Board 173: Fostering Community of Practive (CoP): The Impact on Self-Efficacy and Belonging of Undergraduate Students

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FOSTERING COMMUNITY OF PRACTICE (CoP): THE IMPACT ON SELF-EFFICACY AND BELONGING OF UNDERGRADUATE STUDENTS

I. INTRODUCTION

As of July 2021, 40.4 million students have attended college and dropped out without earning a credential—referred to as the "Some College, No Credential" (SCNC) population [1]. Out of the 40.4 million SCNC population, only 2.1% re-enroll into a degree program. Student retention is recognized as remaining in a college or university program until the course of study is complete, regardless of whether they pass or not, or until the students gain a degree [2]. Students who cancel their enrollment are classified as dropouts [3]. The six most prevalent factors that contribute to a lack of retention among students include: classroom and academic environments, grades and conceptual understanding, high school preparation, interest and career goals, race and gender, and self-efficacy [4], [5], [6], [7], [8]. Self-efficacy is defined as one's "belief in their ability to produce desired results by their actions" [9]. The literature corroborates the fact that self-efficacy is generally a predictor of academic achievement and that students with lower academic performance are more likely to drop out [2], [3], [10], [11], [12]. The decision to drop out of post-secondary school is connected to long-term economic deficiencies that affect family dynamics, amplifying inequalities in future generations [13]. It will be more difficult for people to exceed their parent's education level, meaning those who dropout of college will make a decision with long-term effects [14].

People who drop out due to classroom and academic environments, grades and conceptual understanding, interest and career goals, and self-efficacy, will contribute to these generational social and economic disparities [13], [15]. Our research explores how cultivating a passionate community can combat the previously mentioned factors that decrease student retention and increase self-efficacy, which in turn mitigate the SCNC population. Studies also show that students with higher self-efficacy pursue their goals, dedicate more time and effort into tasks, and show perseverance when faced with challenging situations, all of which contribute to a better academic performance [2].

The Social Cognitive Theory (SCT) describes the influence of individual experiences, behavioral patterns, and environmental influences on one's learning and overall academic success [16], [17], [18]. Individual influences and environmental factors are a significant component to an undergraduate student's self-efficacy and sense of belongingness to their post-secondary institution. A study compared university freshmen who were not as involved in social activities to a group that was very active in extra/co-curricular programs. Students who were not as involved did not place much value on peer-to-peer relationships, performed poorer in the academic curriculum, and were more likely to consider dropping out [19]. Therefore, small social circles and a lack of peer-to-peer relationships limit an individual's source of motivation or encouragement to persist in high stress academic environments [20]. Understanding the influences of undergraduate learning through the SCT will allow us to target the factors that push students to retain their degree program. Replicating these influences to a wider audience and making them more accessible will address the growing issue of retention and its impact within the United States.

We utilized previously listed factors and Bandura's Social Cognitive Theory to delineate common barriers that may result in a lower self-efficacy and prevent a student from completing their degree. Many undergraduate students, especially from community colleges, choose to drop out for reasons such as work, family, health, or any other commitment that takes immediate priority [21], [22], [23], [24]. A study in 2017 found that developing a community of practice (CoP) encouraged individuals to collectively take action on improving their campus and working together. CoP is also shown to develop professional aptitudes—the ability to confidently and efficiently adapt to working conditions through building specialized skills [25]. CoP is defined as "a group of people who share a concern or passion for something they do and learn how to do it better as they interact regularly" [26], [27], [28], [29]. We believe that community of practice through extra-curricular or co-curricular participation will have a positive impact on belonging and self-efficacy. We define extra-curricular activities to be voluntary, non-credit educational or recreational activities done with peers [25]. Co-curricular activities are conducted alongside a curriculum and require a student's involvement outside of normal classroom hours to meet the curricular requirement [25]. Developing a CoP requires collaboration among the college domain, college community, and college activities [30], [31], [32], [33], [34], [35], [23], [36]. Therefore it increases communication and interaction among students and strengthens communication skills, self-efficacy, and sense of belonging in their community [37], [38], [39], [40], [41]. Fostering self-efficacy and a sense of belonging has also been shown to develop a student's self-sufficient learning ability in the classroom, as well as beyond that in the community and professional settings [9].

We hypothesize that increasing community of practice through participation in student extra/co-curricular activities could increase students' sense of belonging and self-efficacy, which will consequently increase retention. The goal of this research is to find a connection between participation and academic achievements. The findings from our research can be utilized to establish interventions to assist students' retention and overall academic success.

II. METHODS

A mix-method approach was used to assess the connection between student's participation and overall academic success. We conducted surveys and qualitative case study interviews that examined the impact participation has on students' self-efficacy and sense of belonging. Participants self-reported Grade Point Average (GPA) was used to correlate to student academic success [42]. The survey responses do not collect any identifiable or traceable information from the respondents to ensure that students are comfortable providing sensitive information such as their GPA. Questions from the survey and case study interview were derived from Bandura's and Wenger's social theories of self-efficacy and belongingness [16]. The survey was used to gather data on student participation and understand its correlation to self-efficacy, sense of belonging, and GPA. The case study interviews utilized the appreciative inquiry (AI) method to further analyze self-efficacy from undergraduate students and alumni.

