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Project Based Learning Impact on Positive Affect and Negative Affect

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Project based learning (PBL) for construction education has established positive learning outcomes for students in Construction Management programs. Business management research has shown increased Positive Affect (PA) and lower Negative Affect (NA) align with positive business behaviors. The main objective of this study was to investigate whether implementation of PBL in Construction Education using a real-world capital improvement project with requirements for development of pre-construction deliverables would have an impact on student participants' Positive Affect and or Negative Affect toward the real-world Owner, Customer, and Users of the subject project. Throughout the PBL module, students engaged with project stakeholders through meetings, discussions, and correspondence to develop the capital improvement project deliverables of a project scope, schedule, estimate, and programing documents. Students completed a pre and post survey to see if their PA and or NA would be changed after the completion of the PBL module. At the conclusion of the project based learning module, the researcher found increased Positive Affect toward the owners and decreased Negative Affect toward the owners, requesters, and users.

Key Words: Project Based Learning, Positive Affect, Negative Affect, Construction Education

Introduction

The learning benefits of project based learning (PBL) for construction management courses are well documented including the development of soft skills that are often not learned from a passive learning pedagogy (Barlow 2011) . The addition of real-life PBL adds to the experience and education value of finding multiple perspectives and is a more efficient means for student learning (Von Kotze & Cooper, 2000). Teaching non-technical competencies of leadership and communication skills are shown to benefit from PBL (Walters. 2011).

Higher levels of Positive Affect (PA) in business management have been found to be a predictor for increased soft skills, better managerial ratings, performance, and decision-making ability (Staw. 1993). Task performance was found to have a larger correlation with Positive Affect (PA) and Negative Affect (NA) than the traditional considerations of the Five Factor Model (FFM) personality traits (Kaplan. 2009).

Common stakeholders that construction management graduates will interact with include project owners, project requesters, and project users. The purpose of this work is to investigate whether implementation of PBL in Project Management for Construction course could have an impact on participants PA and NA toward real-world construction stakeholders of owners, requesters, and users. If PA and NA are found to be impacted at the conclusion of the PBL module, it could provide an opportunity to influence participants in a positive direction with additional skills that would serve them well in their future professions. These professional skills for undergraduate students in engineering-based degrees are seen as a challenge to cultivate in the classroom, yet they are critically important to professional performance (Coll and Zegwaard, 2006).

Literature Review

Positive Affect / Negative Affect Definitions

Watson (1988) defines Positive Affect and Negative Affect as the following:

> Positive Affect reflects the extent to which a person feels enthusiastic, active, and alert. High PA is a state of high energy, full concentration, and pleasurable engagement, whereas low PA is characterized by sadness and lethargy.
>
> Negative Affect is a general dimension of subjective distress and unpleasurable engagement that subsumes a variety of aversive mood states, including anger, contempt, disgust, guilt, fear, and nervousness, with low NA being a state of calmness and serenity.

Watson expands that while PA and NA are in very close relation, they are not themselves seen to be exact opposites. Barsade (2007) also defines PA and NA similarly as Watson while also indicating that while PA and NA traits are seen to be associated, they are not antithetical of each other.

Positive Affect / Negative Affect Workplace Influence

Workplace behaviors and predictors of workplace behaviors have been the subject of many research endeavors. Many of these efforts have been those that focus on the FFM personality traits as potential indicators (Barrick and Mount, 1991). The FFM know commonly in Psychology as the "Big Five" include; Extraversion, Emotional Stability, Agreeableness, Conscientiousness, and Openness to Experience. However, some research has been shown to indicate PA and NA are additional traits of an employee that business could both aim to cultivate in their desired direction while also seeking hiring practices that would look to identify these attributes in job candidates. Kaplan found in their 2009 research that not only did PA and NA have an impact, but also that PA and NA were related but different from the FFM personality traits of neuroticism, extraversion, openness, agreeableness, and conscientiousness. Kaplan went on to find levels of NA to be more predictive of Counter Work Behavior (CWB) than the FFM (Kaplan, 2009).

Another study investigated PA with regards to multiple desired managerial performances and found PA to be correlated to positive trends of employees' decision making, interpersonal performance, and managerial potential (Staw. 1993). Creativity has been found to be positively influenced with increased employee PA (Isen, 1999). Job behavior link with affect research interest has "surged in recent year," (Kaplan, 2009). Moreover, Kaplan's meta-analysis of over 57 primary studies investigated these links.

While research has been completed on PA and NA outcomes in the workplace, this research expands on previous findings. This research explored if a course of Project Management for Construction could possibly serve as a means for positively influencing students' PA and NA.

