

From *Henry V* to *Starman*: Linking the Humanities and Social Sciences to Engineering

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Abstract

ABET criteria require engineering programs to demonstrate that their graduates have, among other things, “the broad education necessary to understand the impact of engineering solutions in a global and societal context” and “a knowledge of contemporary issues.” These outcomes are usually addressed with curriculum requirements for courses in the humanities and social sciences. However, without additional mechanisms for making a connection between these courses and the engineering profession, it is doubtful that most students will fully realize the relevance and value of the material.

This paper describes efforts to link the humanities and social sciences to traditional engineering courses through the use of brief vignettes based on historical events, plays, songs, movies, and other forms of art. The vignettes are chosen to introduce or highlight selected engineering topics and/or demonstrate the impact of engineering on individuals and/or society. In addition to helping students understand the relevance of the humanities and social sciences in their work as engineers, the vignettes can also serve to demonstrate real world applications of engineering principles, increase the appeal of the engineering profession for some students, provide active learning opportunities, promote efficient use of instructional time, and add an element of fun to the classroom. Examples based on the movie *Starman*, Shakespeare’s play *Henry V*, and the song *The Wreck of the Old 97* are included.

Introduction

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For more than fifty years, numerous works by leading engineering educators have proposed the integration of engineering with the humanities and social sciences as a means of improving engineering education.² And while a number of successful programs have been developed, many of them have only been offered as curriculum options or limited only to honors students. Few programs exist that impact large numbers of mainstream engineering students. There are also numerous impediments to the integration of engineering with the humanities and social sciences,

including a resistance to change on the part of both engineering and liberal arts faculty and a perceived need to pack more and more technical content into a fixed or declining number of credit hours.³

This paper describes the author's efforts to link the humanities and social sciences to traditional engineering courses through the use of brief vignettes based on historical events, plays, songs, movies, and other forms of art. While this approach is certainly not a direct integration of courses, it is an attempt to bridge the gap. The approach described is relatively easy to implement and can be used in almost any engineering course.

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Vignette Example #1: *Starman*

This vignette includes a showing of the trailer for the 1984 film *Starman*⁴ and a discussion of the NASA Voyager 1 and 2 space probes launched in 1977. Of the three examples presented in this paper, this one has the greatest potential to demonstrate the need for linking engineering with the humanities and social sciences. A brief summary follows:

In 1977, NASA launched the Voyager 1 and 2 space probes. The primary goal of the Voyager missions was to explore the outer planets of the solar system, including Jupiter, Saturn, Uranus, and Neptune. These missions lasted through early 1990 and were highly successful. Since then, both spacecraft have continued to collect and transmit data as they traveled to the outer edges of our solar system. In 1998, Voyager 1 became the most distant man-made object in space. As of late-2004, it was almost 14,000,000,000 miles from Earth. Round-trip light time to Voyager 1 is well over 25 hours. Despite these incredible distances, NASA is still able to communicate with both spacecraft.

Both spacecraft carry a greeting to any type of extraterrestrial life that might be encountered. Attached to each spacecraft is gold-plated, copper phonograph record containing images, sounds, music selections, and greetings in a variety of languages from planet Earth. Dr. Carl Sagan, a noted physicist, led the group that selected the information used to portray the life and cultures found on Earth.

The movie *Starman* is a fictional look at what might happen if an extraterrestrial civilization ever finds one of the spacecraft and manages to decode the information on the record. The film was directed by John Carpenter and starred Jeff Bridges and Karen Allen. Some critics consider the film to be Carpenter's best work, and Bridges was nominated for an Academy Award for his portrayal of the friendly alien visitor.

The NASA Jet Propulsion Lab website⁵ provides much of the information for this vignette. It includes a wealth of information about the Voyager missions, interesting technical facts about the spacecraft and the missions, and an overview of the contents of the gold records. Sagan⁶ provides a complete history of the development of the gold records, their contents, and the reasons for the selections included.

