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Navigating the Transition

Problem-Based Learning as Technical Writing Pedagogy

Justin G. Whitney * | Tennessee State University, United States

Abstract

This article reports on an IRB approved multi-semester qualitative study investigating student experiences during the challenging transition to Problem-Based Learning (PBL) in a technical writing (TW) course. The primary purpose of this research is to evaluate the effectiveness of specific strategies utilized to facilitate this transition and to develop practical principles for instructors implementing PBL. Transitional strategies include: a structured, recursive PBL framework (based on Hmelo-Silver's cycle), a four-day cyclical schedule, incremental assignments, and a questioning strategy deriving answers from the problem description. Utilizing thematic analysis of student interviews, reflections, and researcher field notes, this research identifies initial student frustration and uncertainty largely stemming from a perceived lack of direct instruction and concerns regarding assessment standards. While these transitional strategies produced some benefits, they did not eliminate student frustration and uncertainty. However, findings also reveal that strategically implemented, collaboratively created checklists (functioning as contract grading) and required peer reviews provided crucial support, mitigating

* Corresponding author:
Justin G. Whitney, Email: jwhitne2@tnstate.edu

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anxieties and fostering deeper engagement. Furthermore, PBL encouraged creative expression in assignments and facilitated functional, contextualized discussions of grammar and mechanics. This research offers practical principles for TW instructors seeking to ease student transition into PBL, thereby maximizing its potential pedagogical benefits.

Keywords: Problem-Based Learning; Technical Writing; Pedagogy; Student Transition; Assessment; Contract Grading; Qualitative Research

Introduction

This article reports on a multi-semester study using PBL as TW pedagogy. In particular, I focus my attention on the transition that occurred as my students and I adjusted to the new pedagogy. I employ multiple strategies to facilitate this transition (discussed below). My goal with this research is to report on how students articulate their transition into PBL pedagogy. I aim for these analyses to highlight general principles that future instructors can use to reduce the challenges technical writing students face when transitioning into PBL and to help access the potential it promises.

My findings are both consistent with previous research on PBL and add nuance to them. While students initially experienced frustration and uncertainty during their transition to PBL due to a perceived lack of direct instruction and concerns about meeting assessment standards, this research reveals that a collaboratively created checklist used as a form of contract grading (Inoue, 2004; Litterio 2016), as well as required peer reviews provided valuable support for students, fostering engagement and likely mitigating anxieties. In addition, PBL cultivated a positive pedagogical impact for learning technical writing where students came to view their assignments as opportunities for creativity and personal expression. Lastly, this research finds that PBL facilitated functional and contextualized discussions of grammar and mechanics by connecting them directly to their problem-solving utility.

Literature review

A survey of relevant literature quickly finds competing definitions for technical writing (Allen, 1990; Brasher, 2020). What scholars do find consensus on is that technical writing (TW) is not like other kinds of writing. Dissimilar from academic or creative writing, technical writing's primary purpose is not often the author's personal expression. Rather, TW prioritizes the communication of technical information. Technical writing is pragmatic, its purpose is to

communicate knowledge that readers need for accomplishing goals or solving problems (Spring, 1997; Atkinson and Corbitt, 2021, p. 6). TW is so driven by this purpose that it encompasses innumerable genres and modalities, because the form it takes is dependent on what's most effective for helping its readers (Atkinson and Corbitt, 2021, p. 27).

From this perspective, teaching TW necessarily involves helping students see the indelible link between communicative effectiveness and the context in which that communication occurs. Rather than focusing on rote skills or mechanics divorced from their application, technical writing educators have long agreed that students benefit from studying how audience and purpose influence the effectiveness of one's communicative choices (Miller, 1979; Bridgeford et al., 2004; Williams et al., p. 247). There is far less agreement, however, on what pedagogy is best for fostering this fundamental knowledge.

Such a pedagogy would help students focus their attention on how language functions in context and to organize/design their language toward accomplishing goals within those contexts. One method that educators rely on is Task-Based Learning (TBL). Task-Based Learning occurs when assignments indicate what writing task students need to complete and then lessons are designed to assist students with completing the required task. In this case, Powers explains, "lessons are constructed according to the language required to perform specific tasks rather than according to the aspects of language such as structures and vocabulary" (2008, p. 73). Ellis (2017) writes that proponents of TBL aim to promote "interactionally authentic contexts (p. 113) …where learners can draw upon their existing linguistic resources (p. 111) where then, as Powers adds, it is assumed "that students will learn… through induction as they focus on task completion" (2008, p. 73).