Project Based Learning

Project based learning in construction education has a long history of application. Examples include course labs, service projects, and or group projects. Construction Management courses that include PBL can have a positive outcome on construction student's leadership and communications skills that will be used in their future careers (Walters, 2011). The professional competencies needed for technical careers like Construction Management are proposed to be best achieved with the use of authentic experiences relevant to their discipline of study (Coll & Zegwaard, 2006). The strong potential benefits of PBL in teaching Construction Management were evident enough for the Building Construction Management department of Purdue University's Polytechnic Institute in 2014 to commence on a full retreat looking to see if they could transition their full curriculum to PBL learning ladders (Benhart, 2017).

A hands-on project experience (PBL) prior to graduation was found to be a critical element of learning (Ahmed, 2014). Furthermore, Ahmed, Yaris, Farooqui, and Saqib went on to identify through industry research that listening ability and developing client relations are among the most important skills and attributes for Construction Management students to learn. They go on to conclude that curriculum integrated with project based learning has potential to develop the needed skills for Construction Management students (Ahmed, 2014).

Multiple research endeavors have evaluated different aspects and outcomes of PBL in teaching construction management. Sirotiak found PBL can increase soft skills like communication, problem solving, and improved teamwork for students in construction engineering / management education (Sirotiak, 2009). Sirotiak saw the potential for further research to be conducted into what additional factors beyond this are affected and by PBL. This research builds on the recommendation of Sirotiak and seeks to expand on former findings of impacted factors by exploring potential changes in PA and NA as a result of working on real world PBL in construction management.

Method

This study utilized a pre and post survey experimental design wherein participants were undergraduate students from the Fall 2022 semester of the Construction Project Management course at California State University, Chico. This university's Construction Project Management course had traditionally not included PBL pedagogy. As part of this study, the course was re-constructed around the inclusion of a real-world PBL module that ran throughout the semester. Students were required to interact with real project stakeholders for a capital improvement project on their campus including the owner, requester, and users. They were challenged to consider empathy as part of their interactions with stakeholders in an effort to gain their perspective. Student groups' final deliverables were pre-construction documents of a scope, schedule, budget, and programming documents with the goal of meeting the project requirements and expectations set by the requester, staying within constraints from the owner, and meeting the current and future needs of the users.

Multiple components were introduced as part of the PBL module strategy to potentially impact the PA/NA of students. Students had assigned readings and open group discussion of *The Field Guide to*

Human-Centered Design by Ideo.org (IDEO, 2015). Readings and discussions focused on the interview chapter concerning strategies to gain insight from stakeholders' perspective and to increase potential for capturing the stakeholders' desired outcomes. Students were also assigned and held open discussion on the interviewing article of "How to Conduct a Great Interview" from Culture of Entrepreneurship Mindset and Undergraduate Research – CEMUR an NSF funded program at California State University, Chico with resources on program and project management. The Principal Architect/ Studio Director from LPA Design Studios of Sacramento joined the class in leading students through a workshop on running a successful construction project programming meeting.

The PBL module included student requirements to schedule, coordinate, and meet multiple times with the stakeholders of owner, requester, and users. Students conducted programming meetings which focused on capturing the goal outcomes of the project request while also navigating at times conflicting scope requests from the stakeholders. An iterative process was employed of gathering information, presenting information, and gathering feedback to define, refine, and confirm the scope, schedule, and budget of the project. Throughout these interactions with stakeholders the students gained coaching from instructor prior but students functioned independently for all communications, meetings, and presentations with stakeholders. The PBL component concluded with students developing the capital improvement project deliverables of a project scope, schedule, estimate, and programing documents.

Students were informed on the first day of class they would have the option to participate in the study. Additionally, it was explained to students that participation in the surveys, both pre and post, were completely voluntary and that they had the option to decline involvement in the surveys with no impact to their grade or instruction they would receive. The course was a 300 level course, that by the nature of pre-requisites, those participating were representative of students with a Junior (third-year) student standing.

The survey utilized Watson's proven scale for measuring positive and negative affect with ten items each for a total of twenty items from the developed scale of the Positive and Negative Affect Schedule (Watson,1988). Watson's seminal article in 1988 on PANAS Scales used for this research has been cited over 52,300 times according to Google Scholar at this time (Google Scholar, 2023). The Survey had three main parts to it. The first part consisted of an explanation of Owners and Owner's Representatives (Owners) and the role they play on a construction project. Then students scored each of the twenty PA/NA items from Watson's PANAS Scale on a semantically differential scale of 1 (very slightly or not at all) to 5 (extremely) on how they felt toward Owners right now. The second part included an explanation of Project Requestors followed by scoring the twenty PA/NA items for feelings toward Project Requestors right now. The third part explained User Groups and Future Occupants (Users) role and was followed by scoring the same twenty PA/NA items for feelings toward Users right now.

At the conclusion of the PBL module students completed the post survey. The post survey replicated the questions and structure of the pre-survey. Once again student subjects were asked about their feelings right now toward each of the stakeholders of owner, requester, and then user. Watson's proven scale of Positive and Negative Affect Schedule was again used.

