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# Transforming Curriculum: A Process for Implementing Problem-Based Learning in a College-Level Course

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# TRANSFORMING CURRICULUM

## A Process for Implementing Problem-Based Learning in a College-Level Course

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## Abstract

Transforming curriculum by implementing Problem-Based Learning (PBL) in the college-level classroom helps students internalize the concepts of a course, improve their critical and reflective thinking skills, learn to problem-solve using questioning, and ultimately construct a better understanding of course concepts in a personally relevant way. This article introduces a process for implementing PBL in a college-level course. Each of the four main ideas in PBL, motivation, collaboration, reflection, and facilitation, are addressed with a particular focus on the role of the educator in designing and implementing PBL in the classroom. An example of how the process works in a specific college-level course is provided with explanations of the thinking that went into each of the steps in the process and the outcomes of the implementation, including examples of student assignments and the challenges and benefits of the implementation.

*Keywords:* problem-based learning, PBL, college coursework, concurrent enrollment, dual enrollment, teaching

## Introduction

In some fields, college courses are primarily lecture-based. In some cases, students have issues with engagement in a lecture-based environment. A solution to this issue would be to incorporate ideas for more student engagement and creativity in assignments and the presentation of content. One well-documented educational model to accomplish this goal is problem-based learning (PBL). PBL has been implemented since the 1980s (Barrows & Tamblyn, 1980) starting in medical education and has an incredible amount of data supporting its efficacy in the subsequent decades (e.g., Gijbels et al., 2005; Kong et al., 2014). The goal of this article is to describe PBL and provide a simple process for college-level educators to follow to transform their curriculum by converting traditional assignments in a lecture-based course into PBL assignments. This process might help mitigate some of the challenges educators face with implementing PBL into their teaching.

## Problem-Based Learning

PBL is a well-known type of student-centered instruction, originally implemented in medical education by Barrows and Tamblyn (1980). These researchers learned that students in small groups were better able to construct knowledge using medical case studies that required students to problem-solve based on supplied information to diagnose a patient. Often, case studies were missing some information, typical of medical issues, so small group discussions helped the students

determine the next steps based on the information available. PBL has since become a common practice in the medical field and has been adopted by other fields as a common way to teach content, described in more detail below.

PBL is defined as "an active learning method based on the use of ill-structured problems as a stimulus for learning" (Hmelo-Silver & Barrows, 2006, p. 24). An ill-structured problem does not necessarily have a "correct" answer but forces students to explore alternate ideas or solutions and organically construct knowledge. Youngerman and Culver (2019) describe PBL in three ways. First, "learning is collaborative and self-directed" (p. 24), meaning that PBL incorporates group activities in varying formats and encourages student ownership of learning goals and outcomes rather than predetermined goals. Second, educators take on the role of a facilitator, which puts the student as an "autonomous learner responsible for their own progress" (pp. 24-25). Finally, like Hmelo-Silver and Barrows (2006), Youngerman and Culver (2019) describe PBL as working with authentic and ill-structured problems. This promotes interdisciplinary thinking and problem-solving using synthesis and higher-order thinking skills on "real world" (Savery, 2015) problems.

According to Hmelo-Silver (2004) and Pecore and Bohan (2012), the four main components of PBL are motivation, collaboration, reflection, and facilitation. Motivation is described as "highlight[ing] the relevance of the problem to the learner" (Pecore & Bohan, 2012, p. 128), or establishing ways to help students engage in the learning goals. Helping students make personal connections and allowing students choices are ways to motivate students in learning in a PBL environment. The second component, collaboration, is described as "promoting shared knowledge construction and enhancing higher-order thinking and problem-solving skills" (Pecore & Bohan, 2012, p. 128). This involves students working and dialoguing with others through opportunities to discuss in class in formal or informal ways, participating in small group and partner work, and verbalizing and exchanging ideas with others. The reflection component of PBL helps "learners understand the relationship between their learning and problem-solving goals" (Hmelo-Silver, 2004, p. 247). This provides opportunities for student metacognition about their learning by allowing for ongoing reflection through student journals, reflective discussions, or other ways where they can relate new knowledge to prior knowledge and the reapplication of knowledge. The final component, facilitation, involves the teacher "emphasizing learning through problem-solving," "modeling good learning and thinking strategies," and helping "move students through problem-solving stages while monitoring progress for involvement in critical thinking" (Pecore & Bohan, 2012. p. 128). Facilitation involves teachers modeling learning and thinking strategies such as modeling the assignment and thinking aloud to model thought processes (Pecore & Bohan, 2012). It also includes teachers using mentor text (written examples), using open-ended questioning during formal and informal discussion (Hmelo-Silver & Barrows, 2006), and understanding that there is no "right" answer.

