A Model for Integrating Professional Writing Students into a Technical Design Team

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Abstract

In technical design classes composed of multidisciplinary teams the difficulties of integrating the liberal arts are well known. These include classroom dynamics, conflicting communication styles, the lack of a common language, and differing problem-solving frameworks. We have piloted a program to integrate teams of undergraduate professional writing students into the Engineering Projects In Community Service (EPICS) curriculum. This program is running on three EPICS teams in conjunction with the Writing For the Computer Industry course in the English department at Purdue University. EPICS is a multidisciplinary vertically integrated design class in which teams of students work on open-ended technical problems in partnerships with local not-for-profit organizations. They design, build, test and deploy projects into the community that meet their partners' specific needs. Our model for integrating professional writing students into EPICS teams allows EPICS students to draw on the expertise of professional writings students in human factors and information design. It gives professional writing students experience working on behalf of technical experts implementing a real-world project. Writers functioned as documentation consultants who helped EPICS teams assess their documentation needs and then produced documentation for end-users. EPICS teams provided subject matter experts and documentation reviewers. Initial products include a troubleshooting guide for an interactive museum exhibit, a user's manual for a county probation database, and an administrator's handbook for EPICS' information management system. Writers gained experience communicating with technical subject matter experts, analyzing systems and investigating the job-specific needs of the products' real-world end users, translating complex technical information into user-friendly documentation aimed at an audience with low-to-intermediate technological proficiency, and working as members of a cross-disciplinary team. EPICS students gained experience communicating with both technical and non-technical audiences, experience defining the scope of their projects, and a greater awareness of the needs and requirements of their customers.

I. Introduction

Purdue University's Professional Writing Program offers a one-semester course, Writing for the Computer Industry, intended to give students practical experience creating software documentation and other materials relevant to the computer industry. The initial goal of this project was to provide professional writing students with meaningful experience developing software documentation and conducting usability testing. Instructors in the Professional Writing Program at Purdue have adopted several approaches to teaching documentation, including having students document undocumented shareware, easily available over the Internet; soliciting clients with documentation needs from inside the English Department; and, occasionally creating documentation for local non-profit organizations. For students enrolled in Writing for the Computer Industry, pedagogical goals included:

- Developing the ability to communicate orally and in writing with technical experts and subject matter experts
- Giving students practical experience analyzing systems and the job-specific needs of real-world end-users
- Giving students practical experience translating complex technical information into user-friendly documentation aimed at an audience with low-to-intermediate technological proficiency
- Developing teamwork skills in a cross-disciplinary environment

Initially, the instructor of Writing for the Computer Industry approached the EPICS program about participation in the documentation project, with no particular view other than finding an on-campus client that offered some of the benefits of a "real" non-profit client, but without the logistical problems entailed in getting students to an off-campus client as winter approached. One of the drawbacks of documentation projects undertaken by students in Writing for the Computer Industry in previous semesters – projects that entailed creating documentation either for local non-profit groups or on-campus clients – was that students gained experience working with end-users to document stable "finished" applications, but they did not acquire any experience working with technical experts or with systems that were still in the development cycle. EPICS proved to be uniquely positioned to provide technical writing students with a much richer opportunity to create "real" documentation in what Amare[1] described as "the cultures of technical communication." Once EPICS had agreed to participate, pedagogical goals were also established for the EPICS participants. These included:

- Giving EPICS team members practical experience communicating orally and in writing with both technical and non-technical audiences
- Developing skills and enhancing experience with defining the scope of their projects
- Developing a greater awareness of the needs and requirements of their customers
- Working on multidisciplinary teams

This paper will provide an overview of the EPICS program, describe the EPICS-English 424 collaborative pilot project in detail and discuss plans for enhancing the cross-disciplinary collaboration between technical writers and engineering students on future projects.

