
AC 2011-1496: REDESIGNING A COURSE ON ELECTRONICS DISTRIBUTION NETWORKS TO MEET THE CONTEMPORARY INDUSTRY NEEDS

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Redesigning a Course on Electronics Distribution Networks to Meet the Contemporary Industry Needs

Introduction

The current focus of the electronics industry in the U.S. is primarily on research and developmental activities. Most of the manufacturing and assembling of electronic products has been off shored to countries such as Mexico, Taiwan, Malaysia, Mexico etc. The computer and electronic product manufacturing industry in the U.S. lost about 600,000 jobs from the years 1998 – 2008 and is expected to lose another 250,000 jobs in the years 2008 – 2018 [Bureau of Labor Statistics, 2010]. The industry has become global and this creates new challenges in the optimizing the distribution channels for electronic products. Additionally, the average life span of electronics products and technology is becoming shorter and shorter. So, electronic products need to be made available to customers as quickly as possible and that is very challenging when the supply chain of the products spans several countries.

In Spring 2009, the Electronics Distribution Networks course at Texas A&M University was redesigned to address the new challenges in the industry. This class is a required class for the Industrial Distribution curriculum of the Engineering Technology and Industrial Distribution (ETID) department. The course is specifically targeted at ETID students who are majoring in Industrial Distribution or Electrical Engineering Technology. The class was redesigned to include content on globalization of electronics distribution networks. The concepts on managing lean agile global supply chains were included in the course. Also, due to the short life cycle of electronics products and technology, the electronics industry is always a moving target. Many practitioners and industry representatives were involved in the class so that they can shed light on current state of in the industry. The course was redesigned to provide students with access to global resources, industries here in the U.S. and also various trade associations. This article will talk about how the class was designed to strike a balance between teaching the fundamentals of electronics distribution and making the learning current and relevant to the students. The students who have taken this class have the basics of the 100 year old electronics distribution industry and the experience to solve current problems in the industry.

Course Content

In the Industrial Distribution curriculum, Electronics Distribution Networks is a course students can opt to take at the junior or senior level. One or two sections of this class are offered every semester and there are about 50 students in each class. This course is offered as a three credit course and meets twice a week for an hour and fifteen minutes every meeting period. The class is offered in the Spring and Fall semesters which span 14 weeks. The 28 class periods were divided carefully between guest speaker, lectures, in class exercises and exams. With the given time limit in mind, a sequential process was followed to design the class.

The steps that were followed are

1. A comprehensive list of learning outcomes was developed for this course.
2. An outline of the course was created before the beginning of the semester so that in class activities, homework and exams can be provided to students at the right time. This provided the students a tentative schedule so that they can plan their other activities accordingly.
3. Clear and Concise grading guidelines were prepared to grade homework and exams. Thought was put into coming up with the grading guidelines such that students get more points for showing higher level of understanding.
4. Detailed grading rubric was created for the project.
5. Students were encouraged to post on discussion boards.
6. An outline for the exams was created after a thorough analysis of the topics that need to be tested and the level of skills that need to be exhibited by the students.

The objective of this course is to expose students to the electronics distribution industry through an interdisciplinary approach combining team projects, individual study, and exposure to industry executives. The course should equip students with tools to do well at an electronics distributor. The Industrial Distribution curriculum includes courses such as Industrial Electricity and Industrial Automation. Students would have taken these classes prior to taking the Electronics Distribution Networks class. These courses provide the necessary technical background and so, the focus of the Electronics Distribution Network class is more on the business and the distribution aspect. The Electronics Distribution Network course objectives are listed in Table 1.

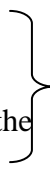
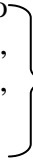

<ol style="list-style-type: none"> 1. Describe the difference between electrical and electronics. 2. Interpret a block diagram. 3. Identify various electronics components. 4. List the significant events that influenced the evolution of the electronics industry. 	 <p style="text-align: center;">Basics of Electronics Distribution</p>
<ol style="list-style-type: none"> 5. Design the process of how an electronics manufacturer goes to market - Product Selection, Channel Selection, Partner Selection, Partner Engagement Plan, Ongoing Assessment, Conflict Resolution, Terminating Relationships 6. Analyze the various challenges specific to electronics industry. 	 <p style="text-align: center;">Electronics Distributor Business Model</p>
<ol style="list-style-type: none"> 7. Summarize expectations of the training programs at various electronics distributors. 8. Use a pivot table. 9. Create a pivot table and pivot chart. 10. Reflect on how the economy has influenced the electronics industry. 11. Explain the role of NEDA in supporting the electronics industry. 12. Identify new trends/products in the industry. 	 <p style="text-align: center;">Getting ready to hit the ground running in Electronics Distribution</p>

