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Refining Instructional Modules for Engineering Lab Writing Using a Community of Practice Approach

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Refining Instructional Modules for Engineering Lab Writing Using a Community of Practice Approach

Abstract

Laboratory report writing instructional modules have been developed and refined using a community of practice (CoP) approach. Supported by the National Science Foundation Improving Undergraduate STEM Education initiative, researchers at three institutions have refined and reorganized a series of scaffolded laboratory writing modules based on the work of faculty and graduate students at a CoP meeting. This paper documents the process used at the CoP meeting where draft modules were made available and a model laboratory session was considered. Other published laboratory report writing resources were evaluated alongside the draft modules to determine areas of overlap and novelty and to ensure the completeness of the revised modules. The process of revising instructional modules was valuable for both the quality of the modules and the development of the community of practice.

The modules are now organized into two guides, published at http://labs.wsu.edu/engineering-lab-report-writing/. An Instructor's Guide to Engineering Lab Writing, targets instructors and provides model lab writing and data analysis learning outcomes for consideration when planning a laboratory session, as well as approaches for course organization and teaching to support lab writing outcomes. A library of lab report types and a model rubric for lab report scoring complete the instructor-oriented resource. A Student's Guide to Engineering Lab Writing, supports students who are learning lab report writing for the first time or are advancing as technical writers. It is organized according to traditional lab report format and is aligned with the learning outcomes in the instructor modules. The content in the student-oriented modules is scaffolded to support continuous development. The modules are arranged in order of increasing cognitive difficulty, first addressing formatting conventions and arrangement, then section contents and methods of data analysis, and finally effective methods of interpretation, reasoning, and conclusion writing.

This paper demonstrates the mutually reinforcing nature of collaboratively developed instructional material and the growth of a community of practice. The CoP approach to structuring a meeting was effective for gathering targeted and relevant feedback in a short period of time as well as for developing the CoP itself. The instructional modules revised at the CoP meeting were significantly improved creating a sense of ownership and inclusion by those participating in the meeting. They are now publicly available to serve a growing community of practice focused on engineering lab writing.

Introduction

Laboratory report writing is often the first opportunity for engineering students to practice writing in the discipline, allowing them to demonstrate technical domain knowledge as well as academic and professional writing conventions. Prior writing knowledge depends on a student's high school experience as well as college coursework that may take the form of composition courses, technical writing courses, writing-intensive courses (WICs), or courses based on a broader curriculum with writing included in many courses (writing across the curriculum, or WAC). The authors of this paper have investigated student laboratory report writing performance and the influence of each of these prior writing contexts. In prior work, we have described the initial development of instructional modules that support engineering laboratory report writing with a particular focus on instructors [1]. In this paper, we describe the process of refining these modules using a community of practice (CoP) approach. Thus, this paper presents the mutually reinforcing aspects of community-of-practice development and collaborative instructional materials design for engineering laboratory writing. It also presents the revised modules themselves and documents the improvements made by the CoP meeting participants.

Engineering instructors are experts in writing engineering literature but are challenged when instructing writing to engineering students. On the other hand, engineering students, particularly in the lower division, experience writing difficulties in engineering lab courses due to the strangeness of engineering lab reports as a new genre for them [2]. The genre characteristics of engineering lab reports are quite distinct from those of writing assignments in college-level general education writing courses, which students often take before arriving engineering labs [3,4]. In addition, Wolfe [5] argued that textbooks on technical writing have gaps when applying their content to writing instruction in engineering. Engineering educators have made efforts to support engineering instructors' writing pedagogies to improve engineering students' writing in the major; a few recent studies include the work by Conrad [6,7] to develop web-based instructional modules [8], including genre-based units, language units, and grammar and mechanics lessons, to support civil engineering instructors' writing instruction and undergraduates' writing in the major. The modules were derived from Conrad's linguistics research on connecting writing and perspectives between practicing civil engineers and engineering undergraduates [6,7]. Popovics et al [9] applied Conrad's modules to reform their undergraduate lab course in civil engineering and earned positive feedback from instructors, teaching assistants, and students. Buswell et al. [10] developed writing intervention tools, including rubrics, graded writing examples, and strategies for developing writing prompts. Genau [11] introduced a 4-page Materials Science and Engineering (MSE) Technical Writing Guide to enhance scaffolding the report writing experience for students in the major. Kim and Olson [3] used instructional materials to improve engineering students' transfer of writing knowledge from first-year composition courses to introductory engineering lab courses in mechanical engineering.

