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A programmatic intervention to promote entrepreneurial self-efficacy, critical behavior, and technology readiness among underrepresented college students

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ABSTRACT

Underrepresented students face challenges in accessing entrepreneurial education and careers in science, technology, engineering and mathematics. In attempts to address this deficit, a five-week social entrepreneurship program (named Poder) with a focus on technology was implemented at one of the largest community college systems in the U.S. Conceptually, the program curriculum was grounded in Social Cognitive Career Theory and Critical Consciousness, two approaches noted for helping underserved students. In order to evaluate the efficacy of the program, students from diverse backgrounds (n = 106) completed pre- and post-test measures, which included instruments assessing entrepreneurial self-efficacy, entrepreneurial skills, civic participation, critical behavior, technology optimism, and technology innovation. Results from paired samples t-tests and a series of repeated measures mixed-design ANOVAS suggest that students experienced significant increases in all outcome measures, except for civic participation, and effects were not moderated by race/ethnicity, gender, or immigration status. These results suggest that the program, designed with a culturally responsive curriculum, was effective in promoting the career development of culturally diverse and underrepresented students. We discuss conceptual and practical contributions for addressing educational attainment gaps and systemic issues in entrepreneurship and STEM education.

1. Introduction

The United States' science, technology, engineering, and math (STEM) enterprises continue to rapidly grow and evolve, as do the entrepreneurial opportunities to create ventures to meet consumer demands and apply STEM principles to solve pressing societal challenges in local communities, the country, and the world (National Science Board, 2018). Indeed, employment in STEM occupations has grown by 79% since 1990, at a faster rate than overall job growth in the U.S. (Graff, Fry, & Funk, 2018). Projections show that STEM job growth in the U.S. economy between 2014 and 2024 will range from 1.4% to 28.2%, depending on occupation group, and that 99% of these jobs require some form of postsecondary education for entry (Fayer, Lacey, & Watson, 2017). Unfortunately, a myriad of barriers continue to make higher education in STEM, as well as in its entrepreneurial applications, to be complicated and

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tenuous for underrepresented minorities (i.e., Latinx-Americans, African-Americans, Native Americans), women, immigrants, and low-income students (Burke & Mattis, 2007; Grossman & Porche, 2014; Whittaker & Montgomery, 2012). According to the National Science Board (2015), there is a wide gap between underrepresented minorities and White college degree holders in science and engineering fields (S&E), where minorities make up 14.4% of graduates while Whites are 76.2%; and women represent only 27.5% of the college-educated S&E workforce.

These gaps have serious implications for the U.S. economy and its workforce, which consists of 29% underrepresented minorities, 46.9% women, 16.9% immigrants, and 4.9% the working poor (American Immigration Council, 2017; Bureau of Labor Statistics, 2018a, 2018b). As evidenced by low representation and educational attainment gaps, these communities face difficulties entering STEM educational fields, persisting through graduation, and subsequently entering and progressing through career pathways (McFarland et al., 2018). Many of these difficulties relate to systemic inequalities and social oppression, such as facing discrimination based on race/ethnicity, gender, immigration status, class, among others (Autin, Douglass, Duffy, England, & Allan, 2017; Baran, Valcea, Porter, & Gallagher, 2018; Cadaret, Hartung, Subich, & Weigold, 2017; Hall, Nishina, & Lewis, 2017; Wilkins-Yel, Hyman, & Zounlome, 2018). Innovative interventions and scholarship efforts have been put in place to address racial and gender gaps in STEM, including in K-12 education, at universities, and at the advanced graduate preparation level (Bernstein, 2011; Bernstein, Bekki, Wilkins, & Harrison, 2016; Dawson, Bernstein, & Bekki, 2015; Scott & White, 2013). However, much is still unknown about how to intervene in order to close attainment gaps in community colleges, which enroll about one third of all postsecondary students (National Science Board, 2018).

