

INTEGRATED PROBLEM-BASED LEARNING: A CASE STUDY IN AN UNDERGRADUATE COHORT DEGREE PROGRAM

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Abstract

The tuition fee for education in United States is skyrocketing, and 30% of students across US universities drop out after the first year. Faculty have reported having limited impact on students' college careers, yet many universities continue delivering classes in a traditional manner with no major changes on the horizon. This chapter shares a case study of a transformational integrated undergraduate cohort-based BS degree program built on the foundation of Problem-Based Learning at the Frisco Campus of the University

of North Texas. The chapter identifies five major pillars of the degree program including 1) cohort-based and problem-based learning as the pedagogy, 2) partnership with industry organizations to provide hands-on experience for students, 3) integration of curriculum between all cohort-based classes, 4) internal partnership with student services to get students ready with life skills and finally 5) organizational partnerships to provide three internships for students before graduation. This chapter shares the journey from concept of the program, to the completion of the first year, along with what program components worked and did not work. The study concludes with the achievements and changes that were made for the academic year (2020-2021) and further research directions are suggested in addition to key lessons learned.

Key words

Problem-Based Learning, Cohort-Based Degree Model, Industrial Partnership, Undergraduate Business Education

Introduction

According to College Atlas (2018), it is projected that 70% of Americans will study at a four-year college, but less than 62 % among them will graduate with a college degree in six years, and 30% of students will drop out of college at the end of their first year across all universities in the United States. Another survey by LendEDU (2018) found that 55% of students in United States struggled to find the money to pay for college and 51% dropped out of college because of financial issues. An increasing drop-out rate of undergraduate students in the United States has reminded higher education faculty, researchers, and stake holders that increasing the credit hours and prolonging the dominant 4-year schedule of undergraduate studies are not viable solutions to the issue.

Facing the increasingly competitive job market, many post-secondary institutes have prioritized preparing students to acquire the most desired soft skills by employers to increase the chances of their graduates getting employment. The National Association of Colleges and Employers (NACE, Peck, 2017) ranked communication, problem-solving and collaboration as the top three desired skills for employers. Krause (2009) pointed out that employers want to hire graduates that already have these above-mentioned skills, the consensus was that the essential skills should have developed in college and should only require refining onboard the job. Given the acknowledgement, Bauer-Wolf's study (2019) still found employers reported having difficulty finding such candidates for their openings. These three major

issues prevent undergraduate education in United States from fulfilling the needs of students. An undergraduate degree that serves the needs of students and is financially affordable is highly desired.

To address these three issues, a reform of curriculum instruction and program design is desired in the interest of current and prospective students of higher education, faculty, stake holders and policy makers. In order to better prepare students facing the job market upon their graduation, one of the suggested reforms, among many others, is to expose students to real-world scenarios to develop problem solving skills through hands-on experiences that require communicating and collaborating with others.

Problem based learning (PBL) is an instructional method that originally comes from medical education, now it has been adopted and implemented as an instructional pedagogy in diversified fields and domains. Significantly different from traditional teacher-centered and lecture-based teaching methods, PBL is rooted in constructivist learning theory (Savory and Duffy, 1995). It relies largely on student autonomy, which requires students to work autonomously in a goal setting, take on responsibilities, collaborate and communicate in their learning (Wijnia, Loyens and Derous, 2011). While instructors serve the role of learning facilitators, PBL emphasizes on student self-directed discovery and learning through solving real life issues. PBL instruction, hence, aids students to build on their soft skills and enhance them during their undergraduate studies.

To better support the implementation of PBL at the level of undergraduate degree design, cohort-based learning is introduced along with

the PBL as the core to facilitate the cultivation of the soft skills. Additionally, four other pillars are added to achieve the overall success of the undergraduate degree education reform: integrated academic curriculum, student service integration, internship and organizational partnership.

The current study shares the exploratory case study of the integration of the above five components at an undergraduate degree program level. The University of North Texas (UNT) Frisco campus launched UNT's first PBL cohort program for First Time in College Students (FTIC) in Fall 2019. Twenty-three freshmen students were admitted to the undergraduate degree program Project Design and Analysis (PD&A). So far students have worked on a transportation project (Fall 2019), and a business improvement project with a focus on improving efficiency in how restaurants were opened (Spring 2020) with the City of Frisco (COF) as an industry/organization partner.

The PD&A program is an innovative exploration for instruction and program design in higher education. The goal of UNT initiating such a program is to tackle two challenges faced by postsecondary institutes in the United States and worldwide: student retention and career readiness. In the current study, we propose to conduct an exploratory case study to showcase the ongoing PD&A program, and seek to answer the following research questions:

1. What are the key processes of integrating five pillars into the PBL cohort PD&A program?
2. How does PD&A program address the typical three issues (employer desired skills, student drop-out rate and financial burden) faced by US higher education institutes?

3. What key learnings were applied to the PD&A program after the first year in this design-based research approach of teaching?

Literature Review

Theoretical Foundation of Problem-Based Learning

Problem based learning (PBL) is an instructional method that originally comes from medical education in the early 90s, but now it has been adopted and implemented as an instructional pedagogy in many diverse fields and domains. PBL roots are found in constructivist learning theory (Savery and Duffy, 1995), relying largely on student autonomy, which requires students to work autonomously in the learning goal setting, taking responsibilities for their learning, collaboration and communications (Wijnia, Loyens and Derous, 2011). PBL emphasizes on student self-directed discovery while instructors serve the role of learning facilitator and help students learn by solving real life problems.

