

Facilitating Faculty Conversations: Development of Consensus Learning Goals

Rachel E. Pepper, Stephanie V. Chasteen, Steven J. Pollock and Katherine K. Perkins

Science Education Initiative and Department of Physics, University of Colorado, Boulder, CO 80309

Abstract. Our upper-division course reform efforts at the University of Colorado start with expert input from non-PER faculty, and these conversations with faculty enrich and guide our course reforms. We have discovered additional benefits of these conversations, such as the fact that they serve as a forum for discussions of pedagogy and PER. However, it is not always obvious – to the faculty or to the PER researchers – what approach will lead to successful meetings. During the process of several course transformations we have met with diverse faculty to generate consensus learning goals and course assessments. We describe the general approach used to structure and facilitate these meetings, and include details on what these meetings entailed, how we achieved broad participation and productive conversations, as well as potential pitfalls to avoid.

Keywords: physics education research, faculty discussion, learning goals, conceptual diagnostic

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INTRODUCTION

It is widely-acknowledged in the education research and reform community that the creation of learning goals is important and beneficial when teaching a course [1, 2]. However, it is common for faculty to neither create nor use explicit learning goals. It has also been found that PER-based curriculum transformations are often not taken up by non-PER faculty, and that one potential solution to this problem is for PER researchers to view faculty as partners in the process of improving education [3].

At the University of Colorado (CU), we have addressed both of these issues by holding a series of faculty discussions in parallel with course transformation efforts for four upper-division courses. These discussions have been valuable research tools, allowing the development of consensus learning goals and for turning some key learning goals into assessments. We have also discovered that there are many other benefits to holding such meetings, both to the faculty who attend the meetings and to the department as a whole.

While holding such meetings has been an effective PER tool in our case, we hear from other departments at CU that similar meetings in their department have not been as successful, and have sometimes been detrimental. We therefore share in this paper our experience creating successful faculty meetings focused on learning goals and assessments. The approach we describe may serve as a model for structuring and facilitating these discussions which other departments may want to adapt to their context.

BACKGROUND

For the past 5 years at CU, several science departments have been working to improve undergraduate science education as part of the CU Science Education Initiative (SEI). In the Department of Physics, the focus has been on improving upper-division courses: E&M 1, Quantum Mechanics 1, the senior laboratory course, and a sophomore Classical

Mechanics/Math Methods course (PHYS 201).

The physics department at CU has around 50 tenure track faculty members and the department graduates about 50 majors each year. Faculty course assignments rotate; faculty typically do not teach the same course two semesters in a row. Before the SEI grant, the physics faculty had transformed the introductory courses to use interactive techniques. Faculty have a generally high interest in PER, and many faculty have spontaneously used clickers in upper-level courses not transformed by the SEI [4].

The first step of all the SEI course transformations has been the creation of student learning goals for the course including both course-scale, and topical-scale goals [5]. For all the courses listed above, course learning goals were determined by holding a series of faculty discussions. These meetings were open to the whole faculty, but generally attended by a smaller group of interested faculty members. While all four courses held successful and productive faculty discussions, in this paper we focus primarily on the discussions surrounding PHYS 201 as a case study.

The faculty at CU decided to transform PHYS 201 in the spring of 2010 as part of the SEI grant activities, and a series of 3 biweekly meetings were held over the summer to determine learning goals for this course. In the fall of 2010, a further series of 4 biweekly meetings were held to select the most important learning goals to include in a conceptual diagnostic on the PHYS 201 material.

Overall 19 faculty members (4 PER, 15 non-PER) participated in at least one of the series of 7 meetings, with an average of 9 faculty at each meeting. Each faculty member attended on average 3.4 meetings. Overall, 31 faculty in the department have participated in at least one of the 18 SEI-led meetings from one of the four transformed courses. We consider this high participation a measure of the success of these meetings. The most recent meeting (#18) was attended by 11 faculty, likely indicating that they perceive such meetings as valuable. In contrast, other departments at CU have held meetings where no faculty have attended, or have held a first meeting where faculty have expressed a

desire to never hold such meetings again.