1. Survey

Survey questions derived from Bandura's toolbox focus on self-efficacy, behavior, and observational learning. Behavioral factors include social interactions and role modeling [42]

[43]. Environmental factors include physical surroundings and available resources. The survey aims to gauge how participation in extra and/or co-curricular activities affects self-efficacy, sense of belonging, as well as academic success. We utilized a five-point Likert scale in our survey, which allows respondents to convey their level of agreement or disagreement to a series of statements [44], [45], [46], [47], [48]. The components are as follows:

a. Self-efficacy
b. Sense of Belonging
c. Participation
d. Community of Practice
e. Grade Point Average (GPA)
f. Barriers

We classify the participants as active and inactive. Participants who were classified "active students" included those who participated in extra/co-curricular activities such as tutoring, mentoring, and student organizations. Participants who are classified as "inactive students" included those who did not participate in any of the previously mentioned activities.

2. Case Study Interview

The case study interviews utilized the AI method, which is a strengths-based approach that looks at the positives rather than the negatives of a situation [49], [50]. When interviewing participants about the barriers they faced, the AI method was used in order to understand what specific factors allowed the participants to overcome adversities. This is necessary in order to initiate a "mental shift" from focusing on their weaknesses to focusing on their strengths [49]. Individual interviews include anecdotes of self-efficacy and belongingness of students over time, and their interview responses were matched with their academic success and professional aptitude. The interview followed a semi-structured format where we asked a set of core questions; however, based on a participant's response, we asked supplemental questions utilizing the AI method. This qualitative aspect of the research assesses the impact participation can have on student retention by using Yin's six phases of a case study research: plan, design, preparation, data collection, analysis and reporting [8], [51]. This process allowed us to consider the nuances of the undergraduate's experience in a CoP that were not apparent in the survey, as well as how their self-efficacy changed based on modeling and observational learning [27], [52], [53], [29], [54]. The case-study interviews assessed the potential of student involvement in cultivating a community of practice, which, in alignment to Wenger's Theory, is expected to enhance a person's sense of belonging and self-efficacy [35].

III. RESULTS

1. Demographics

Three hundred forty-nine (349) participants responded to the survey. Two hundred eighty-three (283) students are in a community college, sixty-four (64) students are in a 4-year institution, and two (2) are alumni working in the professional field. Two hundred thirty-seven (237) people (67.91%) are active participants in co/extracurricular activities, whereas one hundred twelve (112) people (32.09%) are not.

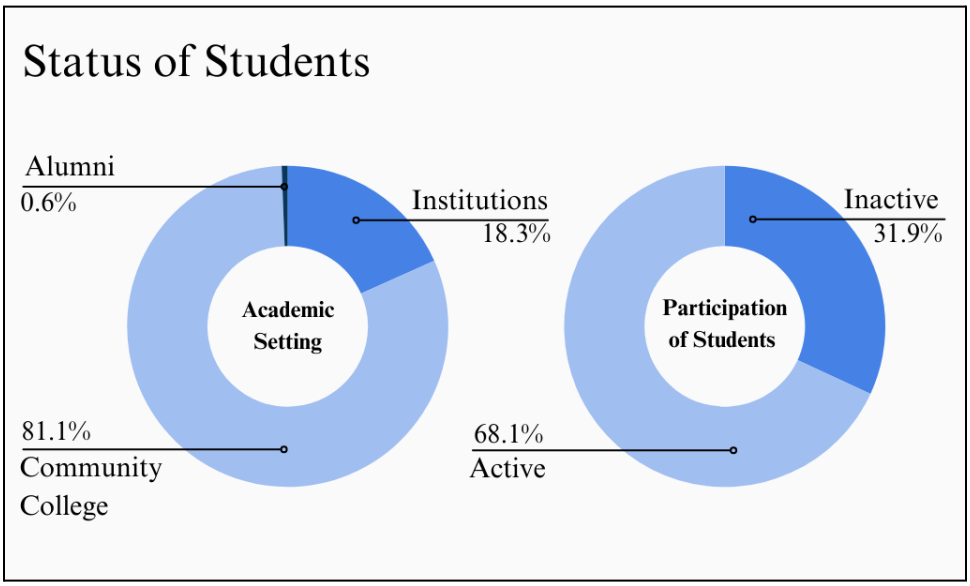

Figure 1. Depicts the main classifications of the study participants.

2. Barriers

Assessing the possibilities that deter students from participation, the survey asks about barriers between both active and inactive students. The results show the degree of barriers between both groups of students is surprisingly similar.