Barrows (2002) identified four key components of PBL: Ill-structured problems that trigger not only students' thoughts on the cause, but also the solution; student-centered approach that allows students to decide what they need to learn; teachers serve as facilitators and tutors, instead of traditional knowledge provider, and guide students to ask meta-cognitive questions and gradually release learning responsibilities to students; and authenticity of problems presented to students to learn, keeping alignment to professional or

'real world 'practice. With the four key components of PBL set forth, Savery (2006) defined PBL as an instructional approach that is learner-centered and empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem.

To implement PBL successfully, Savory and Duffy (1995) provided eight principles, and comment on the critical features of PBL on learning goal setting, problem generation, problem presentation and facilitator role. PBL model addresses collaboration and communication skills, and educators have achieved the common understanding that these skills cannot consistently improve through traditional curriculum and academic program setting. Consistent instillment is the pursued pedagogy of fostering long lasting soft skills.

PBL in Undergraduate Business Education

An increasing number of instructors have recognized the importance of PBL and the implementation of PBL into various courses and curricula, through which evidence has been observed regarding the benefit of PBL in various domains and subjects in undergraduate studies, including medical education, biomedical engineering (Perrenet, Bouhuijs and Smits, 2000), chemical engineering (Woods, 1996), software engineering (i.e. Ferreira and Canedo, 2019), and thermal physics (van Kampen et al., 2004). PBL has shown its effectiveness in the above fields, but studies also found that the connection between PBL and business and economic studies are tenuous (Rosinski and Peeples, 2012), although these domains are highly practical.

Jone and McMaster (2004) applied PBL in a 3-year undergraduate Information Science degree program, where students across all years formed groups to solve real-life business problems, suggesting the possibility of successfully reconciling academic learning objectives with real-life project demands in business studies. However, Bigelow (2004) pointed out that simply implementing PBL in improving student's problem-solving skills may not be sufficient after students graduate and face organizational problem solving. More steps are in demand to further prepare students to solve real-world problems and collaborate with others. Brundiers, Wiek and Redman (2010) proposed that collaborating with community and industrial partners provides students real-world learning opportunities, which emphasized the importance of connecting the learning experience closely with the real world. Martínez León (2019) reported teaching an engineering course with the PBL model through the execution of Lean Six Sigma (LSS) projects implemented through university–industry partnerships. This study reported that such model facilitated the integration and application of theoretical knowledge through the development of professional skills in undergraduate students, as demanded by business partners and organizations. However, the feasibility and validity of such pedagogical exploration applied at the academic program level remain unclear.

Miller, Hill and Miller's (2016) study provided a good example of applying PBL in an undergraduate supply classroom to introducing Lean Six Sigma by providing students an ill-structured business problem in a setting students are familiar with, which focused their learning efforts on technical

mastery of concepts and tools. It helped cultivating critical thinking, teamwork, and project management beyond the content of the course. Miller, Hill and Miller (2019) further investigate PBL as in-class simulation to teach operations and process improvement concepts and emphasized problem-solving, teamwork, and intra-firm cooperation for large, semester-long process-improvement projects for multiple student groups, which expand the application and instructional design of PBL.

In undergraduate business education, research on the application of PBL in curriculum and instructional design beyond one course and one semester, is highly desired in order to explore the skills improvement, curriculum integration, and the best practices of adopting PBL as the main pedagogical strategy in undergraduate education.

Cohort-based Learning Model

As educators become more aware of the importance of collaboration, an increasing number of educators and educational researchers have begun to appreciate the educational benefit of cohort-based learning. Cohort-based learning provides students opportunities to foster their creativity and innovation, as these skills are not as readily utilized in other instructional contexts. In the cohort-based learning model, students form long-lasting groups that allow them to extend the learning and collaboration beyond the classroom thus fostering long-term friendships which indirectly contributes to keeping the dropout rates to a minimum. Although cohort-based learning

poses special requirements for program structure and curriculum design, the benefits of this model is evident (Saltiel, Russo and Dawson, 2002).

PBL and Cohort-Based Learning

PBL being adopted and implemented as the major pedagogy program-wise is not commonly seen. PBL implementation throughout a cohort-based undergraduate degree program is an innovative design in post-secondary education. Throughout the documented literature, Jin et al. (2019) reported their achievements in adopting PBL in cohort-based classes of an undergraduate science academic program, and found that students who underwent this model showed increased awareness and interest in solving problems. The program itself showed increased enrollment, doubled retention rate and decreased average time of completing the degree by almost two years. However, such examples are uncommon, and little is known about the instructional design, student learning transition and connection to the real world.

Based on the research findings listed above, one of the objectives for the current study is to seek to understand how to better prepare students to be job-ready by integrating industry partnerships and curriculum into a cohort-based PBL instruction for a new Bachelor of Science degree in Project Design and Analysis (PD&A) at University of North Texas (UNT) Frisco campus.

Methodology

The current chapter proposes to apply an exploratory case study to examine the impact of a PD&A undergraduate degree with PBL and cohort model as the core feature implemented on UNT Frisco campus. Case study is useful for the study of individual case or cases within a current, real-life context or setting (Yin, 2014). Given the timeliness and on-going feature of the PD&A program, exploratory case study helps to identify causal relationships among factors and develop explanations for the on-going scenario (Maxwell, 2004).