A particular kind of TBL regularly found in technical writing classrooms are often referred to as genre-based approaches (GBAs). GBAs emphasize teaching language by focusing on particular genres and their use in specific contexts. At the heart of GBAs, Nordin explains, "is the view that writing pedagogies should offer students explicit and systematic explanations of the ways language functions in social contexts" (2006, p. 78; Hyland, 2003, p. 18). Kim adds that, "in the genre approach… the knowledge of language is intimately attached to a social purpose, and more focus is on the viewpoint of the reader rather than the writer" (2006, p. 35), indicating also that instructors should work to help students connect a genre's structural features with their communicative purposes (p. 34).

The increased attention to social context and its impact on communicative effectiveness is an important step in the right direction, but Genre-Based Approaches have some notable critiques. Pennell and Miles put it well when they explained that "many genre-based approaches tend to rely on situations or cases

for the context within which students employ a particular genre, such as a memo or business letter" (2009, p. 384). Students focus on the task of recreating genres by using detailed contextual information that the instructor provides to guide their choices (Pennell and Miles, 2009, p. 385). Nevertheless, Pennell and Miles explain, there is a tendency for genre-based approaches to rely on context only as background for writing assignments (2009, p. 384). In such classrooms, Pennell and Miles argue, "students do not see how genres and documents emerge from a particular problem and situation" because they are given "the answer up front" (2009, p. 384). Instead of having students produce genres or documents *in response* to a situation, the genres students create are predetermined and only applied to a situation (p. 385; Derewianka, 2003, p. 139). Such a pedagogy, Takahashi explains, can "leave students feeling dependent on instructors" rather than pushing them to think for themselves (2008, p. S31).

Problem-Based Learning (PBL) is theorized to have affordances that respond directly to the above critiques, and as Diamond (2019) asserts it, is readily applied to teaching technical writing (p. 160). "The crucial difference," Pennell and Miles maintain, that PBL offers is in the "pedagogical sequence" (2009, p. 384). Where GBA provide students with the genre (task) and the essential concepts students need to create that genre, De Graaf and Kolmos explain that PBL identifies a problem as the "starting point of the learning process" (2003, p. 658; Rosinski and Peeples, 2012, p. 10). The specific PBL framework employed in this study is based on the recursive problem-solving stages articulated by Hmelo-Silver (2004), which moves students through identifying the problem, generating hypotheses, identifying knowledge deficiencies and application of new knowledge before reflecting on the abstract knowledge gained and evaluating their work (p. 237). This cyclical approach and its theoretical underpinnings are the structural foundation for the four-day schedule implemented in the course (discussed in detail in the Course and Institutional Description section below). Students are assigned unstructured problems—challenges that don't have a clear or predetermined solution—and their submitted responses to those problems are what instructors assess. This "pedagogical sequence" is an important part of why PBL is a good choice for teaching writing. Rosinski and Peeples (2012) explain that students learn "new content, skills, and methods…through the process of investigating and addressing the problem, rather than being supplied, studied, and/or practiced prior to engagement with the problem" (p. 10). Without a ready solution, students must learn to rely on their creative thinking skills to invent effective responses (Ersoy and Başer, 2014) as well as on collaboration with others to create solutions not possible alone (Barber and King, 2016, 242; Hmelo-Silver, 2004, p. 246). Instructors take on a supportive role as they work with students to help them create their own solutions (Hmelo-Silver, 2004, pp. 244-245; Haith-Cooper, 2000). PBL shifts student roles away from passively receiving information and encourages them instead to become the initiators of their own

learning, acting as inquirers and problem solvers during the learning process (Hung et al., 2008, p. 493; Stentoft, 2017, p. 55). Kumar and Refaei explain that a well-crafted real-world problem gives students chances to write for diverse audiences using new forms of communication (2017, p. 2). They also say that PBL allowed students to apply what they were learning in the classroom to contexts beyond the classroom immediately and in a relevant way (Kumar and Refaei, 2013, p. 67).