WHAT THE DISCUSSIONS ENTAILED

Meetings were organized and facilitated by a postdoctoral Science Teaching Fellow (STF) who provided an agenda for each meeting to the faculty in advance. The agenda was summarized by the STF at the start of each meeting and relevant background materials provided as handouts (e.g. a list of topics covered by the course in previous semesters). The floor was then opened for discussion of the first agenda item. During discussion, the STF took notes, and recorded and facilitated the conversation. After each meeting, the STF summarized the meeting in a progress report provided first to the faculty in attendance for their input, and later to the entire physics faculty.

As an example of the types of issues encountered in the discussion of learning goals, one discussion focused on the importance of skills versus concepts in a middle-division physics course. One faculty member pointed out that many of the goals that the group had listed as important were skills rather than concepts. For instance, one consensus course learning goal is that “students should be able to project a given vector into components in multiple coordinate systems, and to choose the most appropriate coordinate system in order to solve a given problem.” The group as a whole decided that both skills and concepts were important at the middle-division, and that skills were a large focus in PHYS 201. Faculty also discussed the content of the course: For instance, faculty decided that vector derivatives would best be taught in E&M1, rather than in PHYS 201, that waves and complex numbers should be taught in Modern Physics (a prerequisite to PHYS 201), and that Green’s functions need not be taught until later. It is notable that after a short discussion, there was broad faculty consensus on all of these determinations.

In addition to discussions of learning goals, the meetings provided a forum for a rich set of productive conversations. For example, faculty discussed curriculum alignment, including which math and physics topics belonged in PHYS 201 and the curriculum overall. Faculty also discussed student attitudes towards physics and towards the PHYS 201 course. Some faculty argued that it may affect student attitudes negatively to have a purely math methods course as one of the first “real” physics courses that students take.

Another conversation focused on what students typically struggle with most, such as separation of variables in E&M1. Faculty also discussed how many times students need to be taught one topic. For instance, was it OK that students were hitting a brick wall with separation of variables in E&M1, or would it be better for them to encounter the topic in PHYS 201 first, and hopefully then find it easier in E&M1?

There was also a productive discussion about the utility of creating a conceptual diagnostic. One faculty member

questioned why make a diagnostic at all when individual faculty all write final exams to assess the goals that they value. Several reasons were brought up by faculty (including faculty not in the PER group).

BENEFITS OF DISCUSSION

The most obvious benefit of the discussion was achieving the stated goals of the meetings: determining learning goals, and selecting which should be tested on a conceptual diagnostic [6]. Another important benefit was deciding what physics content belonged in which semester of the sequence; what content belonged in prerequisite or follow-on courses; and what content was a low priority for coverage.

Beyond these course-specific benefits, there were further benefits to the faculty who attended and the department as a whole. One such benefit was that these meetings served as a forum for faculty to discuss pedagogy and student difficulties, and to share their individual knowledge on these topics, as outlined above. Anecdotally, we find that these discussions also had the effect of making discussing education in informal faculty-faculty interactions more common and acceptable in the department. We also hear from the junior faculty members who attended that the meetings were particularly beneficial to them as a forum to connect with their colleagues and have their voice heard.

As a further benefit, these discussions involved more of the faculty in thinking about PER – such as the utility of creating a conceptual diagnostic, or whether there was anything “wrong” with PHYS 201 to begin with. Moreover, these meetings provided a forum for a sort of “cross-pollination” between the set of faculty who tend to teach the upper-division courses, and PER faculty. Through these meetings, upper-division instructors and PER faculty both gained an opportunity to discuss issues of teaching and learning, and to glean from each others’ expertise.

ELEMENTS OF SUCCESS

Not all faculty meetings successfully achieve the benefits noted above. To assist those who may want to hold similar discussions, we consider some of the elements of our faculty discussions that we believe made them successful. The elements of success reported in this section are based on our collective impressions after holding 18 such discussions in our department. A cross-department comparative discussion held at CU in which successful and less-successful faculty discussions were compared provided us with some context to judge which elements are more important for achieving success.