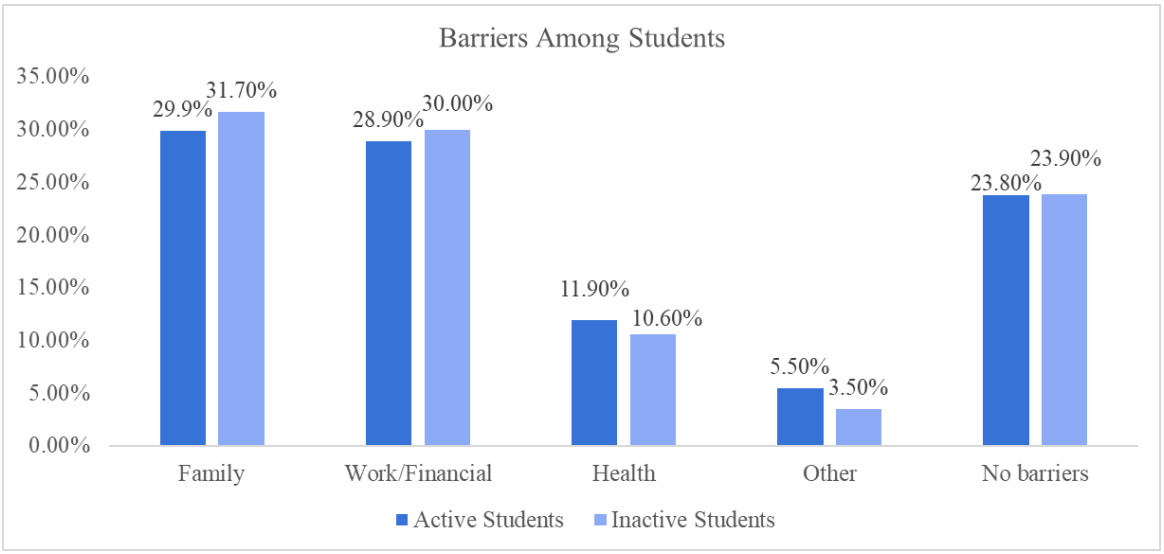

Figure 2. Compares the barriers between active and inactive students.

Figure 2 shows that students who are active and inactive experience the same barriers: Family, work/financial and health are the top barriers. From our data, students still participate while

experiencing barriers. Referencing the top barrier, “Family”, the number of active students facing this is 29.9% and the number of inactive students facing this is 31.7%. This shows that students still continue to actively participate even though they face the same barriers as those who do not.

3. Impact of Participation: Sense of belonging, self-efficacy

The survey asks if participation in extra/co-curricular activities has increased their self-efficacy and belonging to their community. Out of two hundred thirty-nine (239) active students, one hundred sixty-two (162) students (67.8%) indicated that participation in extra/co-curricular activities had a positive impact on their sense of belonging, and one hundred ninety-two (192) students (80.3%) indicated that their participation had a positive impact on their self-efficacy (**Figure 3)**. Only eighteen (18) students (7.5%) indicated that their participation had a negative impact on their sense of belonging, and eight (8) students (3.3%) expressed a similar negative impact on their self-efficacy. Fifty-nine (59) students (25%) indicated their participation did not have an impact on their sense of belonging, and thirty-nine (39) students (16%) indicated no impact on their self-efficacy. Based on this survey component, participants who are active are shown to have a high sense of self-efficacy and increased sense of belonging to their community (**Figure 3**).

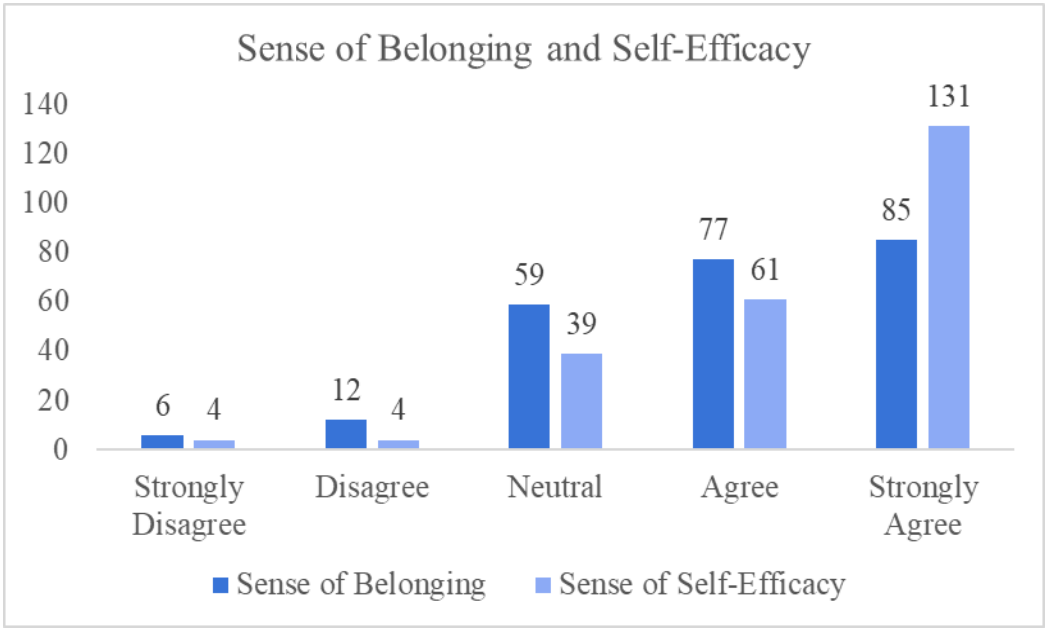

Figure 3. Summary of active participants responses to questions assessing their sense of belonging and self-efficacy as a result of participation in extra/co-curricular activities.

