Incorporating Universal Design for Learning Principles in Online and Hybrid Technical Communication Courses

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Abstract—This paper draws on best practices in Universal Design for Learning (UDL) to evaluate newly-designed hybrid and online technical communication courses. Technical communication courses generally include students who are from multiple disciplines and who may be resistant to taking a required course offered by faculty outside their major. A UDL framework that enables students to engage with course content in multiple ways can both lessen student resistance and increase students' confidence in their professional skills. By comparing face-to-face assignments and student outcomes with online assignments and outcomes, we demonstrate how the incorporation of UDL principles encouraged us to make our courses more engaging, accessible, and flexible for diverse groups of students. We also highlight the recursive nature of these changes by explaining the ways our online course development has influenced the design of our face-to-face classrooms and assignments.

Index Terms—hybrid, asynchronous online, technical communication, universal design for learning (UDL)

Introduction

Online learning is increasingly part of students' higher education experience. Recent reports, including the Educause Horizon Report [1] and The Babson Survey of Online Learning [2] report an increase in hybrid, online, and multimedia learning. Redesigning courses for these new environments gives faculty members opportunities to rethink their pedagogical practices and the way they deliver course materials to students. When adapting a course to an online format leveraging the learning management system (LMS), it's tempting to rely on existing pedagogies first and then integrate technology into that tried-and-true structure. Yet, a strictly pedagogy-first attitude assumes that technologies are neutral and that any practices can be simply mapped onto any technologies to serve any student. But merely dragging and dropping face-to-face content into an online course misses opportunities for the multiple means of representation and customized learning experiences that technology can afford.

To help faculty take advantage of features that enhance student learning and motivation, Rose-Hulman Office of Learning and Technology offers a paid summer course development workshop for faculty who are designing online or hybrid courses. One focus of the workshop is to help faculty members create accessible courses using Universal Design for Learning (UDL) principles. In this paper, we describe the transition of our required writing course, Technical and Professional Communication (Tech Comm), into online and hybrid formats. Specifically, we focus on how UDL principles helped us rethink our classroom pedagogies and created opportunities for us to develop new, more accessible course materials. Our course, like many technical writing courses, includes students from science, engineering, and computer science departments, who are often resistant to taking a required course offered by faculty outside their major. We found that a UDL framework enables students to engage with course content in multiple ways, which lessen student resistance and increase students' confidence in their professional skills.

In the sections that follow, we first provide a literature review of UDL and the ways that accessibility extends beyond its typical association with disability. Using UDL principles as our guiding framework, we then provide examples of how we used LMS features make our courses more engaging, accessible, and flexible for diverse groups of students while still meeting established outcomes for writing and professional development. Specifically, we discuss an online course designed and implemented by Professor Sarah Summers and a hybrid course designed and implemented by Professor Jessica Livingston, with guidance from Instructional Designer Janie Szabo. We conclude by highlighting the recursive nature of these changes and explaining the ways our online course development has influenced the design of our face-to-face classrooms and assignments.

Beyond Accessibility: Universal Design for Learning

In order to appreciate the UDL framework, it is important to review the three main principles, which address the what (recognition brain networks), the how (strategic brain networks), and the why (affective brain networks) of learning. CAST's 2011 UDL framework suggests that these three main principles and associated nine guidelines, shown in Appendix A [3], should result in resourceful, knowledgeable learners, strategic, goal-directed learners, and purposeful, motivated learners: "A key premise of UDL is that a curriculum should include alternatives to make it accessible and applicable to students with different backgrounds, learning styles, abilities, and disabilities and to minimize the need for assistive technology" [4]. The following statements

explain each of the three main principles of the UDL framework:

- Principle 1 suggests representing information in multiple ways. For example, including video lectures with built in navigation through slides or captions.
- Principle 2 recommends integrating options for planning and composition. For example, providing varied forms of graphic organizers.
- Principle 3 promotes varying activities that increase interest and self-regulation. For example, integrating weekly reflective writing prompts.

Studies suggest that incorporating these principles into course design increases learning and engagement for all students [5, 6].