I am thus not alone when I began to see PBL as an opportunity to foster effective TW skills in my students. Yet, though the nontraditional components of PBL present exciting pedagogical opportunities, PBL also carries with it significant challenges. Students' entry into higher education often requires a literacy transition, where they adapt to the demands of academic discourse and different study habits (Armstrong and Newman, 2011 p.6). However, the shift into active engagement with ill-structured problem-solving that is required by PBL represents an additional, intensive transition, building on or sometimes frustrating the academic skills gained in the first. Barron and Darling-Hammond (2008) explain that PBL can be "challenging to implement" because it requires "simultaneous changes in curriculum, instruction, and assessment practices—changes that are often new to teachers, as well as students" (p. 12; Barron et. al. 1998, p. 271). Such a transition should be seen as part of a larger literacy transition students undergo as they learn to be effective in the college environment in ways that differ from high school. As Hung et al. maintain, PBL differs substantially from conventional teaching methods, and these distinctions necessarily impact the roles and responsibilities of both instructors and students throughout the course (2008, p. 493). They emphasize that both students and instructors face significant difficulties when moving from traditional teaching approaches to PBL (Hung et al., 2008, p. 493). Students must not only redefine their responsibilities in the learning environment but also adjust their study habits (p. 493). Educators "reposition their roles in teaching from a knowledge/information transmitter to a learning/thinking process facilitator" (Hung et al., 2008, p. 493; see also Maudsley, 1999; Hmelo-Silver 2004). This upending of traditional roles for students and instructors has been linked to uncertainty and frustration that students experience while transitioning into PBL (Hung, Jonassen, and Liu, 2008, p. 493). PBL also displaces traditional assessment practices that instructors have long relied on and to which students are accustomed (Barber and King, 2016, Nendaz and Tekian, 1999, p. 233). Indeed, part of the uncertainty and frustration students face when transitioning into PBL has been linked to concerns about how their work will be assessed (Moro and McLean, 2017, p. 356; Woods, 1996, p. 93). The difficult transition students endure is thus an obstacle to the pedagogical successes PBL can achieve. To facilitate the transition to PBL is thus to increase access to the pedagogical benefits it promises. The following section describes the context of the study, detailing the course design, institutional setting, and the

three primary strategies used to facilitate students' transition into Problem-Based Learning.

Course and institutional description

This course was taught at a public historically black land-grant university located in large city in the Southern United States. Offered through the English Department, it has an ENGL course abbreviation. TW attracts students from a wide range of academic backgrounds due to its open enrollment policy but is notably represented by Criminal Justice and Social Work because TW is required for these majors.

As mentioned above, I designed the class to assist students' transition into PBL. I use three primary strategies for accomplishing this goal. First, I sought to stretch the transition across much of the semester such that earlier assignments took more familiar forms but still included elements of PBL that would steadily increase across the semester. Second, we utilized the same schedule throughout the semester to help students understand and step into their new classroom roles. Third, I incrementally implemented contract grading in the form of checklists that students and I created.

First, I sought to stretch the transition by fitting assignments into three separate categories. The first set of assignments were primarily Task-Based and asked students to create reports, for example exploring basic principles of usability and their relation to effective TW. Students are provided with assignment descriptions including checklists that identify and explain important aspects of the assignment. The second category of assignments was genre-based and included several important developments designed to prepare students for the final PBL assignments. I ask students to create a particular gerne but all discussion and preparation centers around the problem our assigned genre will solve. For example, students are not only asked to complete a written how-to but are also presented with a detailed explanation about who it is for and why it is needed. One important development is that when students ask questions, we use the problem description as the primary resource for determining an answer. That is, when students ask questions, rather than immediately providing straightforward answers, I would explain that the information needed to develop *their own answers* is in the problem description. Then, we would collectively examine the problem description, pinpointing useful information and brainstorming potential answers. My aim was for students to move away from thinking of the problem as having a single right answer and to highlight the importance of understanding the problem and its context for developing their own answers. Questions of tone, for example, were met with, for example,

detailed descriptions of audience and genre expectations. Further, as all answers were emergent through discussion of the problem, my aim was also to avoid examination of grammar or mechanics separated from their pragmatic capacity. In addition, focusing our efforts on the problem offers an excellent opportunity to begin decentering myself as the only knowledge authority. In particular, I maintain that there are infinite ways to respond to any problem and that mine is only one. In this way, I aim for students to see how their written genre became communicatively effective through understanding how it will be used and by whom, but also to see their own rhetorical skills as the vehicle to their success.

The second category of assignments is when we begin cocreating the checklists. Our initial discussion of each assignment included examining the problem description and creating a working technical document identifying what we all agree an effective response should include. I make clear that these checklists identify both what an effective solution needs and the primary criteria for grading their assignments (a more thorough discussion of the checklist provided below).

The final category of assignments includes the last two in the semester, both of which present students with only a detailed description of the problem. These problems are designed to situate students as experts. For example, the second to last assignment identifies that next semester's incoming students would greatly benefit from a text explaining how to complete one of the genre-based assignments. Such a text could identify where mistakes are likely and explain how to deal with them if encountered. Current students write about an assignment they have already completed and to an audience with which they can claim greater familiarity than I, having been in their shoes only weeks earlier.

The final assignment asks students to think about their work after graduation. The problem description informs students that there is a benefit to their future colleagues and supervisors knowing about, and seeing an example of, their skills as a technical writer. The assignment description explains: "They will not know what assignments you completed nor how they strengthened your TW skills in particular ways. A single document can solve this problem." Their final, I specify, calls for them to identify and explain what they learned as well as to showcase that learning. My aim was for students to think of their own experiences, efforts and professional goals as the substance of their writing, something about which they are experts.

