2006-2610: USING HOLLYWOOD MOVIES AS A SUPPLEMENTARY TOOL TO TEACH MANUFACTURING PROCESSES

Z.J. Pei, Kansas State University

Dr. Z.J. Pei received his Ph.D. in Mechanical Engineering from University of Illinois at Urbana-Champaign. He is currently an associate professor in the Department of Industrial and Manufacturing Systems Engineering at Kansas State University. He holds three U.S. patents and has published 40 journal papers and over 60 papers at international conferences. His current research activities include analysis and modeling of silicon wafering processes and traditional and nontraditional machining processes.

Using Hollywood Movies as a Supplementary Tool to Teach Manufacturing Processes

Abstract

Introductory courses on manufacturing processes are difficult to teach and it is challenging to deliver the information in an interesting or entertaining way. As one of the attempts to promote students' learning, Hollywood movies have been used as a supplementary tool to teach such a course at Kansas State University. This paper presents the experience of such attempt. Examples of using Hollywood movies are presented and discussed. Students' feedback and comments are also provided.

1. Introduction

At Kansas State University, "Introduction to Manufacturing Processes and Systems" (IMSE 250) is a required course for students majoring in industrial engineering, manufacturing systems engineering, and mechanical engineering. Many students in other engineering disciplines and humanities and sciences also take it as an elective course. It is intended to not only provide engineering students with technical knowledge for further study in their disciplines, but also expose humanities and social sciences students to manufacturing engineering.

This course is difficult to teach due to several reasons. The first reason is the diverse background of the students. The students taking this course range from freshman, sophomore, junior and senior year. They came from quite different disciplines. As a student said in a mid-term feedback survey, "One thing I would like to suggest is that all of the students here are not studying engineering. So don't assume we are all the same." Table 1 shows the disciplines from which the recent semesters' students came from.

Students are also quite different in their prior knowledge of manufacturing. In a mid-term feedback survey, one student wrote "You may have presented the material too easily to us. We (students) generally need a little more in depth." In the same feedback survey, other students requested that "Don't move quite so fast." Some students have years of working experience in manufacturing environment, while some have never been on any manufacturing floor. There is a lab course, "Manufacturing processes laboratory" (IMSE 251), associated with this course, but not all the students take it. Fig. 1 shows the responses from students to a survey question in the middle of the 2004 Spring semester, "To help you learn better, the pace of the course should be made _____." It can be seen that there are students at both extremes. It is quite a challenge to keep the students at one extreme engaged without losing the students at the other extreme.

Table 1. Students' major curricula

	Curriculum
Engineering	Architectural Engineering
	Biological and Agricultural Engineering
	Civil Engineering
	Computer Engineering
	Construction Science and Management
	Electrical Engineering
	Engineering Undecided
	Industrial Engineering
	Mechanical Engineering
	Manufacturing Systems Engineering
Non-Engineering	Agricultural Communications and Journalism
	Agriculture Education
	Agricultural Business and Management
	Agricultural Economics
	Animal Sciences and Industry
	Agricultural Mechanization
	Business Administration Pre-Professions Program
	English Language Program
	General Agriculture
	Physical Sciences

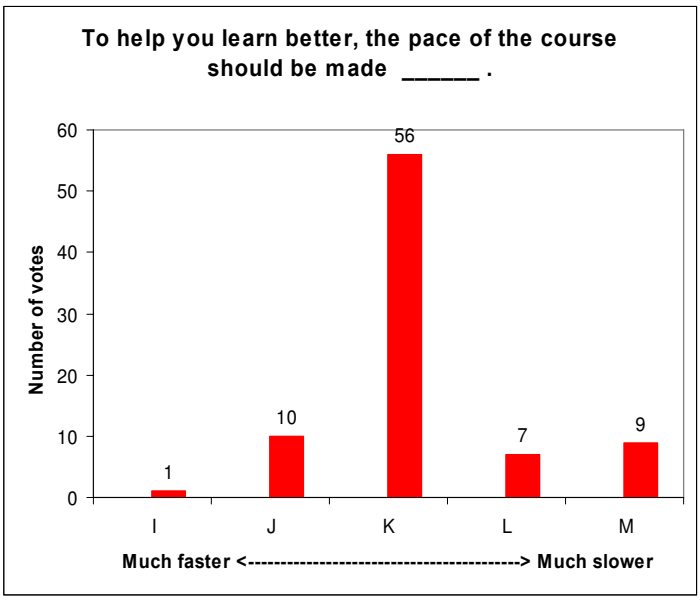


Fig. 1. Students' responses to the pace of the course.

