

Curriculum Element: Using the Wall Street Journal to Provide National and Global Perspectives in an Engineering Economy Course

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Abstract

Objectives: Engineering economy courses typically follow a format that includes the mathematics of time value of money, project analysis using methods such as NPV and IRR, and some tax and depreciation coverage. These topics provide students with a good background to economically analyze projects, but they do not provide a big picture perspective of how engineers interact with the world at large and how engineers are involved in economic undertakings that span the globe. This paper will describe how the Wall Street Journal (WSJ) is used throughout an undergraduate engineering economics course to provide students a world-wide perspective and expose them to societal issues that need the special expertise and analytical approach of engineers. The paper will discuss how this approach is currently implemented and how it could be applied in both large and small sections of engineering economy. The paper will also provide insight strategies for choosing articles and how to navigate potentially sensitive topics that occasionally arise during class discussions.

Content: The content is drawn directly from WSJ articles. Specific articles are selected from several recent editions. The instructor and students read the articles independently at their leisure. It is the students' job to absorb the information and the instructor's job to craft a meaningful discussion and develop questions for a weekly quiz. The nature of the content varies based on the events of the day but generally focuses on articles discussing instances where engineering, societal issues, and economics coincide.

Delivery: The delivery of the content occurs at the beginning of class. Small discussions may occur during the week, but the main discussion takes place after a weekly quiz. Whether the topic is a dam collapse in Brazil, a new airport in Japan, or a subway system in India, students are interested in learning how engineering and economics work together and are interested in discussing these issues in the classroom.

Assessment: Weekly 10-question quizzes are given to provide incentive for students to read the selected WSJ articles. The quizzes account for approximately 10% of the total points available during the semester. Quiz questions are designed to both assess whether or not a student has read the assigned articles and to serve as the basis for class discussions. Quizzes are peer-graded immediately following the quiz.

Introduction

Engineering economy courses typically follow a very similar format that includes covering topics such as time value of money, analysis of alternatives, taxes, inflation, and perhaps risk and uncertainty. These topics have been formalized and are included in every engineering economy textbook. What is easy to overlook is how engineering economy courses also present a wonderful opportunity to expose students to how the engineering profession interacts with economics throughout the world economy. This paper will discuss how the authors have successfully used the Wall Street Journal (WSJ) as a way to included coverage of current topics

and show students how engineers can help shape society and the global economy. Today's engineering students are very interested in learning how their knowledge and skills can be used to make the planet and its environment a better place.

For better or worse, money is a universal factor across engineering disciplines, and students want to understand their role in improving conditions around the planet through economics. Advancing this understanding should be part of the mission of engineering economy instructors, and this mission can be partly accomplished by exposing students to examples of how money and engineering interact in ways both large and small. Traditional engineering economy tends to focus on the micro aspects of economic decision-making, so opportunities to explore larger issues must be sought out.

The authors have used the WSJ as a vehicle to expose students to examples of how engineering, money, culture, and politics all interconnect in a myriad of ways. The essence of our approach is to have students read several carefully selected articles on a weekly basis, and then take a quiz on the material. While a quiz may not initially seem like a winning approach to engage students, the way they are administered make them a fun and effective way of instilling an appreciation for global economics in students. Whether the articles (and follow-up quiz and discussion) is about a subway system in Delhi, a skyscraper in Dubai, or a dam collapse in Brazil, students are very interested to learn how engineering is involved in these activities.

Content

Content for this learning activity is drawn directly from the WSJ newspaper. Each student is required to purchase a substantially discounted subscription to the WSJ. Articles from a wide variety of sections are carefully selected from each week's papers (published Monday through Saturday), with some preference given to articles that cover global issues, economic issues, and issues related to engineering. There are typically 4-6 articles chosen each week, with articles ranging in length from very short (one column in length) to much longer (several full pages). The article titles are sent to students over the weekend for a quiz that typically takes place on the following Wednesday. One recent quiz featured the following articles:

<u>Day</u>	<u>Section</u>	<u>Article Title</u>
Mon	Opinion	Your DNA Could Catch a Criminal
Wed	US News	Proposed Main Power Line Project Clears Key Hurdle
Fri	Future	The Robot Tax Heats Up
Fri	US News	For the Economy, Climate Risks are no Longer Theoretical
Sat	US News	Mississippi Fights with Army Corps over Flood Control

Each of these articles provides its own unique opportunities to discuss about issues that impact the world. For example, the first article involves DNA and privacy, the role engineers have in developing DNA testing, and how making it economically feasible to a wide audience could have far-reaching consequences. The second article encourages students to discuss distributed power systems, such as hydroelectric, wind, and solar and consider how engineers are responsible for developing transmission systems to get the power to where it is needed. Article 3

provided the opportunity for a very interesting discussion on just what exactly is a robot (i.e., whether the definition of a robot is an engineering issue, a political issue, or an economic issue). Article 4 allowed for a discussion about the overall impact of climate on the global economy. Article 5 is of particular interest to Civil Engineers as it discusses the tension between the US Army Corp of Engineers and local units of government.