Overview of the PD&A

The initial motivation when designing the PD&A degree program with PBL and cohort learning design was to provide a feasible undergraduate degree plan that addresses the three major issues faced by many current US higher education institutes: cultivating employer desired skills, lowering student drop-out rate and reducing financial burden. Hence the goals of the PD&A program are 1) to empower the students in applying the knowledge gained in classroom into real life in timely fashion, 2) be “robot proof” and job ready for their upcoming career after graduation, and 3) allow students to complete their undergraduate study with reasonable costs in three years. The new campus of UNT at Frisco, Texas was assigned as the incubator for the launching of the program. The journey of PD&A design was initiated in the

summer of 2018 with the objective of admitting the first cohort of students in the Fall semester of 2019.

The key desired outcomes for the degree program are 1) apply classroom knowledge in solving real-world problems, 2) prepare students to be job ready for their upcoming career after graduation, 3) have high-demand employable skills, 4) reduced cost of education (without lowered tuition fees), 5) better connected with faculty and staff. The method that was chosen to achieve these objectives was to create a Problem Based Learning program with a cohort learning model that allows students to graduate in 3 years from UNT, a Tier 1 public majority minority university in Texas.

Program administrators and faculty consider the journey of the PD&A program, in regard to Problem Based Cohort Learning Model, to be an educational design-based research (DBR). A key characteristic of DBR is that the educational ideas for student or teacher learning are formulated in the design, but can be adjusted during the implementation of these ideas (Baker 2014). Program administrators will continuously update and refine the framework and the course design based on the feedback received from the cohort students, partners, faculty and staff. From the experience of Cohort 1's program in the first year, changes are being made for the upcoming Cohort 2 students for Fall 2020. More degree programs are being launched based on the developing PBL framework in UNT Frisco.

The PD&A degree designed with block scheduling enables students to complete the program in three years. This lays the foundation for students to save money by paying fixed tuition and fee rates for regular semesters, and the reduced tuition fee in the summer based on the existing “save and soar” tuition plan at UNT. Cohort students can also jumpstart their career one year sooner while eliminating all expenses surrounding education which are not tuition and fees such as transportation, meals, etc.

Five pillars of PBL Cohort model

This degree program is designed with PBL and cohort model as the core element with a foundational belief in “partnership” and 4 additional pillars supporting the degree program, as shown in Figure 1 below. Successful partnerships with academic colleges, student services, industry (organizations), student organizations, support organizations, students, staff and faculty are integrated in the only way this program will be successful. The approach of this chapter is to introduce each of the elements shown in the diagram below in detail, share the lessons learned throughout the first-year journey, while discussing the changes that will be made to the program going forward.

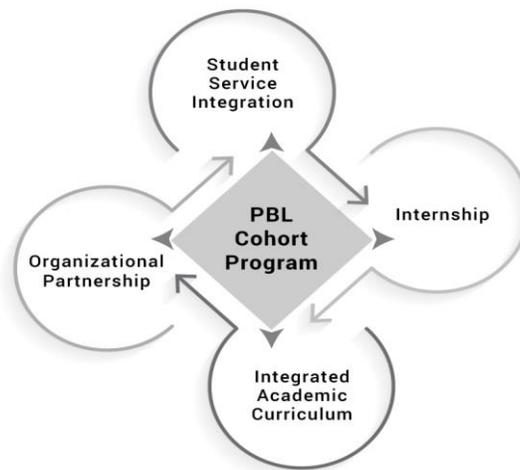


Figure 1: Problem Based Learning Cohort Model

Pillar 1 - Problem Based Learning Cohort (PBLC) model

PBLC model is illustrated in Figure 1. In order to create a culture of collaboration, the concept of cohorts was added to the PD&A program - All the students start and graduate at the same time. Miller, Hill and Miller (2019) suggest a class size of 20-30 students to be appropriate for PBL classrooms. The program hence builds cohorts of approximately 24 to 30 students to help students fully engage in collaboration with other students and allow faculty to provide sufficient attention and assistance to all.

In PD&A, a cohort of students is admitted every Fall semester, they take core and major classes taught with PBL as major pedagogy (93 credit hours), along with required applied seminars (6), elective courses (15 to 18 credit hours), and three internships (3 to 9 hours) in three years for a total of 120

hours. Students take approximately 17 credit hours for six 16-week semesters, and six credit hours for three eight-week summer semesters. The distribution of credit hours are shown in Figure 2. One of the potential disadvantages of the cohort model is that once students drop out or transfer to other institutes, it is challenging to rejoin their original cohort. The program was designed to keep the option of receiving transcripts by semester with individual grades for each class in order to allow students to transfer to or from other programs.