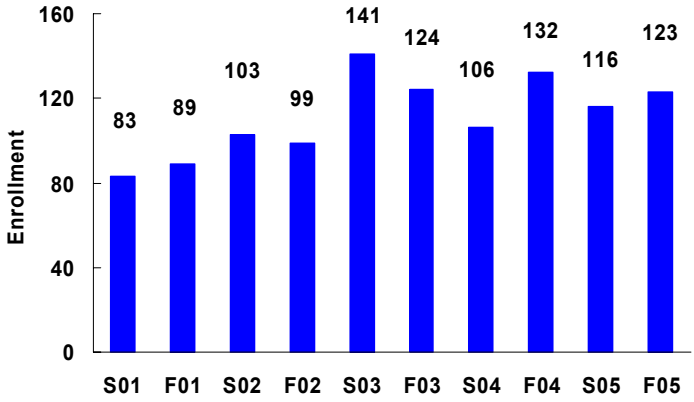


Fig. 2. Enrollment in the past five years.

The second reason for the difficulty is the vast scope of the information the course intends to cover. Engineering materials covered include metals, ceramics, plastics, and composites. Semiconductor materials are also covered. In addition to the four families of materials processing processes (casting, forming, machining, and joining), heat treatment, powder metallurgy, and non-conventional machining processes are also taught. The information covered also includes silicon wafer manufacturing processes (crystal growth, lapping, grinding, etching, polishing) and semiconductor manufacturing processes (deposition, lithography, etching, CMP, etc.). Concepts of manufacturing systems are also introduced.

The third reason is that this course is required for many students and not all of them are interested in the information covered by the course. It is challenging to deliver the information in a way that is interesting or entertaining to these students.

Fourthly, the size of the class is large. Fig. 2 shows the class enrollment in the past five years. With so many students, some methods and techniques proven effective for classes with small sizes cannot be used.

As one of the attempts to promote students' learning, Hollywood movies have been used as a supplementary tool to teach this course. In the following sections, examples of using Hollywood movies will be presented and discussed. Students' feedback and comments will also be provided.

2. Examples of Using Hollywood Movies

2.1 To introduce a new topic or concept

Sometimes, a movie clip was used to introduce a new topic or concept. For example, a clip from "Harry Potter and the Sorcerer's Stone" was used to introduce the topic of heat treatment. In this movie clip, Harry Potter went to a store to buy his first wand. He tried a few wands before getting the one fitting him well. Two scenes in this clip are shown in Fig. 3. After showing this movie clip, the PowerPoint slides shown in Fig. 4 were used to introduce the topic of heat treatment. The lecturer would say things like this, "If we have a magic wand, we could change

the hardness of a steel part from RC 30 to RC 40 or anther value. The magic wand for this purpose is the process of heat treatment."

Fig. 3. Two scenes from Harry Potter and the Sorcerer's Stone.

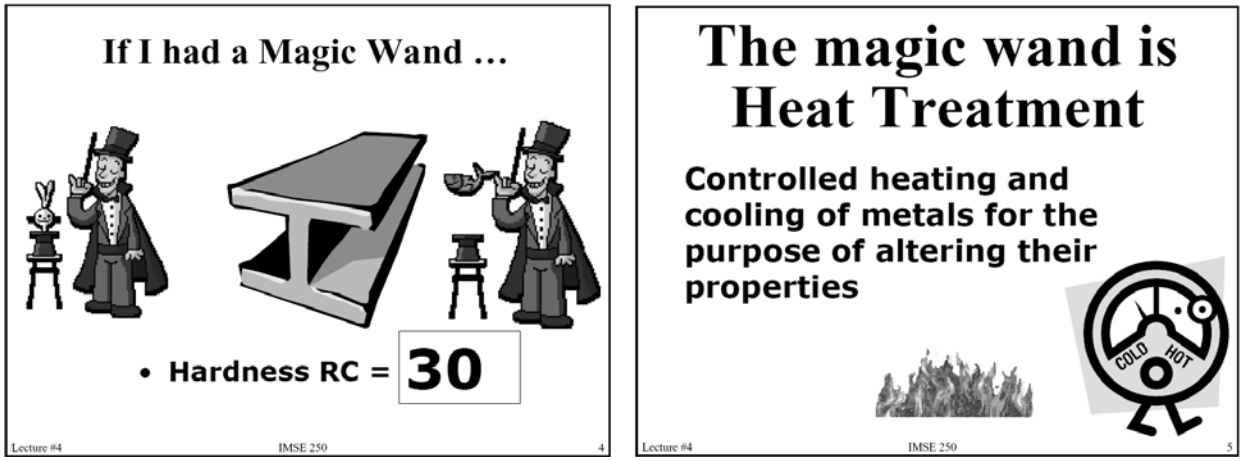


Fig. 4. PowerPoint slides presented after showing the movie clip from Harry Potter and the Sorcerer's Stone.