These are topics that engineering students are not used to discussing in class and go well beyond the formulas and procedures students apply in order to calculate precise answers to questions that sometimes feature layers of simplifying assumptions. The author's goal in selecting articles is to cause students to think about engineering in a much broader context, and to encourage them to think about what they want to accomplish as an engineer and what role they want to have in shaping the future of engineering.

Delivery

The “main event” for this activity occurs during the weekly quiz. We have found that for our course, which meets MWF, having the quiz at the beginning of the class on Wednesday appears to work the best. Articles covered on the quiz are sent to students at the end of the prior week and this gives students several days to read the articles and prepare for the quiz. Quiz questions are read aloud by the instructor, and the quiz questions themselves require short answers (usually a single word or number, but occasionally a one-sentence answer is necessary). In total, the quiz usually takes five to eight minutes to administer.

In reality, the focal point of the activity is not the quiz itself, but the discussion that occurs during the peer grading that takes place immediately after the quiz is administered (more on this in the next section). During the grading, the instructor's role becomes that of a discussion facilitator as answers to the quiz questions are read. Naturally, quiz questions are developed with the post-quiz discussion in mind. For example, the recent quiz featured an article about the Vale Dam collapse in Brazil. A good, discussion prompting question might be:

Why did the Vale Dam collapse?

This simple question is somewhat open ended and could allow for several acceptable answers (since the true cause was not known yet), such as improper design, shoddy construction, or inadequate maintenance. As students consider whether their peer's answer is correct, follow-up questions can be asked by the instructor:

What role did engineers have in enabling or preventing the collapse?

Who is to blame for the collapse – the designers of the dam or the operators?

What can engineers do to help prevent disasters like this from happening again?

Discussions that stem from the original and follow-up questions frequently result in wide-ranging and vibrant discussions, with many more students electing to participate than for discussions about traditional engineering economy topics. Students learn through this discussion that engineering is about more than just equations and numbers, more far more consequential than simply calculating the final answer to a thermodynamics question.

To be successful, this activity requires some instructor overhead. It requires a commitment from the faculty member to spend the time each week to read articles in the WSJ and select ones that will be of interest to students. It requires the faculty member to spend time constructing questions for the quiz and discussions, and precious class time on both. Most importantly, it requires the faculty member to be committed to leading *meaningful* class discussion on the quiz questions. Asking provocative questions about engineering and how engineering professionals can make various choices on a wide variety of issues truly resonates with students. A committed and enthusiastic faculty member can transform this activity into one that many students look forward to and learn a great deal from. However, there are potential pitfalls to avoid. A cavalier approach by the faculty member will be quickly detected by the students, and the quizzes will likely devolve into just another required activity done only to earn course points.

Assessment

While students end up finding that they enjoy the discussions, the quiz and its accompanying points are necessary to get students to actually read the articles. During the discussion/grading sessions, students exchange papers so they can grade each other's quizzes. The quizzes are traded around in various ways throughout the semester, which is meant to encourage students to grade quizzes from someone they do not know. An interesting part of assessing work from someone else (and not the same person all the time) is that it exposes all the issues that may arise in trying to determine if an answer is correct. Again, the quiz questions are carefully crafted, and "How close is close enough?" or "What range is ok?" are both common questions. Grading forces student to understand that unlike what they are commonly taught in engineering, frequently there is not a singular right answer to many questions and there may be several viable answers. We typically let students be the judge with the understanding that the purpose of the quiz and the questions is to see if people are reading the articles.

Although the peer grading process is not without challenges (e.g., cheating, not awarding points when they are warranted), it is also not without solutions. In this course, WSJ quizzes account for approximately 10% of the overall grade and the rest of the coursework is quite demanding. Students seem to be more than willing to spend time reading the articles so they can be sure to earn the points. Our experience is that cheating on quizzes is rare and students take their grading responsibility seriously.

Discussion & Impact

The approach described here works well for the engineering economy classes at Western Michigan University in-part because classes are generally limited to about 35 students per section and there is sufficient time available in class for discussions (this is a 3 credit hour course). Large classrooms would present their own unique challenges. Administration of the quiz could be accomplished using on screen displays to give students the questions. Workable strategies for peer grading would likely need to be developed on a case-by-case basis in order to minimize cheating. Class participation and discussion could be more difficult in a large lecture hall. However, there are technologies available such as clickers and smartphone apps that allow for interaction with large groups, so the issues that come with large classrooms or online

teaching do have potential solutions. The authors believe that the benefits of using the WSJ in a class activity of some kind are worth whatever adjustments are necessary to make it happen.

We believe that required reading such as the WSJ in an EE class can greatly enhance students' understanding of the role that engineers play in making the world and its environment a better place. While the activity requires some additional effort on the part of faculty, the benefits to the students are very apparent in our experience. One of the authors has been teaching EE for over 35 years and has used the WSJ as the basis of class discussions for over 30 years. When meeting with alumni one of the first questions they typically ask is "Do you still require students to read the WSJ?". When they are told that we do, they commonly relate that this activity was one of the most transformative ones they did in college. It opened their eyes to issues and questions that they had never thought of before, and it encouraged them to read a variety of publications to learn more about the world around them. Many say they still read the WSJ and many current students plainly state that they really enjoy the WSJ activity and the in class discussions.