Table 1 Course Objectives

Once the course objectives were developed, various topics that will be covered in class were determined. The topics that were covered in class lectures are Introduction to Electronics

Distribution, History of Electronics Distribution, Various Electronic Components/ Block Diagrams, Product Selection, Channels to Market, Channel Selection, Partner Selection, Engagement Plan, Authorization Agreements, Ongoing Assessment, Inside the Distributor/ Manufacturer, Conflicts, Ending Relationships, Changes due to economy, NEDA, New Products, and Pivot Tables.

Most of the topics covered in class were included in the book “Connecting Resources – A Primer for Electronics Distribution” by Laurie Kane-Sellers, Joan Koerber-Walker and Ben Zoghi. The students also worked on a extensive project. The topic of the project changes every year. For Fall 2010, students had an option between working on two project topics. One was to do market study for the Dallas- Fort Worth area for a large electronics distributor and the other project required students to track the supply chain of an electronic component that goes into a electronic gadget that is sold at a big-box retailer. The market analysis option and the supply chain option both were very interesting to the students. Almost equal number of students chose both the projects.

Other projects that students have worked in the semesters past are the National Electronics Distributor Association (NEDA) undergraduate competition and studying of an electronics distributor. Every Fall semester NEDA, now Electronic Components Industry Association conducts an undergraduate research competition. The students in this electronics distribution class generally work on this during their Fall semesters. The mapping of the supply chain was part of the NEDA competition in Fall 2010. In Fall 2009, student teams had to compare electronics distribution industry to another industry of their choice based on green initiatives. In the Spring semester, students are grouped into teams and each team is provided a contact at an electronic distributor. The student groups interview the contact and also look at other sources to gather information about the electronics distributor and present it to class. By attending the presentation, the entire class gets to know about the inner working of at least ten different electronics distributors.

Students worked on the projects in groups of no more than 5 members. There were several milestones to the project. Students had to come up with the proposal for their project along with a tasklist and a timeline within the first two weeks into the semester. Students were provided feedback on the proposal. Then, teams had to submit a midterm draft of the report that they were working on and there were information midterm project updates done in class. Towards the end of the semester, student groups had to turn in a project report and also present their findings to the class. The attendance for the student project presentations is mandatory as students can learn from the other team’s project. Students also had to create a handout about the project findings. This will be similar to a one page leave-behind and creating this one page handout provides training on conveying your ideas in a succinct and engaging manner. Most of the students from the Industrial Distribution Program choose sales as their careers and creating this one page handout helps them in their career.

Students also think that working on the projects is challenging especially when they have to interact with the company representatives to get information. However, they get exposed to communicating officially and also providing lead time for the company representatives to

respond. The students generally like the NEDA competition better because of their competitive spirit.

Course Delivery

There was one primary instructor for the class but several guest speakers were invited to present various current industry topics. Bringing in guest speakers into the class not only helped the students listen to what is happening out in the real world but also help the faculty getting in touch with people with expertise in the field. Conversations between the teacher and the guest speaker outside class help the teacher understand the industry better and provide material for the faculty to discuss real life examples in class.

Most of the class periods are used for class lectures. Class lectures are kept highly interactive. Given the nature of the topic, sometimes the class might start seeming irrelevant to students especially when the lecture is focused on electronic components. Students fail to see how electronic components feed into all the modern tech gadgets they use, as the components are mostly not visible easily in the product. So, examples about products that are used everyday are discussed in class to show the relevance of the products being discussed in class.

Guest speakers from various electronics distribution companies are brought into class to talk about their products, their supply chains and distribution strategies. This exposes students to concepts that are generally not discussed in textbooks. Sometimes, guest speakers talk about a topic discussed in class or sometimes they talk about interesting experiences from their career. Some of the topics that students like are when a guest speaker talks about various challenges that they face on the job and how they solve the problems. Guest speakers from an electronics components manufacturer and a distributor were brought to talk in a panel to the class. They picked up some issues in distribution and provided their perspectives from a supplier's point of view and the distributor's point of view. Students were very interested in seeing how the priorities differ between a supplier and a distributor.