II. Engineering Projects In Community Service

EPICS^2 provides a unique course structure for students in that it is composed of vertically integrated, multidisciplinary teams. The current pilot semester, EPICS involved students from freshman to senior, from 20 departments, on 24 different teams. It is a repeatable course and students can take it for up to seven semesters. Each team works on multiple projects for a local non-profit organization (project partners). These projects vary in scope and can last from one semester to several years. Goals of the program include:

- Broadening students' education to include experience with design as a start-to-finish process by defining, designing, building, testing, deploying, and supporting real systems
- Bringing affordable engineering expertise to community service and education organizations

The program emphasizes communication, teamwork, the design process, ethics, and customer and community awareness. Project partners benefit from their relationship with EPICS by gaining access to technical knowledge and resources that would otherwise be prohibitively expensive, opportunities to improve current services and create new services, and to try new and innovative ideas. Each project partners can be classified into one of four major categories: Social Services, Access and Abilities, Education, and the Environment.

EPICS teams selected to participate in the pilot project included:

1. **The Information Management System team:** - The team works on web-based database projects for EPICS staff and students. They have developed registration tools, a weekly report system for students, and a task assignment system and scheduler tool for project teams. All of these tools are available via the web (http://myepics.ecn.purdue.edu). Additionally, they have developed a database for EPICS staff to track students and teams. The IMS team initially identified several short- and long-term documentation needs.

2. **The Imagination Station Rea Magnet Team:** The team is partnered with the local children's museum to develop electro-mechanical systems to aid in science, engineering, and mathematics education for a local children's museum. A popular installation at the museum is the team's MagRacer, an exhibit that teaches children about magnetism by racing magnetized cars through wire coils producing magnetic fields. The "MagRacer" team initially requested a troubleshooting guide that could be used by staff members at the museum to repair the MagRacer exhibit.

3. **The Judicial Database Systems (JDS) team:** This team works with the probation departments of Tippecanoe and Jasper counties in Indiana designing and developing database systems to help manage nearly 2,000 active cases. This team had existing documentation for the prototype of the database and requested assistance creating new documentation for an updated version of the system.

III. Pilot project description

For the last six weeks of the semester, writers functioned as documentation consultants, helping EPICS teams assess their documentation needs and then producing documentation for various internal and external end-user groups. EPICS team members served as technical experts; acted as liaisons between writers, subject matter experts and end-users, and functioned as documentation reviewers and/or usability test participants.

After participating EPICS teams were selected, the writing instructor met with each team to introduce the project and develop a preliminary assessment of documentation needs. Initial production plans called for development of a troubleshooting guide for an interactive museum exhibit, a user's manual for a county probation database, and an administrator's handbook for EPICS' information management system. Following these preliminary meetings, the instructor assigned teams of writers to each EPICS project, based on the writers' strengths and the scopes of the proposed documentation projects.

Our model for integrating professional writing students into EPICS teams allows EPICS students to draw on the expertise of professional writing students in human factors and information design. It gives professional writing students experience working on behalf of technical experts implementing a real-world project. The project required writers and EPICS representatives to work together at the beginning of the document development cycle to identify and prioritize documentation needs and to select final projects for documentation based on degree of need and project scope, given tight timelines and limited resources. The documentation teams and deliverables they ultimately produced are detailed in Table 1.

Working in teams of 3-5, students planned a documentation set needed by the EPICS team. The documentation set could include one or more documents that fulfilled internal (EPICS) development team needs, or fulfilled the needs of particular EPICS' end-user group(s). Working with EPICS team members, each group of writers identified the most critical needs for documentation and developed appropriate documents. The project, detailed in Table 2, consisted of six distinct phases, with significant EPICS participation at the outset and at the end of each major development stage – planning, draft development, usability testing.

IV. Results

Typically, the Writing for the Computer Industry class begins with approximately eight weeks of instruction in documentation development concepts and principles, followed by a midterm examination. The semester typically concludes with a six to eight week documentation project for a "real" client, usually a non-profit organization in the community or a client from within Purdue's English Department. Working with development teams in the EPICS program yielded unexpected results, for the professional writing students, but even more significantly for the EPICS participants who were directly involved with this pilot project.

Students were surveyed at the end of the project to assess its impact on a range of evaluation criteria commonly used by the EPICS program (ability to apply knowledge from their discipline to

their project, ability to acquire new knowledge, and ability to function on a multidisciplinary team) and by the Professional Writing program (ability to analyze audiences, work as a member of a team, communicate orally and in writing with diverse audiences). *Appendix A* contains complete survey data for pilot project participants. Overall, those students most actively involved in the project – EPICS students who worked directly with writers and the writing team leaders – gave the project the highest ratings, as shown in Table 3.