At the same time that there has been a push to increase STEM pathways, over 3000 institutions of higher education have also increased entrepreneurial training programs and course offerings over the past several decades (Liguori, Corbin, Lackeus, & Solomon, 2019). In fact, many STEM degrees are now integrating entrepreneurial courses into their curriculum (e.g., Bilán, Kisenwether, Rzasa, & Wise, 2005; Duval-Couetil, Reed-Rhoads, & Haghighi, 2011; Duval-Couetil & Wheadon, 2013). Entrepreneurial skills compliment STEM degrees by offering students the chance to develop their abilities to work in teams, communicate effectively, solve problems, and innovate (Bilán et al., 2005). However, these programs tend to emphasize STEM skills first and foremost, and the entrepreneurial training comes later within their training. Recent research shows that when students who are not yet pursuing STEM degrees are introduced to innovative technologies they have more positive attitudes towards STEM as well as increase their self-efficacy, which may motivate them to pursue STEM pathways (Barker, Melander, Grandgenett, & Nugent, 2015; Byrne, O'Sullivan, & Sullivan, 2016). This suggests that research is needed to answer the question of whether we can motivate students interested in entrepreneurship to pursue STEM careers by introducing new technologies within entrepreneurship education.

Community colleges are a key step in STEM pathways for underrepresented groups. According to a report by the National Science Board (2018), about 47% of recent graduates of S&E degrees attended a community college, including 52% of recent bachelor's degree recipients, 36% of recent master's degree recipients, 50% of women who graduated with an S&E degree, 33% of American Indians/Native Alaskans, 57% of Blacks, 64% of Latinxs, and 43% of immigrant students who graduated with S&E degrees. It is expected that enrollment in 2-year institutions will increase to about 6.8 million students by 2026 (McFarland et al., 2018), and these colleges already enroll large populations of underserved students. For example, community colleges currently enroll very significant portions of all underrepresented minorities (56% of Latinxs, 44% of Blacks, 44% of low-income students) and 20% of community college students are immigrants or children of immigrants (Ma & Baum, 2016; Wisell & Champanier, 2010).

Nonetheless, while community colleges represent an accessible, flexible, and affordable option for students in marginalized communities, their persistence, completion, and transfer rates are notably low (Goldrick-Rab, 2010). With these challenges in mind, we created a culturally-responsive educational intervention program named Poder (Spanish for “to be able to” and “power;” Cadenas, Cantú, Spence, & Ruth, 2018), which aims to instill entrepreneurial skills in order to bridge attainment and career development gaps among underrepresented groups by focusing on key individual social-cognitive, critical consciousness, and technology readiness variables related to higher vocational development outcomes. The aim of the current investigation is to test the effectiveness of the Poder program in promoting changes across time on a set of individual-level variables related to higher academic persistence and career success.

2. Theoretical framework

To conceptualize the current study, we aimed to integrate elements of social cognitive career theory (SCCT; Lent, Brown, & Hackett, 1994; Lent & Brown, 2013) and critical consciousness theory (Freire, 1973; Watts, Diemer, & Voight, 2011). SCCT is a theory of vocational psychology that explains career interests, goals, actions, and performance in relation to domain specific self-efficacy, outcome expectations, as well as contextual and background variables. Mounting empirical evidence (Brown et al., 2008; Sheu et al., 2010) supports the applicability of SCCT to studying vocational outcomes with underrepresented groups, in many disciplines including STEM. Critical consciousness theory emerged from the work of Brazilian educator and scholar, Paulo Freire (1973), who applied this pedagogical style to engage poor communities in educational pathways. This framework is centered on addressing the role of social oppression on the education of those affected by it, and it has been applied widely in a number of fields beyond education, including vocational psychology (Diemer, Rapa, Voight, & McWhirter, 2016; Watts et al., 2011).

