Mighty Minutes for Professional Learning

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Professional learning is "mighty" important to one's career and life. Students who are underdeveloped professionally often lack self-confidence and limit their abilities to contribute and reach goals befitting their potential. Unfortunately, students and faculty resist taking time for professional learning in design project contexts. But, note this: Design project contexts are ideal for developing professional abilities that will transfer to the workplace. They also are ideal for assessing these abilities. Making professional learning a natural part of team projects can yield valuable benefits for individuals, teams, and projects.

The author presents tools that make brief, mighty minute, exercises of professional learning a natural part of project activity. Research-based principles of how people learn are adopted to achieve learning that is contextualized to where it will be applied. Mighty minute discussions build team cohesiveness, personal satisfaction, team and individual productivity, and professional and social dimensions of project work. Periodic self-assessment gives feedback on learning throughout the project. Through mighty minutes of professional learning, a student explores topics, practices tentative understanding, refines and deepens knowledge, and gains appreciation for professional behaviors that transfer to life and the workplace.

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Introduction

Academic and business leaders across the US identify many professional abilities that are crucial to success but often underdeveloped in engineering graduates[1]. Graduates often lack attitudes and/or abilities to take initiative, learn independently, collaborate, think critically, and learn through reflection and self-assessment. Sadly, most engineering students do not receive instruction in the vital professional knowledge, skills, and abilities they will need in the workplace.

All engineering students complete a large (usually capstone) design project as part of an accredited engineering program. Because most capstone projects call for workplace professional abilities, the projects also provide a context for learning professional abilities that will transfer directly to the workplace. These projects also serve as a semi-authentic environment for assessing professional student outcomes (e.g., lifelong learning, teamwork, and professional ethics) required for ABET accreditation[2]. Astute engineering educators capitalize on this natural "laboratory" for learning and assessing professional abilities.

This paper promotes brief professional development exercises to motivate, negotiate, and reinforce student learning of teamwork and other professional abilities in design projects.

Classroom issues

Typically, a number of capstone project issues prevent instructors from implementing intentional professional learning in their classes. Some instructors and students are unwilling to take time from other class and project work for professional learning. Other instructors do not value professional learning or they lack suitable materials to accomplish desired professional learning. Professional learning can be ineffective if either instructors or students are not supportive.

Instructor preparation

Instructors can prepare their students for professional learning by:

- Describing workplace situations where professional abilities are essential for success
- Commending and encouraging student professional behaviors in the classroom
- Giving significant weight to professional factors when awarding grades in classes
- Allocating class time for intentional development of professional abilities
- Modeling professional behaviors in the class

Instructors intending to develop professional abilities in their students should make this obvious in the class syllabus. Specifically define student professional learning outcomes (e.g., teamwork and independent

learning) with details on how these outcomes will be assessed and factored into course grades. Further shape student expectations by describing methods that will be used for professional learning, their frequency, and length.

Give attention to professional learning from the first day of a term to the last. On days when professional learning is a goal, clarify this intent, oversee facilitation, and ensure that students benefit from the effort. Help facilitators manage time, create a climate conducive to sharing and learning, and synthesize new knowledge that aids students' professional growth. By nurturing professional learning, students grow in their abilities, and projects reflect high levels of performance.

Professional Learning Resources

Instructional resources for professional learning must follow principles of how people learn[3] and fit the design project course structure.

How people learn

Motivation and learning theories identify factors that will affect learning of professional knowledge, skills, and abilities. Some of these factors are:

- Learning is motivated by learner self-determination (desires for autonomy, competence, and relatedness to others) and any value learners expect to gain[4].
- Learning is most authentic when outcomes are like what is needed in the learner's envisioned future.
- Learning draws from previous knowledge and builds upon it or refines it.
- Reflection on learning attaches words to conceptual understanding and clarifies what is known.
- Learning must fit in a larger conceptual framework to yield integrated understanding.
- Learning is enhanced and retained through repeated use, especially use in varied contexts.
- Learning is deepened by postulating tentative understandings, practicing their application, and obtaining feedback to correct errors[5].
- Advanced learners search for additional resources, evaluate them, and add credible knowledge to supplement what they know.

Classroom context

Professional learning can be achieved when properly integrated into classes that focus on team project work. Time used to address professional issues must be brief and must add value in the eyes of students.