The concept of a community of practice is popularly attributed to Lave and Wenger in their seminal work on situated learning in 1991 [12]. Hoadley describes the development of the idea of a community of practice moving from a descriptive concept to a prescriptive one, with CoPs first being studied and understood and then built intentionally [13]. He also differentiates an incidental community of practice that is distinguished by its shared practices from a more intentional knowledge-building community that has both agency and a mission to learn. Etienne and Beverly Wenger-Trayner have spent much of their careers refining the CoP concept, offering this definition [14]: "Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly." They identify three critical attributes of a community of practice:

1) A shared domain of interest, which is, in the case of this paper, writing in early engineering laboratory settings.
2) A community: "in pursuing their interest in their domain, members engage in joint activities and discussions, help each other, and share information. They build relationships that enable them to learn from each other; they care about their standing with each other" [14]. The information sharing, meeting over meals, and deliberate knowledge creation provided a place for a community to develop at this first community of practice meeting, and a deliberate tone was set by naming the meeting accordingly.
3) A practice: this includes the development of "a shared repertoire of resources: experiences, stories, tools, and ways of addressing recurring problems—in short a shared practice" [14]. Teaching experiences and stories were shared throughout the meeting time and during focus groups. The deliberate attention paid to the set of instructional modules made for a shared set of tools that was individually applied and collectively revised, making it more likely to be used after the meeting. Since laboratory teaching occurs regularly, and writing is a perennial issue, this community can continue to grow and self-sustain.

The CoP described in this paper is in its infancy and is aligned with the concept of a knowledge-building community. The "CoP meeting" described here was a first meeting of a group of loosely knit participants in an NSF-funded project to study engineering laboratory report writing with a writing transfer lens. Participants at the meeting had engaged directly with at least one of the three institutional principal investigators (PIs) to supply student writing samples from their laboratory-based courses. The five participating instructors, representing the mechanical, electrical, and civil engineering disciplines, had used a series of instructional modules prepared by the PIs to improve their lab writing instruction in the previous year. A total of 10 engineering faculty, two writing faculty, five graduate teaching assistants, and four undergraduate student support staff participated in the meeting.

The CoP meeting was guided by the C4P model of Hoadley and Kilner [15], which defines CoPs to include *content*, *conversation*, *connection*, and *information context*; with each of these Cs supporting a common *purpose*. Content drew from prior research into lab report writing and knowledge transfer models. Conversation at the meeting was encouraged by providing dedicated social time around meals and break periods. Connection was fostered using group-seating tables and changing the composition of the tables for each session. Information context was provided by presenting current resources that support lab report writing as well as the state of the current study on the lab writing performance of students. The common purpose was clearly stated and was based on the goals identified for the meeting by the PI team, namely (1) to provide professional development, (2) to facilitate improvements in the instructional modules, and (3) to build a community of practice.

The 3-day CoP meeting schedule began with sessions devoted to instructor guidance (assignment design and rubric design for writing assessment). Participants evaluated existing web-based student-focused instructional materials [20-24] the details of which will be presented in the following sections. On the second day, a model lab instruction demonstration was presented and the instructor-focused modules were used to improve the demonstration lab learning objectives, assignment, and assessment rubric. Also on the second day, participants reviewed in detail the instructional modules developed by the research team and provided rich feedback. Their recommendations and the revisions made will be reviewed in detail in the following sections. On the third day, participants were tasked with identifying a specific lab they would teach in the coming year and modifying their laboratory materials to include the best practices presented during the meeting. Thus, participants left the meeting with revised materials of their own and a better understanding of the instructional materials they had helped to develop. Focus groups were conducted with the participating instructors and graduate teaching assistants who attended the meeting; their perceptions of lab writing teaching practices and perspectives on the tools available to them were discussed in these focus group meetings. The results of these meetings will be published in a separate paper at the ASEE annual conference this year [19].

One of the more important aspects of a community of practice, as defined by Lave and Wenger, is that it is situated in authentic practice contexts or practice fields. For our community of practice, we situated ourselves by experiencing a simulated quasi-authentic context: a demonstration laboratory scenario. While all the instructors attending the meeting had taught labs, grounding our conversation with a specific laboratory session was valuable and very much in keeping with another distinguishing feature of communities of practice: a shared experience.

