

More than Science Fair Fun:
Poster Session as an Experiential Learning Activity in the Classroom

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Poster sessions are a common activity at technical conferences, offering authors an opportunity to present their work in this medium and easily establish a dialogue with their colleagues. Students entering college often have a perception that ‘posters’ were an activity they left behind at the junior- high or high school science fair. This experiential learning activity re-introduces posters and the poster session as an important and effective way to communicate technical information. A ‘simulated’ technical conference poster session has been developed and implemented as a required class activity within the one-semester, basic Materials Science course. In order to maximize the benefit to the students and achieve the environment necessary for this learning activity, the logistics for the poster session will be outlined. Assessment of the ‘poster session’ will be presented from both the instructor and student’s point of view. To date, the qualitative assessment results show students have a positive opinion on this activity and a better ‘understanding’ of this presentation medium for technical communication. Assessment by the instructor is highlighted by observations of ‘students- teaching- students’ and the student’s ability to use the ‘language of materials science’ in both the written information on their posters and in the oral dialogue with their peers about their selected applications or topics.

I. Introduction

For the past eight years, the ‘*Annual Materials Science Poster Session*’ has been effectively integrated into and is a required part of the ME309 Materials Science course at Western New England College (WNEC). The course introduces the fundamental concepts of materials science and engineering. The primary outcome of this course is to have the students to *understand the relationship between structure, properties, and processing of materials* having applications in mechanical engineering and design. An introduction to the ‘language of materials science’ is key to understanding and utilizing the concepts presented. The analysis of mechanical and physical properties, the manufacturing process, the material specifications for a selected application or component, and the advantages and limitations of selected material are the focus of the project and a technical poster presentation.

From the point of view of an engineering educator, the “Annual Materials Science Poster Session” is a learner-centered activity, which is defined as ‘an activity which provides creative experiences for students with many different learning styles^{1,2}. The students must demonstrate their knowledge of these concepts and an appreciation of the role and importance of material selection in product design through an independent literature investigation, comprised of a

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written report and participation in the “Annual Materials Science Poster Session”, where the students present their work, both orally and in the visual medium of technical poster. The benefit of this classroom experience to students happens in several ways including: **1)** the learning that occurs through the student’s preparation of exhibits (i.e., posters), **2)** the interactive session that creates a dynamic learning environment for students, **3)** the session format that simulates a technical conference and, **4)** the activity provides an alternative assessment method for students who may not excel on written quizzes and exams.

II. Implementation

a. Course Description and Requirements

In the ME309 Materials Science course, students take a step toward ‘life-long-learning’ by participating in this activity as an integral and required component of this course. The course is taught 3 times a week for 50 minutes in a lecture format using the text, Callister, Jr., William D., *Fundamentals of Materials Science and Engineering : an Integrated Approach*, Second Edition, John Wiley & Sons, Inc., NY,NY, 2005³. The poster session is held during the last week of the semester for a minimum two-hour time period in a specially scheduled session.

The poster/presentation is also complemented by a paper, so the entire project (or activity) usually accounts for 10% of the total course grade, i.e., 5% for the poster / presentation and 5 % for the paper. In general, the project is comprised of a paper of 5-8 text pages in length plus figures and a poster prepared and presented in professional manner. The requirements for the “Paper” and “Poster” are outlined in Table 1 and Table 2, respectively. The paper is graded accordingly; 75% for contents of the report, 15% for professionalism and appearance, 5% for references and 5% for abstract. The poster/presentation is graded equally by both the instructor (30% technical content and 20% presentation) and the students (50% student evaluation scores). More detailed information on student evaluations follows in later sections.