The faculty discussions we describe were facilitated by a postdoctoral Science Teaching Fellow (STF) who had specific content knowledge of the course material. As discussed below, we believe that the external role of the STF is important, but this facilitating role could also be taken

on by a motivated member of the department's faculty.

Choosing a topic to discuss: It is key when holding faculty discussions to choose a topic that will motivate attendance of the faculty in a department. Since courses build on one another, discussion of learning goals for an individual course is relevant not only to those who teach the course, but to those who teach courses that come before and after. In a department like ours, where faculty rotate through courses, there is even more motivation to discuss any individual course because many faculty members either have taught it or will teach it in the future. In non-physics departments, where courses do not always build upon each other, it may be more productive to discuss the goals for the overall major and how these broader goals can be addressed by the courses in the major. We have also found that, across departments, faculty are generally most interested in discussing courses intended for majors rather than service courses or introductory courses. Based on less successful experiences in other departments, we recommend starting with courses intended for majors to develop a culture of faculty discussion about education before moving to discussion of lower-division courses.

It is also helpful for there to be some additional motivating factor for faculty for why a discussion is needed *now*. Across the departments at CU these motivating factors have included grant money and a postdoctoral fellow hired for the purpose of course transformation (as for PHYS 201), creation of a new major, money for determining a unified curriculum, fixing a course that most faculty acknowledge isn't working, and helping a junior faculty member succeed (e.g. with getting a NSF CAREER grant).

Before the meetings: Actions taken before the meetings were important to achieve broad faculty participation.

One key element for getting faculty participation is the endorsement of authority figures in the department. About 9 years ago, a Nobel prize winner in the physics department voiced the idea that having faculty meetings to discuss education issues was important. The chair or associate chair sent an email announcing each meeting, so faculty were aware that these meetings were supported by the chair. Support of authority figures has also been important in course reforms at other universities [7]. We also believe it is important to invite the entire faculty in the department. This has always been done for SEI-led meetings in the CU physics department, however, in other departments where this was not done, it caused some resentment among the faculty leading to decreased buy-in about education research and course transformations.

Beyond inviting the entire faculty, we have also found it helpful to individually target key faculty. For instance, before the PHYS 201 meetings, all faculty who had taught PHYS 201 or the next three courses in the physics sequence were sent individual e-mails which expressed the hope that they could come to the meetings, and the

idea that their input would be particularly valuable (5 of 6 faculty invited this way for PHYS 201 came to at least one meeting). It was also helpful that the organizer of the meetings had made a personal connection with several key faculty *before* the meetings by interviewing these faculty to get their ideas about what was important about the PHYS 201 course. Other faculty with a personal connection to the facilitator (e.g. through co-teaching) were also more likely to attend the meetings.

During a meeting: During the meeting the facilitator took several actions in order to maximize the productivity of the discussion.

One important aspect was to distribute and post a concrete agenda for each meeting. However, it was also important not to follow this agenda too rigidly. For instance, in the first meeting of the series the agenda was to discuss broad course-scale learning goals, but it quickly became clear that the faculty wanted to discuss which topics should be covered in the course, and whether the course should revert to separate math methods and classical mechanics courses. Since these topics seemed important to discuss, and also because the faculty participants seemed unwilling to change topics until these had been settled, the facilitator deferred discussion of course-scale learning goals until the following meeting. Other discussions, such as one about the utility of a conceptual diagnostic, were also encouraged as productive despite not having a place on the agenda.

It may also be necessary for faculty to air grievances and to feel heard before being able to move to productive discussion. In the PHYS 201 discussion it was necessary to let faculty discuss the shortfalls of the current course before moving on to discussing learning goals. In E&M1, discussions began with "What is junior E&M1 about? How is it different from the introductory E&M course?" This enabled instructors to air their thoughts and enabled the STF to get a sense of faculty attitudes.