This vignette has been used to clearly demonstrate the significance of linking the humanities with engineering in ENGR 1210, Introduction to Engineering, at Tennessee Tech University. The trailer for the movie *Starman* was shown at the beginning of class and then a brief lecture on the Voyager missions and the gold record was presented. Following this, the students were asked to select items to include on the gold record in order to portray life and cultures on Earth. The actual contents of the gold record were revealed after the students made their selections. Student selections almost always included music selections, various works of art, religious works, and other items clearly linked to the humanities. Discussion of the potential impacts of communicating with an extraterrestrial civilization followed. Students were also asked to select an appropriate technology for storing and presenting the contents of their “gold records.” Discussion of the evolution of audio and video recording technologies followed. Final discussions focused on how the humanities were critical to defining the life and cultures on Earth and on how engineering was essential in transporting and presenting the selected formation.

Vignette Example #2: Shakespeare’s *Henry V*

This vignette includes the history of the Battle of Agincourt (1415) and corresponding selections from William Shakespeare’s play *Henry V*⁷. The character of Henry V, as presented by Shakespeare, is an excellent example of many strong leadership traits, and this vignette is especially useful for leadership studies. A brief summary follows:

On the morning of October 25, 1415, approximately 5900 hungry, sick, and exhausted English troops led by King Henry V faced battle with an army of almost 30,000 fresh French troops. As a result of Henry V’s outstanding leadership, his men’s discipline and skill, muddy battlefield conditions, and a series of tactical blunders by the French, the English forces destroyed the French army. Estimates of French losses range from 7,000 to 10,000, with an additional 1500 prisoners, all nobility, taken to England. English loss estimates range from 100 to 500. This event allowed Henry V to temporarily continue his claim on the French Throne.

In the play, *Henry V*, Shakespeare presents the young English king as an excellent model of leadership. Act IV, which describes the Battle of Agincourt and includes the famous “Band of Brothers” speech, is especially useful for the study of good leadership characteristics, including:

- Leading by example – Henry V lived in the field with his troops and fought with them during battles.
- Being knowledgeable – Henry V was a skilled military tactician.
- Inspiring others – In the famous “Band of Brothers” speech, Henry V inspired his hungry and exhausted army to fight against overwhelming odds and win.

- Knowing your people – On the eve of the Battle of Agincourt, Henry V disguised himself as one of his captains so he could move among the troops and talk with them to assess their condition and will to fight.

Several aspects of the battle are of engineering significance. The English troops consisted primarily of archers with longbows, which proved to be highly effective weapons against the French armored cavalry (knights). The English archers also employed portable defensive structures consisting of sharpened stakes to fend off cavalry charges. Issues of soil trafficability on the muddy battlefield were a major factor in the English victory.

Most of the material for this vignette was obtained by Internet research.^{8,9,10}

This vignette has been used in a class on leadership traits presented in ISE 3910, Engineering Leadership and Project Management, offered by the Department of Industrial and Systems Engineering at Tennessee Technological University. After a brief lecture on the history of the battle of Agincourt, the students took roles and acted out a portion of Act IV of *Henry V* during class. After the student performance, the corresponding scene with the “Band of Brothers” speech from the Kenneth Branagh version of the film *Henry V*¹¹ was shown for comparison. This introduction generated good class discussion of leadership traits.

Vignette Example #3: *The Wreck of the Old 97*

This vignette includes the history of an actual train wreck and some music history about the country ballad that resulted from the wreck. It can provide an interesting introduction for a variety of engineering topics. A brief summary follows:

The Old 97 was a Southern Railway train that carried the mail between Washington, D.C. and Atlanta, Georgia. The mail contract was quite lucrative for Southern Railway, but contained significant penalties for late deliveries. On September 27, 1903, Old 97 derailed at the Stillhouse Trestle near Danville, Virginia, killing nine and injuring seven of the sixteen men aboard. At the time of the accident, the train was approximately one hour behind schedule and was speeding to make up time. As the train approached the curving, wooden trestle at the end of a long downgrade it was going much too fast, possibly as a result of low air pressure in the braking system. The engine left the tracks, pulling the other four cars in the train with it, and all crashed in a ravine approximately 70-feet below the trestle. Speed estimates for the train at the time of the derailment ranged between thirty and almost ninety miles per hour. The true cause of the wreck was never proven. Southern Railway claimed the engineer was responsible, while other reports indicated a wheel flange on the engine might have broken.