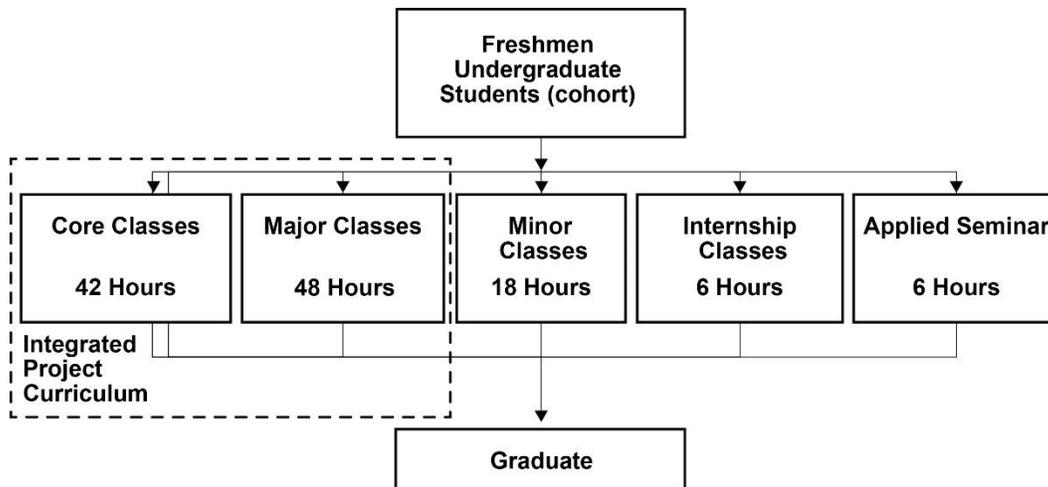


Figure 2: PD&A Credit Hours Distribution

3 year	YEAR 1		YEAR 2		YEAR 3	
	Fall 1	Spring 1	Fall 2	Spring 2	Fall 3	Spring 3
Classes	<ul style="list-style-type: none"> • Collaborative Thinking • College Writing I • US History I • General Psychology • Elective 	<ul style="list-style-type: none"> • Professional Communication • College Writing II • US History II • Probability & Statistics • Cont. Moral issues 	<ul style="list-style-type: none"> • Problem Analysis • Constitution • Context Chemistry • Macroeconomics • Design Thinking 	<ul style="list-style-type: none"> • Team Creativity • Political Behavior & Policy • Environmental Science • Trend Analysis & Forecast • Elective 	<ul style="list-style-type: none"> • Global Design • Into Race & Ethics • Jazz in US & World Hist. • Creative Design • Business Statics & SS 	<ul style="list-style-type: none"> • Thinking in Leadership • Design Anthropology • Intro to Org Design Change • Data Mining & Ops Research
Seminars	APPLIED SEMINAR	APPLIED SEMINAR	APPLIED SEMINAR	APPLIED SEMINAR	APPLIED SEMINAR	APPLIED SEMINAR
Tools	PowerPoint Excel Word	Zoom MS Teams Slack	Advanced Excel JIRA	Mini Tab	Tableau Axure	Tableau (AWS)
Certificate			MS Office	CAPM (PMI) 6 Sigma (Green)	Agile Design Thinking IAIOP	PMI
Credit Hours	17	17	17	17	17	17

Figure 3: Sample Project Design and Analysis degree program overview for 3-year period

The PBCL program marketing was formally launched in February 2019 for Cohort 1 to start classes in Fall 2019 with 23 students signed up. The program was launched with 3 Texas Core classes in History, English and Psychology plus a Project Connections class on Collaborative Thinking, an Applied Seminar, and one Elective of 3 hours. In Spring 2020, the students had 4 Texas Core Classes, Connections class on Professional Communications and an Applied Seminar.

The challenge to delivering this concept arises from the fact that the New College Frisco campus had to bring in a large number of faculty members from different academic units (colleges, departments) and student service

units (student services, recruitment, etc.) to collaborate, as the objectives, measurements and agendas of each of these units could be difficult.

Pillar 2 – Integrated Academic Curriculum

The degree was built on the framework of an existing undergraduate BS degree in Integrative Studies with three concentrations: Project, design and analysis. Project courses are designed as connection courses; the connection generated from these courses lay solid ground for partnering with industries and conducting learning in projects for students. The design and analysis courses along with the applied seminar serve as the other major classes for this degree. In the course design of the degree, eight competencies that employers want in graduate students (NACE, 2018) and the key methodologies and certifications that employers are using to train their employees were instilled in the course curriculum with methodologies and tools such as Strength Finder, SCRUM, Lean Six Sigma, Agile, PIMBOX, Social Styles, DiSC, etc., which are used by employers to improve the skills of their staff in major corporations around the globe. Additionally, by including the technological components into the instruction such as Microsoft Office, Teams, Slack, JIRA, Google Docs, mini-tab, etc. students are prepared for the digital capacity of future jobs.

A connection class in Collaborative Thinking with a focus on Six Sigma given in the first semester is taken by students with the intent to provide the competencies and skills that allow the students to work on a real partner problem from the first semester in a language that most businesses

understand. The partner problem then serves as the center of the integrated curriculum from the first semester allowing all the semester classes to revolve around the project with the exception of electives and the applied seminar as shown in the Figure 4.