It is essential to include a designated facilitator, knowledgeable about the course who is focused on effective facilitation rather than conveying their own opinion. Without effective facilitation, discussion may become circular with faculty taking rigid stances and repeating themselves. *Getting to Yes* [8] is a good resource on effective facilitation.

Throughout the discussion it is helpful for the facilitator to summarize the proceedings so that all parties feel heard. For instance the facilitator might say something like "I hear overall that you want a diagnostic question addressing this learning goal, but don't like the current question as it is written, is that right?" If these summary sentences are synthetic of the recent conversation as well as summative, faculty are more likely to feel as if progress has been made and be ready to move to the next topic.

Another important element for generating faculty goodwill is ending these discussions on time. This gives faculty the sense that their time is respected.

When faculty were still mid-discussion at the end of what was intended to be the final PHYS 201 meeting, faculty decided to have another meeting the next week rather than let the current meeting go long.

After a meeting: After each meeting there are several actions the facilitator can take to make future meetings more productive.

Promptly sending out summaries of the meeting accomplishments to the faculty involved can generate a positive sense of progress about the meetings. After each discussion, the STF provided a brief synopsis of discussion and the decisions made. In some cases, this included re-writing ideas that the faculty had expressed in the form of concrete learning goals that the faculty could then discuss and approve in the next meeting.

Faculty were given a sense of ownership after E&M1 meetings by placing the initials of individual faculty next to learning goals that their ideas had inspired. This helped faculty keep track of their ideas week to week, even when they had been re-phrased in a way that they might not otherwise have been recognizable, as well as indicating to other faculty that the goals had initiated with their colleagues (rather than from the STF or PER group).

PITFALLS

We have also discovered through discussion with other departments several things to avoid when holding faculty discussions about education.

One thing we carefully avoided in meetings in the physics department was a sense of PER proselytizing. We emphasized that the STF was coming to the faculty for guidance on what the goals of course transformation would be. When running the E&M1 discussions, one author (SVC), consciously portrayed herself as an outsider (both to the department and to the course).

Similarly, we avoided any discussion telling faculty how to teach. While pedagogical issues arose in discussion, they were generally addressed by non-PER faculty, sometimes with additional comments by PER faculty. We also made it clear that the learning goals did not dictate what faculty could teach - rather, they could be used by any individual faculty to guide their teaching - or not - at their discretion.

A single meeting on such topics is generally not productive. Departments that have held only single meetings, rather than series of meetings, tell us that these generally do not achieve their goals.

Another technique that we find less effective is to rely on faculty doing homework in between meetings. While it may be productive to assign something so that a few faculty have done it in advance, the facilitator should not plan on the majority of attendees having completed anything. Rather, we have found it most effective for the STF to prepare copies of working documents in advance so that substantive work can be done during the meeting. For instance, in

the discussion of topical coverage in PHYS 201, the STF brought copies of an organized list of what physics and math topics had been covered in the course previously, and in which other courses these topics were used so that the faculty could select from this list which they thought should be covered in the transformed course.

We also found that it is important to be sure to follow up with faculty as to how their input has been used. In cases where the learning goals were used to generate course materials for E&M, at least one instructor indicated that she wanted more information about how the course transformation had proceeded. Faculty want to know that their time has been valued and well-spent, and regular updates to the group send a positive message in this regard.

CONCLUSION

We found these series of faculty meetings to be beneficial - to the department, to ourselves as researchers and teachers, and to the faculty who served on them. Learning goal discussions leverage the familiar framework of focused committee meetings in order to create a rather unusual facilitated conversation about the goals of instruction. The simple question - what should students get out of this course? - spurs faculty to explore ideas about course sequencing, the role of specific physics topics in a student's mastery of the subject, common sticking-points for students, and the scholarship of teaching and learning. Teaching is often a solitary endeavor, and these discussions provide a rich forum for instructors to make their views and values about teaching explicit - a valuable process for all involved. Thoughtful facilitation, open dialogue, and a climate of respect have enabled these discussions to serve as an important seed in the development of individual and distributed expertise in instruction among our faculty.

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