PBL is also a teaching methodology promoted in high school and college courses such as those that study real-world problems, engage with nonprofit partners, or involve mastery of discipline-specific practices (Youngerman & Culver, 2019). Research on PBL includes studies in various settings. For example, in high school, there are examples of courses implementing PBL in science (Ferreira & Trudel, 2012), chemistry (Tarhan & Acar-Sesen, 2013), biology (Pecore & Haeussler Bohan, 2012), technology (Hsu et al., 2012), engineering (Ruth et al., 2019), and mathematics (Widyatiningtyas et al., 2015). In many cases, PBL has been shown to provide positive effects on student achievement and other positive effects. Tarhan and Acar-Sesen (2013) conducted research in high school chemistry courses with a control group and a PBL group. Findings showed that PBL had positive effects on student achievement, aided students in "overcoming alternative conceptions" (p. 575), and helped students develop social skills. Widyatiningtyas et al. (2015) researched PBL with grade 10 senior high students and determined that this approach positively impacted students' mathematical abilities in critical thinking compared to students in a traditional learning environment. Ferreira and Trudel (2012) researched PBL with regular high school chemistry classes. Their research showed significant increases in "student attitudes toward science, problem-solving skills and positive view of the learning environment" (p. 23) in addition to increased feelings of community in the classroom.

Research on instructors implementing PBL has also shown benefits and factors to consider. Yukhymenko et al.

(2014), in their research of PBL used in social science classrooms, found that PBL requires a change in the mindset of the educator to a facilitator and exemplar of problem-solving skills for students, a curator of resources, and a coach to guide students in their decision-making. They also found that educators need to encourage a positive classroom environment, provide time for students to work in small groups, and encourage student independence. Pecore and Haeussler Bohan (2012) researched the teacher aspect of incorporating PBL in a secondary biology classroom. Findings from this study showed some factors account for differences in the effectiveness of PBL, including previous teaching experience, attention to classroom management, an inquiry-based classroom culture, and instructor beliefs about teaching and learning. With adult learners, PBL has been used in educator professional development (McConnell et al., 2013) as well as in its field of conception, medical education (Barrows, 2000). McConnell et al. (2013) studied the effects of using PBL to develop teacher content knowledge on self-chosen topics related to science where K-12 teachers attended summer professional development and worked in "facilitated groups of from five to nine participants to solve rich, ill-structured problems" (p. 216). Their research showed that teacher content knowledge improved through this PBL professional development approach, independent of other factors.

Ultimately, studies have shown PBL helps students develop many transferable skills such as reflective thinking skills (McConnell et al., 2013; Weshah, 2012) and "cognitive learning skills, critical thinking skills, and cooperative working skills" (Tarhan & Acar-Sesen, 2013. p. 575). Most importantly, PBL increases student responsibility for their learning and helps students understand both curriculum and its application more deeply than a teacher-centered approach (Bell, 2010; Hmelo-Silver, 2004; Hmelo-Silver & Barrows, 2006; McConnell et al., 2013; Yukhymenko et al., 2014).

## Implementing PBL: Teacher Process

There are several items for a college-level educator to consider when implementing PBL in a traditional lecture-based course; first and foremost, what might that process look like in practice? A possible process to aid instructors in this endeavor is included in Appendix A with example questions an instructor might ask themselves throughout the steps of the process. Following is an example of what this PBL implementation process looks like in practice in a college-level course.