Our conceptual integration of these two theories is similar to Cadenas, Bernstein, and Tracey (2018) and Cadenas, Cantú, et al. (2018). We posit that in addition to developing an adaptive sense of domain-specific self-efficacy (i.e., entrepreneurial self-efficacy) and skill (i.e., technology readiness), students from marginalized communities also need to engage in critical consciousness development to address systemic oppression as they pursue educational and vocational pathways in entrepreneurial and STEM disciplines. This conceptualization allows us to link seemingly distinct variables related to academic and career success. What follows is a

description of the Poder program, what the integration of SCCT and critical consciousness looks like in practice, and how the program facilitates specific social-cognitive outcomes.

2.1. The Poder program

Poder was implemented as a three-year culturally responsive pilot program for social entrepreneurship offered as a free, five-week experience supported by grant funding from a private foundation. A large southwestern university partnered with one of the largest community college systems in the U.S, to implement Poder and provide students with more opportunities for entrepreneurial development. The program began in the spring 2016 semester at one of the Hispanic-serving community college campuses, and expanded to five community college campuses by the fall 2018. All students within the college system were eligible to apply to the program regardless of GPA, campus affiliation, and/or the stage of their venture idea.

Each community college campus set the dates, times and locations for Poder on their campus based on student enrollment trends and campus room availability. Colleges also determined whether they wanted the Poder sessions to be twice a week for 90 min or once a week for 3 h, and they selected their program facilitators, many of whom were women and/or people of color faculty at their respective campuses. All program facilitators had experience working with diverse student populations. As part of the Poder program, all facilitators received professional development training on multiculturalism and college readiness. The training was designed to give facilitators tools and techniques to encourage students to imagine solutions to problems in their own communities and lead dialogues that challenged students to consider how their social venture idea related to their intersecting identities along race/ethnicity, gender, sexual orientation, socioeconomic status, immigration status, spirituality, ability, education level, among other factors.

The program consisted of at least 30 h of education, where 15 h consisted of attending in-person facilitated trainings and 15 h involved completing self-paced online modules, customer discovery interviews, and attending meetings with a mentor. Throughout the in-person sessions, students learned about the Business Model Canvas (Osterwalder & Pigneur, 2010) to identify community issues and design ventures in response, how to collaborate with others, how to seek feedback, and how to iterate their ideas upon critical reflection. Using an introductory lesson adapted from Cisco's Networking Academy curriculum, students learned about the Internet of Things (IoT), a technology application of interconnected devices that can communicate with the Internet using sensor technology. This type of technology was presented to students as a tool to maximize their social venture's impact by being able to make processes more efficient, create services and products that are more responsive to community needs, etc. Online self-paced modules focused on critical consciousness, growth mindset, and educational/career planning. The facilitated in-person discussions referenced the online topics in the context of social entrepreneurship and the customer discovery process that students conducted in their communities to validate their ideas. At the end of the five-week Poder program, students could apply to compete in a live pitch event competition for an opportunity to win seed funding to help them start, grow and/or launch their business idea. This competition was designed to help reduce the barrier of limited funding opportunities for women and/or people of color entrepreneurs. The following are specific outcomes that we designed the program to bolster.

2.1.1. Entrepreneurial self-efficacy and entrepreneurial skills

In a recent review of two decades on research on entrepreneurial self-efficacy, Newman, Obschonka, Schwarz, Cohen, and Nielsen (2018) define this construct as “individual's beliefs in (their) abilities to perform tasks and roles aimed at entrepreneurial outcomes.” The authors of that extensive review acknowledged entrepreneurial self-efficacy's grounding in social cognitive theory (Bandura, 1989), which frames the bulk of research in this area, and they summarize the research linking entrepreneurial self-efficacy to entrepreneurial intentions, entrepreneurial emotions/mental state, entrepreneurial behavior (i.e., planning, opportunity recognition, task effort, investment, goal commitment, persistence), venture creation, and entrepreneurial performance. Aiming to promote entrepreneurial self-efficacy, the Poder program was designed with many of the same antecedents related to entrepreneurial self-efficacy identified by Newman et al. (2018), thus providing students with cultural and institutional environments of support within the program, intensive education and training on social entrepreneurship to boost entrepreneurship skills (Obschonka, Hakkarainen, Lonka, & Salmela-Aro, 2017), entrepreneurial experience through the development of a social venture project, role/models and mentors, and a learning environment where individual differences were acknowledged, appreciated, and seen as assets.