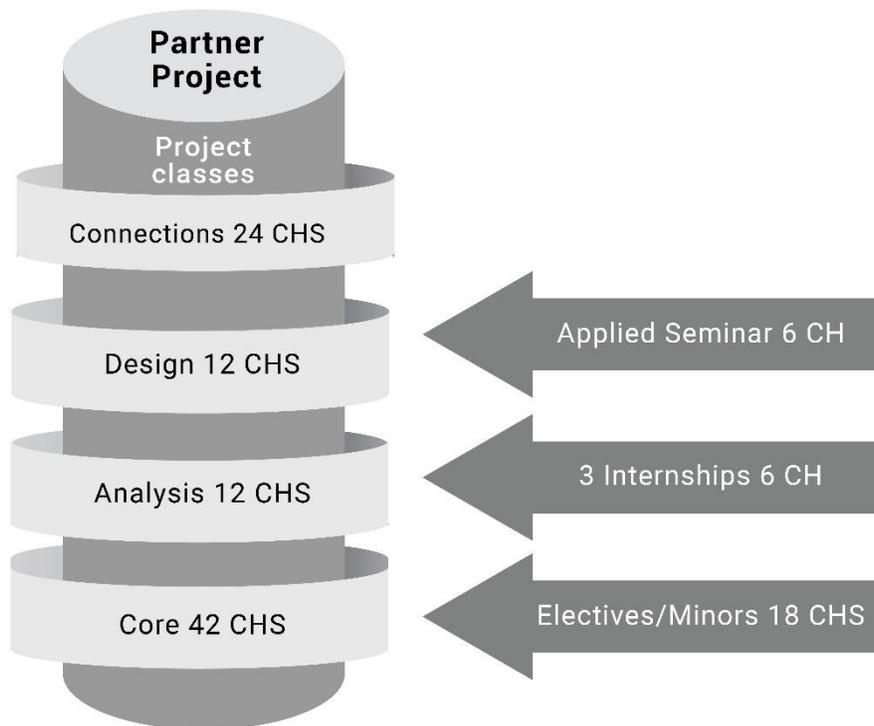


Figure 4: Major and Core classes revolve around the project

The faculty of the PD&A program work together as a team to connect individual courses in the Core Curriculum to integrate around the partner

project, as well as collaboratively developing integrative syllabus and course work. One example of the integrated curriculum from the Fall 2019 semester is when the partner project revolved around mobility, including transportation challenges and driverless cars. In the history course, student learnings from prior to 1865 included the migrations of Mayans to associate with population growth in the City of Frisco as well as the introduction of railroad as a new mode of transportation for that time along with the acceptance criteria from the people at that time. In Psychology, the discussions included what constitutes the psychological needs of people when they move, and what facets one needs to consider when selecting public transportation routes and vehicles, such as disability. In English, the assigned articles were pertaining to mobility, and most of the writing assignments were focused around mobility, smart cities, etc. All the initial reading and class assignments were revolved around using Six Sigma tools on mobility use cases until students were prepared for being in a position to transition to the class mobility project with the City of Frisco (COF).

The connection course of Fall 2019 titled “Collaborative Thinking” focused on adopting the Six Sigma methodology of the DMAIC (Define, Measure, Analyze, Improve and Control) process. Additionally, the students built a code of conduct for their team, learned the Bruce Tuckman five stages development process that most teams follow of norming, forming, storming, performing and adjourning, and learned how to run effective meetings with clear objectives, action logs and parking lot. The Six-Sigma toolbox also exposes students to tools like scope development, interviewing techniques,

process mapping, stakeholder management, data stratification, fishbone diagrams, 5 whys, Gemba boards and presenting skills. By doing so, students are expected to establish a good foundation for team building, and an understanding of appropriate tools on the partner project. All the faculty in the cohort program facilitate the students to build their skills of collaboration and communication.

Assignments given in one class can be leveraged in the other classes. For instance, in English the students learn to write good business memos that are presented to the client along with the client presentation three times in the semester. The business memo is graded in the English class, as well as the Connections class. Another example is that the students learned how to take surveys in the Psychology class, and the results of the survey were analyzed and stratified with the help of the psychology professor. Later the results were used in the connections class in designing the routes, and presented to the partner in the final presentation.

Pillar 3 – Organizational Partnership

Working with real world business partners can engage students with authentic real-world problems. The pillar named “Organizational Partnership” comes from the partnership established in this program with the Industry, Government institution or a non-profit organization. The program has identified a Time, Treasure and Talent partnering model for organizational partnership (3TPM) with expectations identified in each of the categories as shown in Figure 5 below.

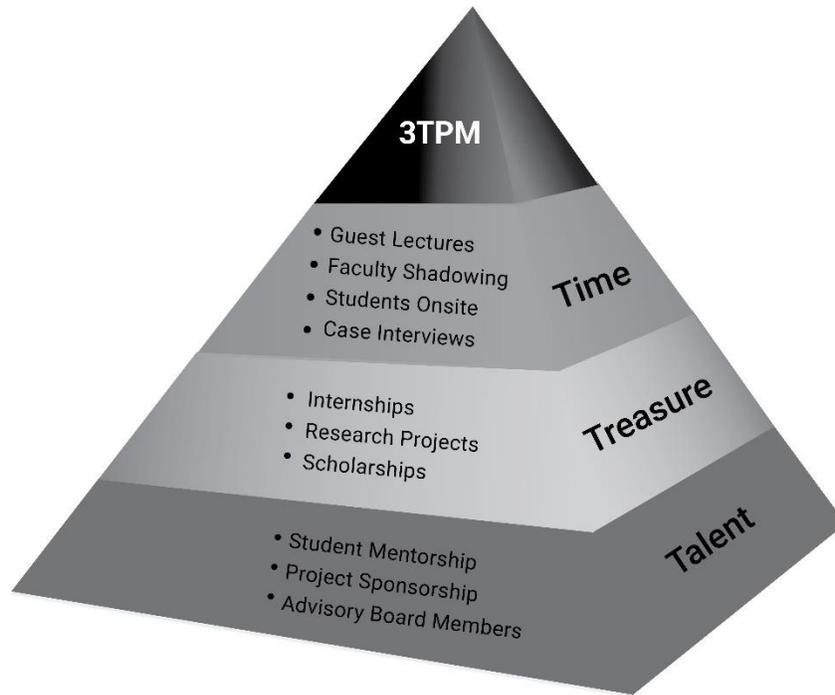


Figure 5: 3T Partnering Model (3TPM) for PBL organizational partnerships

a. Guest Lecture - Industry partners are invited to provide four 45-minute workshops as applied seminar classes each semester on campus or at the organizational partners' sites to share their experiences with what the students are learning, such as project management, six-sigma, transportation and communication. These workshops serve several purposes: it is an opportunity for the students to see how what they have learned in class can be applied in real life with real examples, it exposes students to industry personnel for potential internship opportunities, and it allows the students to learn how to network with industry professionals.

