Field trips: a teaching tool in an introductory course on Process Industry

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Abstract

The Engineering Technology program at Texas A&M University-Corpus Christi offers two B.S. degrees in Control Systems Engineering Technology and Mechanical Engineering Technology. Students in both degree programs are required to take an Introduction to Process Industry course. The main goal of this introductory course is to introduce students to the operations, equipment, and organization of industrial facilities. Delivery of the course involves three mechanisms: lectures, laboratory lessons, and field trips. One of the unique aspects of the course is that it relies heavily on field trips. Overall, student satisfaction with the course seemed to be high, with a majority of students feeling that the course achieved its intended goals and was a positive learning experience. This paper describes the benefits of field trips and shows how they contribute to accomplishing course objectives. The information presented should be helpful to other institutions in integrating field trips into their courses.

Introduction

Industrial field trips can be an effective teaching tool [1]. This can be particularly true in an introductory course where students do not have a good background on the topics covered. Therefore, field trips have been integrated into the Introduction to Process Industry course (ENTC 1203) at Texas A&M University-Corpus Christi [2]. This Engineering Technology course covers the process industry terminology and operations. Course requirements include participation in field trips to local and/or regional industries.

A major objective of the field trips is to get familiar with the responsibilities of technicians, technologists, and engineers working in various technical positions. Another goal is to get familiar with the operations, equipment, and facilities of manufacturing and process plants.

Field trips have several benefits that make them a valuable component of the course. For example, they help faculty gain knowledge about current industry tools, practices, and operations. They can also increase exposure of the engineering technology program, which is particularly important for a new program. Furthermore, they give students the chance to expand their vision of their chosen field by observing the operations of industrial facilities [1].

Student feedback has been generally positive since they get a chance to actually see the processes and equipment presented in the lecture and text. Students can gain knowledge from being able to ask plant engineers and technicians about 'real-world' situations. It is also easier to have active class discussions based on actual scenarios rather than hypothetical ones. Field trips can also accommodate the different learning styles of students.

Course Description

This introductory course covers the process industry terminology and operations including basic process principles, plant instruments and equipment, quality control, environmental issues, health and safety issues, and plant organization [3]. A computer-based training system "Distillation Expert Trainer, DEXTER" is used in the laboratory [4]. DEXTER is an integrated computer-based training system, consisting of lessons, quizzes, drills, and a simulator. The lessons are comprehensive interactive sessions that cover various aspects of process technology.

Methods and activities for instruction include the following: lectures, laboratory assignments based on DEXTER lessons, and tours of local/regional industries.

The course is normally taught once a week, and it consists of a one-hour lecture followed by a three-hour laboratory period. Table 1 shows a weekly schedule using the textbook chosen for the course [3].

Table 1. Weekly Schedule

Week	Textbook Readings	Topics
1	Ch. 1	Process technicians
2	Ch. 2	Basic process principles
3	Ch. 18 & 19	Environmental/safety issues
4	Ch. 13	Process chemistry
5	Ch. 14	Distillation
6	Ch. 3	Valves
7	Ch. 4 & 5	Pumps and Compressors
8	Ch. 6, 7	Steam turbines; quality control
9	Ch. 8	Instruments
10	Ch. 9	Heat exchangers
11	Ch. 10 & 11	Heating/cooling systems
12	Ch. 15 & 16	Steam systems & boilers
13	Ch. 12	Reactors
14	Ch. 17	Extruder operations
15		Final Exam

Assessment is based on pop quizzes, two midterms, laboratory exercises, tour reports, and a final exam. At successful completion of this course the student should be able to:

- Define key terms used in process technology
- Describe the roles and responsibilities of process technicians and technologists
- Identify instruments and equipment used in the process industry
- Describe and apply the basic principles of pressure, fluid flow, temperature, and distillation
- Describe the operations and applications of valves, pumps, compressors, steam turbines, and heat exchangers
- Define quality control principles and terms
- Describe air pollution control, solid waste control, toxic substance control, and community right-to-know principle
- Define standards and codes found in a safety program.

Field Trip Implementation

Field trips to local and/or regional industries are part of the course requirements. The main goal of this activity is to allow students to see the application of principles covered in the lectures and textbook.

The instructor selects the appropriate sites for the filed trips. The trips are normally scheduled during the laboratory time to allow enough time for all the activities involved. Local companies donate their time to accommodate the students at their facilities. The 'tour guide' typically shares his or her professional experience, which allows students to gain more insight into the company process and operation. Table 2 shows a sample of the companies visited during the semester of Fall 2002.

Table 2: Sample field trip sites and company information

Company Name	Type of Business
Sherwin Alumina Company	Production of Alumina from raw material
Central Power & light	Electric power generation plant
GPM Engineering	Consulting engineering firm
FMC Measurement Solutions	Design and build measurement systems for oil companies

Each student must submit a written report a week after a tour is taken. The report will consist of a summary of tour activities and a tour evaluation form as shown in Figure 1. The summary must include the following:

- Description of the products and services of the company
- Description of what took place during the tour and a summary of the major activities
- Description of what was seen and heard
- Statement of what was learned.

Student feedback has been generally positive as shown by comments in their tour reports. The feedback from participating companies has also been positive since they get a chance to interact with students and provide more exposure to their industry and operations.

Tour Evaluation Form

1. The most important thing I learned from participating in this tour was:_____
   _____
2. This tour can be improved if_____
3. Did this tour increase your understanding of the responsibilities of technicians, engineers, or technologists?
   ___Yes ___No
4. Did this tour increase your understanding of the operations, equipment, and facilities of industrial facilities?
   ___Yes ___No
5. I recommend that this tour be taken by future classes. ___Yes ___No
6. Overall, this tour was ___Excellent ___Good ___Fair ___Poor
7. Other comments. _____

Figure 1. Tour Evaluation Form

In addition to playing a significant role in achieving the course objectives, field trips can help the engineering technology programs as follows: increase exposure of the program, strengthen relationships with industry, help faculty gain new technical knowledge, and keep faculty familiar with job opportunities.

Conclusion

Industrial field trips can enhance student learning particularly in an introductory course. Therefore, field trips have been integrated into the Introduction to Process Industry course at Texas A&M University-Corpus Christi. An additional benefit of field trips is that company engineers and managers inform students about career opportunities as well as what they look for when they hire an employee. Overall, student satisfaction with the course seemed to be high. A majority of students felt that the course achieved its intended goals and was a positive learning experience.

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Biography

HESHAM SHAALAN, Ph.D., is an Associate Professor of Engineering Technology at Texas A&M University, Corpus Christi, Texas. He received his B.S.E.E. and M.E.E. degrees from the University of Houston in 1986 and 1987, respectively, and his Ph.D. from Virginia Tech in 1992. He is a member of Eta Kappa Nu Honor Society, American Society of Engineering Education (ASEE), and Senior member of the Institute of Electrical and Electronics Engineers (IEEE).