Table 1. The “Paper”

Cover/ Title Page	The paper is to be bound neatly in a standard report cover with the Title, Author and Date displayed.
Abstract	The abstract is one paragraph which describes and summarizes the contents of the paper. This text clearly states the problem, the most pertinent facts or observations about the work and the role of “material science and engineering” in your application or investigation.
Contents of the Report (5-8 pages)	Format: title page, <u>abstract</u> , body of report, references (Figures labeled clearly and referred as Fig. #. All references listed and labeled.)
<i>Introduction</i>	This section brings the reader “up to speed” on your application and the vocabulary unique to your investigation. This section may also contain the general theory or principles pertinent to your topic. (1 page)

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<i>Discussion</i>	Your report is to include information supporting the “ PROCESSING – MICROSTRUCTURE – PROPERTY ” principles elucidated in your investigation. (5-8 pages) Some examples are: schematic diagram or flow chart of the manufacturing process; primary variables in the process; the equilibrium phase diagram; the crystal structure; the basic polymer structure; typical micrographs of the structure; tensile strength; yield strength; effect of temperature; other principles discussed in class.
<i>Summary –</i>	This section highlights the most important aspects of your project and summarizes the importance of the “ processing – microstructure – property” principles. (1 page)
List of References	Detailed information that identifies each reference is to be delineated in this section. The numbering of a reference is generally sequential, i.e., it is based in its order of appearance in the text. Designation of references is to be done by numbers in brackets, ^[1] .

Table 2. The “Poster”

The poster board	Must contain the following information: (a) title, (b) author, (c) introduction to problem or investigation, (d) presentation of your investigation and (e) summary.
Suggestions	Highlight the important facts and do not try to cram everything on the poster board; use a font size large enough to read from a reasonable distance; neat professional appearance and be creative with your presentation!!

b. Preparation for and logistics of the “Annual Materials Science Poster Session”

The “Annual Materials Science Poster Session” is treated as the ‘*big event*’ of the semester. This culminating event allows the students to integrate of many specific materials science topics covered throughout the semester and provides them with an opportunity to apply this new knowledge to ‘real world’ applications. As shown in Table 1 and 2, the project requirements support the expected outcome, which is the familiarity with the ‘language of materials science’ highlighting the correct use of vocabulary and application of basic concepts. As outlined in the following sections, preparation and logistics for both the instructor and the students are essential to success of this learner-centered activity.

i. Topic selection

To engage the class, the instructor requires each student to select a topic or area of investigation that is of interest to them personally. Often students select products based on their hobbies such as sports equipment, musical instruments and automobiles, or various applications from their

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experiences gained through industrial internships. About mid-semester, a brief statement of their topic or selected ‘materials science’ application is submitted by each student and must be approved by the instructor. The instructor believes this step is critical to the success of this activity because the areas of investigation stay focused on a very specific application or component and students do not ‘wander’ away from the project objectives, the “processing-properties- structure” interrelationship. Typically, the student may have an interest in automobiles and in his/her original statement select the materials used in a car, then the instructor has time and the opportunity to work with the student to focus on a specific component of the car, such as the exhaust system, tires or cylinders. Thus, especially at the busy end of the semester, the student tends to meet the requirements and objectives set for the activity. Also, the instructor can prevent duplicate poster presentations by reviewing the topics and suggesting the students investigate different materials used for the same application or product, e.g., golf clubs or guitar strings.

ii. Standards

The instructor provides each student with an inexpensive, white 22”x 28” poster board. This maintains a uniform size for the posters as they are all displayed together during the session. As noted in Table 2, there are few specifications on the posters allowing the students to be creative while displaying key technical information.

iii. Environment

Another responsibility of the instructor is to create an environment that simulates the poster sessions at professional technical conferences and symposiums. The logistics done by the instructor prior to the actual poster are critical to the success of this activity. An alternative facility usually has to be located so students can hang up their posters and easily move around during the poster session. Before the students arrive, numbers are posted on the walls and correspond to the location where each student will hang their poster. Also, the student’s poster number corresponds to the rotation order (Figure 1) and student evaluation sheet (Table 3). The rotation schedule can be modified to fit the class size and two or more simultaneous rotations are arranged for larger classes (30 or more students). (Free time after the ‘official’ session is allocated for students to independently view all the posters.) The instructor must schedule a minimum of a two hour time period where the entire class can get together, often early morning is best at WNEC. Thus, it is necessary (and beneficial) to provide food at this event. On a lighter note, the free ‘breakfast buffet’ provides an incentive for students to come a bit early and creates a relaxing, less formal environment for the student to interact and ‘teach’ each other.