4. Comparing GPA

First-year college freshmen, who did not have a recorded GPA at the time of filling out the form, had their responses omitted for this part of the analysis. From a total of two hundred ninety-four (294) participants who self-reported their GPA, the sample can be broken down into participants facing barriers vs people with no barriers, as well as active students vs inactive students.

The average GPA of students facing barriers is 3.434 on a 4.0 scale. The average GPA of students who do not face barriers is 3.654 on a 4.0 scale. Both of these groups include people who are active and inactive in participation.

GPA vs Barriers

Active Students	GPA	GPA with Barriers	GPA with no Barriers
191	3.621	3.533	3.721

Inactive students	GPA	GPA with Barriers	GPA with no Barriers
103	3.355	3.345	3.441

Figure 4. Depicts GPA across active and inactive students based on the existing or non-existing barriers.

We compared the responses according to active participants and inactive . Active students facing barriers in **Figure 4.** is 3.47% higher than the average GPA of students facing barriers in general (including both active and inactive groups). The GPA of inactive students facing barriers is 2.60% lower than the average of the whole group of students facing barriers. Although students facing barriers have a lower GPA, students with barriers who actively participate perform better in academics and have a higher GPA on average.

5. Results Among Inactive Students

Figure 5. shows that out of ninety-seven (97) inactive students, seventy-one (71) reported that they would choose to participate if given the opportunity to do so**.** The ninety-seven (97) participants reasoned that the barriers they are experiencing prevent them from participation. A minority of twenty (20) students did not express interest in participating even if they did not face their current barriers, and the remaining six (6) students are unsure if they would participate.

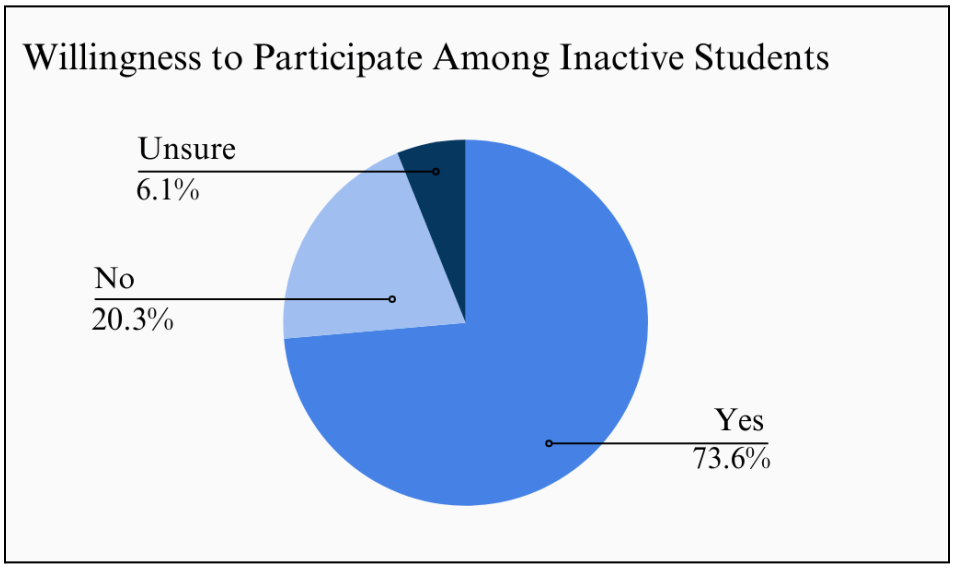

Figure 5. Depicts inactive students' willingness to participate in extra/co-curricular activities.

6. **Case Study Interviews**

We conducted a total of five (5) interviews.

All interviewees participated in **extra-curricular and co-curricular activities** such as membership or leadership in chapters of national organizations, taking part in student government, volunteering, or tutoring. All the case study participants are continuing their undergraduate degree or have graduated. Of the five (5) case study interviews, two (2) are alumni that are currently working full-time jobs in their respective professional fields.

All case study participants affirmed that their participation and involvement in extra/co-curricular activities allowed them to take part in a **community of practice**:

> "We were all motivated to become engineers and to do well in our respective fields…We want to make sure that everybody else was doing just as well as we were. (Participant #4)"

Impacts of participation

All the case study participants expressed that they experienced an **improved sense of belonging** being surrounded by a community of practice:

> “It made me feel like I belong… in this community, even though it was a really small community (Participant #3).”

> “I talked to everyone. I knew their name, even if, if I didn't know them, I would like go up to them and try to like, start a small conversation and get to know them. (Participant #5)”

All the participants feel that they have **improved their professional aptitude**. All the participants highlighted their improvement in communication, leadership, and organizational skills which are all crucial in a professional environment. Involvement in extra/co curricular activities lead to undergraduates obtaining internships in their professional field. Based on the skills Participant #1 gained by participating as an executive officer within their chapter of a National Organization and as a campus tutor, Participant #1 stated:

> “These new skills eventually brought me to the engineering automation department where I spent hours troubleshooting, and understanding automation hardware. (Participant #1)”

> “But yeah, those opportunities like tutoring and research led me to apply for internships over the summer. And I got to intern at [redacted R1 Lab institution] this past summer. (Participant #2)”