2.1.2. Critical consciousness: critical behavior and civic participation

Emergent research links critical consciousness development to higher educational, vocational, and health outcomes for individuals facing marginalization (Diemer et al., 2016). Moreover, researchers identify multiple components of critical consciousness, such as critical reflection, critical action, critical motivation, and political agency (Watts et al., 2011). Acknowledging that underrepresented minorities, women, and low-income students face unique and steep systemic challenges, we designed the Poder program with the aim of facilitating critical consciousness development. Students in the program are prompted to reflect on systemic issues impacting their communities, and facilitators lead dialogues that promote collective critical reflection about these issues, and their intersection with students' cultural identities. Students then apply what they are learning in the program to design a social venture that addresses a community issue, thus having the opportunity to move from critical reflection to critical behavior and civic participation, the latter defined as the desire to become involved in supporting the less fortunate with time and resources (Gabelnick, 1997; Weber, Weber, Sleeper, & Schneider, 2004).

2.1.3. Technology readiness: optimism and innovativeness

Technology readiness is defined as "people's propensity to embrace and use new technologies for accomplishing goals in home life and at work" by Parasuraman (2000, p. 308), who arrived at four factors underpinning this construct by conceptual, qualitative, and cross-culturally validated scale development work (Meng, Elliott, & Hall, 2009; Parasuraman, 2000; Parasuraman & Colby, 2015). These factors include technology optimism, a positive view of technology and associating it with control and agency; technology innovativeness, being a pioneer and creative thinker in relation to technology; technology discomfort, perceived lack of control over technology; and technology insecurity, distrust and skepticism about technology. We created the Poder program to specifically address technology optimism and innovativeness components of technology readiness in students in relation to one of the most far-reaching technologies of our time, the Internet. To accomplish this, students received access to introductory lessons about the Internet of Things (IOT; Gubbi, Buyya, Marusic, & Palaniswami, 2013; Lee & Lee, 2015), received scaffolding lessons on how to integrate IOT into social ventures, and had free access to more advanced IOT modules through the Cisco Networking Academy (Behrens, Collison, & DeMark, 2006; Moss & Smith, 2010; Murnane, Sharkey, & Levy, 2004).

3. The present study

The purpose of the study is to examine the effectiveness of a five-week culturally-responsive educational intervention program (i.e., Poder), on culturally underrepresented community college students. In this study, we were specifically interested in investigating the effects of the program on a set of domain-specific (i.e., entrepreneurship, technology, critical consciousness) social-cognitive variables supported by research to predict successful educational attainment and career development. Our first research hypothesis (H1) is that the program is effective overall in promoting significant increases on entrepreneurial self-efficacy, entrepreneurial skill perceptions, critical behavior, civic participation, technology optimism, and technology innovativeness. The second hypothesis (H2) contends that demographic variables (i.e., race/ethnicity, gender, immigration) do not moderate the overall effects of the program due to the culturally sensitive, student-centered, and critically conscious approach in which the program is facilitated.

4. Method

4.1. Participant and recruitment

The research sample consisted of 106 students, across five community colleges in a large Southwestern Metropolitan area who participated in the Poder program. Participants completed pretest measures at the beginning of the program and posttest measures when learning had concluded, 5-weeks later. Participants identified as White (32.1%), Latinx (31.1%), Black (19.8%), and Other (17%). Due to the low number of participants that identified as American Indian or Alaska Native, Asian and Native Hawaiian or Pacific Islander, they were included in the Other category. In addition, 75.5% were born in the U.S., while 21.7% were immigrants (i.e., students born outside of the U.S.) and 2.8% of participants did not disclose where they were born. The majority of participants identified as male (52.8%). Ages ranged from 19 to 70, with the average age being 30 and 73% of participants' age range was between 19 and 35. The majority of program participants were pursuing a 2-year Associate's degree from a community college (84.9%) and 34% of participants were working towards a certificate at a community college. Research was conducted with approval from the Institutional Review Board from the host research institution as well as from the community college system.

