings could be translated into real actions.

In conclusion, my goal of taking up teaching as a profession after working in the industry was precisely this. It was to bring pragmatic approach to the classroom where students were not just memorizing to make their grades but were also seeing the other aspects of learning that would make them well equipped for their further jobs. By including diversity, production and service industry, this course was appealing to those students who thought that Motion and time study was a Manufacturing only "thing." By the end of my second semester of teaching this course, quite a few students had already chosen projects in Lean Ops & Strategy and were actively engaging with me on their projects. They were able to get incredibly superior results on their projects and were very motivated.

Engineering Technology is an exciting field where students can bring theory and practice together. They can also get a flavor of the business world and learn to put themselves on the path of success.

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