

PsyCap to Promote & Assess Professional Skills for Undergraduate Engineering Students

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Abstract - The purpose of this proposed study is to determine if Psychological Capital (PsyCap), collective orientation, and learning goal-orientation can assess the impact of the development of the following ABET student outcomes: teamwork (d), ethics (f), communication (g), life-long learning (i) and awareness of contemporary issues (j), throughout an engineering student's academic career. We hypothesize that PsyCap will be positively related to both collective orientation and learning goal-orientation, and the development that occurs with collective orientation and learning goal-orientation would be predicted by development in PsyCap. This study will also address the condition of an engineering student's development, as defined by PsyCap, from freshman to senior year and if measuring PsyCap throughout an engineering student's academic program accurately assesses the impact in changes in relevant ABET student outcomes. This working paper outlines the methods and anticipated results of this study, which will be implemented in fall 2015.

Index Terms – ABET student outcomes, Assessment, PsyCap, Professional Skills Development

INTRODUCTION

In a profession at the forefront of technological developments, where the need for a particular set of skills is constantly changing, aspiring graduates of accredited engineering programs have a standard to measure up to. Set by the engineering accreditation entity, ABET, the standard requires engineering programs to ensure a student can demonstrate 11 specific abilities prior to graduation. The 11 abilities, annotated a-k, are known as Student Outcomes and are Criterion 3 of the ABET Engineering Accreditation Commission's Criteria for Accrediting Engineering Programs.

Creative methods for relating student outcome attainment have been around since the advent of the revised standard, EC2000, nearly two decades ago [1]. In the context of professional skills, the focus is on student outcomes relating to teamwork (d), ethics (f), communication (g), life-long learning (i), and awareness of contemporary issues (j). Due to the high variability in

individual achievement, the student outcomes pertaining to professional skills can be difficult to assess [2].

In our attempt to integrate professional skill development and assessment into an engineering program, this project will explore the use of Positive Psychological Capital (PsyCap) as a measure of ABET student outcomes. PsyCap is a higher-order, core construct, consisting of hope, efficacy/confidence, resilience, and optimism. This core construct is described as "one's positive appraisal of circumstances and probability for success based on motivated effort and perseverance" [3]. Although a relatively new construct, the positive impact of PsyCap on important workplace behaviors and attitudes is well established in the organizational behavior literature; some examples include work performance [4], leadership [5], creativity [6], team performance [7], and wellbeing [8]. We are utilizing PsyCap because it is well developed; is related to a number of positive workplace outcomes that appear to be related to ABET student outcomes (d), (f), (g), (i), and (j); includes significant evidence supporting its developmental nature (i.e., it can be learned); and could be implemented efficiently with faculty, advisors, and students because it requires minimal training. It is our view that using PsyCap to measure a students' academic, relational and workplace PsyCap is a step in the direction of learning how to measure and develop this extended conception of student learning beyond just ABET student outcomes.

Because of this study's exploratory nature, we cannot categorically propose a direct relationship between PsyCap and ABET student outcomes (d), (f), (g), (i), and (j). Therefore, in order to validate our claims we determined there was a need to include additional measures of the aforementioned ABET student outcomes.

Collective orientation measures one's attitude toward working with others and is empirically related to team performance [9]. This measure will be used to evaluate outcomes (d) and (g). *Learning goal-orientation* is related to learning and academic performance, which is related to a commitment to life-long learning, and job performance [10]-[11]. This measure will be used to evaluate outcome (i). Outcomes (f) and (j) will not be the focus for this paper. Measures will be identified to assess (f) and (j) in time for Phase III implementation of this project.

The purpose of this study is to determine if PsyCap can assess the impact of the development of ABET student outcomes (d), (g), and (i) throughout an engineering

student's academic career. The central research question for this project is: Does measuring PsyCap throughout an engineering student's academic program accurately assess the impact in changes in relevant ABET student outcomes? In order to effectively respond to this question, we developed the following hypotheses for each phase of the study.

I. Phase I

In order to test PsyCap in relation to the ABET outcomes the following hypotheses will be tested during Phase I of this project.

Hypothesis 1a: PsyCap will be positively related to collective orientation.

Hypothesis 1b: PsyCap will be positively related to learning-goal orientation.

II. Phase II

To test PsyCap in relation to a specific academic intervention, the following hypotheses will be tested during Phase II of this project.

Hypothesis 2a: Changes in PsyCap will be positively related to changes in collective orientation, as a result of taking the course Interpersonal Skills for Engineering Leaders.

Hypothesis 2b: Changes in PsyCap will be positively related to changes in learning-goal orientation, as a result of taking the course Interpersonal Skills for Engineering Leaders.

Hypothesis 2b: Students who take the course Interpersonal Skills for Engineering Leaders will have a higher level of positive PsyCap than students who do not complete the course.