Participants were recruited from each of the five Poder sessions held on separate community college campuses. The research team developed a collaborative relationship with program staff in order to implement the study. To illustrate, the research team worked closely with the program coordinator to create a data collection schedule that upheld the logic of the research design while not interfering with daily program operations. Moreover, data collection plans were shared with all community college leads to ensure plans were sensitive to district system of operations. Program facilitators were then recruited into the project after they were introduced to the research study and the research team during their program training. As facilitators served as gatekeepers to our population of interest (i.e., students), the research team maintained open communication and collaboration with facilitators to foster their support of the project. All data collection plans were shared with facilitators prior to the launch of the program to ensure data collection did not impede on classroom plans and activities.

Participation in the study was voluntary. On day 1 of the program, approved members of research team were deployed to each program site to introduce and recruit participants to the study. Along with an explanation of the research project, all students were provided a paper copy of the consent letter for their records. All participants were provided an opportunity to consent before starting the pretest. Students spent up to 30 min completing the survey. Towards the close of the program, students were provided the same survey as a posttest (in class) to measure any changes once all learning had concluded. Students were provided incentives for survey participation, they were provided $5.00 cash for each survey completed (pre and post, $10.00 total).

4.2. Missing data

A total of 180 community college students participated in the study by providing responses to our survey. Using available item analysis (Parent, 2013), we excluded participants who were missing more than 25% of data on any scale, either at pretest or posttest. Available item analysis (AIA) involves creating a restrictive inclusion criteria for each variable relative to each scale in the study. Thus, 74 out of 180 participants (41%) were removed due to missing over 25% of data on any scale, with 8 participants missing over

this amount of data at pretest (4.4%), while 66 participants (36.6%) were missing large portions of data at posttest. The large amount of missing data at posttest was related to students not attending the last session of the program due to a number of reported barriers (i.e., scheduling conflicts, personal/familial responsibilities, and lack of transportation), as well as not attending this session if they were not interested in pitching their ideas for seed funding, which occurred on the last day of program. We were left with 106 matched pre/posttests from participants who completed repeated measures.

4.3. Instruments

4.3.1. Demographic survey

The program participants were asked to report demographic information that included ethnicity, gender, age, city of origin and educational attainment.

4.3.2. Entrepreneurial self-efficacy

Participant perception of their entrepreneurship abilities was assessed using a modified version of the self-efficacy scale in the Engineering Entrepreneurship Survey (Duval-Couetil et al., 2011). Ten out of the original 15-item scale were used to measure general venture abilities. The items that were excluded had a greater focus on engineering entrepreneurship abilities, while remaining items were thought to be most relevant for determining broader entrepreneurship self-efficacy. For each statement, participants rated their level of confidence on a scale from 0 (0% Not at all Confident) to 10 (100% Completely Confident). Example of items on the scale include “Write a clear and complete business plan” and “Know the steps needed to place a financial value on a new business venture”. In a previous study, Duval-Couetil et al. (2011) had an internal consistency estimate of $\alpha = 0.96$. The authors established content validity by a comprehensive literature review and evaluations by 20 experts, face validity was established by exposing students to a protocol and evaluating survey comprehension and relevance, and construct validity was evidenced by differences in results between students who had and had not been exposed to entrepreneurship education (Duval-Couetil et al., 2011). The present study showed an internal consistency estimate of $\alpha = 0.94$ (pretest) and $\alpha = 0.95$ (posttest), with a pretest scale mean of 47.63 ($SD = 24.08$, and posttest scale mean of 78.59 ($SD = 20.22$). Additionally, construct validity is evidenced in the current study by this measure's moderately strong correlation with a similar measure, entrepreneurial skill, and non-significant correlations with measures of distinctly different constructs such as civic participation and technology optimism (see Table 1).