Train wrecks were not uncommon in the early 1900’s, and the wreck of the Old 97 might have never gained much public attention had it not been for the song, *The Wreck of the Old 97*, which was written shortly after the accident. The song became very popular and established a number of “firsts” in music history, including:

- A version of the song recorded by Vernon Dalhart for Victor Talking Machine Company (RCA) was the first American record to sell over one million copies. This was a significant boost for both the company and the relatively young country music industry.
- Several persons claimed to have composed the popular ballad, which resulted in the first major lawsuit involving copyright of a song, including a hearing by the Supreme Court.
- Over the years, the song has been recorded by many of the top country music artists, including Roy Acuff, Hank Snow, Johnny Cash, Woody Guthrie, Mac Wiseman, and Flatt and Scruggs.

The Blue Ridge Institute and Museum website¹² provides a brief overview of the accident, the text of two newspaper articles written at the time of the accident, a brief history of the song, and an audio clip of the song as recorded by Henry Whitter, one of the original artists. Gregory¹³ provides the most detailed history of the train wreck. Scott¹⁴ provides an interesting history of the song, including analysis of the different versions of the song lyrics that have evolved over time. Recordings of the song by top country music artists are readily available.

As mentioned, this vignette could provide an interesting introduction for several types of engineering courses, including:

- Introduction to Engineering or Dynamics Course – Conduct a forensic engineering exercise to estimate the speed of the train at the time of the accident. Given the overall weight and dimensions of a train engine and the radius of a curving section of track, estimate the speed required for the train to turn over as it travels through the curve.
- Materials Course – Introduce a materials class on fracture mechanics by focusing on the possibility of a broken wheel flange.
- Engineering Ethics Course – Discuss the ethics of the railroad company and their treatment of the engineer. Although ordered to make up time, the engineer was ultimately blamed for the accident by the railroad company. His family was denied the benefits paid to the other victims of the accident. Copyright issues related to original works could also be discussed.

Implementation

The use of brief vignettes to link the humanities and social sciences to traditional engineering courses is relatively easy to implement and can be used with any engineering course. In depth research of the vignette topic is not usually required, so preparation time is minimal. Internet-based research is sufficient in many cases. Since the vignette is used to introduce or highlight an engineering topic, it is integrated with the normal class lecture and can be structured to require very little additional class time, thus promoting the efficient use of instructional time. It is not always necessary to have an in-depth discussion of the humanities and/or social science issues related to the vignette. Simply using a movie, play, song, or other form of art as an example in an engineering course may have some benefit. The topic of the vignette can be something of direct interest to the instructor, thus minimizing faculty reluctance to try the approach.

Additional Benefits

The vignettes can also serve to demonstrate the real world application, and sometimes misapplication, of engineering principles. Historical vignettes related to famous engineering disasters are frequently used to demonstrate a variety of design issues. Some additional discussion of the social consequences and impact of the disasters could make these lessons even more effective.

Female engineering students frequently respond more positively to lectures and assignments that include a focus on the social impact and significance of their problem solutions.¹⁵ Vignettes that provide such connections can be used to make engineering courses more appealing to female students, perhaps improving the retention of women engineering students. This is especially important in introductory courses where the students form their initial impressions of the engineering profession. In addition to the female students, other engineering students with strong ties to the humanities, such as musicians, may find certain vignettes appealing.

Vignettes may also be designed to incorporate active learning opportunities, an excellent technique for maintaining student interest and attention. Having students act out a scene from a play or sing a song can be a great way to energize a class and have a little fun.

Conclusions

The use of brief vignettes based on historical events, plays, songs, movies, and other forms of art can be an efficient and effective technique for linking the humanities and social sciences with engineering courses. The vignettes are chosen to introduce or highlight selected engineering topics and/or demonstrate the impact of engineering on individuals and/or society. In addition to helping students understand the relevance of the humanities and social sciences in their work as engineers, the vignettes can also serve to demonstrate real world applications of engineering principles, increase the appeal of the engineering profession for some students, provide active learning opportunities, promote efficient use of instructional time, and add an element of fun to the classroom. While no quantitative assessment of this technique has been conducted, qualitative student feedback has been overwhelmingly positive.

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Biography

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Kenneth W. Hunter, Sr. is currently an Associate Professor in the Basic Engineering Program at Tennessee Technological University, where he received his B.S. and M.S. degrees in mechanical engineering. He has over 29 years of engineering experience, including positions in academia, industry, the United States Army, a government laboratory, and his own consulting business. He is a registered P.E. in the State of Tennessee.