Scardamelia and Bareiter introduced the concept of a learner developing and setting their own agenda for knowledge construction [16]. This is a wonderful aspect of early participation in a CoP, when the artifacts of knowledge are less formally established. Later participants may not have this unique opportunity to set the agenda to such an extent, although successful CoPs will often grow and evolve their participants and their practices. Taking cues from popular social networks like Facebook, web-based platforms like Open Social [17] and wikis have been developed to support virtual CoP development. Other web-based tools exist, but Wenger-Trayner is careful to point out that no one technology can most effectively support a community of practice [14].

Many for-profit programs now exist to encourage and measure the effectiveness or maturity of a community of practice. Wenger-Trayner offers a simple way of deciding whether and how to measure a CoP [14]: "If measurements are in support of intelligent conversations about real value creation, they tend to be useful. But if they are a substitute for such conversations, they tend to become counterproductive." These conversations are beginning, now that this community of practice appears to be growing, and will be the subject of future research. Currently, the PIs represent the core of the CoP. As the CoP grows, ideally it will encounter more instructors who wish to participate and the practices will evolve and be shared more broadly. The goal of any educational research endeavor is to identify effective approaches and disseminate them broadly. Community of practice approaches have become very popular to accomplish this, but generally require a level of consistency. Another NSF-funded project to develop infrastructure instructional materials (The Center for Transportation Infrastructure and Education, CIT-E) has been able to grow and sustain a strong community of practice over many years, offering a model to follow [18].

A quality of CoPs, as described by Hoadley, is that members tend to perceive experts within the community and aspire to become one [13]. Numerous experts exist on the PI team, including both engineering and writing professors. Thus, specific knowledge and experience is represented in a way that engenders aspiration. Participating faculty may or may not have experience in instructional design, teaching best practices, or rhetorical moves, but they share the experience of promoting writing in lab contexts early in an engineering curriculum.

Another distinguishing feature of CoPs is that members can participate peripherally before engaging more meaningfully as they develop a greater sense of belonging [14]. However, the CoP meeting was more carefully prepared to require engagement by the participants, just as students would be actively engaged by an instructor in the classroom. As the CoP evolves, it is likely that instructors and students will engage with the material more regularly and perhaps without encountering other members of the community. Thus, it is important to encourage the continued participation by a research community in developing best practices. With the instructional modules made public, peripheral participation, in addition to more intentional involvement, will be possible.

Numerous features of a community of practice could be examined here, but this paper will focus primarily on one: the development of instructional modules as a means of both building and examining the effectiveness of a community of practice. The meeting schedule demonstrates the diversity of activities in the CoP meeting, but all other content tended to focus on the refinement of the instructional modules the PI team had previously developed [1].

Two research questions were articulated: (1) How effective was the CoP at developing/refining the instructional materials, and (2) How effective was the exercise of developing instructional materials in building the CoP? The module development and its influence on CoP development will be further scrutinized here, while the impact of both on new faculty will be discussed in another paper [19].

Methods

Two activities from the CoP meeting will be described here and used as the basis for assessing the CoP effectiveness of refining the laboratory writing modules: (1) an outside-source benchmarking exercise and (2) instructional module review.

Outside-Source Benchmarking Exercise

The outside-source benchmarking exercise required four four-person teams to review one of four publicly available writing resources:

1. Monash University's Write Like a Pro, Engineering Lab Report website [20]
2. Purdue University's Online Writing Lab, Writing Engineering Reports [21] and Handbook on Report Formats [22]
3. Pennsylvania State University's Writing as an Engineer or Scientist resource at craftofsciencewriting.org [23]
4. Portland State University's Civil Engineering Writing Project [24]

The prompt used to elicit the participant response is provided in Figure 1. Teams reported their results to the larger group and cataloged their thoughts in an online shared document.

Instructional Module Review

The module review activity requested feedback on the instructional modules that were developed by the project team and are available on the project website [25]. Four four-person teams were arranged with new composition, using individuals from the previous exercise who had evaluated different resources so that ideas from all existing resources would be considered. Each team was given four modules to review, one from the instructor-focused material and three from the student-focused material. Teams responded to the prompt in Figure 2. They recorded their feedback about each module in an online shared document and reported their findings to the larger group.