b. Project Sponsorship – Project sponsorship partners are required to commit to sharing their talent with academia to help the students learn by applying what they have learned in class with the project. In return, the partners benefit by receiving free consultation on a business challenge that they might be struggling with. The first year partner, the City of Frisco (COF) , and the second year partner, nThrive, helped us in 1) providing a real business scenario or business problem for the students to work on, 2) committing and coming into the class three times, and 3) providing access to facilities, people, data and policies for the students to acquire additional knowledge and providing deep insights on the project.

The three visits were at the beginning of the semester to provide an overview of the business scenario/problem, a second visit to review student progress, and a third visit to attend the final presentation at the end of the semester. Occasional visits were made during the semester as well.

There are five scenarios that faculty could potentially use to work with the students in the PD&A program (shown in Figure 6):

1. Fictitious Projects: Projects created for the students based on research. The project outcomes are likely to be predetermined and known to the faculty;

2. Case Study: Faculty use case studies from databases like Harvard Business Review to create projects for the students. These are sometimes used to help derive the background for the anchor project and is typically done with results already defined;

3. Case Interview: The partner company recaps an event that has happened in the past, and creates a project with the faculty by taking out the name of the company and the parties involved in the execution of the project and modifying the data, in order to create a scenario for the students to work on;

4. Business Scenario: The faculty work with companies on projects that are based on real business needs and without a predefined answer. In business scenario projects, some dependency on the client exists and student contact is not overwhelming. In this scenario, the project teams in the class are competing to conduct research on competing companies, products, performing surveys or interviews to provide different perspectives to the partner on the most ideal business scenario;

5. Business Problem: These projects revolve around industry business problems and have all the traits of the business scenario, but has medium to high dependency on the partner. In this scenario, the partner provides a large complex business problem, and students work in small teams to deliver a solution to the client. More than one of the stakeholders have to be involved in the student journey to make the project meaningful for the students as well as the recommendation meaningful for the partner. As shown in Figure 6 below, the projects students worked on with COF are categorized as P3 (Mobility project in Fall 2019) and P4 (Business Process Improvement project in Spring 2020) accordingly, which indicates that the partner involvement level in these projects are high.

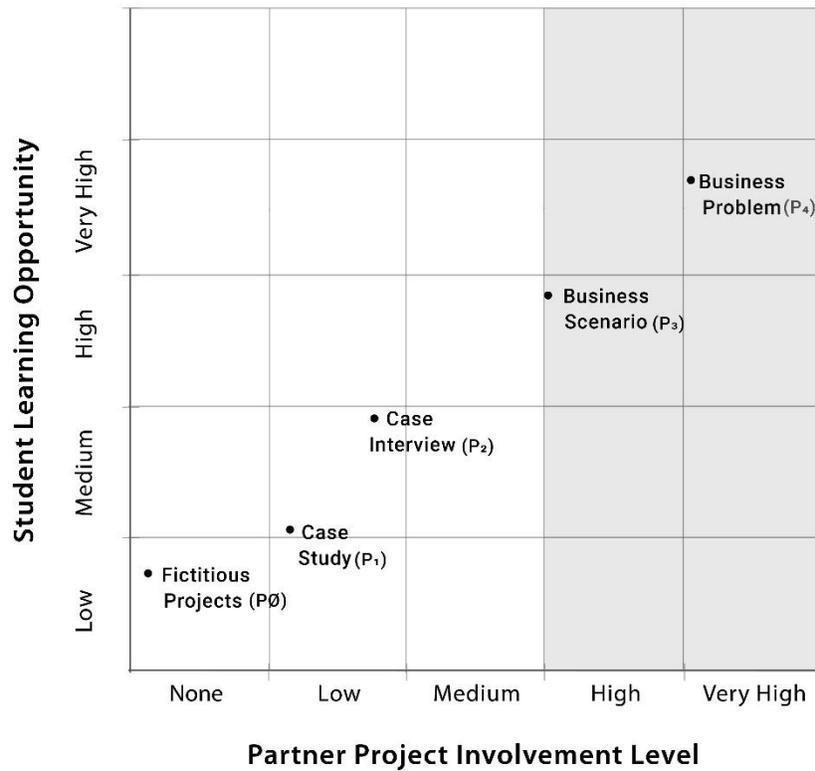


Figure 6: 5 methods of incorporating projects into PBL curriculum

c. Advisory Board – An organizational partnership advisory board is intended to be launched with representatives from Industry and non-profit organizations in Fall 2020 or Spring 2021.

d. Internships: Internships with organizational partners is so important to the success of the program that internships are considered to be one of the five pillars of the program.

Pillar 4 – Student Services Integration

The 4th Pillar, integrated student services, is intended to provide students full support for their success in PD&A program.