Table 3. Poster Session Rules

1. Please hang your posters next to your assigned number. ME309 → #
2. Refer to the attached sheet for the ‘PRESENTER and EVALUATOR’ schedule. Students with a number corresponding to a PRESENTER will stand by their poster <i>first</i> . Students with a number corresponding to an EVALUATOR will rotate to the posters listed on the sheet. All EVALUATORS will complete the attached ratings sheet after visiting each poster. After the rotation is complete, the groups will switch roles.
3. Presenters: Explain your poster to the ‘Evaluator’ <i>briefly</i> for 3 minutes . Evaluators: Complete the evaluation sheet and discuss the poster <i>briefly</i> for 2 minutes . (Time is allotted at the end of class for further discussion.)
4. Move forward, as indicated on the attached sheet, to the next poster and repeat the procedure.

To assure active participation by the entire class, the rules of the “Annual Materials Science Poster Session” are reviewed along with the Rotation Schedule and are shown in Table 3 and Figure 1, respectively. One ‘Presenter’ explains their poster to one ‘Evaluator’ for approximately 3 minutes, then, the two students discuss the topic for the remainder of the 5 minutes (or specified allotted time) and finally, the ‘Evaluator’ completes in the evaluation sheet (Table 4). Next, the ‘Evaluator’ rotates or moves to the next poster, while the ‘Presenter’ stays in place and gives their explanation to the new ‘evaluator’. The instructor (or other individual) keeps time to assure adherence to the Rotation Schedule, which is similar to a rotation scheme in volleyball. The ‘Presenter’ may present up to six times as indicated in the Rotation Schedule (Figure 1). These quick, less formal poster presentations force the student to practice several times and interact one-on-one with their peer by answering their questions. In general, the instructor has observed that students improve their presentation, their ability to answer questions, and even modify their presentation to address the questions and interests of their peers. Then, the roles of ‘Presenter’ and ‘Evaluator’ are switched and the rotation is repeated.