Videos on semiconductor manufacturing, a video tour of a fab facility and a video tour of an electronics distributor facility are shown in class. Students learn quicker when shown something on video. Using videos will get their attention and also provide them with the knowledge on emerging technologies. The course materials used are most PowerPoint slides. The course materials are just for guidance or a check sheet. The text book has good reading material. Students should be able to look at the slides and refresh their memory on what topics were covered. They will go back to the book and read the material related to that material. There is some additional information on the topic that is discussed in class. Students are expected to take notes on their lecture notes.

There are many quantitative tools that are taught in this course and the blackboard/whiteboard is used to teach these concepts. Some examples of the quantitative tools are how to calculate channel efficiency, how to assess a channel mix etc. Students understand it better when the complete problem is worked with them instead of just showing the solution on a lecture slide. Students also learn to build and interpret Pivot Tables in EXCEL. There has been feedback from industry saying that using Pivot Tables will help the students perform some initial

data analysis and gather business intelligence. The Pivot Tables are not just useful in electronics distribution but useful in all industries.

Course Assessment

Learning in class is assessed by in class quizzes, homework assignments and exams. In class quizzes in class are mostly unannounced. Students will generally work with a partner or a team on their in class quizzes. The quizzes are generally very short and generally last for 10 minutes. The in class quizzes help the instructor to emphasize a concept and also provide a natural break during a 75 minute lecture.

Students have to do several activities as a part of class work. The two major activities that students are responsible are for homework assignments and project. Homework assignments are challenging and time consuming than the in class quizzes. There are many questions that give them experience on how they will be evaluated during the exams. Homework assignments are equally spaced throughout the semester. Depending on the difficulty of the homework, they might have a week or more to work on it. Some case studies are also assigned to students as homework or for inclass discussions. Most of the cases used in class are Harvard Business cases. Few examples are Elimiate the Middleman, Arrow Electronics, Samsung Electronics.

There will also one or two questions on the homework which will test the students' knowledge a little bit beyond what was covered in class. These questions will only be worth a few points but it keeps the students interested. They were assigned homework assignments. They also have a midterm exam and a final exam. Class participation was primarily gauged by attendance for guest speaker sessions and the project presentation sessions.

The lectures help students get to know the core concepts in the field of electronics distribution. The guest lectures expose them to practical methodologies used in industry currently. The concepts learnt through the lectures are tested on the in class quizzes, homework assignments and the exams (midterm and final). The exams are set such that 70% of the class should be able to make at least a B. Then there are few questions to differentiate the A's and the B's. A possible assessment of learning for the class is provided in *Table 2*.

Mandatory Class Attendance	50
Discussion Board Participation	50
In-Class Quizzes	100
Homework Assignments	150
Project	250
Midterm Exam	200
Final Exam	200
Total	1000

Table 2 Assessment of Learning

Student and Industry Response

Student evaluation is done at the end of the semester as a part of course evaluation by the university. Students have indicated that they like the class and the student evaluations have been above 4 on a 1-5 scale. The students like most of the topics that are being taught but as mentioned before, students fail to see how distribution of resistors or capacitors is relevant to them. This class traditionally was taught as an elective class and now has been made a required class. In the past, students who really wanted to know more about electronics distribution and have jobs in that field took this class. Now, as every Industrial Distribution student is required to take this class, they do not see the relevance. More emphasis is given in class to the basic concepts as they not different from one vertical market to another.

Representatives from almost all the top 15 electronics distributor were provided with a copy of the syllabus and asked if the topics look relevant. The industry executives believe that this class is designed with a good balance of theory and practice. They especially like the sequence of the topics covered in class. Industry representatives like the aspect of student working on very realist problems for their projects. One of the projects that students did in class was to do a market analysis. A market analysis of some magnitude is always done at an industry. Few suggestions on topics to include are how the aerospace and defense market is affecting electronics distribution and also how to deal with a cyclical economy. These topics are very timely given the economic times we are under right now. The topics and the class methodology were also discussed with other faculty and the author of the textbook and they all provided feedback that the topics are relevant and focused.

Conclusion

The class was redesigned to incorporate more material on global electronics especially on mergers and acquisitions. Mergers and acquisitions almost happen every day in electronics distribution. That is that reason why the whole electronics distribution is dominated by a handful of large distributors. Also, the topics that are related to global electronics supply chains were also included through lectures and projects. Guest speakers from Guadalajara, Mexico where a lot of electronics contract manufacturers were invited to class to discuss how the industry has expanded there. All these concepts included in the class have made the class more current and relevant. This also made the class more fun for the students.

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