Despite these wide-ranging benefits, research about implementing UDL in science, technology, engineering, and mathematics (STEM) fields primarily focuses on accessibility, including the use of technology accommodations, due to Americans with Disabilities Act (ADA) and Web Content Accessibility (WCAG) requirements for online learning environments [7].

From the ASEE archive, one paper authored by Monemi, Pan, & Varnado (2009) suggested the use of UDL for course design benefiting all learners: "Varied instructional methods using UDL are provided to engage students in the learning process throughout the quarter" [8]. However, Monemi et al. still noted that, "it was clear from the assessment results that using UDL concept helped greatly the students with limited ability, hard to grasp, slow learner or thinker" [8]. Thus, the focus remains on students with disabilities.

Our focus in this paper is to demonstrate the ways that UDL benefits all students in a course and creates opportunities for learning and engagement for students with a range of abilities and preferences. We view UDL not only as a way to incorporate ADA compliance but as an approach to course design accommodating all students. As we discuss in the following section, the benefits of UDL are especially important for our Tech Comm courses, which combine students from our various fields of study.

A. UDL and Technical Communication

Tech Comm is a required, upper-level writing course usually taken by students in their junior year. The course is based in the rhetorical tradition, which means that analyzing and adapting to a specific audience are central to the writing process. The course objectives, which are determined by the writing faculty and shared across all sections of the course, include writing in several genres, collaborating with teammates, and developing project management skills. Within these shared objectives, Tech Comm instructors have freedom to design their own courses and assignments. While some sections focus more heavily on research, for example, others focus on humanitarian engineering or usability. This flexibility made it possible for us to expand our course offerings to hybrid and online versions and to adapt course content to take advantage of these new formats.

There are several broad ways that the hybrid and online Tech Comm courses incorporate UDL principles. The first set of guidelines encourage instructions to offer students multiple means of representation. Using an LMS enables instructions to meet those needs in a variety of ways. Both courses offer alternative text for images displayed in the LMS and leverage HTML code to facilitate responsive design. The online course incorporated multiple means of media, including written text and screencasts, to deliver students announcements and updates for the asynchronous learning environment. Each of the courses provide options for comprehension by showcasing student examples and embedding or linking to online resources that complement the adopted textbook. In the following sections, we highlight these and other activities as they correspond to specific UDL guidelines and discuss their implementation and the changes we observed from our face-to-face courses.

Asynchronous Online Tech Comm

I (Prof. Summers) designed the online Tech Comm Course as a ten-week summer course that students take alongside professional activities, like completing an internship or working in a research lab. Because students might be anywhere in the world, the course is totally asynchronous. The course is structured so that students see a week's worth of assignments at a time. While I provide a suggested breakdown of activities by day, students are free to work ahead or catch up at the end of the week as long as they meet assignment deadlines. Below, I discuss the UDL principles that I most heavily relied on when designing the course to promote multiple ways of learning and communicating and to keep students engaged throughout the summer.

A. Options for Expression and Communication

As participants in the course development cohort, we were introduced to the range of activities available in the LMS and encouraged to leverage a variety of these activities to meet UDL Principle 5: Provide Options for Expression and Communication. In a fully online course, this includes providing students with a variety of ways to communicate with me and each other and a variety of ways to compose. My face-to-face course frequently relies on in-class discussion of models and in-class writing. Designing an online course presented me with an opportunity to communicate with students in new ways and to ask students to share their ideas across multiple media. While multimedia experiences are sometimes seen as distractions, pedagogical research reframes distraction as disruption--a way to embrace the changes that follow from new technology opportunities. For example, as Camplese and McDonald (2010) found when they designed courses that embraced these new pedagogical environments as welcome disruptions, not distractions, students "ask questions, provide resources, gain confidence, and interact in ways that shattered our previously established ideas about how a class should work" [9].