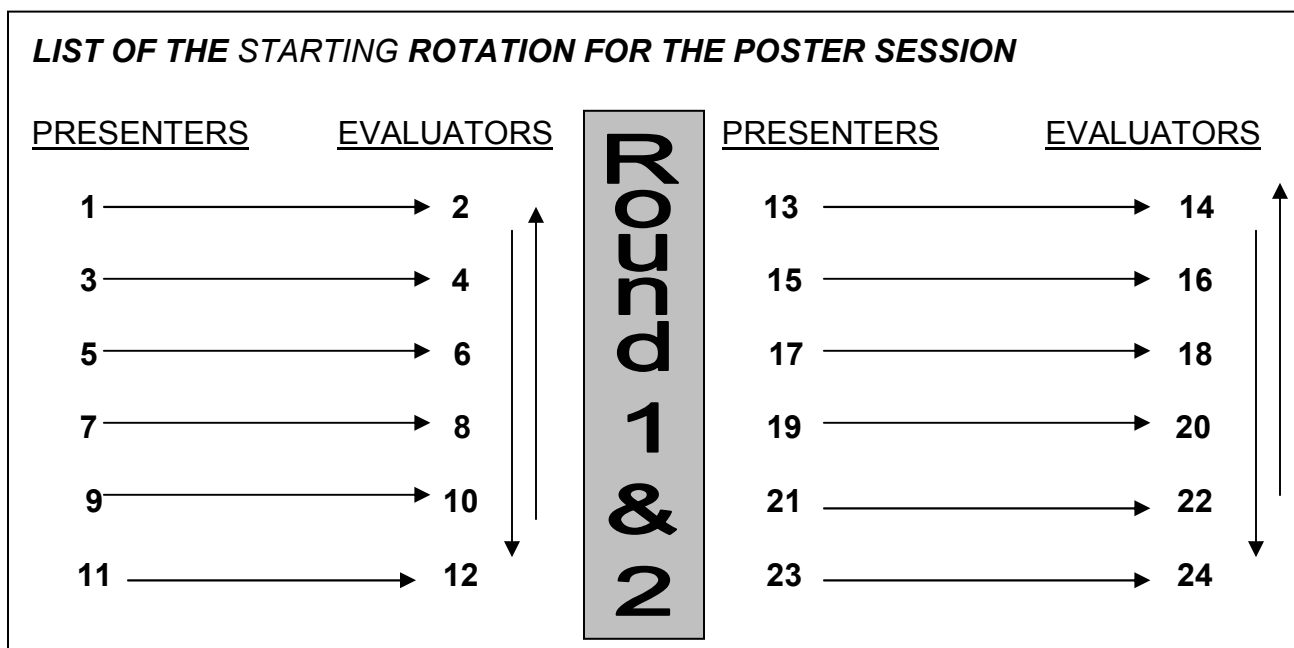


Figure 1. Sample rotation schedule for a class of 24 students

iv. Evaluation

At the start of the activity, each student has a ‘packet’ with the poster rules, Rotation Schedule and evaluation sheet (Table 4). This formality and organization creates a professional and serious environment and allows the poster session to run smoothly in a time effective manner. As presented in Table 4, each student is responsible for rating several posters/presentations according to criteria highlighting presentations skills and technical content. Also, each student must record one new or interesting fact learned during the presentation in the ‘Required Comment’ section. Peer evaluation engages students in the activity, giving them a purpose to

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listen and become involved in the poster session. Ratings on the poster and presentation are consistently in the ‘5=excellent to 4=good’ range as recorded by the students and the instructor on the evaluation sheets. In general, students are required to demonstrate the ability to connect the fundamental theory presented in class throughout the semester to information in handbooks, web sites and technical manuals. Assessment by the instructor is highlighted by observations of ‘students- teaching- students’, where students are the ‘experts’.

Table 4. Poster Session Evaluation Sheet

		PRESENTATION			TECHNICAL CONTENT *		
Student Name	Poster No.	Professional appearance	Clarity of presentation	Ability of presenter to discuss topic	Stated objective clearly developed	Effective use of terms and concepts	Knowledgeable presenter
<i>Mike O. Structure</i>	1						
<i>Nan O. Meter</i>	2						
<i>Crystal A. Range</i>	3						
<i>Paul E. Mer</i>	4						

* **REQUIRED COMMENT** - Record one unique and interesting fact that you learned from this poster (and record in the last column of your evaluation sheet.)

v. Instructor observations

Based on the instructor’s experience holding numerous poster sessions, several positive and qualitative observations have been noted. Student-to-student interaction is *dynamic* during the poster session. There is always a ‘buzz’ in the room and the students look forward to the free time at the end of the formal rotations when they can revisit particular poster or just see a friend’s work. Students enjoy the opportunity to be creative with the ‘graphic art’ in their posters, while improving their communication skills in this medium. Students are encouraged to create a poster that will ‘catch the eye’ of a person walking by it, yet be informative and technically accurate. Very few specifications are put on the poster as shown in Table 2 and student’s casual comments suggest they enjoy this freedom. The posters are mounted on bulletin boards in the hallways of the school and students return to the exhibit with their peers and review the posters.

The project, which includes the poster/presentation and the paper, promotes life long learning through the use of handbooks, technical papers, and critical evaluation of web sites. The instructor has observed students who become frustrated with traditional web searches (for fundamental technical information) and become enthusiastic about professional society handbooks, especially those available on-line or on CD-ROM with search capabilities. These additional skills and experiences with new literature resources demonstrate to the students the connection between this course and the technical applications, which they may encounter during their engineering careers.

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III. Assessment of “Annual Materials Science Poster Session” on student learning

These qualitative results were tabulated from student surveys aimed to assess the student’s perspective and opinion on the “Annual Materials Science Poster Session.” Several questions were posed (highlighted in bold below) and representative / typical student responses are quoted.

1. Take a moment to reflect on your experiences during our poster session. Please comment on you learning experience.

“The experience that resulted from the poster contest was quite positive. I learned so many interesting things about things we are exposed to everyday.”

“I liked it a lot. I put a lot of work into my poster and I enjoyed explaining it a lot. It fun to talk about something you like doing in a way that ties into class material.”

“I learned a lot, at first I didn’t realize how much material science is related to all these different materials then after seeing all the different steps to produce different properties, it got me thinking about how much work is put into all the materials we use everyday.”

“It was a good learning experience because each person was an ‘expert’ on their subject. Also, it was nice to learn from classmates instead of from a teacher.”

“I liked how the presentations were informal and among peers only. It wasn’t nearly as nerve racking as expected which allowed me to concentrate more on the material rather than on my actual presentation. It’s been a while since I have taken a trip to the library as well so this was a good refresher.”