Three out of the five participants confirmed that they felt an **increase in self-efficacy**:

> “I think it also gave me a lot of confidence in myself, to be able to have that gap in my education and still be able to come in, have a community, make a difference… And being able to help other students…it really helped my self-efficacy because it helped me realize what I was capable of. (Participant #1)”

> “...And you know that sort of bonding with one another really motivates you to do well and encourage others to do well. (Participant # 4)”

Three out of the five participants accentuated their **improvement in their academics** pertaining to GPA and scholarships. Working together with a group that shared strong goals of graduating, pushed the participants to also work harder in academics to reach the same outcome:

> “I realize a lot of the students that were involved, per se in student government or research, were very academic driven. The students really cared about their academics as well as their extracurriculars, so being surrounded by other students like that. Definitely pushed me to stay on track with my academics (Participant #2).”

> “…to get this [redacted name of scholarship and amount] scholarship… it allowed us to basically go to like conventions or like if we had an internship… The scholarship funds help pay for those extra expenses… [I] went to three different conventions within a month across the US and that's how I was at [redacted name of convention] and I interviewed for [redacted Fortune 500 company] there and got the job where I'm sitting now. (Participant #4)“

All of the participants have experienced barriers during their time in undergrad including financial and familial/work as major environmental factors. Although many initially did not immerse themselves in extra/co-curricular activities due to external barriers, they reported **overcoming those obstacles** after finding a CoP. For some students, these obstacles did not disappear with a CoP, but rather, they were able to work around them to reach their goals:

> "My biggest barrier was my language. Even though I knew how to speak English…. it's just I did not have enough confidence to speak it, speaking English in front of native speakers… but after joining [redacted organization] I was obligated to talk to people which was initially a little bit difficult, but with time it just became more and more fun, and now I can easily talk to people. (Participant #3)"

> "I'm someone that struggles with a lot of anxiety… I feel like that makes it a little easier to resonate with others… You're not the only one in that… I think that helps me push forward in overcoming this fear. (Participant #2)"

The support allowed two of the participants to reduce what they referred to as **"imposter syndrome,"** an inability to recognize their capabilities and instead doubt their abilities, which is likely due to an increased sense of self-efficacy and sense of belonging.

> "Having that sense of confidence, just really, it really helped me a lot to, to feel like I wasn't an imposter. (Participant #1)"

All case study participants believed that having other people pursuing the same degree around them increased their confidence and comfort. Resources such as free tutoring and mentoring improved the participants' academic standing in school and motivated them to take on more responsibilities such as becoming the tutor and mentor themselves. Having an environment of motivated individuals pushed participants to seek opportunities in other extra/co-curricular activities where they took on internal leadership positions and external internships. Building connections through shared goals in these communities of practice increased the undergraduates' sense of belonging.

IV. DISCUSSION

The results suggest that engagement in extra/co-curricular activities through community of practice empowers students' self-efficacy and sense of belonging. As illustrated in **Figure 3** and in the case study interviews outcomes, participants who engage in these extra/co-curricular activities found that they experienced positive impacts in their lives—ranging from increased confidence, increased professional aptitude, and an increased sense of belonging in their community. It is interesting to note, participants classified as active or inactive experienced the same barriers (**Figure 2**). However, it is important to recognize barriers as a factor for a lack of participation with inactive students. For inactive participants, it is important to recognize that the barriers were factors for a lack of participation. Having this knowledge serves as an opportunity for institutions to develop intervention to increase participation. Despite sharing similar barriers, a majority of active students perform better in academics which is assessed through their self-reported GPA as depicted in **Figure 4**. In the case study interviews, we found that some

participants faced similar barriers later on in their education, but were able to overcome them when they began to integrate and involve themselves in extra/co-curricular activities.

The case-study interview participants have reaped the benefits of community of practice. Being able to connect with individuals pursuing the same goals while supporting each other through shared struggles forms a sense of shared identity among an undergraduate community. Cultivating these spaces in colleges can give students a reason to attend school beyond academics. Our research shows the influence of CoP on undergraduates' self-efficacy and sense of belonging, providing valuable insights for institutions in establishing CoP to tackle college retention challenges.

V. FUTURE WORKS

The current survey participants are all randomized. Although only a group of active participants was selected for our case study interviews, we will explore inactive students in the future. Further refining the survey questions would allow for more data on both active and inactive participants while further limiting the effects of acquiescence and dissent bias.

We will diversify our student responses as the majority of our data is collected from community college students. Future research will be done to study the reasoning as to what barriers, if any at all, differentiate the active and inactive participants. This focus arose from how we found that active and inactive students have very similar barriers. We would also explore, based on this finding, why certain students choose not to participate despite benefits for personal and professional development. It is possible that it is attributed to the “other” factors; however, results are inconclusive. Another potential inference is a lack of resources or interests at certain community colleges and universities which bring up the importance of creating these opportunities for college retention.

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VIII. REFERENCES

[1] J. Causey, A. Gardner, A. Pevitz, M. Ryu, and D. Shapiro, "Some College, No Credential Student Outcomes Annual Progress Report – Academic Year 2021/22," National Student Clearinghouse Research Center, Herndon, VA, Apr. 2023.