Outside-Source Benchmarking Exercise

1. In a group, visit and explore one of the four lab writing resources.
2. Use the back side of this handout to evaluate the resource on the basis of the writing outcomes rubric from this project.
3. Answer the following questions:
    - Is the resource more valuable for a student learning to write or a faculty member preparing a laboratory exercise?
    - What elements of the resource are most effective for a student?
    - What elements of the resource are most effective for an instructor? Should they be included in the modules developed by our research group?
    - What could we develop that does not currently exist in available resources?
    - Is the website effective for this content or is another medium potentially better? For example, KEEN cards, printable pdfs, modifiable documents, or Canvas Commons modules?

Figure 1. Prompt to CoP participants requesting evaluation of existing lab writing resources during the Outside Source Benchmarking exercise.

OBJECTIVES: Provide feedback for ***modules and supplemental materials***

<u>Participant tasks:</u>

Each individual reviews the first module assigned to the group.

After each participant has reviewed the module, consider the following prompts for discussion:

- Is the purpose of module clear or not?
- Is the module content clear and well organized?
- Is the scaffold level appropriately identified (fundamental, intermediate, advanced)?
- Is it appropriately linked to higher/lower scaffolds to help students or faculty to step back or seek more advanced topics?
- Is it helpful for lab assignment, lab assessment, and/or feedback?

Things to consider/evaluate/comment on regarding **supplemental materials:**

- Is the purpose of supplemental materials clear or not?
- Are the supplemental materials clear and well organized?
- Are the supplemental materials sufficient?

As an instructor or a TA, what would you like to be improved so you could implement in your labs most effectively?

Figure 2. Prompt to CoP participants requesting feedback on the project-developed lab writing instructional modules.

Results

Outside-Source Benchmarking Exercise Results

Four web-based writing resources were examined and evaluated by the CoP participants [20-24]. The results of their evaluation are provided Table 1. There is variety in the resources currently available to students and the degree to which they support the learning outcomes established by our research team. In general, there are more and better resources treating writing format and conventions, but less material providing effective guidance on data analysis, interpretation, and discussion, which are some of the outcomes that students find most challenging [26,27].

Table 1. Evaluation of existing resources in their treatment of the lab writing learning outcomes.

Lab Writing Learning Outcomes Writers in early engineering lab courses are able to	**Degree to which outcome is addressed by the resource (high, med, low, none)**			
	Monash	**Purdue**	**Craft of Science Writing**	**CE Writing**
1) Address technical audience expectations by providing the purpose, context, and background information, incorporating secondary sources as appropriate.	High	Med	Med	Med
2) Present experimentation processes accurately and concisely.	High	Med	Med	Low
3) Illustrate lab data using the appropriate graphic/table forms.	High	Med	Med	Med
4) Analyze lab data using appropriate methods (statistical, comparative, uncertainty, etc.).	High	Low	Low	Low
5) Interpret lab data using factual and quantitative evidence (primary and/or secondary sources).	High	Low	Low	Low
6) Provide an effective conclusion that summarizes the laboratory's purpose, process, and key findings, and makes appropriate recommendations	High	High	Med	Med
7) Develop ideas using effective reasoning and productive patterns of organization (cause-effect, compare-contrast, etc.).	High	High	Low	Low
8) Demonstrate appropriate genre conventions, including organizational structure and format (i.e., introduction, body, conclusion, appendix, etc.).	High	High	Med	High
9) Establish solid and consistent control of conventions for a technical audience (grammar, tone, mechanics, citation style, etc.).	High	High	Med	High

The Monash University resource is much better aligned with engineering lab report writing, specifically, than the other resources. As a student-oriented tool, it is well-structured, provides useful examples, and interactive; it will be referenced in the instructional modules developed by our team. Purdue's Online Writing Lab has existed the longest and provides a valuable template and genre guidance but has limited guidance related to data analysis and interpretation, which is the substance of most lab reports. The Craft of Science Writing website presents writing instruction in both text and video formats and offers good guidance and report writing examples, but details about data presentation and interpretation are supported less than more specific writing guidance like tone, style, and ambiguity. CE Writing has detailed grammar and style guidance and references numerous common civil engineering writing genres, but it lacks connection to prior writing experiences for novice laboratory report writers. Each of these resources will be referenced where appropriate in the instructional materials developed by our team.