I (first author) teach several college-level courses, including a concurrent enrollment Adult Roles and Financial Literacy course. Concurrent enrollment courses, sometimes called dual enrollment, are college-level courses taught to high school students. These courses are expected to meet the standards of both a college course and a high school course, and students taking these courses are traditionally college-bound. The goal for students in concurrent enrollment courses is to show mastery of the learning objectives at a college level. The course under discussion, titled Family Relations at the affiliated college, fulfills either a college general education diversity requirement or a college general education social studies requirement. This course is traditionally taught in a lecture-based format with written assignments and multiple-choice exams.

### Review Classes and Assignments

The first step in the process is to choose a class and a major assignment (or series of assignments) that would benefit from additional instructor modification to improve student learning outcomes. The traditional culminating assignment that counted as the final for the above course was called the Personal Family Awareness Paper and Cultural Genogram, described in more detail below. Instructors typically assigned the paper and gave students little or no class time or teacher support to complete the assignment. In the past, my students had an incredibly difficult time understanding the assignment directions and the rubric provided by the college. Students completed the paper grudgingly and were not motivated

or engaged. Many of the end products did not fulfill the purpose of the assignment. The paper was difficult to grade and more than half of the students in my sections had to re-do the paper because of a lack of understanding of the purpose of the assignment or because of poor writing. Since students were not achieving the desired student outcomes and were not meeting the learning objectives, I decided to choose this assignment to consider as part of transforming my curriculum to PBL.

According to Hmelo-Silver (2004), it is important to begin this process with instructor goals. My goals were to (a) increase student engagement in the assignment, (b) provide opportunities for students to show an understanding of the personal and professional relevance of the content of the course through the assignment, (c) incorporate more social learning opportunities in a traditionally individual assignment, (d) break down a substantial final paper into more manageable pieces so as not to overwhelm students, (e) connect the assignment more explicitly to student learning outcomes, and (f) improve student learning outcomes.

## Review Assignment Parameters

For this course and assignment, I first looked at the requirements from the college. Because this was a concurrent enrollment course, I had to obtain permission from the college supervisor to make changes to the assignment, including what I could change and what I was required to keep the same. This took some negotiation. I also had to keep in mind the state's strands and standards for the high school course curriculum. In addition, I considered how much class time could be allotted and what percent of the final grade could be attributed to this assignment.

## Consider the Purpose of the Assignment

The purpose of this assignment, the Personal Family Awareness Paper and Cultural Genogram, was to place students in the mindset of a marriage and family therapist by analyzing their own family, looking for family dynamics and patterns across three generations. A major expectation of the assignment was to have students analyze and code their families based on previously learned concepts using the lexicon for the field of marriage and family therapy (Youngerman & Culver, 2019). This exercise allowed students to synthesize and apply the concepts they learned in the course in a context that was real-world and relevant to them. Ultimately, the assignment provided a way for students to show mastery of the course's content (Youngerman & Culver, 2019).

## Break Down the Assignment

The Personal Family Awareness Paper and Cultural Genogram assignment was designed to assist students in understanding the cultural elements and extended family dynamics that influence their family in specific ways. This assignment contained four major parts: Part 1- the visual Cultural Genogram, and Parts 2A, 2B, and 2C – the written portion of the assignment. The Cultural Genogram was a visual representation that had to contain multiple points of analysis of three generations of students' families (e.g., family dynamics, emotional triangles, cutoff and enmeshment). Part 2 was broken down into three parts. Part 2A was an analysis of the family dynamics, processes, and patterns across the three generations, basically a written explanation of their visual representation. Part 2B was a comparative analysis and description of how the three generations varied in specific ways, (i) communication and conflict styles, (ii) parenting styles, and (iii) the levels of cohesion and flexibility in each generation. Part 2C was a summary and discussion of how understanding a family's culture and identity helped a person (in this case, the student) better understand other families and their cultures. For more detail, the rubric for Part 2 of the assignment is provided in Appendix B.