[2] C. A. Fior, S. A. J. Polydoro, A. M. S. Pelissoni, M. A. Dantas, M. J. Martins, and L. D. S. Almeida, "Impact of Self-Efficacy and Academic Performance in the Dropout of Higher Education Students," *Psicol. Esc. E Educ.*, vol. 26, Nov. 2022, doi: 10.1590/2175-35392022235218.

[3] A. Cervero and J. C. Núñez, "Factors that determine the persistence and dropout of university students," *Psicothema*, no. 30.4, pp. 408–414, Nov. 2018, doi: 10.7334/psicothema2018.155.

[4] M. A. Beasley and M. J. Fischer, "Why they leave: the impact of stereotype threat on the attrition of women and minorities from science, math and engineering majors," *Soc. Psychol. Educ.*, vol. 15, no. 4, pp. 427–448, Dec. 2012, doi: 10.1007/s11218-012-9185-3.

[5] S. S. Starobin and F. S. Laanan, "Broadening female participation in science, technology, engineering, and mathematics: Experiences at community colleges," *New Dir. Community Coll.*, vol. 2008, no. 142, pp. 37–46, Jun. 2008, doi: 10.1002/cc.323.

[6] L. L. Leslie, G. T. McClure, and R. L. Oaxaca, "Women and Minorities in Science and Engineering: A Life Sequence Analysis," *J. High. Educ.*, vol. 69, no. 3, pp. 239–276, May 1998, doi: 10.1080/00221546.1998.11775134.

[7] J. Thompson *et al.*, "Creating Pathways for Success and Engagement for Women in Engineering," in *2022 CoNECD (Collaborative Network for Engineering & Computing Diversity) Proceedings*, New Orleans, Louisiana: ASEE Conferences, Feb. 2022. doi: 10.18260/1-2--39111.

[8] R. K. Yin and T. Hollweck, "Case Study Research Design and Methods (5th ed.)," *Can. J. Program Eval.*, vol. 30, no. 1, pp. 108–110, Mar. 2015, doi: 10.3138/cjpe.30.1.108.

[9] A. Bandura, "Social learning theory," *Englewood Cliffs NJ Prentice Hall*, p. 247, Sep. 1977, doi: 10.1177/105960117700200317.

[10] A. A. Hayat, K. Shateri, M. Amini, and N. Shokrpour, "Relationships between academic self-efficacy, learning-related emotions, and metacognitive learning strategies with academic performance in medical students: a structural equation model," *BMC Med. Educ.*, vol. 20, no. 1, p. 76, Dec. 2020, doi: 10.1186/s12909-020-01995-9.

[11] R. Stinebrickner and T. Stinebrickner, "Academic Performance and College Dropout:

Using Longitudinal Expectations Data to Estimate a Learning Model," *J. Labor Econ.*, vol. 32, no. 3, pp. 601–644, Jul. 2014, doi: 10.1086/675308.

[12] T. C. Wagenaar and V. Tinto, "Leaving College: Rethinking the Causes and Cures of Student Attrition.," *Contemp. Sociol.*, vol. 17, no. 3, p. 414, May 1988, doi: 10.2307/2069700.

[13] R. D. Conger, K. J. Conger, and M. J. Martin, "Socioeconomic Status, Family Processes,and Individual Development," *J. Marriage Fam.*, vol. 72, no. 3, pp. 685–704, Jun. 2010, doi: 10.1111/j.1741-3737.2010.00725.x.

[14] G. P. McCarron and K. K. Inkelas, "The Gap between Educational Aspirations and Attainment for First-Generation College Students and the Role of Parental Involvement," *J. Coll. Stud. Dev.*, vol. 47, no. 5, pp. 534–549, Sep. 2006, doi: 10.1353/csd.2006.0059.

[15] J. S. Catterall, "An Intensive Group Counseling Dropout Prevention Intervention: Some Cautions on Isolating At-Risk Adolescents Within High Schools," *Am. Educ. Res. J.*, vol. 24, no. 4, pp. 521–540, Dec. 1987, doi: 10.3102/00028312024004521.

[16] A. Bandura and L. Locke, "Social Foundations of Thought and Action: A Social-Cognitive View," *Acad. Manage. Rev.*, vol. 12, no. 1, p. 169, Jan. 1987, doi: 10.2307/258004.

[17] T.-L. Griffiths, J. Dickinson, and C. J. Day, "Exploring the relationship between extracurricular activities and student self-efficacy within university," *J. Furth. High. Educ.*, vol. 45, no. 9, pp. 1294–1309, Oct. 2021, doi: 10.1080/0309877X.2021.1951687.

[18] S. Amato-Henderson, J. Mariano, P. Cattelino, and B. Hannon, "Who You Know Does Matter in Engineering Self Efficacy," in *2007 North Midwest Section Meeting Proceedings*, Houghton, MI: ASEE Conferences, Feb. 2021. doi: 10.18260/1-2-1114-36161.

[19] J. F. Mattanah, L. J. Brooks, B. L. Brand, J. L. Quimby, and J. F. Ayers, "A Social Support Intervention and Academic Achievement in College: Does Perceived Loneliness Mediate the Relationship?," *J. Coll. Couns.*, vol. 15, no. 1, pp. 22–36, Apr. 2012, doi: 10.1002/j.2161-1882.2012.00003.x.