The second strategy I utilized to smooth the transition into PBL is with scheduling. Throughout the semester, I utilized a weekly schedule inspired by the problem-based learning cycle identified by Hmelo-Silver (2004, p. 237). These steps include identify the problem/scenario, generate hypotheses, identify knowledge deficiencies, apply new knowledge and finally abstraction where

"students reflect on the abstract knowledge gained" and evaluate their work (2004, p. 237). In fact, it was this series of steps that initially caught my attention. I was immediately struck by how similar Hmelo-Silver's steps were to the conventional writing process steps which are often identified as prewriting, research, drafting, and revision. I realized the class could be scheduled to engage in steps that fulfilled both criteria.

Our schedule worked on a four-day cycle. On day one, students write a reflection about the previous assignment where students abstract the knowledge gained from, and evaluate the quality of, their work. I then introduce the new assignment/problem. We practice close reading strategies as we slowly go over the description. This work fulfills the 'identify the problem/scenario stage' of Hmelo-Silver's PBL cycle. Part of our efforts are directed toward creating an initial draft of a checklist students can rely on as criteria for completing the assignment, which also functions as an initial attempt at generating hypotheses. For early iterations, I bring a document up on the projector and then I add/revise it using students' own words. Later versions might open editing access and ask students to write on the document. On day two we review the problem description and revise the checklist. This activity explicitly addresses the identify knowledge deficiencies and the planning required for the apply new knowledge stages. We aim for a single technical document identifying what we all agree an effective response should include, with special attention paid to content requirements, genre expectations and audience/purpose considerations. For each entry on the checklist, we write brief descriptions for why the entry is needed as well as how to effectively fulfill the requirement (additional description below). On day three, students are asked to write out ideas and examples for how they will respond to the problem before sharing them, first in small groups and then with the class for feedback. Students are asked to complete a draft of their assignment and bring it to the next class. This work serves as the primary apply new knowledge stage. Day four is a graded peer review where students work in small groups to identify and remedy any shortcomings (additional detail provided below). This collaborative review functions as a final evaluation, setting up for reflection at the beginning of next class. Students were provided with a list of questions to assist in their peer reviewing. Early classes involved identifying and modeling effective peer review strategies, with students taking increasing control as the semester progresses. Our next class begins the cycle again. My hope was that this cycle would facilitate students' transition into PBL because, even though the assignments and their role in classroom practices became less familiar as we shifted from Task to Problem-Based Learning, the schedule did not, and so students could rely on the classroom experience to which they were familiar to facilitate the uptake if their new roles.

Cocreating the checklist and using it as a form of contract grading is the third and final strategy, I employed to facilitate students' transition into PBL. As Littero explains, Contract grading is generally recognized as a method of negotiation between students and faculty regarding their course performance and has been utilized in various ways in writing classrooms since it first appeared in the 1970s (2016, p. 1). Like Inoue (2004), I worked from the "hermeneutic dialectic circle" offered by Guba and Lincoln (1989, pp. 44-45) where each stakeholder offers input into the evaluation. In this "round-robin style" we engaged in a "recursive negotiation and consensus making" that resulted in the communal production of a technical document identifying what students needed to include in their assignments to achieve educational success (Inoue, 2004, p. 222). Students were not required to speak. My hope was that access to a thorough co-created checklist identifying what each assignment called for would quell assessment related anxiety because students would have access to, and some control over, specific assignment requirements they could work towards. Further, I hoped that the sum of these strategies offered a smoother transition into PBL and thus greater access to the educational benefits it promises.

Methodology

This IRB approved qualitative research utilizes thematic analysis to investigate how students articulate their transition into PBL. Denzin and Lincoln explain that qualitative researchers investigate subjects in their natural environments, seeking to understand or interpret phenomena based on the meanings individuals ascribe to them (2011, p. 3). A thematic analysis is thus particularly well-suited to report on how students articulate their transition into PBL because it aims to summarize the value participants perceive and is primarily focused on generating a descriptive account of the participants' understanding (Lochmiller, 2021, p. 2029). A thematic analysis begins with coding, where researchers pour over data to identify units of language to which codes are attached. Saldaña defines a code as "a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (Saldaña, 2013, p. 3). Thematic researchers code their data and then look for patterns across those codes. Lochmiller (2021) adds that categories represent emergent patterns that the analyst gathers together to create thematic statements (p. 2032; Saldaña, 2015). It is these thematic statements that will explain what the underlying data suggests and illuminate how my students interpret their transition into PBL learning (Lochmiller, 2021, p. 2032).

The study utilized triangulation across three primary data sources that were gathered across one school year and two separate course sections. Data sources

include semi-structured interviews with students, student reflective writing, and researcher field notes.