Table 1. Documentation teams and deliverables

ENGL 424 Team	# on team	Assigned to EPICS Team	Project description	Preliminary Needs Assessment	Final Deliverables
IMS 1	4	EPICS Management Information System	Web-based administrative database system	User's Guide	User's guide for EPICS administrators
IMS 2	3	EPICS Management Information System	Web-based administrative database		Coding procedures and protocols policy guide
IMR	4	Imagination Station Children's Museum – Mag Racer	Mag-Racer museum exhibit	Troubleshooting guide to help museum staff (volunteers) repair an electronic exhibit	1. Improved exhibit instructional signage 2. Instruction booklet: *Electronic Switch Construction and Replacement* for EPICS team
JDS	5	Judicial Database	Superior Court probation and parole database system, Accel-based	User's Guide	Users' guide for probation/parole officers and court clerks
SMART Board	4	None – Control group	Interactive whiteboard system	Tutorial	Tutorial for teachers and students, novice users of a touch sensitive whiteboard

Working with cross-disciplinary teams that were actively involved in the development cycle for their own real project added a layer of communicative, strategic and logistical complexity for the writers and for the engineers. This complexity was evidenced by responses from writers and engineers to the short answer portion of the follow-up survey. Asked what they found most challenging about the project, engineers said "communicating the needs of the team and project partner with the writing team," "trying to explain technical data to people who do not understand the system," and "trying to nail down the exact steps to be documented." Among the issues writers found most challenging were "managing schedules and deadlines" and "learning how to steer ourselves through the project." Another team leader noted, "understanding the technicalities of computer programming was difficult, but possible with the help of the client and my team members." Survey responses lead us to conclude that this cross-disciplinary collaboration provided the sort of experience in communication and problem solving called for by Vest and Anderson[3], and Bridgwood[4].

Table 2: Documentation project phases and deliverables

Project Phase	Week	Description	Deliverables
Project planning	1-2	Develop a complete formal project plan: detailed audience analysis, task list with complete descriptions of each task to be documented, document design prototype with style sheets and templates, and a detailed work plan and schedule.	Submit final, revised planning report to instructor for a grade and final project approval before proceeding to the next phase.
Project review	2	Submit the project planning report to EPICS, conduct a content walk-through and review with technical experts and/or subject matter experts as necessary.	
Document development	3-4	Develop a complete draft document (all text and visuals).	Before scheduling technical expert/SME review, submit draft to instructor for a grade and draft document approval.
Document review	4-5	Send completed draft document to technical experts and/or subject matter experts as necessary for review. Revise as necessary.	
Usability test	4-5	In consultation with SMEs, technical experts, and instructor, identify criteria for usability testing, write test plan, recruit test participants, and conduct test.	Submit usability test report and plan for document revision, along with test plan and all test materials, to the instructor for a grade.
Document completion	6-7	Prepare final version of document(s) in specified formats for delivery to client.	Submit final documents. Submit one copy to client and one copy to instructor.

Table 3. Mean of average scores and standard deviation of average scores for all questions and all participants

Student category	Mean of average scores	StdDev of average scores
EPICS student who had direct contact with the writers	3.72	0.48
EPICS students who had little contact with the writers	3.02	0.07
Writing team leader	3.95	0.53
Writers working directly with EPICS teams	3.61	0.34
Writer control group	2.95	0.60

As teachers of engineering and technical communication who are committed to the development of successful cross-disciplinary teams, we were especially pleased by the reported changes in attitude about the contributions of engineers, by the writers, and writers, by the engineers. EPICS team members who worked directly with writers had a mean score of 4.4 (out of 5.0) and a standard deviation of .55 for the survey item "This project enhanced my appreciation of the

contributions of individuals from other disciplines." Writing team leaders had a mean score of 4.0 for the same item, compared to a mean score of 2.50 for those in the writing control group. In addition, engineers reported that their views of technical writers had changed. Asked to describe the ways in which working as part of a consulting team changed their understanding of the role of technical writing or technical writers (a question we had included for the writing students, not anticipating that the engineers would offer responses), they noted "I feel they are very important now"; "It made me appreciate what they can do for a team/project"; and "It was nice to see such a structured approach to documentation."