[20] V. Dupéré, E. Dion, T. Leventhal, I. Archambault, R. Crosnoe, and M. Janosz, "High School Dropout in Proximal Context: The Triggering Role of Stressful Life Events," *Child Dev.*, vol. 89, no. 2, Mar. 2018, doi: 10.1111/cdev.12792.

[21] J. White, V. Ray, and D. Koo, "The Importance of a Thriving Student Organization for a Nonresidential College Campus," in *2014 ASEE Annual Conference & Exposition*

Proceedings, Indianapolis, Indiana: ASEE Conferences, Jun. 2014, p. 24.1224.1-24.1224.9. doi: 10.18260/1-2--23157.

[22] T. Zephirin, "Integration Outcomes and Cultural Capital in a NSBE Chapter," in *2019 CoNECD - The Collaborative Network for Engineering and Computing Diversity Proceedings*, Crystal City, Virginia: ASEE Conferences, Apr. 2019. doi: 10.18260/1-2--31734.

[23] N. Yates and B. Nagle, "Engineering Achievement: An Exploratory Case Study of Minority Engineering Organization Chapter Activities," in *2016 ASEE Annual Conference & Exposition Proceedings*, New Orleans, Louisiana: ASEE Conferences, Jun. 2016, p. 27297. doi: 10.18260/p.27297.

[24] K. Shirvani, "ASME Early Career Leadership Intern Program to Serve Engineering (ECLIPSE): A Talent Pipeline Model for Developing Early Career Mechanical Engineers into Future Leaders," in *2020 ASEE Virtual Annual Conference Content Access Proceedings*, Virtual On line: ASEE Conferences, Jun. 2020. doi: 10.18260/1-2--34168.

[25] K. R. Bartkus, B. Nemelka, M. Nemelka, and P. Gardner, "Clarifying The Meaning Of Extracurricular Activity: A Literature Review Of Definitions," *Am. J. Bus. Educ. AJBE*, vol. 5, no. 6, pp. 693–704, Oct. 2012, doi: 10.19030/ajbe.v5i6.7391.

[26] E. Wenger, *Communities of Practice: Learning, Meaning, and Identity*, 1st ed. Cambridge University Press, 1998. doi: 10.1017/CBO9780511803932.

[27] B. Díaz, C. Delgado, K. Han, and C. Lynch, "Use of Communities of Practice to Analyze and Improve Graduate Engineering Education.," in *2022 ASEE Annual Conference & Exposition Proceedings*, Minneapolis, MN: ASEE Conferences, Aug. 2022. doi: 10.18260/1-2--40996.

[28] N. Bowers, M. Jordan, K. Fisher, Z. Holman, and M. Evans, "Fostering Belonging through an Undergraduate Summer Internship: A Community of Practice Model for Engineering Research Education," in *2019 ASEE Annual Conference & Exposition Proceedings*, Tampa, Florida: ASEE Conferences, Jun. 2019. doi: 10.18260/1-2--32856.

[29] M. Epps *et al.*, "ENGAGE: Co-curricular Engagement for Transfer Students," in *2021 ASEE Virtual Annual Conference Content Access Proceedings*, Virtual Conference: ASEE Conferences, Jul. 2021. doi: 10.18260/1-2--37033.

[30] S. Gehrke and A. Kezar, "The Roles of STEM Faculty Communities of Practice in Institutional and Departmental Reform in Higher Education," *Am. Educ. Res. J.*, vol. 54, no. 5, pp. 803–833, Oct. 2017, doi: 10.3102/0002831217706736.

[31] J. Maloy, M. B. Kwapisz, and B. E. Hughes, “Factors Influencing Retention of Transgender and Gender Nonconforming Students in Undergraduate STEM Majors,” *CBE—Life Sci. Educ.*, vol. 21, no. 1, p. ar13, Mar. 2022, doi: 10.1187/cbe.21-05-0136.

[32] “Incheon declaration : education 2030 - towards inclusive and equitable quality education and lifelong learning for all,” World Bank Group, Washington, D.C., 101711, Dec. 2015. [Online]. Available: http://documents.worldbank.org/curated/en/167341467987876458/Incheon-declaration-education-2030-towards-inclusive-and-equitable-quality-education-and-lifelong-learning-for-all

[33] Y.-R. Huang and S.-M. Chang, “Academic and Cocurricular Involvement: Their Relationship and the Best Combinations for Student Growth,” *J. Coll. Stud. Dev.*, vol. 45, no. 4, pp. 391–406, Jul. 2004, doi: 10.1353/csd.2004.0049.

[34] D. Perez, J. Gibson, and R. M. Lynch, “Utilizing A Capstone Project As A Catalyst For Reengineering, Recruitment And Retention,” in *2006 Annual Conference & Exposition Proceedings*, Chicago, Illinois: ASEE Conferences, Jun. 2006. doi: 10.18260/1-2--334.

[35] Denison University *et al.*, “Leveraging the quantity and quality of co-curricular involvement experiences to promote student thriving,” *J. Campus Act. Pract. Scholarsh.*, vol. 1, no. 1, pp. 39–59, Feb. 2019, doi: 10.52499/2019006.