Participants and data gathering

The researcher interviewed a total of four students (two after the first semester and two after the second). Participants were recruited through a general invitation extended to all students across both sections, resulting in a convenience sample of volunteers. The initial interview questions were revised before each participant to account for any new information learned as well as altered questions to better fit participants, sometimes referred to as semi-structured interviewing (Drever).

The written reflections students completed after each major assignment served as a fruitful source of data. Across the two sections (18 and 20 students, respectively), approximately 229 student reflections were collected from six major assignments. Each reflection asked students to respond to different prompts, such as asking students to summarize, assess and identify ways to improve upon their work or to consider what they learned, how they learned it and to speculate on how they might rely on that learning in the future. Student reflective writing has been utilized in PBL design before (Chiriac, 2024; Johansson and Svensson, 2019). The reflections served dual purposes. First, as Hmelo-Silver reminds us, "reflecting on the relationship between problem solving and learning is a critical component of PBL" (2004, p. 247). Reflection can help students understand the relationship between their problem-solving efforts and the knowledge gained from those efforts, a meta insight one can rely on to achieve future learning goals (Hmelo-Silver, 2004, p. 247; See also: Gardner and Korth, 1997, p. 52). Second, the student reflections offered key insight into students' thinking that served this research well. The researcher began making field notes before the teaching started and continued after the year was over. The researcher documented any statement providing insight into students' experience transitioning into PBL. The researcher would make quick notes during class and write them out more thoroughly after class while the events were still fresh in memory. These notes include reflexive journaling (Ortlipp, 2008) as well as extemporaneous statements made by students, both of which highlight student experience and served as an important source of data.

Data Gathering and Sources	Interviews and Iterative Coding Cycles (dedoose.com assisted)	Rigor and Verification
Source 1: Interviews • 4 student volunteers (semi-structured)	**Interviews 1 and 2** • Questions derived from student written reflections and field note data	**Verification 1** • Triangulation across all data sources. Themes emerge across all data sources
Source 2: Student Written Reflections • ~228 total documents. (1 reflection for each 6 assignments, 2 sections)	**Coding Cycle 1** • Descriptive coding to create initial codebook • Codebook refinement: Organization, Revision, Combination/Splitting	**Verification 2** • Audit trail: saving codebook versions and subsequent review of code evolution in relation to data gathered and peer feedback
Source 3: Field Notes • Reflexive Journaling • Documentation of extemporaneous statements from students	**Interviews 3 and 4** • Questions revised using data from interviews 1 and 2 and student written reflections	**Verification 3** • Member checking: Questions/Follow Up Questions for Interviews 2-4 derived from previous data already gathered and serve as verification
	Coding Cycle 2 • Apply refined codebook to interviews 3 and 4 • Group codes into categories and ultimately into themes	**Verification 4** • Peer debriefing (Work-In-Progress conference presentation with feedback)

Figure 1. Data Sources, Coding Cycles and Verification.

Data analysis, coding cycles and rigor

The data was analyzed after each set of interviews, all of which occurred at the end of each semester. Coding and analysis were facilitated using Dedoose.com. The researcher relied on the reflection data to create the first set of interview questions and an initial list of codes. For the researcher, descriptive coding seemed most productive. In an effort to uphold the authenticity of the participants' statements, the researcher sought to do as little interpretation as possible while constructing meaning (Miles and Huberman, 1994, p. 57). Instead, the researcher simply assigned a class of phenomena to a segment of text (p. 57). The coding process began with a slow review of the first interview transcript, generating new descriptive codes along the way (e.g., "Frustration/anxiety related to Assessment" or "Checklist/Contract Grading"). After examining the whole transcript, the researcher reviewed the list of codes generated (codebook)

to organize, revise, and reflect on them. The researcher revised the codebook by changing wording, combining codes, and breaking codes into smaller conceptual pieces. The codebook generated from the first interview was used to code the second interview. Using data from the second interview, the researcher again revised the codebook. After each interview, the researcher would then code the available field note data using the updated codebook to confirm and elaborate on the emerging categories. This iterative revision process allowed the researcher to refine and develop the codes generated. Categories, and ultimately themes, were defined by the recurrence and conceptual grouping of codes across all data sources.

The study established rigor through triangulation across all data sources. For example, the interviews served as a method of verifying data. The researcher asked the same question, but included follow-up questions in direct response to data received from other participants or reflection data. The reflections were also helpful with data confirming as questions were posed in response to data received. In addition, the researcher maintained an audit trail by saving each codebook before revision so that the progress could be reviewed. Lastly, the researcher presented work-in-progress findings at a conference and received feedback from peers to enhance the credibility of the findings.