Professional learning is best received by students at times when they recognize their need. This might occur as students struggle with team or professional problems, enter an unfamiliar work setting, or try to make sense of a contentious work session.

A bookend approach is devised to stimulate professional learning with brief exercises at the start and end of a work session, when students are least likely to be absorbed in project work. At the start, students discuss a professional issue and postulate how to address it as a team. Then while the team engages in project work, they apply this tentative understanding. At the end of the work session, teams reflect on their performance of the targeted professional behaviors. Reflection will deepen understanding and reinforce desired behaviors in project work. Over time, these exercises will build understanding and yield long-lasting impacts on students' professional learning.

Structure of professional exercises

Mighty minutes learning exercises are structured to stimulate thought, discussion, and action to address professional issues relevant to team and project work. Table 1 lists elements typically contained in an exercise. Each element is discussed below.

Table 1. Elements of Professional Learning Exercises

Element	**Actions Prescribed**	**Purpose**
Introduction to topic	Students see topic in relevant context	Connect with other knowledge
Questions to discuss	Small groups discuss topical questions	Engage every student in topic
Sharing	Small groups share views with class	Broaden views and knowledge
Principle	Students consider relevant principle	Compare with established view
Project work	Teams use tentative understanding	Test knowledge in real context
Observations & follow-up	Students reflect on working knowledge	Revisit and modify learning
Rating	Students self-rate understanding	Judge stage of development

Introduction to topic identifies the professional topic to be discussed and background that shows its relevance to students.

Questions to discuss and *sharing* provide focus to discussions—first in small groups, then across the class. Small group discussions encourage all team members to articulate their views so others hear them. Sharing in the larger class adds more views about the topic so that new ideas surface and learning is broadened. Students reach tentative understandings of how to behave related to this professional topic.

Principle states a concept that reveals cultural or workplace standards or perspectives that may otherwise be missed but are important to understanding the topic. This may help students generalize or refine their understanding of the topic.

Project work, fitting between the bookends, is project-focused activity that students normally do in the class. Project work done with professional learning discussions fresh in mind provides an opportunity to apply tentative understanding of the topic.

Observations and follow-up invites reflection and sharing by students in the class. Experiences shared will seed reflection and aid learning in action[5]. Reflection may reinforce or challenge students' understandings of the topic and show them new ways to apply this knowledge in the future.

Rating encourages the learner to judge how well this professional behavior has been mastered. This provides a point of reference for self-assessment in the future.

Example professional learning exercises

Professional learning exercises were created to address professional issues commonly needing team attention in a capstone design course: design thinking, teamwork development, and professional development. Exercises first appeared in a 3x5 inch card deck format for flexible selection of a day's topic; this allowed minimal notes and posting used cards as reminders of follow-up actions. A second, more detailed version of activities was formatted into a 6x9 inch book to keep activities in order and to support more extensive note-taking; this format will capture notes from discussions and follow-up actions. Each format is discussed below.

Figure 1 is an example card for the professional responsibility topic of honest communication. Students are asked to discuss their expectations and concerns about honesty in team communication related to several possible points of conflict. *Discussion* will reveal varied perspectives and lead to common expectations and practices that strengthen teamwork. The *principle* highlights the importance of honest lips. Follow-up *action* calls students to deliver communication that can increase value delivered.

Figure 1. Honest Communication Exercise

Professional development exercises in book format are the result of feedback from card users indicating that fonts are too small and cards are too numerous to handle easily. Therefore, design thinking and teamwork development exercises were converted into book format and are available from Amazon.com[6,7]. Exercises are presented one per page, printed in larger fonts, contain the full set of elements described in Table 1, and provide room for recording thoughts and actions.

Figure 2 shows an example book exercise for discussing ways to show teammates respect. The *introduction* identifies reasons for addressing this topic. *Questions for discussion* help students discover how teammates may interpret actions differently with regard to showing respect. The *principle* highlights the importance of having a humble heart to deal properly with showing respect. *Observations and follow-up* prompt the student to think about how to show respect and to take specific action to show respect.