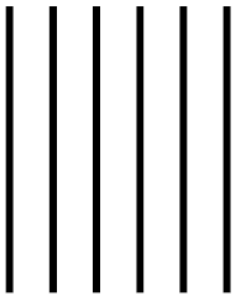
2.2 To provide the frame for class discussion

For example, a movie clip from "Shanghai Noon" was used to provide the frame for class discussion on material properties. In this clip, Chon Wang (by Jackie Chan) and Roy O'Bannon (by Owen Wilson) were trying to escape from the jail by bending the metal bars using a piece of wet cloth. Two scenes in this clip are shown in Fig. 5. After showing the movie clip, the class would have a discussion on the questions shown in Fig. 6.

Fig. 5. Two scenes from Shanghai Noon.

Brain Twister

In the movie segment (Shanghai Noon) we watched today, Chon Wang (by Jackie Chan) and Roy O'Bannon (by Owen Wilson) were trying to escape from the jail by bending the metal bars using a piece of wet cloth. Here are some questions related to this scene to test how much you know about material properties.



Questions (1-5) Assume that after the cloth was removed, the two bars returned to their original shape, as shown in the figure to the right. Also assume the bars were made from steel.

(1) Which one of the following material properties is the most important to determine if Chon and Roy could succeed in their attempt to escape?

(A) Young's modulus. (B) Yield strength. (C) Tensile strength.
(D) Toughness. (E) Hardness.

(2) If the bars were made from aluminum instead of steel, would Chon and Roy's escape be easier?

(A) Yes. (B) No.

(3) If the steel bars were heat treated (in a way most favorable to Chon and Roy) before installation, would Chon and Roy's escape be easier?

(A) Yes. (B) No.

(4) If the bars were made from a different grade of steel (that had lower carbon concentration and hence was softer), would Chon and Roy's escape be easier?

(A) Yes. (B) No.

(5) If the steel bars were made by cold rolling instead of hot rolling, would Chon and Roy's escape be easier?

(A) Yes. (B) No.

Fig. 6. Discussion questions after showing the movie clip from Shanghai Noon.

2.3 To test students' understanding

For example, a movie clip from "Star Wars: Episode II Attack of the Clones" was used to test students' understanding about four basic families of materials processing methods (casting, deformation, machining, and joining). In this clip, machines were making machines using different manufacturing processes. Two scenes from the clip are shown in Fig. 7. Before showing the movie clip, the slides shown in Fig. 8 were presented to the class. Students then answered the quiz question while watching the movie clip.

Fig. 7. Two scenes from Star Wars.

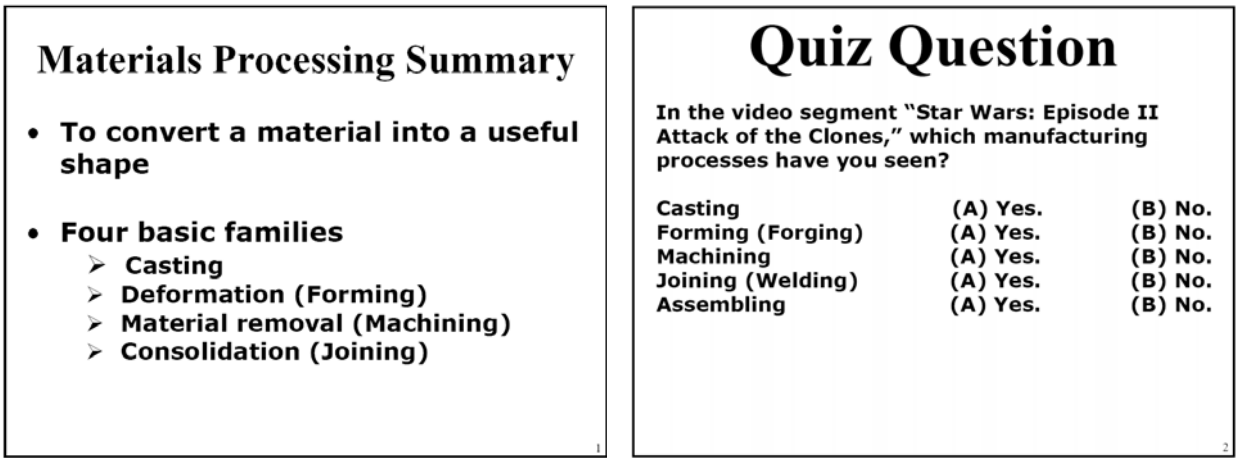


Fig. 8. PowerPoint slides presented before showing the movie clip from Star Wars.

3. Comments from Students

Students really like the movie clips, as evidenced by their comments listed below.