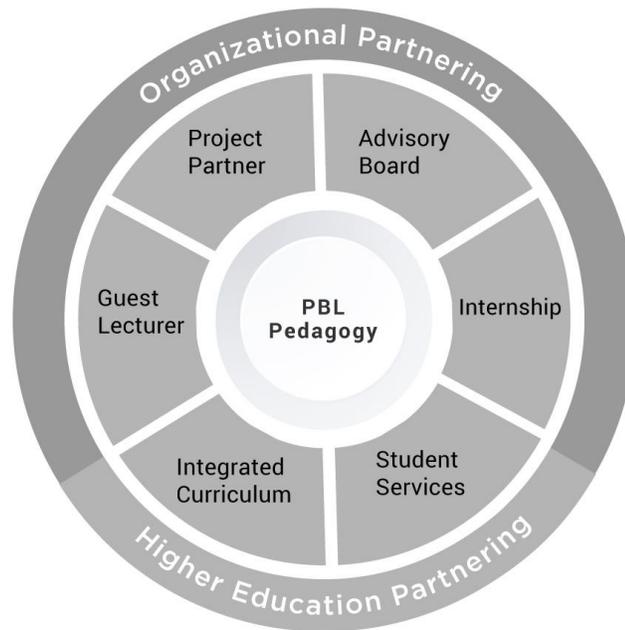


Figure 7: Organization and academic partnering opportunities in PBL

- Different from the traditional applied seminars hosted by Student Services with no grades assigned, PD&A applied seminars are designed to facilitate mutual understanding between faculty and students on the course load and assigned 1 credit hour with 3 hours

of contact time, which gives students incentive to attend the seminar. The applied seminars in the first semester guide students starting their college journey by providing them life and learning skills. The focus areas of the student services classes include: building life skills, such as coping with stress, timely delivery when the stress is high - especially after week 4, when many tests come up at the same time;

- fostering time management, personal finance and learning strategy skills.
- preparing students to be internship ready by teaching resume writing, LinkedIn profile development, etc.;
- preparing students to be job search ready by teaching interviewing techniques, dressing for success, mockup interviews, etc.

Student services and academic services work together in this program by focusing on helping students build life skills over three years and bringing professionals from the industry so the students can get firsthand feedback and be ready for their future business career. Providing opportunities for the students to start building a network of professionals for their career can equip students with a cutting-edge advantage for job market competition.

Pillar 5 - Internships

The final pillar in the model is internships. Partnering companies work with academia and student services to provide internships so the students can obtain applied experience. The partners benefit from receiving students with

great skills at a low cost while they are still in school, and full-time well-prepared talents upon graduation. Three different internships with a total 9 credit hours in three years are required before graduation for each student. The internship curriculum focuses on industry partners helping the university to provide opportunities for the students to gain experience in the 8 NACE job ready competencies as previously mentioned, as well as leveraging the learnings from the classroom and projects.

UNT's external organizational partners along with UNT's academic internal partners, such as Finance, Student Services, and other administrations of UNT, collaborated with New College to provide internships for almost all of the students in the program.

Discussions

Exploring the PBL pedagogy in cohort model is an innovation in reformation for higher education. As of now, the following experiences and lessons are learned. First, how to manage dual credit in the cohort program. The original plan was that students with dual credit would only audit the class without enrolling and paying, since the learning from the class would apply to the project. However, without incentive to get grades, the students were not motivated to be in class and maintain scholarships without full time enrollment status. The stance in the program was changed to welcome students to attend core classes without mandatory attendance requirement, even though portions of the class content would apply to the project. Administrators of the program select teams with enough representation from

all classes to fill the gap of missing skills on the project. Additionally, most of the students that came in with dual credit had taken classes in English, History or Political Science, which are mandatory core classes in Texas. In order to address this challenge, these six classes have been split over six semesters to balance the class loads for students.

The second learning was the challenge of the Connections class. The Connections class was designed to be a lab with 3CHR of credit and 6 hours of contact time. This was also the class where all faculty attend the class together. This class had created a number of challenges: 1) increased work load for faculty members - a lecturer in Core was using 50% of their load catering to a cohort of 25-30 students. 2) ineffective time use - having four to five faculty members in a class prevent them from working on their other duties; 3) keeping the students in the classroom for too many hours. To address these challenges, the curriculum committee allowed faculty to shift some course content to the lab (example 6 Sigma methodology for collaborative thinking), adjust the class from 3 CHR to 4 CHR, and match the contact time to the credit hours. Another change to be made is to have all the faculty meet for 30 minutes prior to the weekly Connections class. The implementation of this meeting could provide more flexibility to all the faculty teaching in the PD&A program who are dual appointed in two colleges and increase the efficiency in the integrated curriculum design by focusing on the themes of the projects, and entitle faculty to plan their classes around the themes with a couple of touch points instead of managing all the details of the integration. Although significant time was spent planning the integration, the team came up with a

similar course cycle with the traditional courses. The weekly 30 minutes faculty meeting can help not only increase the work efficiency for faculty, but also help students to achieve greater success.

The faculty and staff are in the process of implementing the second learning by implementing a new class integration partnering model (CIPM). In this model, each faculty participate in the decision of how much integration they will participate in for the semester based on provided project. The integrated curriculum methodology is shown below in Figure 8. The methodology has four one-time events: project overview, level of integration discussion, weekly syllabus adjustment and reflections. The methodology also has three recurring events over the semester: sixteen thirty-minute touchpoint, sixteen invites to the lab and four client presentations.