“Overall, I thought it was interesting and showed examples of things discussed in class. It is also a good way to learn about people and the interests they have.”

2. Have you had any previous experiences with this presentation medium, i.e., posters. If yes, indicate when and for what purpose (ex. Science fairs)

From this sample class of 24 students, 15 students had some previous experience, (e.g., 2 in elementary school, 7 in middle school, 3 in high school and/or 3 in other college courses).

“Yes, if you count elementary school science fairs. It obviously was not this in depth though.”

“In high school, for presentation of projects, but never as in-depth as this project”

3. Did you like most about this poster session? And the least?

To summarize, the majority of the students liked the poster format and learning about all the different materials science applications the most. And many cited that they like the early morning hour the least but the food was good.

“Asking questions was the best! Waking up early was the worst!”

“Like-the poster dislike- the paper”

“Most: seeing different ways to set up posters creativity Least: waking up early”

“I like doing smaller presentations on a one on one basis”

“It gives the students a chance to investigate and talk about something that interests them. It also gives valuable presenting experience.”

4. Other learning tools and evaluation methods used in this class were homework, quizzes and exams. Compare your experiences in the poster session (poster/paper project) to your experiences with these other methods.

“The poster / paper was a good learning tool, because it allowed us to use different tools to find the needed info”

“I learned the most while doing homework, but the poster project was the most interesting”

“The poster/paper project was different because it was doing work on something that interested me. For that reason I think learned more from the project than from other learning tools.”

“I personally learned more by doing hands on work so the poster project was great way for me to apply what I have learned over the semester. In turn allowing me to apply the concepts other than to problems.”

5. What skills and/or experiences from this poster session do you think will help you in the future?

“Researching, public speaking, what should go on a poster”

“Being able to choose the most valuable information”

“Presenting a topic to someone one on one it’s harder because you see their reactions and know if they are interested in what you have to say”

“That my public speaking skills have become better to small groups”

“Actually going to the library to do research on a project. Neat concept”

6. As you participated in this activity, what surprised you the most?

“That materials science really plays a part in everything! There is so much out there that is affected by the processing. Also people chose really cool subjects!”

“How much I knew about the concepts”; “How easy it would be to talk about the poster”;

“The fact that I actually learned something”; “The sincere interest of other students”

“How long it took to put everything together, and just how much info is out there and there are so many variations”

“How what I learned in class was being used to present these materials and how I actually knew what everyone was talking about”

Reflecting on the breadth of student comments, the expected outcome was achieved, i.e., utilizing the fundamental concepts and ‘language of materials science’ to learn about new and different ‘real-world’ applications of materials. Also, students liked this learner-centered activity and from the feedback, they realized they had become the ‘experts’ by utilizing their classroom knowledge and sharing it with their peers.

IV. Future work

In the spirit of continuous improvement and the ABET Criteria, work will continue toward methods to quantify assessment data and to facilitate student responses and feedback. Additionally, to ensure that the “Annual Materials Science Poster Session” becomes an integral part of the culture of our School of Engineering, this activity is held in ME309 Materials Science every year and earns positive feedback comments from students each year that are, in turn, passed on to future students.

V. Summary

College students are introduced (or re-introduced) to the presentation medium of posters (or exhibits) as a powerful, yet unique form of communicating technical information. This experiential learning activity allows the students to practice ‘life long learning’ skills that may be used throughout their professional engineering careers, such as literature research, report writing and poster sessions at technical conferences. Other benefits included the experience of establishing a dialogue or more informal conversation on technical subjects with their colleagues in school and in their future workplace.

The “Annual Materials Science Poster Session” has been developed and implemented as a required class activity within the one-semester, basic ME309 Materials Science course. In order to maximize the benefit to the students and achieve the environment necessary for this learning activity, the logistics for the poster session are both the responsibility of the instructor and the students, with everyone playing their assigned role. To date, the qualitative assessment results show students have a positive opinion on this activity and a better ‘understanding’ of this presentation medium for technical communication. Assessment by the instructor is highlighted by observations of ‘students- teaching- students’ and the student’s ability to use the ‘language of materials science’ in both the written information on their posters and in the oral dialogue with their peers about their selected applications or topics.

VII. Acknowledgements

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VIII. References

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