III. Phase III

To test the longitudinal relationship of PsyCap and the development of ABET outcomes the following research questions will be addressed:

- What is the engineering student's development, as defined by PsyCap, from first-year to graduation?
- Are developmental changes in PsyCap sustainable?
- What impact did the course Interpersonal Skills for Engineering Leaders have on students PsyCap development?

METHODS

This project is part of a broader college-wide program review. The primary focus of this paper are phases I and II. Both phases will be implemented in fall 2015.

I. Phase I

The first phase of this experimental study will collect baseline data. Baseline data collection will enable us to determine convergent validity and developmental change over a course of an academic year, without a controlled intervention. At the beginning of their freshman and sophomore year, students will complete the PCQ-24 (a measure of PsyCap), 10 survey items related to learning-goal orientation, and 15 survey items related to collective orientation. Collective orientation will measure teamwork and communication, whereas learning goal orientation will measure life-long learning. The sample will consist of approximately 500 first-year engineering students who are enrolled in a freshman engineering seminar course during the fall 2015 semester and who will subsequently enroll in a sophomore engineering seminar course during the fall 2016 semester.

II. Phase II

The second phase will consist of a quasi-experimental design with a sample of students (n = 200) enrolled in two sections of the course Interpersonal Skills for Engineering Leaders during the spring 2016 semester. Students will complete the PCQ-24 and survey items related to learning-goal and collective orientation at the beginning and end of the semester (i.e., pre-post design). In order to control for random variables, a non-engineering comparison group will be selected to collect data. This phase will determine if students who completed the course will demonstrate changes in PsyCap that are positively related to collective and learning-goal orientation and to determine if students who take the course have a higher level of positive PsyCap than students who do not complete the course. It will also provide evidence for the developmental capacity of PsyCap within a classroom setting. The decision to focus on the course Interpersonal Skills for Leaders was made because the course's learning outcomes align in part with the ABET student outcomes (d), (f), (g), (i) and (j). The core learning outcomes focus on the principles and practices of positive interpersonal relationships for leadership development, effective interpersonal communication, self-awareness and awareness of others, and the building of trusting relationships as a basis for understanding and developing leadership.

III. Phase III

The third phase of the study will incorporate a longitudinal design that will track the participants throughout the course of their academic experience. Our intent is to examine the long-term impact of both PsyCap development and the well-established measures that are theoretically linked to ABET outcomes (e.g., collective orientation, learning goal-orientation). Four times throughout the student's academic career data will be collected using PCQ-24 and survey items

related to learning-goal and collective orientation. A longitudinal structural equation model will provide a representation of the development of engineering students. However, at this time the details of the data collection procedures are not yet determined. Additionally, measures for outcomes (f) and (j) will be determined before implementation of this phase.

ANTICIPATED RESULTS

After conducting a pilot study with 481 freshman engineering students, the Cronbach alpha reliabilities of the three PsyCap scales were above 0.88 (Academic PsyCap Cronbach alpha = 0.89; Relationship PsyCap Cronbach alpha = 0.90; Workplace PsyCap Cronbach alpha = 0.90), suggesting that the scales are appropriate for use with this population of students. Furthermore, based on the content of the course and prior research with a similar interpersonal skills and leadership course, we expect to see changes in both PsyCap relationship and workplace scores after students complete their first-year leadership and interpersonal skills course [14].

The domain specificity of the PsyCap scales are expected to correlate to different ABET student outcomes, and a description of the anticipated relationships is provided here. It is expected that relationship PsyCap will be related to collective orientation, in that, students with high relationship PsyCap will be more comfortable working with others (e.g. in teams) to complete work, higher collective orientation.

Based on social cognitive theory [15], when individuals have more success in a given activity, they are more likely to have confidence engaging in that activity and improve performance. Based on this theoretical framework, the same is expected for teamwork activity. When individuals have success working in teams (higher performance), they are more likely to engage in teamwork activities in the future. Prior research provides evidence that higher workplace PsyCap was reported as a significant predictor in team performance [7]; thus, a positive relationship between workplace PsyCap and collective orientation is also expected.

A meta-analytic review of goal-orientation provides strong evidence that a learning goal-orientation is related to both learning and academic performance [16]. As stated, a relationship between GPA and academic PsyCap has been reported in prior research with business students [12]. Thus, we anticipate that academic PsyCap will be positively related to learning goal-orientation.

CONCLUSION

As engineering colleges consider enhancements to the knowledge and skills developed by its future graduates, PsyCap has the potential to significantly impact engineering education ranging from first-year to graduation, and even beyond. Specific outcomes that could be impacted by

focusing on PsyCap development include increases in first-year to second-year retention, increased graduation rates, employability of graduates, and professional success of graduates. Furthermore, this work has the potential to standardize ABET outcome attainment for the development of professional skills for students. Because PsyCap also includes a model for training and development which could efficiently be included into a program so faculty, advisors, and students could all be using the same model integrating PsyCap in academic advising, introductory courses, and capstone experiences has the potential for transformative change within engineering education.

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