Writing team leaders' responses to that question included "We learned there is much more than writing involved in developing documents" and "it helped me realize how important it is to clearly define an attainable goal with the client before actually beginning to work." In addition, writing team leaders reported that what they found most beneficial about the project was "learning to work with a team and a client" and "doing real and useful work for an EPICS team."

V. Summary

It appears that EPICS is uniquely positioned to provide technical communication students with a much richer experience than is available with the non-profit or internal English Department clients usually selected for documentation projects in Writing for the Computer Industry. Creating documentation for EPICS gave professional writing students the opportunity to create documentation for real systems *during* the development cycle, with all of the developmental, logistical, communicative and interpersonal difficulties, the natural setbacks and small victories, that process inherently entails. The collaboration also has benefits for those engineering students who worked directly with writers in terms of their appreciation of the contributions of those from other disciplines, their ability to act as advocates for the end-user, awareness of the ways in which document design contributes to overall product usability, and improved ability to define the scope of a project.

Students were united in their frustration with the time constraints of the project as well as in their desire for fuller participation from participants across the board. The most common response to a request for suggestions for improvement was a variation on "Getting both teams involved from the beginning of the semester"; "More time!!!"; or "Encourage more group interaction with the EPICS team."

Instructors' plans for improving this project the next time around include:

- Changing the format of Writing for the Computer Industry so that the collaboration with EPICS partners runs throughout the course of the semester, allowing more time for students to coalesce as teams, make mistakes, and recover from them
- Fostering more full-team participation on both sides, so that all writers and EPIC team members are meeting face-to-face on a regular basis (by requiring writers to attend EPICS meetings, requiring writers to present full, formal reviews to the whole EPICS team, and integrating EPICS team members more effectively into the document review and usability testing processes)
- Building more writing into the process for the engineering students, possibly by

encouraging submission of weekly or bi-weekly status reports
- Improving project selection to ensure that participating teams have identifiable documentation needs of appropriate scope
- Closer collaboration between the writing instructor and EPICS team advisors.

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Biographical Information

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Appendix A

Table A-1: Summary of surveys from EPICS students who worked directly with the writers and who did not work with the writers.

Evaluate the following on a five-point scale, with five being high and one being low.	EPICS students who had direct contact with the writers		EPICS students who did not have direct contact with the writers	
	Mean score	StdDev	Mean score	StdDev
This project improved my ability to identify and acquire new knowledge as a part of the problem-solving/design process	3.4	1.14	3.08	0.72
This project enhanced my awareness of the customer in the engineering design process	3.8	1.10	3.04	0.62
This project improved my ability to function as a member of a multidisciplinary team	4.2	0.84	3.13	0.68
This project enhanced my appreciation of the contributions of individuals from other disciplines	4.4	0.55	3.25	0.79
This project improved my ability to effectively communicate *in writing* with technical audiences	3.2	1.30	3.00	0.51
This project improved me ability to effectively communicate *orally* with technical audiences	3.4	1.34	3.04	0.55
This project improved my ability to effectively communicate *in writing* with non-technical audiences	3.4	1.52	3.00	0.51
This project improved me ability to effectively communicate *orally* with non-technical audiences	3.8	1.30	3.08	0.65
This project enhanced my awareness of engineering ethics	3	1.22	3.04	0.55
This project enhanced my awareness of professional responsibility	3.2	1.10	3.00	0.51
This project enhanced my appreciation of the role that engineering can play in social contexts	4	1.22	3.04	0.55
Working with writers improved my ability to define the scope of my project	4	0.71	2.91	0.42
This project enhanced my awareness of the engineering/development team in the product development process	3.8	1.30	3.08	0.58
This project enhanced my awareness of the place of documentation in the product development cycle	4.2	1.30	3.04	0.55
This project improved my ability to effectively communicate *in writing* with technical experts	3	1.22	2.92	0.41
This project improved me ability to effectively communicate *orally* with technical experts	3	1.22	2.92	0.41
This project improved my ability to effectively communicate *in writing* with subject matter (non-technical) experts	3.2	1.30	3.00	0.51
This project improved my ability to effectively communicate *orally* with subject matter (non-technical) experts	3.6	1.14	3.00	0.51
This project enhanced my understanding of the needs of the end-user	4	1.22	3.00	0.51
This project enhanced my understanding of the needs of the client as a part of the documentation development team	4	1.22	2.92	0.41
This project improved my ability to analyze audiences	4	1.22	2.96	0.55
This project required me to act as an advocate for the end user	4.8	0.45	3.00	0.51
This project enhanced my awareness of the ways in which document design contributes to overall product usability	4.4	0.55	3.04	0.55
This project enhanced my awareness of the ways in which documentation contributes to overall product usability	3.8	1.30	3.00	0.51
This project improved my ability to analyze systems (software applications, mechanical operations)	3.4	1.14	3.04	0.55
This project improved my ability to analyze end users' job tasks	3.8	1.10	2.96	0.46
This project improved my ability to identify and acquire new knowledge as a part of the problem-solving/design process	3.4	1.14	3.08	0.72