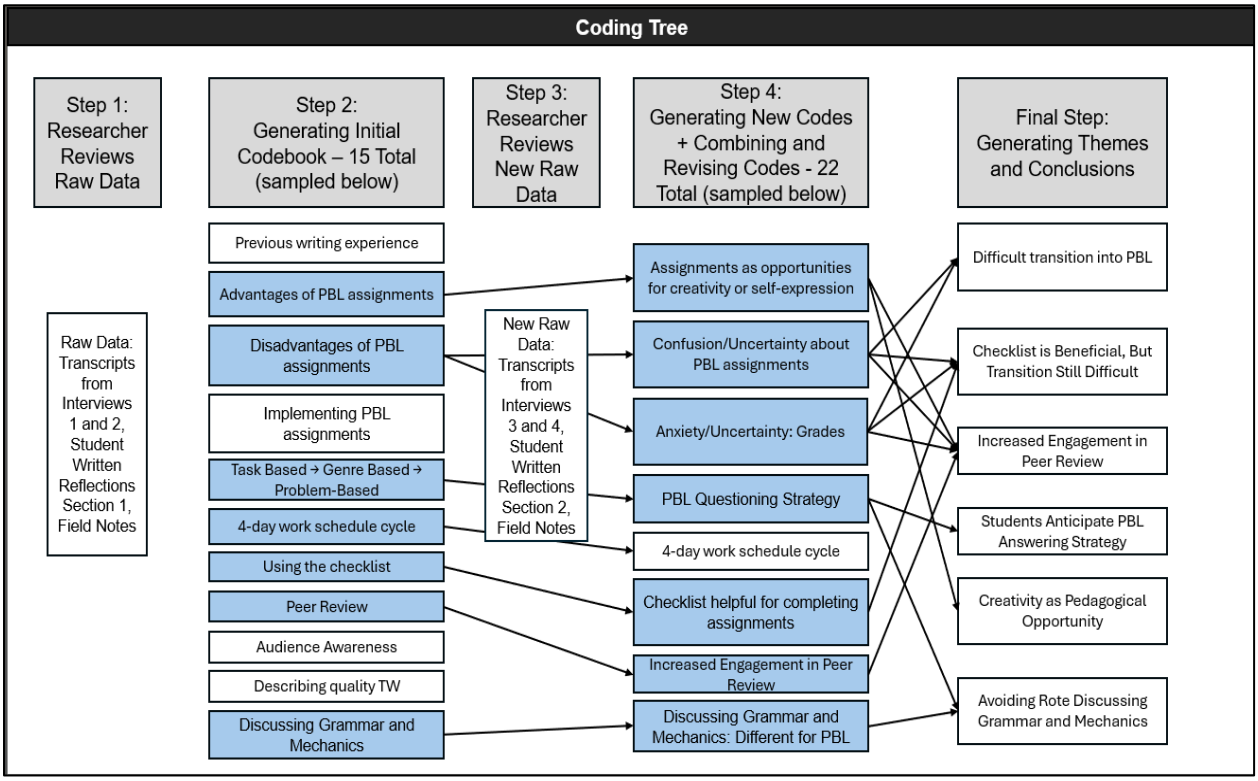

Figure 2. Coding Tree.

Findings and discussion

Student transition into PBL

As forecasted by previous research, students characterize their transition to PBL with frustration. As one student put it, "the [PBL] assignments were different from my other classes and that took getting used to." When asking about the last two assignments, one student explained "we weren't given the information we needed… in class like other classes." They went on to say, "teachers are supposed to help me whenever I have a question." Students' frustration was particularly evident in class. For example, toward the end of one class in which our attention was focused largely on reading and understanding the problem, one student exasperatedly asked "But what are we supposed to do? You haven't told us what we need to do." Another, after a lengthy discussion of the assigned problem and development of the checklist, stated "Can I please get specific instructions for this assignment?"

There was also some consensus that students' responses were motivated by uncertainty about meeting assessment standards. Multiple students connected their frustration with the assessment of their work. As one student put it in an interview, the PBL "assignments were harder because you didn't tell us exactly what to do" but went on to say that "I need to make good grades to keep my GPA and those assignments made me worried." Another explained "I think students in general would be frustrated if they didn't receive the direct help. They are like, how do I know if I'm doing it right."

The checklist

My hope was that our co-created checklist would quell assessment related anxiety because students would have access to, and some control over, specific assignment requirements they could focus on and work towards. While a thorough understanding of how students relied on either the checklist or our collaborative efforts to create it is beyond the scope of this research, a theme emerged indicating that students saw the checklist as helpful for completing assignments. During interviews, we discussed which assignments students thought were the hardest and why. One student indicated "for the last assignments, we did the checklist, which was good. I used that." When discussing the final assignment, another student stated that "It's easier when you have a checklist for sure." Students also remarked about the checklist in their reflections. One wrote, "from the beginning I used the list and the list conversation from class." Another student wrote that they "used the checklist that was put together during the classes in hopes [of touching] on all the subject matter that was requested." Given the consensus on the usefulness of the

checklist when completing assignments, it is reasonable to conclude that the checklist did have some positive impact on students' transition into PBL. A positive impact, it should be remembered, that wasn't enough to curtail the negative experiences students related above. One student put it well when they explained, "Yes, I use the checklist. I use the checklist. But I still didn't know what to do. I still had to decide what to say and where it should go and what it should look like."