While there were 30 students in the course only 28 completed the pre-survey. Of the 28 that completed the pre-survey only 24 completed the post-survey. The data set that was analyzed was limited to those students that completed both the pre and post surveys. All surveys, pre and post, were not reviewed by the instructor for this research until after the semester course grades had been

officially submitted. The data set was then aligned to each respondent's number to track changes not only for the course as an aggregate but also for the analysis of the individual.

Results

Using analysis of a Paired Samples T-test across all six experimental conditions for evaluating respondents' changes, tests yielded one statistically significant result and multiple results with directional support of change. See Table 1. Findings are seen to have directional support as a result of the limited sample size as this represents exploratory study with one class and is limited to 24 complete respondents who completed both pre and post surveys. Changes were calculated in each of the six conditions as Post – Pre with a positive number for PA indicating an increase in PA and a negative number for NA indicating a decrease in NA.

Change in Positive Affect feelings towards owners was found to have a statistically significant result ($p=0.017$). This change was the largest and indicated to have the most impact after having completed the PBL. Other changes in PA were seen in the data with feelings toward the requester (MD = 0.542), however these values did not yield statistical significance. Interestingly, the PA felt toward Users had no change as the full class mean difference of pre to post had the same total average of PA (MD=0.00).

In all three experimental conditions of Owner, Requester, and User there was a Negative Affect decrease for the mean difference from pre to post values (MD= -1.958; MD= -1.917, MD = -1.000 respectively) . These results indicate a decrease in feelings of negative affect toward the three stakeholder groups after having completed the PBL. The change of NA toward Owner represented the largest NA change with Requester in a close 2nd and the smallest change seen with the User.

Table 1

PA and NA Pre to Post; Paired Samples t-Test (Complete Respondents)

Positive Affect (PA) Pair	**Mean Difference (MD)***	**SD**	**T-Value**	**P-Value**
Owner_Post_PA – Owner_Pre_PA	4.00	7.63	2.567	0.017
Requester_Post_PA – Requester_Pre_PA	0.54	7.88	0.337	0.740
User_Post_PA – User_Pre_PA	0.00	10.90	0.000	1.000
Negative Affect (NA) Pair	**Mean Difference (MD)***	**SD**	**T-Value**	**P-Value**
Owner_Post_NA – Owner_Pre_NA	-1.96	6.60	-1.453	0.160
Requester_Post_NA – Requester_Pre_NA	-1.92	7.62	-1.233	0.230
User_Post_NA – User_Pre_NA	-1.00	8.64	-0.567	0.576

*(10) 1-point semantic differential ratings

Discussion

The purpose of this study was to determine if implementation of Project based Learning using a real-world capital improvement project in a Project Management for Construction course would change students' PA and NA toward project stakeholders of owners, requesters, and users. Notable changes were seen in PA toward Owner and NA changes across all three stakeholder groups.

The Positive Affect change toward Owners, with students' knowledge of the Owner/ Owner's Representative as the person or person's having the responsibility to approve or reject construction change orders, there is potential that respondents experience was influenced by prior intimidation and worry. Prior experiences the students may have had of owners and change order negotiations potentially were limited to experiences with them or a project they were part of consistently negotiating on cost related items.

The collaborative programming efforts of the PBL module to develop scope, schedule, budget and programming documents had taken place through multiple meetings onsite and in the conference room. The students potentially experienced working with the owner as someone that is working toward a shared goal along with them. The shared goal and the instructor coached method of taking an empathic perspective to the stakeholder's requests, needs, and limitations was found to have potential to increase PA toward this stakeholder group. Owners/ owner representatives will likely continue to fill the role of controlling the funding transactions with a contractor, but having an increased PA may provide the perspective to work in a more positive approach in-place of counter-productive behaviors.

Interestingly the changes for Negative Affect were found across all stakeholders, the largest change being toward owners and a close second being requesters. As with the PA change, the data would suggest that working on real-world capital improvement projects can impact students' NA toward stakeholders. Students' interactions with stakeholders were no longer theoretical or based on narrative from instructors and or past project team members. The students themselves were holding the meetings, emailing, and speaking with stakeholders. The engagement from students and direct experience potentially reduced the NA students held of unformulated perceptions of owners, requesters, and users. If these trends of reduced NA were to continue, the literature would suggest that students in their future business roles could have increased positive workplace outcomes.

The PBL format for Construction Management students has been found to impact PA and NA in a direction that would suggest positive future workplace outcomes. The collaborative efforts at the beginning of a project may provide a more favorable window of opportunity for building increased PA and decreasing NA if compared to other phases. The phase of a project at which to engage PBL would be a recommended area for future study. Study of the impact on PA/ NA with regards to the point at which a construction managers start to interact with stakeholders could provided valuable insight to owners if they are seeking to grow the positive business behaviors and project outcomes that could be a result of increased Positive Affect and decreased Negative Affect.

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