Script, Industry Fellows, ASEE 2011

[Title page]. I am Josh Tenenberg, from the University of Washington, Tacoma. A recent major study on Engineering Education calls for centering 21st century Engineering Education in professional practice: “[I]f students are to be prepared to enter new-century engineering, the center of engineering education should be professional practice, integrating technical knowledge and skills of practice.” Similar sentiments are expressed by the National Academy of Engineering in their recent report *Engineer of 2020: Visions of Engineering in the New Century*.

This paper describes the Industry Fellows model for industry-academic collaboration in engineering education. [Industry fellows model] Industry Fellows involves a university faculty member [image] and a practicing industry professional (the industry fellow) [image] in the joint curriculum review, planning and [image] teaching of a course related to the professional's domain of expertise. In the balance of this talk, I present a video overview of Industry Fellows, describe how I have instantiated the model, summarize the mixed-method evaluation data, and describe the key characteristics that make this model novel.

[Theater marquee] I’ll start by showing a video that describes the Industry Fellows model. You will hear perspectives from students, an industry fellow, and me, the participating faculty member. [Movie]

[Instantiating the model] The video was filmed just after I completed working with an industry fellow the first time. Since then, I have worked with industry fellows two more times. Twice in [hci image] an undergraduate human-computer interaction course, and once [cs image] in an undergraduate course in software development. I will provide some details of how I instantiated this model in practice.

All three times I worked with industry fellows, we met long before the term in which the course was offered. [Planning meetings] The purpose of these meetings was to develop common ground about the course. I met enough times so that we could answer the following three questions. [click] 1) What will students be able to do on course exit? [click] 2) What specific work will we assign to students?[click] 3) How will we sequence the topics from week to week?

 [Industry fellow interaction] Two times that I taught the course, the industry fellow’s interaction is what I characterize as “heavyweight”. [Heavyweight] This involved the industry fellow attending one of the two weekly class sessions in person, which we usually debriefed just afterward and at the same time planned for the following week. In addition to the class time, this also required time for the industry fellow to travel to the university, and a small amount of time for preparation. [Lightweight] In the lightweight version, which I did once, the industry fellow attended the first and last class sessions of the term in person, and then “phoned it in” during the balance of the term. We averaged 15 minutes of remote interaction weekly between students and the industry fellow using skype. And he and I would have a weekly phone call of about 15 minutes so that I could bring him up to speed on what was going on in class. In both the heavy and lightweight versions, I had a long retrospective meeting with the industry fellow after the course completed, to discuss what worked, what didn’t and what we would do differently if we were to teach the course together again.

One of the key principles in Industry Fellows is to divide labor along lines of expertise. [divide labor] This means that the teacher should do all of the “teacherly” things, such as writing syllabi and homeworks, and assigning grades. In addition, the teacher has the pedagogical expertise to determine how to best structure the classroom interaction so that the industry fellow can connect their workplace expertise to students. On the other hand, the industry fellow’s role is to enact their practice in the classroom using familiar materials. One of the main ways is in responding to student work using authentic representations of practice. I frequently have students present these representations, followed by commentary, critique, and discussion among all participants in the class, particularly the industry fellow. In the software development course, this includes such things as user stories and UML class diagrams, while in the human-computer interaction course this includes sketches and prototypes. These displayable representations mediate the interaction between student, teacher, and industry fellow. In addition, they enable industry fellows to enact their expert practice in the classrooms. Professional practitioners need no preparation in order to respond to student-generated work since this work comprises the daily activity of the industry professional.

At the end of the course, I collected evaluation data from 51 of the 55 students enrolled in the three courses in which an industry fellow was involved. I first present the quantitative data. [data table]. I asked students to indicate on a 5-point Likert scale how the participation of the Industry Fellow impacted four aspects of the course: first, their motivation to do the coursework. The table indicates that 44 of the 51 students indicated a positive impact, 7 students indicated no impact, and no student indicated a negative impact. You can read the remaining results for the other three questions that I asked of students. [pause to let them read]

I then asked two open-ended questions, which I display here. [two questions – pause for reading] I did a content analysis of the responses to these questions. There were two prominent themes. First [click] was the theme of “Connecting the classroom to the world of professional practice.” [click] You can see some of the specific quotes that relate to this theme. [pause]. Second [click] was the theme of “Developing technical skills through the industry fellow’s critiques”, [click] with some representative quotes here.

The Industry Fellows model involves more than simply pairing an industry professional and a teacher. [click] The following is a set of key principles that characterizes the model:

1. [click] Choose the right course: at the boundary between academia and industry.
2. [click] Choose industry fellows with intrinsic motivation; don't pay for participation.
3. [click] Explicitly negotiate the time commitment of the industry fellow early.
4. [click] Divide the labor along lines of expertise.
5. [click] The instructor has ultimate responsibility for the course.
6. [click] Plan the course together weeks or months in advance.
7. [click] Use externalized artifacts to mediate the interaction among the industry fellow, students, and the instructor.
8. [click] Have ongoing interaction between the industry fellow, students, and the instructor throughout the academic term.

There is general agreement by blue ribbon task forces and engineering researchers that 21st century engineering education must be centered on the professional practice of engineering17,24. As such “faculty need to make clear what expert practice looks like, modeling or otherwise making visible both thinking and doing24”. With its direct interaction between students, faculty, and practicing professionals over an extended period of time, Industry Fellows offers a novel model for helping to bring engineering education into the 21st century.

[Acknowledgements slide] Thank you.