A final note before moving forward, I found the checklist to be very helpful when grading. While my own transition into PBL was also not an easy one, I was happy to have the checklist. I knew my students, at the very least, had access to a resource providing specific information about assignment requirements. Further, the communal production of the checklist led me to believe that students did not strenuously object to any of the criteria that we had arrived at. This combination helped me to be more confident with assigning grades.

These findings point out interesting implications for practice and directions for future research. Future instructors can rely on a contract-grading checklist to facilitate their students' transition into PBL. Future researchers might investigate if and how students relied upon the checklist as well as how doing so can mitigate specific aspects of anxiety and better facilitate students' transition into PBL. Further research could also investigate how the checklist, and the methods for its creation, could be altered in ways that elevate students' confidence in assessment outcomes. In addition, if the checklist was helpful for grading, future research could also look at how the checklist mitigates the instructor's experience as well as how that change in instructor experience impacts the students.

The four-day schedule cycle

No themes emerged to indicate students believed the four-day schedule cycle was helpful for transitioning into PBL. Nevertheless, answering classroom questions by delving into the problem description rather than providing simple straightforward answers did have an impact on students' preparation for problem-based learning, although its educational benefit is questionable. As mentioned above, I shifted to this more problem-based method of answering questions during the genre-based assignments. I did my best to make it clear that we would address questions together by looking into and better understanding the problem and its context such that students could arrive at their own answers. After a few weeks, it became evident to me that students had come to anticipate how questions would be answered in class. In fact, before the last two assignments, when students asked questions, I would turn to them and say, "where is the best place to get the information needed to answer this question?" Their responses made it clear to me they knew the answer, before we began the final two assignments. Further, across the data, a theme emerged indicating that,

by the time students got to the PBL assignments, they had grown to anticipate how questions would be answered. One student reflected, "We didn't always get the answers we were looking for but [the instructor] always worked with us to figure out something we could use." Another reflected "I know [that when I have a question, I can] look into the purpose and audience and the situation [for the answer] like we always did in class" Students had already experienced not receiving straightforward answers and thus knew what awaited their questions.

Experiencing these non-traditional classroom interactions, however, does not mean students had an easier time transitioning into PBL. While students were aware of the method, as indicated above, not receiving straightforward answers was still a significant source of frustration and uncertainty. In fact, one student explained that it was "frustrating not getting answers [because we knew that the problem statement is] where you are going to get your response from." Additionally, but importantly, though no student expressly stated they chose not to ask questions, a decreased willingness to ask questions when doing so renders no straightforward answer, and results in frustration, is a short conceptual leap.

While the above interactions point to mixed educational results, they also point to students anticipating parts of their PBL assignments before they were encountered. As such, instructors can call upon the classroom interactions discussed here as part of a greater preparation strategy for PBL. Future research could investigate how to maximize this anticipation in ways that facilitate the uptake of PBL methods. Future research might also investigate what supportive forms of engagement, such as classroom activities or additional reflective writing, might help students further engage in the questioning process and achieve more through it. Future instructors might also benefit from longitudinal research to understand whether and how students rely on the learning gained through the above process in their future classes or professional life. Perhaps the student frustration reported here served as preparation for future problem-solving efforts. Lastly, researchers could investigate if and in what ways students became less likely to ask questions or engage in class because of such unconventional classroom practices.

Fostering peer review engagement

Proponents of PBL have long identified effective collaboration to be one of their primary pedagogical concerns (Barber and King, 2016, 243; Hmelo-Silver, 2004; Hmelo-Silver and Eberbach, 2012, p. 3). Past research has found that PBL can create opportunities to significantly enhance the knowledge, attitudes, and skills important for collaborative learning (Murray-Harvey et al., 2013). This research has reached a similar finding. While we engaged in much collaborative work across both semesters (for example, in co-creating the checklist), the peer review required for each assignment and conducted in-class on the last day of the four-

day cycle played a particularly important role. This research finds that there was enthusiastic engagement with in-class peer reviewing and that the PBL pedagogy played an impactful role in this engagement. Across the data, a theme emerged indicating that students saw the peer review as a way of dealing with frustration resulting from grade uncertainty. Students indicated that uncertainty associated with grades encouraged active engagement in the peer reviews. For example, one student stated "It was challenging, but, I feel like it was good to have the peer reviews because we could use the problem to think through each assignment to make sure we did it correctly. It was challenging but the peer reviews helped a lot." Another student put it well when they told me that the "peer reviews [for task-based assignments] were not all that helpful because I had a better sense of what to do but the peer reviews [for the PBL assignments] were really helpful because I wasn't sure if I was moving in the right direction."