## Identify Changes to Implement

In thinking about how to achieve a more desired outcome with this assignment, I considered the four aspects of PBL and how I might adjust. Over three years, I made multiple changes to this assignment. I describe the various changes I made below, with the rationale for each change.

In PBL methods, it is important to consider student motivation (Hmelo-Silver, 2004; Hmelo-Silver & Barrows, 2006; Pecore & Haeussler Bohan, 2012) and reflection (Weshah, 2012). Thus, I added a future family aspect to the assignment by adding a reflection piece for each of the comparative analysis sections (Part 2B, i, ii, and iii – see Appendix B). This required students to look at patterns of behavior across generations in conjunction with what they learned in the course and reflect on what they wanted to implement in their future families, whether it was from their current patterns or not. This additional aspect increased student motivation by making the information more personally relevant, and the reflection highlighted the power students have as agents of change in their current and future families and helped them see the relevance of the course curriculum to their lives.

Multiple components of PBL were incorporated in my next change, including motivation, collaboration, and facilitation (Hmelo-Silver, 2004; Pecor & Bohan, 2012). During this time frame, the affiliated college requirements changed for this assignment and so did the parameters needed to meet the learning objectives. The product for Part 1 changed from a single chart using standard genogram symbols to a tri-fold presentation with pictures and basic text requirements. In addition to this required change, I added a small group presentation for this portion of the assignment for multiple reasons. One reason was to prepare students for the next part of the assignment, specifically Part 2C, which required them to build on previous knowledge and make connections to foster greater understanding (McConnell et al., 2013). Adding this collaboration piece also made students' knowledge more flexible by providing opportunities to collaborate with students with different life experiences and backgrounds. This aided students in making connections and broadened their understanding more than in years past. Another benefit to the addition of a presentation was an increase in student choice (what information to include on the trifold, the format of the presentation, who to present to) to aid in student engagement. All these changes required facilitation on my part. For example, I changed the order in which I had students complete the assignment, which facilitated their knowledge construction process (doing Part 2B first helped them organize Part 1, Part 1 provided a concrete visual to reference while they wrote Part 2A, collaborating with students in the presentation process helped students write Part 2C). These changes also required an adjustment to the schedule, as discussed in more detail below.

An integral part of the facilitation of the PBL process is assisting students through the problem-solving stages through open-ended questioning and modeling (think aloud or demonstration) (Hmelo-Silver, 2004; Perore & Bohan, 2012). One of the major issues I had previously with section 2B was students were not using the correct terminology or were using the terminology incorrectly, which revealed a gap in their knowledge construction. To facilitate students through this process, I modeled the thought process they should use and the questions they should ask themselves as they were coding and analyzing their families in that section of the assignment. I used my own family as the example and verbalized how I would code my family and why, explaining anecdotally how I understood my coding was correct, while writing my outline for that section on the whiteboard. One semester, as I implemented this change, a student asked if I had a word bank that students could use as a reference to be sure that they were using the appropriate terminology required. Up to that point I had never provided my students with a word bank but created one at the student's request, an example of how educators may need to make adjustments along the way.

My next change was prompted by my participation in a writing professional development group. I learned that adding mentor texts is an excellent way to help students with their writing (Graham & Perin, 2007; Hillocks, 1986). Mentor texts, sometimes called anchor texts, are examples of writing or examples of a project. Research shows that having stu-

dents study mentor texts allows students to "emulate the critical elements, patterns, and forms embodied in the models in their own writing" (Graham & Perin, 2007, p. 20). These mentor texts help students study the writing process and formatting required for an assignment with an example of what that looks like in practice rather than having to abstract that knowledge from the directions and rubric. I provided three very different visual examples for Part 1 that were given to me from the college and one student example (all student examples with permission) shown in Appendix C, and one student example for Part 2B shown in Appendix D. Previously, students were floundering with the writing portion of the assignment each time it was assigned, for various reasons. Students did not know where to start, what the final paper was supposed to look like, what formatting was required, and what APA was (first time with APA for many). For some students, it was their first college-level course. Providing mentor texts was a way to help facilitate student learning using teacher scaffolding.[1]