[36] L. Massi, P. Lancey, U. Nair, R. Straney, M. Georgiopoulos, and C. Young, “Engineering and computer science community college transfers and native freshmen students: Relationships among participation in extra-curricular and co-curricular activities, connecting to the university campus, and academic success,” in *2012 Frontiers in Education Conference Proceedings*, Seattle, WA, USA: IEEE, Oct. 2012, pp. 1–6. doi: 10.1109/FIE.2012.6462276.

[37] K. Alfano, “Board 2: A Case Study of Community College Transfer and Success in a 2+2 Program,” in *2018 ASEE Annual Conference & Exposition Proceedings*, Salt Lake City, Utah: ASEE Conferences, Jun. 2018. doi: 10.18260/1-2--29979.

[38] D. Espiritu and R. Todorovic, “Increasing Diversity and Student Success in Engineering and Computer Science through Contextualized Practices,” in *2020 ASEE Virtual Annual Conference Content Access Proceedings*, Virtual On line: ASEE Conferences, Jun. 2020, p. 34817. doi: 10.18260/1-2--34817.

[39] P. Buckley and P. Lee, “The impact of extra-curricular activity on the student experience,” *Act. Learn. High. Educ.*, vol. 22, no. 1, pp. 37–48, Mar. 2021, doi: 10.1177/1469787418808988.

[40] K. Jordan and S. Sorby, “Intervention to Improve Self-Efficacy and Sense of Belonging of First-Year Underrepresented Engineering Students,” in *2014 ASEE Annual Conference & Exposition Proceedings*, Indianapolis, Indiana: ASEE Conferences, Jun. 2014. doi: 10.18260/1-2--20695.

[41] C. Claudette, “The Benefits of Participating in Extracurricular Activities,” *BU J. Grad. Stud. Educ.*, vol. 5, no. 2, pp. 17–20, 2014.

[42] T. T. York, C. Gibson, and S. Rankin, “Defining and Measuring Academic Success”, doi: 10.7275/HZ5X-TX03.

[43] R. I. Sirko, “Methodological approaches to studying the professional aptitude of an individual,” *Eur. J. Humanit. Soc. Sci.*, pp. 48–51, Aug. 2016, doi: 10.20534/EJHSS-16-2-48-51.

[44] G. M. Sullivan and A. R. Artino, “Analyzing and Interpreting Data From Likert-Type Scales,” *J. Grad. Med. Educ.*, vol. 5, no. 4, pp. 541–542, Dec. 2013, doi: 10.4300/JGME-5-4-18.

[45] J. F. C. de Winter and D. Dodou, “Five-Point Likert Items: t test versus Mann-Whitney-Wilcoxon (Addendum added October 2012)”, doi: 10.7275/BJ1P-TS64.

[46] C. Mircioiu and J. Atkinson, “A Comparison of Parametric and Non-Parametric Methods Applied to a Likert Scale,” *Pharmacy*, vol. 5, no. 4, May 2017, doi: 10.3390/pharmacy5020026.

[47] A. Barua, “Methods for decision-making in survey questionnaires based on Likert scale,” *J. Asian Sci. Res.*, vol. 3, no. 1, pp. 35–38, Jan. 2013.

[48] C. Berry and J. Fenn, “STEM Success Stories: Strategies for Women and Minorities to Thrive, Not Just Survive, in Engineering,” in *2018 CoNECD - The Collaborative Network for Engineering and Computing Diversity Conference Proceedings*, Crystal City, Virginia: ASEE Conferences, Apr. 2018, p. 29578. doi: 10.18260/1-2--29578.

[49] J. Reed, A. Nilsson, and L. Holmberg, “Appreciative Inquiry: Research for Action,” *Handb. Res. Inf. Technol. Manag. Clin. Data Adm. Healthc.*, pp. 631–645, Jul. 2009.

[50] V. Collington and J. Fook, “Instigating change through Appreciative Inquiry: A Case Study,” *Int. J. High. Educ. Manag.*, vol. 3, no. 1, Aug. 2016.

[51] P. Baxter and S. Jack, “Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers,” *Qual. Rep.*, vol. 13, no. 4, pp. 544–559, Jan. 2008, doi: 10.46743/2160-3715/2008.1573.

[52] D. H. Schunk and F. Pajares, “The Development of Academic Self-Efficacy,” in *Development of Achievement Motivation*, Elsevier, 2002, pp. 15–31. doi: 10.1016/B978-012750053-9/50003-6.

[53] E. Usher, N. Mamaril, C. Li, D. Economy, and M. Kennedy, “Sources of Self-Efficacy in Undergraduate Engineering,” in *2015 ASEE Annual Conference and Exposition Proceedings*, Seattle, Washington: ASEE Conferences, Jun. 2015. doi: 10.18260/p.24723.

[54] M. Ostadali Makhmalbaf and D. Simmons, “Curricular and Non-Curricular Factors Impacting Development of Leadership Competencies in Undergraduate Civil Engineering and Construction Students,” in *2015 ASEE Annual Conference and Exposition Proceedings*, Seattle, Washington: ASEE Conferences, Jun. 2015. doi: 10.18260/p.23768.