These findings add insight into the practice of peer reviewing in TW classrooms. Writing education researchers have long recognized the productive capacity of peer review when teaching technical writing (see, for example, Eschenbach, 2001, pp. F3A-1; Gragson and Hagen, 2010; Guilford, 2001). If PBL functions to increase a student's reliance on and active engagement with peer reviewing, and peer reviewing is a beneficial pedagogical practice, then their combination may be particularly impactful for TW students and their instructors.

Creativity as pedagogical opportunity

Another finding that merits discussion here has to do with a particular positive interpretation students developed for their PBL assignments. Students made clear that, while PBL requires that students make their own determination for how to solve problems, the resulting agency could be recognized as an opportunity for creativity and personal expression that had a positive impact on students' experience in the class. For example, one student stated that "Even though it only has to do with this class, I would like to show [my work] off to the world, like, look at my assignments, look what I did." Another student told me that the "Confusion [he endured] was a little bad, but the opportunity to do what [he] thought was right makes it overall… a good thing." Another student explained that "We completed the assignment, but we kind of made it our own." Tangentially, another student remarked that she found the PBL assignments "interesting" because "they were more personal…you know, we could make the assignments our own."

Increased enjoyment with the assignments or class is an important pedagogical opportunity. On one hand, adding to the enjoyment students derive from their TW course and coursework may be especially generative given the lack of motivation that some have documented in their TW students (Linsdell and Anagnos, 2011, p. 21; Tatzl et al., 2012, p. 280; Peck et al., 1999, p. 4.2181.8). But,

on the other hand, any added enjoyment may come as a welcome relief given the difficult transition into PBL.

On a final note, some TW instructors might worry that urging students to see their PBL assignments as opportunities for creativity could have negative consequences. Some might worry that students pursuing creativity might be led in directions that run contrary to effective technical communication, particularly when students have so much control over how their assignments are written and designed. For example, developing technical writers might overemphasize color, imagery or effects in ways that ultimately reduce usability. I would counter, however, that this research indicates that students can see their work as creative and still create effective TW. Importantly, thinking of their work as creative does not mean that students have unrestricted latitude in their writing. While this research suggests that encouraging students to see their assignments as opportunities for creativity can have a positive impact on their interpretation of the course and coursework, such encouragement should never be separate from the primacy of effective communication that is the main goal of TW. This research suggests that creativity *in the service of information transfer* is a pedagogical opportunity.

Avoiding rote discussion of grammar/mechanics

One last finding that deserves attention here concerns how PBL facilitated discussions of grammar and mechanics. In particular, because class discussions and all questions were answered in relation to the problem, all discussions of grammar and mechanics occurred in relation to the problem as well. We discussed grammar and mechanics numerous times across the semester, but, when we did, our discussions inevitably highlighted their operationalization as part of a strategic effort to assist readers with solving a problem. The result is that we never discussed grammar and mechanics apart from their function. Their learning went far beyond rote memorization of grammatical and punctuation rules. Students were instead asked to consider how different grammatical choices can lead to different readerly interpretations and thus different effectiveness for one's TW. Just as questions of tone were met with detailed descriptions of audience and genre expectations, so to where questions about grammatical person when writing to a supervisor. Such an analysis and the learning gained from it are not only much more likely to transfer beyond the classroom but, I would argue, also create more interesting discussions than those surrounding memorization. Given these affordances, future research might focus on how certain kinds of problems or solution approaches are more effective for learning particular grammatical structures or issues.

Conclusion

This study explored the multi-semester implementation of PBL in a TW course, focusing specifically on the student transition into this new pedagogy. Consistent with existing research, the findings reveal that integrating PBL principles within a more traditional learning environment presents significant didactic, institutional, and cultural challenges for students, evidenced by their initial experience of frustration and uncertainty when confronted with ill-structured problems and altered assessment practices. However, this research ultimately asserts that the transition can be managed to provide meaningful and effective learning experiences if conducted with care and specific pedagogical scaffolding. The research adds important nuance by detailing that a collaboratively created checklist mitigated assessment-related anxiety, uncertainty about grades drove students to rely heavily on required peer reviews, and the agency required by PBL led students to view their work as an opportunity for creativity and personal expression. Furthermore, the problem-centered approach facilitated functional and contextualized discussions of grammar and mechanics, connecting these skills directly to their strategic utility. These insights provide concrete strategies for future instructors to understand and mitigate transitional challenges, ultimately increasing student access to the significant pedagogical benefits PBL offers in fostering valuable technical writing skills.

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