In both the face-to-face and the online Tech Comm course, students compose job application materials. The

unit begins with students selecting and analyzing job advertisements and researching companies. In my face-to-face class, we brainstorm things students might want to find out about a company and list them on the board. Then, students work independently to research their chosen companies and submit a memo to me detailing their research. In my online course, rather than just list possible research questions or record a lecture, I created a short screencast of me researching a sample company. The video showed my computer screen as I navigated a company's website and explained to students what I was looking for as I clicked on each section. Following the screencast, students had two ways to communicate their findings.

First, they participated in a brainstorming forum with their peers to discuss preliminary ideas about their job ads and their company research. After they had a chance to share ideas informally with peers, the students completed a more formal planning memo addressed to me using the Quiz feature. I read and responded to these memos, giving them feedback to shape their cover letters and resumes.

The LMS activity logs reveal that every student in the course viewed the video, and many students returned to the video later in the week--presumably as they were composing their memos. Providing multiple means of communication--both text-based instructions and the video--gave students more flexibility to learn at their own pace, revisit course ideas, and use my example as a model. In face-to-face discussions, students who are advanced enough in their job search would be ready to engage with the examples I provide, but many students may be more worried about finding the right job ad or company and not yet ready to research. The multimedia resource, which I plan to make available to my face-to-face students, gives students access to course examples exactly when they need them. Additionally, by giving students the opportunity to write about their ideas informally with their peers--rather than just asking a few students to share examples in class--each student had the opportunity to develop ideas before submitting a more formalized version to me. This additional writing option provided students with practice communicating their ideas and resulted in clearer, more complete memos.

B. Options for Recruiting Interest

Providing a variety of course media and options for communication can motivate students to complete activities and keep the course from seeming repetitive, but I [Prof. Summers] also wanted to encourage students to engage deeply with the course material. Engagement is a challenge in RH330 regardless of the format; as a required writing course, many students view it as less important than their engineering courses--just a box to check on the way to graduation. In my face-to-face classes, I design hands-on projects, including LEGO building projects and paper prototyping, to keep students engaged. Because hands-on collaborative projects would be difficult to facilitate online, I needed other ways to encourage students to engage with course content. I turned to the UDL guidelines for recruiting interest, including "optimizing individual choice and autonomy" and

"optimizing relevance, value, and authenticity," as I designed the primary course project.

When I designed the online course, I decided to take full advantage of the online format and require that students who enrolled in the course also participate in an internship, co-op, or formalized research experience during the course. As a result, all of my students had professional experiences at the same time that they were learning about professional communication. The course assignments asked students to leverage these experiences. For example, in a face-to-face course in which not every student has had work experience, I give students generic workplace documents to analyze. Because the online course coincided with internships, students analyzed real documents from their own workplaces and labs. Students also received feedback on their portfolios from workplace mentors, and wrote professional emails to respond to real workplace needs. As a result, the course was tailored to students' individual experiences and had authentic ties to their professional lives, which reinforced the value and relevance of the course.

I also tailored the collaborative assignment to students' goals for the course to increase their sense of autonomy and the value of the course. In the introductory discussion board, I asked students to share what they hoped to learn from the course. Many of them included specific professional communication tasks, like making small talk in the office and creating a professional online presence. Because students wanted to work on these skills, I redesigned the collaborative project to ask groups of students to create webcasts on professional communication skills. The resulting assignment encouraged students to draw on their professional experiences and to adjust the assignment to meet their own goals and needs as a team For example, as part of their projects, students did academic research and interviewed their workplace mentors. The flexibility of the online format allowed me to make changes as the course evolved to allow students to have control over some of the course outcomes and do authentic research that they believe will be valuable to their professional communication skills.

Hybrid Tech Comm

In transforming a face-to-face course to a hybrid course, the central challenge is determining which activities are better suited for the LMS vs. the classroom. In the hybrid version of the course, students only meet 2 rather than 4 times a week and then complete work in the LMS in lieu of class for the other 2 days. I (Prof. Livingston) decided to use in-class time largely for student presentations, workshops and conferences on drafts, as well as team meetings. In the hybrid version of my course the graded course projects remained the same, but some of the activities that would take place during class time, such as reviewing rhetorical principles and best practices and assessing sample documents, were moved to the LMS and a portion of the grade allocated for successful completion of them. I selected these aspects of the course for the following pedagogical reasons: 1) to improve student retention of course concepts 2) to increase individual student accountability and 3) to improve the quality of the

learning experience. UDL Principles were important both in considering how to design the LMS to complement the in-class portion of the class as well as how to enable students to develop the skills to be successful in the hybrid format.