A big part of facilitation in PBL is moving students through the problem-solving stages (Hmelo-Silver, 2000; Pecore & Haeussler Bohan, 2012; Yukhymenko et al., 2014), planning how to do that, and deciding what the pacing should be. One of the adjustments I made to this assignment was to consider how much class time would be required when changing to a problem-based model. Previously I used a class period to introduce the assignment and then gave students two to three class periods in class to work on it. In making these changes to a PBL model, I introduced an overview of the assignment earlier in the semester, broke the assignment into pieces, and had students work on specific pieces rather than assign the whole assignment at once (specifically working on identifying and coding different aspects of their families as we went through those topics so that the terms were fresh). I changed my teaching to include more in-class work time, similar to a flipped classroom model where content learning is done outside of class and class time is used to work on assignments, so that students could ask questions of me or other students while working on the project. I modeled different sections at the beginning of the class (e.g., one class period model Part 2B, another class period Part 1), and the rest of the class, students worked on that section. In making this change, I found that the amount of class time I had allotted was not quite enough, but I was unable to use more class periods for it in my scope and sequence. So, with permission from the college, I removed one of the requirements for this assignment and integrated that part of the assignment with a different assignment I was doing to make this assignment slightly shorter.

Another aspect of facilitation that I integrated for this assignment was to allow students to make revisions based on instructor feedback (Johnson et al., 2019) as well as adjusting the time of year when I assigned the project. I, as the instructor, gave very detailed and specific feedback so that students could make changes if desired. Research shows that timely detailed electronic instructor feedback shows improvement in subsequent student drafts (Johnson et al., 2019) and electronic feedback also improves the quality of instructor feedback (Sopina & McNeill, 2014). Because of the level of detail required in providing comments on precisely why a student lost points and what they needed to do to fix each section, grading required more time. Rather than post grades, I waited to post the grade and comments so that students had access to them all at the same time, and I gave them one week to make their revisions. Any revisions were required to be noted in a different colored font. Allowing students to revise based on feedback is a way to show that the emphasis is on student learning. As far as schedule adjustment, since my class was taught across a full year in a high school setting, I considered when winter break was scheduled and began the assignment before the break so that students who got behind in class could work on part of the assignment over the break. I also allowed students to turn in drafts before the break

1. I was initially reluctant to provide a mentor text, worried that my students would just copy and paste from the example. To help mitigate that, I saved the example paper as a PDF. Even then I was a little leery. However, I was pleasantly surprised when I found that not a single student had copied anything from the example other than the format. For those thinking of using mentor texts as a scaffolding method and are worried about the temptation for plagiarism, I would recommend using a program like Turnitin to check for copying.

so that I could look them over and give them a preliminary grade according to the rubric. This allowed me to provide students with feedback they could use to adjust their work, which incentivized students to finish the assignment as much as possible before the break.

## Implement Changes and Evaluate After Assignment Completion

When implementing a PBL model in teaching, it is important to keep the purpose of the assignment at the forefront, in this case, to improve student learning outcomes as well as reflect on the goals (Hmelo-Silver, 2004). Analyzing the changes made to the course, analyzing final student assignments, and asking questions are important parts of teacher reflection. Questions I ask myself might include: Did the changes work the way I thought they would? Did the adjustments help fulfill the main purpose of the assignment? What did not work? What additional adjustments may need to be incorporated? Do I need to revisit my goals? Table 1 includes the goals I set for my implementation and the changes I made to accomplish those goals.