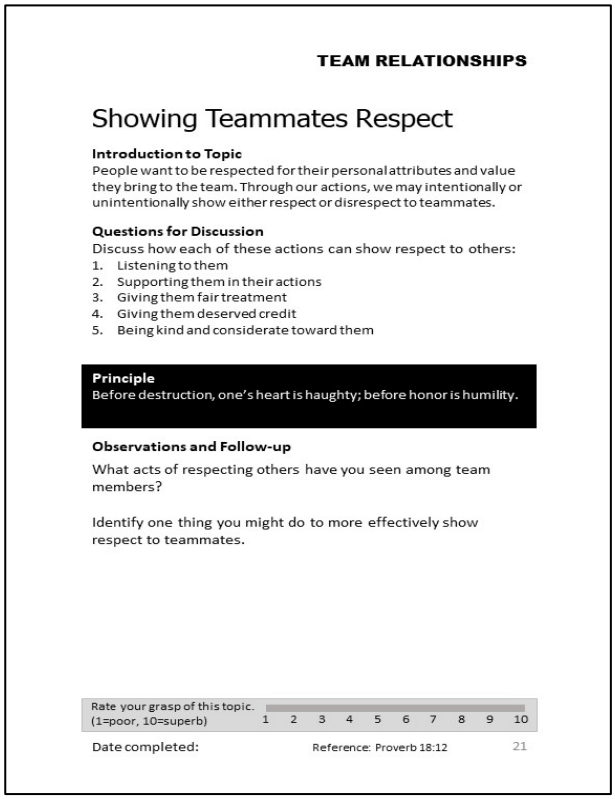

Figure 2. Showing Teammates Respect Exercise

A third format for professional learning activities is a PowerPoint file with each slide containing a different topic. Slide content is similar to the card deck, but electronic form makes it easier to handle.

Implementing Exercises

Mighty minutes professional learning exercises have been used in a limited number of capstone courses in the US and elsewhere and in one high school level robotics team co-coached by the author. These implementations are discussed briefly below.

Capstone project course

In one capstone course, a deck of cards was distributed to each project team leader and to faculty advisors of

projects. At the start of a project work session, the capstone projects coordinator selected a relevant professional topic (card) for discussion. The project advisors, who had varied perspectives on professional development, oversaw their project team's use of the exercise. The team leader generally facilitated the exercise and encouraged team members to record learning from the exercise in their professional development journals.

High school robotics project

In the 13-member high school team, the team leader selected and used one exercise in each 3-hour meeting. At the start, the leader introduced the topic, asked pairs to discuss questions, called for report-out, and encouraged members to practice what they learned. Then the team engaged in its regular project activities. On some days, at the end of the work period, the leader asked members to reflect on how they saw the targeted behaviors practiced that day.

Results

Results from using professional learning exercises varied, largely depending on how exercises were promoted and conducted. Discussion of two different implementations (below) reveal some of the key issues.

Feedback from capstone usage

Feedback from the capstone course projects coordinator reported mixed results from their use of cards. Project advisors had not been prepared to use the exercises as intended, so varied implementations occurred. This experience led to the following insights:

- Students unaware of professional development intent see little value in doing these exercises
- Facilitators unfamiliar with exercises are unable to facilitate them effectively
- Advisors unfamiliar with exercises are unable to effectively promote and guide their use
- The large number of cards (over 100) makes professional development seem unwieldy
- Professional exercises need to be connected with other professional development done in the class
- Project advisors and students must be prepared to make professional development activities effective

Feedback from high school usage

Professional behavior exercises used with high school students were more successful. The author advised their effective use, and students participated enthusiastically. After 18 exercises were used, the author surveyed students to determine impacts on student professional development. Results showed:

- Time spent on professional exercises was worthwhile (38% strongly agree, 54% agree).
- Greatest value was gained in keeping a professional focus (38%), keeping all members engaged (23%), and learning how to improve (23%).

A survey near the end of the project showed:

- Value retained from much earlier professional activities was: moderately high to high (54%).
- Topics valued: taking initiative (83%), learning by failure (58%), building team unity (42%).
- Suggestions: use professional exercises regularly, revisit topics a second time, and bring closure on the topic at the end of the project work period,

Conclusions

Brief professional learning exercises can develop professional awareness, knowledge, and practices in projects. Exercises prompt discussions that raise professional issues and help students construct common understandings and behaviors that improve unity and professional performance of individuals and teams.

When exercises are properly introduced and facilitated, students engage conscientiously, discuss openly, learn in context, and gain competence in professional abilities. Such activities offer benefits to project teams from high school through college capstone project classes. Students say that the benefits gained justify the time invested.

The author invites collaborators to test additional professional learning exercises in project classrooms.

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