- Dr. Pei does a nice job of mixing in movies to explain the concepts.
- The movie clips were super!
- I like the movie segment, which can help us learn and relax at the same time; also, it makes us understand the topic easier.
- Movies are useful to show real world examples of the processes discussed in class. Help to make the class more interesting.
- I liked the movies; they helped apply the information in class to real life.
- I enjoyed watching movies because I could understand them and apply the material in real life.
- I like the movies; they made me think and put what I have learned to use and made me think outside the box.
- I really like the movie segments he shows during class to make the application of different processes clearer.
- I also liked watching movies that were related to the subject matter.
- I like the Hollywood movies that help me see the actual processes.
- I like showing little movie segments to back up your lectures.
- I like the movies that demonstrate the different processes.
- Movies capture my attention and keep me interested (especially the movie segments from recent Hollywood films).
- I like now you incorporate things into movies that we watch. It helps me remember better.
- Movie clips are also very good.
- I like everything you do. It is all great, especially the movies.
- I like relating processes to movies, it helps me see what you are talking about better.
- I like it when you show movies that involve manufacturing.
- I think that the movies are a good idea.
- I believe you should continue everything, especially the movies.
- The movies are a good break while still teaching.
- Hollywood movie clips help to change the pace and keep me interested.
- I like how you use movies to reinforce the presentation, you are trying to get across during lecture.
- I like relating processes to movies, it helps me see what you are talking about better.
- Movie segments, gives a nice break/world example.
- The Hollywood movies allow me to remember the concept even better.
- I like your use of Hollywood movies for examples in manufacturing processes. It helps to make the processes shown stick in your head.
- I enjoy the movie segments.
- I like the lecture style where it's a mix of slide shows, movie clips, TTYP, it keeps me awake.

4. Concluding Remarks

In general, students favorably responded to the practice of using Hollywood movies in classroom lectures. This has certainly contributed to the high students' evaluations on the course as a whole. Fig. 9 shows the students' evaluation on the course excellence of IMSE 250.

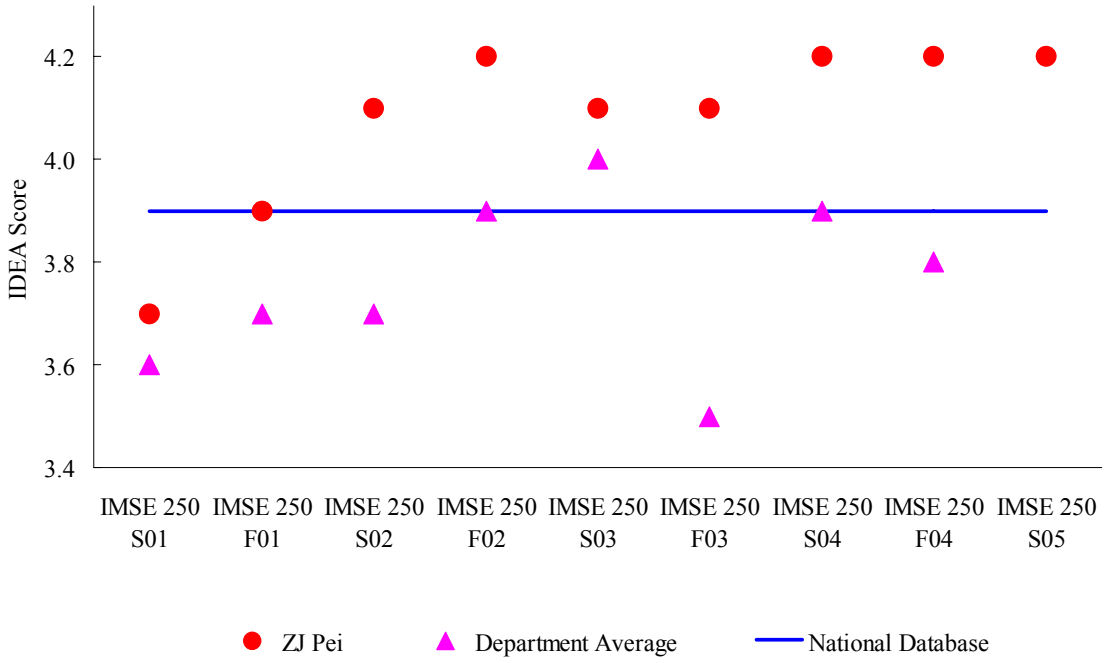


Fig. 9. Students' evaluation on the course excellence of IMSE 250.

Acknowledgements

The author would like to thank the students in IMSE 250 during these years for their feedback, comments, suggestions, and participation. Thanks are also to the Department of Industrial and Manufacturing Systems Engineering at Kansas State University for their support in getting the movie clips.