**Table 1.** ***Instructor Goals and Changes to Assignment***

| **Instructor Goal** | **Changes Implemented to Meet the Goal** |
|---|---|
| Increase student engagement in the assignment | Added a future family aspect; integrated a presentation; added discussions |
| Provide opportunities for students to show an understanding of the personal and professional relevance of the content of the course through the assignment | Modeled thought process; provided student examples; added more class time to work on and discuss the project |
| Incorporate more social learning opportunities in a traditionally individual assignment | Encouraged informal discussion; facilitated whole class discussion; added class time |
| Break down a substantial final paper into more manageable pieces so as not to overwhelm students | Adjusted time allotted across the semester for the assignment; adjusted the sequence of teaching and modeling; added content outside of class to allow for in-class working time; removed one section of the assignment |
| Connect the assignment more explicitly to student learning outcomes | Provided mentor texts; provided feedback to students on drafts; allowed students to revise and resubmit the assignment |
| Improve student learning outcomes | Final data supported that student outcomes improved |

The changes I implemented for my first goal, increasing student engagement in the assignment, were met. Making the assignment more personally applicable through the future family aspect and integrating a presentation aspect to Part 1 helped students meet the learning outcomes for the assignment and be more involved and invested in the final product. I could see this engagement during our workshop time in class, in the discussions students had, in the questions students asked, and in their final papers.

I provided opportunities for students to show an understanding of the personal relevance of the content, my second goal. To accomplish this, I modeled my thought process using my own family as an example for the analysis section of Part 2B, provided the students with student examples, and provided more class time for students to work on and discuss the assignment.

Incorporating more social learning in an individual assignment, which was my third goal, was quite difficult. Adding class time, encouraging informal discussion, and facilitating class discussion did help with this, but I am going to keep working on this goal. I am considering adding a small group exercise for the students to practice doing the coding and

analysis for Part 2B based on case studies. This might aid in incorporating more social construction of knowledge to meet this goal.

I met my fourth goal by breaking down the final paper to make it more manageable and less overwhelming for students. The changes all helped the students keep better track of what they were expected to be doing along the way, rather than being paralyzed thinking of the whole assignment. Adjustments were made to the time allotted to the assignment, the sequence of teaching and modeling for the assignment, the flipped style classroom (moving content-learning to outside of class so more class time is spent on working on assignments) with workshop days, and the assignment requirements regarding a section of the assignment that fit better elsewhere.

Connecting the assignment more explicitly to student learning outcomes was the ultimate goal and the reason for the majority of changes made to the assignment. The two changes that were the most beneficial in helping students meet the learning outcomes were providing mentor texts and giving feedback by allowing students to revise and resubmit. These changes allowed students to see that I was more interested in their mastery and understanding of the content than I was in a grade, although grading is an important aspect to consider for any educator looking to implement this process.

My final goal of improving learning outcomes was met, as evidenced by comparing my first year attempting changes to this assignment to my most current year. The first year, the only change I made was allowing students to revise and resubmit based on feedback. The most recent year, containing all the changes described above, showed a significant increase in students achieving the learning outcomes. For example, in fall semester of 2017, 27% of students did not satisfactorily meet the learning outcomes on the assignment[2] with 65% of students scoring 80% or higher[3]. For fall 2020, the most recent semester, only 12% of students did not meet the learning outcomes with 76% of students meeting the performance objective. This data constitutes a decrease of 56% in the number of students not meeting the learning objectives and an almost 17% increase in students meeting the objective. More work is required; however, this clearly shows the efficacy of the changes made in terms of learning outcomes.

I am considering a few additional changes. For example, I liked how modeling the thought process for Part 2B helped clarify the process for my students, but next year I am going to film myself while I am modeling. That way I can upload the video to my online course learning management system for students who were absent that day and have that as a resource for students to refer to while they are writing outside of class time. Also, I am planning on implementing small group case studies when teaching students how to code and analyze families to help them build knowledge together as a collaborative effort before them applying it to their own families.

## Challenges and Benefits

One of the major challenges of modifying an assignment to consider PBL is the time investment. This assignment did not get to its current point immediately. I enacted the process and changed only one or two things with each iteration, resulting in the current assignment. This process took place over years with varying reasons for each change implemented, some of which were based on professional development or learning from professional conferences, and others from student input.