A. *Options for Expression and Communication*

Often student discussions of course content in the face-to-face course were unsatisfactory. Many students did not contribute, and some of their comments tended to be nitpicky and/or argumentative rather than constructive. Furthermore, in course evaluations some students expressed that they did not have clear take-away points following the discussion of samples, and I observed that students sometimes inaccurately remembered the discussion, for example mimicking rhetorical strategies that were discussed as ineffective in class.

In the hybrid course, in the LMS students complete quizzes covering the course textbook, which introduces rhetorical principles and provides best practices. The quizzes are designed as a learning tool to reinforce important concepts rather than to test students' memory of them.

Students have the option of repeating the quizzes as many times as necessary to earn 100%. Because students have been resistant to reading the course textbook, I designed this new model provide a grade incentive for all of the students to skim the text at minimum for the answer to the quizzes to receive credit. To further reinforce the rhetorical principles, each module includes multimedia content, such as videos and external websites, which are embedded into the LMS when possible.

Each module also includes sample documents embedded as PDFs. Although the sample documents are imperfect, I select samples from the higher range of previous student work. Students assess the samples within a discussion forum that includes a prompt and a word requirement for responding. For example, students evaluate presentation slides before designing their own and are given the following prompt:

> Review the sample student presentations and post your assessment of ~300 words that references specific details of the slides. You should address 1) the design of a few slides that are particularly effective, 2) a few slides for which the design could be improved with suggestions for doing so, and 3) lessons that you are taking away from this review and will apply to your own team's slides.

Discussion forums are graded on a credit/no credit basis as an incentive for completion. If students complete the assignment according to the instructions, then they receive full credit. Generally, more than 90% of the class completes each assignment.

Most discussion forums that I use require students to post their response before they can see other students' responses. After they have posted though, they can read their classmates responses and return to the forum when they are drafting and revising their own documents. In addition, after the student deadline for the forum, I send a wrap-up of the forum that includes key summary. This wrap-up is posted both in the forum itself and in the Announcements forum which automatically sends the message to the students' email account so that they receive the content even if they do not seek it out. In addition, the activity logs show that some students do return to the discussion forums as they are drafting their own documents.

The LMS provides students a different means of communication than that which is used in the classroom space. In the discussion forums, students are more professional and constructive than in the classroom, perhaps because their communication is written. Furthermore, student responses are more thoughtful and detailed than they would be in a class discussion. The more motivated students often make specific reference to course concepts in the textbook and apply the course concepts in their assessment of sample documents. Most importantly, all the students gain practice in rhetorical analysis and assessment contrary to the limited few that would in a classroom discussion.

B. *Options for Executive Function and Self-Regulation*

One of the challenges for both online and hybrid courses is not consistently seeing students in the classroom and being able to check in on their progress. Students must employ or develop self-regulation strategies to make appropriate progress in the course. As described in the UDL guidelines, courses should help students monitor their progress and develop strategies for self-reflection and self-assessment.

Both the online and hybrid courses include checklists that detail all the assignments that students need to complete as well as deadlines. For example, the checklist for the module in which students are designing slides and giving a team presentation includes the following Checklist:

- View ~2 min. technical jargon parody clip, read ECM 33: "Presentation slides," review materials on assertion-evidence slides and complete Quiz 7
- Evaluate sample student slides in the Presentation Slides DF
- Prepare your team's slides and have a draft for review at the Presentation Slides Workshop (be sure to revisit the genre conventions for policy briefs when planning the structure of your talks)
- Read Audience Accommodation in Written Documents, review sample drafts, and post in the Audience Accommodation DF
- Read ECM 20: "Collaborating," 18: "Drafting" and 22: "Headings" and complete the Quiz 8
- Upload your team's slides on the day of your Public Briefing Presentation