Instructional Module Feedback

Sixteen previously developed lab writing instructional modules [1] were reviewed by the CoP meeting participants. The feedback was diverse, both broad and detailed, with suggestions that fell into the following categories:

- Organization and arrangement
    - Reorganize from fundamental, intermediate, and advanced (seems arbitrary) to align explicitly with the learning objectives and report sections (clearer to novice lab writers).
    - Consider scaffolding learning objectives or ordering the learning objectives/report sections according to cognitive levels, for instance, formatting conventions, introduction, methods, graph/table, interpretation, ideas, and conclusions.
    - Consolidate some module contents to support a new organizational scheme.
- Editorial changes
    - Change module titles (e.g., Primary and Secondary Sources becomes Discussion).
    - Replace "lab report" with "lab writing" to allow for more genres (reports, memos, letters, reflection question responses, fill-in-the-blank, etc.) while still achieving one or more of the lab-writing outcomes.
    - Address miscellaneous typographic errors, grammar suggestions, and phrasing.
- Content recommendations
    - Expand instructor resources, including more examples of different genres of lab reports (e.g., memo, letter, reflection questions).
    - Add a list of technical learning outcomes for engineering labs.
    - Add a module devoted explicitly to methods, expanding on contents of the format module.

- Linking, referencing, and cross-referencing
    - Add links between modules.
    - Add links to other web-based learning resources.
    - Improve and add references in all modules.
- Formatting suggestions
    - Increase the use of graphics, color, and font.
    - Improve table formatting.
    - Add dynamic features.
    - Arrange graphic and textual elements more effectively.
- Web hosting and module distribution
    - Consider distribution methods to facilitate easy adoption (editable documents, learning-management-system integration).
    - Consider mobile device and browser compatibility.
- Summary document production
    - Prepare portable pdf versions for download.
- Model the best practices you espouse
    - Organize modules with Introduction-Methods-Results-Discussion-Conclusion (IMRDC) format.
    - Demonstrate the best practices we describe; website/document/module conventions as an example of effective lab writing. Label and reference all tables and figures in text and edit writing carefully.

In response to the feedback, the overall organization and naming of the modules was changed significantly from modules that attempted scaffolding by the difficulty of various topics to two guides, one for instructors and one for students, that are arranged around the traditional laboratory report format. The webpages for the two guides are shown in Figures 3 and 4. The previous and revised organization is detailed in Table 2.

Figure 3. Homepage of the Student's Guide to Engineering Lab Writing.

Figure 4. Homepage of the Instructor's Guide to Engineering Lab Writing.

Table 2. Original and updated configuration of the lab writing instructional modules.

Original Modules as Presented in [1]	**Updated Instructional Resources**
• Preface ▪ Introduction to Modules for Engineering Lab Instructors ▪ Assignment Design ▪ Assignment Rubric Design	An Instructor's Guide to Engineering Lab Writing • Lab Writing Learning Objectives • Lab Technical Learning Objectives • Assignment Design and Examples • Activity Design and Examples • Assessment Design and Scoring Rubrics • Whole-Lab Design Example
• Fundamental ▪ F1 - Audiences of Engineering Lab Reports ▪ F2 - Lab Report Organization ▪ F3 - Lab Report Conventions ▪ F4 - Data Analysis 1: Simple Statistics ▪ F5 - Data Presentation • Intermediate ▪ I1 - Lab Data as a Primary Source ▪ I2 - Summary/Conclusion Writing ▪ I3 - Data Analysis 2: Trendlines ▪ I4 – Referencing • Advanced ▪ A1 - Logical Appeals (Claim-Evidence-Warrant) ▪ A2 - Data Analysis 3: Error ▪ A3 - Data Analysis 4: Propagation of Error	A Student's Guide to Engineering Lab Writing • Format (F2) • Introduction (F1) • Methods (F2 + new) • Results (F5) • Analysis (F4, I1, I3, A2, A3) • Discussion (I1) • Conclusions (I2) • Reasoning (I1, A1) • Conventions (F3, I4) • Glossary (new)