Another challenge was learning the role of a facilitator rather than a lecturer. The thought processes involved are much different than I believed going into this process. It takes reflexive thinking (Freire, 1998). I am no longer the font of

2. scored below 70% after revision

3. the college standard of meeting a performance objective

knowledge, but the questioner, and through my questioning and subtle guidance the students construct their learning. It takes practice and a paradigm shift, but the benefits I saw from these changes were worth it.

One benefit of incorporating PBL in my classroom, as promised by the research (Bell, 2010; Hmelo-Silver, 2004), was that students took responsibility for their learning. As the process proceeded, student questions changed. I could see the concepts were being internalized and the students' depth of understanding was reflected in the questions they asked. For example, rather than asking superficial questions like what vocabulary should be used, students asked questions related to analyzing their family conflict resolution styles. The further this process went, the more of a hands-off approach I was able to take as students required less and less facilitator support. The students also retained the material. For example, I referenced concepts that were used in this assignment later in the year, such as parenting styles, and students were able to have richer discussions on those topics than in previous semesters. Students had a deeper understanding of the concepts and remembered them from earlier in the semester.

Another benefit for my students was the collaborative aspect of PBL (Pecore & Bohan, 2012). As this was an individual assignment, I was not sure just how much collaboration I could incorporate. One of the ways I incorporated collaboration early in the learning process was to refer students to other students who had already talked to me about similar questions. Being given permission to talk with each other about their assignments led to excellent informal discussion during the work time in class. I was able to see, through my observations going around the room, that having these discussions or even just having a sounding board to clarify their thinking helped students construct the knowledge they needed (Pecore & Bohan, 2012) and helped them achieve the main purpose of the assignment while also incorporating the collaboration aspect of PBL.

As mentioned above, one of the challenges to consider is the time investment; however, this is where I saw a worthwhile benefit in how much time I saved overall. In fall semester of 2017, it took me between 30-90 minutes to grade an individual paper at the end of the course, depending on how well the student followed the rubric and assignment requirements as well as how much feedback the student required. By implementing all these changes with partial drafts turned in earlier in the process, I was able to grade all the papers in a quarter of the time while still giving the students robust feedback.

## Conclusions

One focus of PBL is the usefulness of the concepts students are supposed to learn. Making knowledge functional helps students not only understand the concepts more effectively, but also helps them remember and internalize those same concepts (Bell, 2010; Hmelo-Silver, 2004; Hmelo-Silver & Barrows, 2006; McConnell et al., 2013; Yukhymenko et al., 2014). Various critical thinking skills like reflective thinking (McConnell et al., 2013) and cognitive and cooperative learning skills are both a function and benefit of PBL (Tarhan & Acar-Sesen, 2013). Using the facilitator educator as the model of effective learning and asking open-ended questions with no "right" answer forces students to think more deeply than simple definition-based questions (Hmelo-Silver, 2004). Open-ended discussions allow students to reflect on their thinking (Weshah, 2012), discuss together, and build off each other's knowledge to construct better understanding (Hmelo-Silver & Barrows, 2006). This process helps with transferable skills (Bell, 2010).

Implementing PBL into a college-level course is a significant process with many moving parts and requires thought, effort, and coordination on the part of the facilitator. Sometimes the changes do not work the way they are envisioned, or the changes may run counter to the purpose. What worked with one class may not work with another class. The instructor's administration may make changes to the course or the assignment requirements. However, there are still benefits of incorporating PBL. One of the most prominent benefits of PBL is that it instills in students personal responsibility for their learning (Hmelo-Silver, 2004), because students care about what they are learning and are willing to put in the effort

to learn without being spoon-fed information from a "sage on the stage." The example above shows how this process can be implemented over some time in a college-level course in a straightforward way. PBL is a high-impact method to help students meet their learning objectives (Hmelo-Silver, 2004; Hmelo-Silver & Barrows, 2006; McConnell et al., 2013), a goal of all college-level instructors. If instructors can teach students the process of learning, regardless of the subject, students can become lifelong learners.

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