Because students in a hybrid course have the additional challenge of monitoring their progress in both the LMS and in the classroom--e.g completing discussion forums online and bringing drafts to class when needed--I include a Calendar that includes both in the Syllabus. In addition, I also include a mini-calendar of the relevant weeks in each module so that students can keep track of their assignments without having to check multiple locations. Students also have the option to work ahead on their assignments, and students express in course evaluations

that they appreciate the flexibility of the hybrid course that enables them to work at their own pace. The presentation module includes the following calendar for a hybrid class that meets on Tuesday and Friday but has online assignments due on Monday and Thursday:

TABLE I.
SAMPLE MODULE MINI-CALENDAR

	Mon.	Tues.	Wed.	Thurs.	Fri.
Week 7	Quiz 7 by 11:59 p.m.	Slides DF		Prep for Slides Workshop	Upload draft of slides to Slides Workshop
Week 8	Audience Accom. DF by 11:59 p.m.	Public Briefing		Quiz 8 by 11:59 p.m.	Public Briefing

Even though Quiz 8 is contained in the following Module, it is listed on the calendar during Week 8 so that students do not think that they do not have an assignment that day. However, it's necessary to remind them in class in advance that they will be proceeding to the next Module while teams are still giving presentations in class.

Although the collaborative project in the hybrid course is the same as in the face-to-face class, student teams need to take more responsibility for meeting regularly when they are seeing each other in class less frequently than students in a face-to-face class. Therefore, guiding students project management practices becomes more important. In the hybrid course, the collaborative project includes several project milestones, such as a working bibliography and collaborative outline, that assist students in making progress and teach them how to create internal deadlines on a large-scale project.

Students also reflect and assess their project management, teamwork, and communication skills at the beginning and end of the collaborative project. Prior to forming teams, students take a personality test and reflect upon the results in a discussion forum, identifying their strengths as a team member, what roles they like/dislike to take in group projects, and possibly frustrations that they've had with previous team projects. Students can read other student's post before submitting a team member preferences form as well as returning to them when they are working in their teams. At the conclusion of the collaborative project, students assess the performance of their team and each member, considering what collaborative strategies they used successfully (e.g. shared planning, outlining, recording decisions and action items, using online tools, revising as a team) and what they learned from their experience about project management, collaborative writing, leadership and/or teamwork. The prompt encourages honest and constructive feedback, stating that acknowledging mistakes and shortcomings (of yourself or the team as a whole) establishes your credibility because it demonstrates conscientious reflection and the possibility for improvement in the future. Even though the team evaluation is a factor in determining individual teamwork grades, students are often honest in their reflections, taking responsibility for their own shortcomings.

Conclusion

In designing our Tech Comm courses with elements of the UDL framework, we have expanded our pedagogical practices and have provided our students with multiple means of representation, action and expression, and engagement. This experience has us re-evaluating our face-to-face classes, considering ways to implement elements of UDL in those courses as well as which activities in those classes might be more successful in the LMS.

I (Prof. Summers) have brought many of my online activities--like demonstrating to students how I would research a company--into my face-to-face course. More broadly, I've used my LMS page to be more transparent about course and assignment-level goals and objectives. In an online course, it's important to present those clearly to students in each unit to promote the self-regulation and reflection. I often discuss those objectives in my face-to-face course, but I've been more intentional about using the LMS to highlight them.

Similarly, I (Prof. Livingston) have incorporated several elements into my face-to-face classes, such as weekly checklists and discussion forums. I use the discussion forums to have students apply course concepts which both prepares them for in-class discussions as well as increases their engagement from just speaking in class to writing as well. Based on the higher quality of work when assessing sample documents in the hybrid Tech Comm course, I am planning to revise the structure of another one of my other courses that require students to engage with non-fictional texts to a hybrid format.

As these examples demonstrate, incorporating UDL principles goes beyond accessibility and even beyond online learning. Once we had practice applying these principles, we were able to see the ways that small pedagogical shifts and experiments can support engagement and learning for all of our students.

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