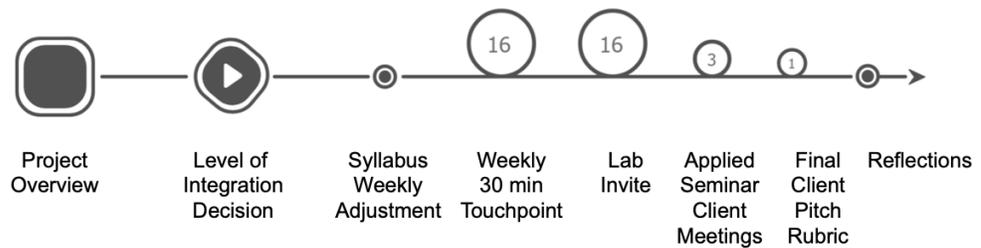


Figure 8: PBL Integrated Curriculum Methodology (ICM)

The third learning is the time limitation of executing real problem projects. In 16 weeks, students completed the design, measure, analyze, implement and controls on the project for the COF, which is too short for

executing projects. The students would have a better learning experience if these learning items are spread over two semesters. Built on the empirical evidence, the quantity of projects remained the same, but the design and continuation of the project into two semesters is one of the changes that was incorporated. Taking projects to completion with proper analysis will improve the learning experience of the students in the current and future cohorts.

The fourth learning is the requirement of re-thinking the students and faculty evaluation in the PD&A program. The PBL pedagogy differentiates the UNT at Frisco campus from all other programs at UNT main campus that follow the traditional pedagogy of teaching. At Worcester Polytechnic Institute (WPI), an experienced PBL college, there are no prerequisites and the minimum grade a student gets is a C, which would be more relevant in Frisco, yet we follow the traditional pedagogy policies from Denton. At UNT Frisco's PBL program, students work with partners on real business problems that do not have a predefined answer, which requires significantly more time and effort for the student as well as faculty. Additionally, student teams work intensively with faculty, especially for three partner presentations that happen over the course of each semester hence the grades, faculty load, sequences of classes should all be reviewed from a PBL pedagogy perspective vs the traditional pedagogy.

The last major learning is that a better model is needed to collaborate with the organizational partners. This is the first time that UNT worked with a PBL model to involve organizational partners, like nThrive, for long-term

projects, which entails a steep learning curve for both parties. UNT needs to have a more efficient model for partnering with both organizations to develop long term partnership for curriculum integration, internships and guest lecturers.

Interviews were conducted by media from UNT, Frisco and the Dallas-Fort Worth metroplex, as well as independent observers and researchers, who collected some empirical evidence from the Cohort 1 students, faculty, staff and the industrial partners. Some representative quotes from each category of contributors that provide insights from the participants of the program and reveal their experience are listed below. Some quotes from students are:

“It has just really been an awesome experience so far like I have really gotten a lot more experiences with the real world and business, I had not imagined myself doing this as I graduated from high school.”

“I am really excited to kind of experiences we get with some of the businesses around Frisco and be able to work with them more hands-on and I am really excited to be working with a closer-knit group of people.”

“Whenever I interact with my professors, any question I ever have, anytime I ever have a problem, or I need to talk to them, they are always there, super supportive.”

These quotes reflect that students appreciated the length of the program being three years, a bachelor's degree in science, equipped with a lot of real-world hands-on experience for them in a close-knit group of students, faculty, staff and industry partners. Besides, the partnership design has played an important role in students' learning experience and vividly elaborated the

essence of PBL. These quotes also reflect the close relationship among students and student-faculty, brought by the cohort model. Familiarity and friendship are the foundation of collaboration, which is one skills that employers seek in all graduates.

As for the PBL program model, here are some of the quotes from faculty:

“I really love the program, it is great to watch the interaction between students and how they work together while they are building life skills in team work, in collaborative thinking, leadership, and project management at a very young age”

“What you learned was in the service of connecting the content that you gained the knowledge and skills that you gained with real-world skills that could actually have an impact around you.”

Faculty participating in this program also clearly see the beneficial features of the program and enjoy the benefit of working closely with students and teaching with full engagement. From implementing this program, the faculty, staff and administrators are discovering new paths and possibilities of undergraduate program design in US higher education institutes. This lays the foundation for developing a transformational program and will provide opportunities for building the empirical evidence for applying PBL and cohort program as the UNT Frisco's instructional pedagogical strategy.

Further studies and Conclusion

The launch of the PD&A program is in its infancy at the UNT Frisco campus and the plan is to continue this longitudinal study with design-based research to constantly reflect on its results. Based on the objectives of the program, as mentioned in this chapter, there is a need to measure if the students are ready for jobs on day 1 by conducting a comparative study on the enhancement of soft skills and/or NACE competencies for the students in the PD&A program compared to their peer group in traditional pedagogy. More comparative studies are also needed on job placement between peer groups and the performance the students have after they start their jobs.

The development of business cases and the evaluation scale of Cost Benefit Analysis of PD&A based on cohort size of 25-30 students is also desired to see the retention levels and student partnering after graduation, in order to evaluate the impact of PBL and cohort model on the initial objectives. The scaling should include organization models, partnering models, faculty readiness, traditional faculty workload measurements, student services integrations, etc.

Development and implementation of organizational/industry partnering models for higher education to have deep relationships with the industry in the areas of Time, Treasure and Talent since two of the pillars in the PBL Cohort Model focus on organizational partnering to be successful.

There is a firm belief that when a student from a Problem Based Learning Cohort is able to experience six projects over six semesters and three

internships with partners working in a Project Based Learning environment where the role of the faculty is that of a facilitator and a network of industry professionals, they will be the movers and shakers of the 21st century.

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