Table A-2: Summary of surveys from writers.

Evaluate the following on a five-point scale, with five being high and one being low.	Writing Team Leader		Writer who worked directly with EPICS team members		Control	
	Mean	StdDev	Mean	StdDev	Mean	StdDev
This project improved my ability to identify and acquire new knowledge as a part of the problem-solving/design process	4.00	0.00	3.45	0.69	3.00	1.15
This project enhanced my awareness of the customer in the engineering design process	4.00	0.82	3.45	0.69	2.00	0.82
This project improved my ability to function as a member of a multidisciplinary team	4.25	0.96	3.73	0.90	3.50	0.58
This project enhanced my appreciation of the contributions of individuals from other disciplines	4.00	1.41	3.27	0.90	2.50	0.58
This project improved my ability to effectively communicate *in writing* with technical audiences	4.25	0.50	3.73	0.65	3.75	0.50
This project improved me ability to effectively communicate *orally* with technical audiences	4.25	0.96	3.36	1.03	2.75	0.96
This project improved my ability to effectively communicate *in writing* with non-technical audiences	3.25	1.26	3.70	0.67	2.50	1.00
This project improved me ability to effectively communicate *orally* with non-technical audiences	3.25	1.26	3.18	1.08	2.50	1.00
This project enhanced my awareness of engineering ethics	2.75	1.26	3.18	1.40	3.00	1.63
This project enhanced my awareness of professional responsibility	4.00	0.82	4.27	0.47	3.50	1.29
This project enhanced my appreciation of the role that engineering can play in social contexts	3.25	1.50	2.91	1.14	2.00	1.15
Working with writers improved my ability to define the scope of my project	3.75	1.26	3.73	0.79	4.00	0.00
This project enhanced my awareness of the engineering/development team in the product development process	3.50	1.91	3.36	1.21	3.25	1.50
This project enhanced my awareness of the place of documentation in the product development cycle	4.50	1.00	3.91	1.14	4.00	0.00
This project improved my ability to effectively communicate *in writing* with technical experts	4.25	0.96	3.45	0.82	2.50	1.00
This project improved me ability to effectively communicate *orally* with technical experts	3.75	0.96	3.30	0.95	2.25	1.26
This project improved my ability to effectively communicate *in writing* with subject matter (non-technical) experts	3.25	1.26	3.82	0.98	3.00	1.41
This project improved my ability to effectively communicate *orally* with subject matter (non-technical) experts	3.25	1.26	3.45	0.93	2.50	1.29
This project enhanced my understanding of the needs of the end-user	4.50	0.58	4.20	0.42	3.25	0.96
This project enhanced my understanding of the needs of the client as a part of the documentation development team	4.75	0.50	4.10	0.88	3.25	1.26
This project improved my ability to analyze audiences	4.50	0.58	3.60	1.51	2.50	1.29
This project required me to act as an advocate for the end user	4.50	0.58	3.70	0.82	2.25	1.26
This project enhanced my awareness of the ways in which document design contributes to overall product usability	4.50	0.58	4.10	0.88	3.50	0.58

This project enhanced my awareness of the ways in which documentation contributes to overall product usability	4.50	0.58	3.90	1.10	3.50	0.58
This project improved my ability to analyze systems (software applications, mechanical operations)	4.00	0.82	3.60	1.35	3.50	1.00