Discussion

The modules have two distinct audiences: students and instructors. CoP participants thought the modules ought to be more clearly differentiated, with guidance for instructors on the one hand

and guidance for students on the other. The CoP participants recognized the novelty of the instructional design support for instructors preparing laboratory report writing assignments, material, and assessment tools and suggested that this be emphasized. It was discovered later that they did not identify instructor resources at the Craft of Science Writing website [23]. The original modules targeted instructors in the preface with content related to the organization of the modules, the design of assignments, and the development of grading rubrics. Missing from these instructor-oriented modules were tools to support development of the lab activities themselves as well as ways to convey and differentiate technical learning objectives and writing learning objectives. Thus, the modules have evolved to include more content, but also to be more complete, clear, and specific. The modules for students did not have substantial gaps, but did present opportunities for editing, clarification, and reorganization, with a methods module and a glossary making up the bulk of new content.

Because the learning outcomes are related primarily to a section of the lab report, it was recommended to reorganize the modules around lab report sections, or more specifically, particular learning outcomes, rather than on the performance level of the content as fundamental, intermediate, or advanced. Instructional design could then focus on a subset of the writing outcomes, targeting one or more in each lab writing assignment. In this way, the scaffolded nature of the modules would be maintained and more easily adopted and assigned by a particular instructor, but their relevance for a student would be clearer. For example, if an instructor wants to emphasize conclusion writing in a particular week, they can list outcome 6 for that week's lab and offer the conclusion writing module as support to the students.

The suggestions of the CoP participants related to formatting and visual elements led the PI-team to look beyond their existing web authoring platform to other platforms that allow for greater creativity and control of the content. Challenges related to access and permissions at one institution led the team to explore other collaborative web development platforms with the potential to control permissions more easily. The team ultimately settled on Google Sites for its combination of formatting, integration of Google Docs/Sheets/Slides/Forms, and control of permissions and publishing by the interinstitutional group.

Related to the first research question (how effective was the CoP at developing/refining the instructional materials?), the team is very pleased. The clarity of instructor and teaching assistant needs, as well as module organization, formatting, and content, was improved because of the CoP efforts. The suggestions provided an excellent set of tasks that could be addressed by the PIs and shared with the CoP and the public for further use and improvement. The improvements documented here demonstrate the positive evolution of these instructional resources and the effectiveness of the CoP in eliciting them.

Regarding the second research question (how effective was the exercise of developing instructional materials in building the CoP?), it is useful to revisit the features of a CoP as having domain, community, and practice. Given that the modules articulate an instructional practice in the domain of engineering writing, and that they were effectively evaluated and improved by this burgeoning community, they function as a sort of measurement of the CoP itself. The depth of understanding of the CoP participants is represented in the modules themselves, given their co-development. Additional assessment of the CoP, by examining the responses of the focus groups conducted during the meeting, is the subject of another paper published this year [19]. Further development of the CoP and ongoing assessment will be part of the work of this research team in the future.

Conclusions

This paper documents the refinement of engineering lab writing instructional modules using a community-of-practice approach. A set of 16 draft modules were made available to CoP participants for use in lab instruction prior to the meeting. At the meeting, publicly available engineering writing resources were evaluated alongside the draft modules to determine areas of overlap and novelty, and to improve the modules. A clearer and more readily adoptable set of instructional materials is now available as An Instructor's Guide to Engineering Lab Writing and A Student's Guide to Engineering Lab Writing, publicly available at https://labs.wsu.edu/engineering-lab-report-writing/ for use and improvement by what the authors hope is a growing community of practice.

The Instructor's and Student's guides employ evidence-based methods and features for lab writing instruction requested by instructors and teaching assistants. Specifically, the Instructor's Guide is built on a framework of clear alignment between learning objectives, assignment design, activities, and assessment. Best practices, guidance, and tools for effective feedback are also provided. The Student's Guide has a primary structure that is scaffolded around increasingly demanding writing tasks, beginning with report format, continuing with effective writing of traditional report sections, and culminating in effective conclusion writing, reasoning, and writing conventions for a technical audience. Both guides are consistent with each other and cross referenced for easy navigation.

This project demonstrates the mutually reinforcing nature of collaboratively developed instructional material and the growth of a community of practice. The CoP approach to structuring a meeting was effective for gathering targeted and relevant feedback in a short period of time as well as for developing the CoP itself. The instructional modules revised at the CoP meeting were significantly improved and created a sense of ownership and inclusion by those participating in the meeting.

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