4.3.3. Entrepreneurial skills

To measure participant perception of entrepreneurial skill, we used a 6-item scale from the Engineering Entrepreneurship Survey (Duval-Couetil et al., 2011). Items addressed six skills including communication and ability to evaluate uncertainty. Participants were asked to rate their perceived skill level on a 5-point Likert-type scale from 1 (Poor) to 5 (Excellent). In a previous study, Duval-Couetil et al. (2011) had an internal consistency estimate of $\alpha = 0.74$, and the procedure for establishing validity in that study was described in the previous section on Entrepreneurship Self-Efficacy. The present study showed an internal consistency estimate of $\alpha = 0.76$ (pretest) and $\alpha = 0.80$ (posttest), with a pretest scale mean of 20.5 ($SD = 3.9$) and posttest scale mean of 22.66 ($SD = 3.7$). A moderately strong pretest correlation with a measure of similar construct (entrepreneurial self-efficacy) and non-significant correlation with a measure of a different construct (technology innovation) provide evidence for construct validity (see Table 1) in the current study.

4.3.4. Civic participation

Participant civic attitudes and behaviors were assessed using a 6-item scale on the Civic Participation scale (Weber et al., 2004). Using a 5-point Likert scale, participants were asked to rate their agreement with the statement, ranging from 1 (Strongly Agree) to 5 (Strongly Disagree). Examples of items on the scale include “I am concerned about local community issues” and “People should find time to contribute to their communities.” In a study by Weber et al. (2004), the scale had an internal consistency estimate of $\alpha = 0.84$, and validity was established using confirmatory factor analysis that supported this set of questions tapped onto a distinct

Table 1
Variable correlations, means, standard deviations, and internal consistency across time.

	ENTSE	ENTSKILL	CIVICPART	CRITBEH	TECHOPT	TECHINN	MEAN	SD	α
ENTSE	–	0.50*	0.07	0.16	−0.17	−0.09	4.85	2.39	0.94
ENTSKILL	0.52*	–	−0.03	0.11	−0.08	−0.14	3.40	0.66	0.76
CIVICPART	0.17	0.04	–	0.33*	−0.09	0.03	4.43	0.55	0.84
CRITBETH	0.22	0.09	0.33*	–	−0.03	−0.14	2.61	0.90	0.82
TECHOPT	0.24*	0.08	0.26*	−0.06	–	−0.06	2.48	0.32	0.91
TECHINN	0.21*	0.15	0.11	0.26	0.64	–	3.18	0.33	0.80
MEAN	7.82	3.78	4.53	2.95	4.28	3.79			
SD	2.04	0.61	0.50	0.87	0.67	0.71			
α	0.95	0.79	0.87	0.85	0.91	0.81			

Note. $P < .05$* Values for pretest are presented above the diagonal; values for post-test are presented below the diagonal. Descriptive statistics for Time 1 are presented in the vertical columns, and descriptive statistics for Time 2 are presented in the horizontal rows.

construct, as well as strong correlations with two related scales (self-efficacy for service and attitudes towards helping) and near zero correlations with a divergent scale on fashion leadership. The present study showed an internal consistency estimate of α = 0.84 (pretest) and α = 0.86 (posttest), with a pretest scale mean of 26.59 (*SD* = 3.31) and posttest scale mean of 27.15 (*SD* = 3). In this study, evidence of construct validity can be established with a moderately strong pretest correlation with a measure of a related construct, critical behavior, and non-significant correlations with measures of distinct constructs such as entrepreneurial self-efficacy (see Table 1).

4.3.5. Critical behavior

Participant critical behavior was assessed using a 3-item subscale included in the Measure for Adolescent Critical Consciousness (*MACC*) measure (McWhirter & McWhirter, 2016). Using a 4-point Likert scale, participants were asked to rate their agreement with the statement, ranging from 1 (Strongly disagree) to 5 (Strongly Agree). Statements inquired about participants' involvement in activities and groups that promote equality and social justice. In the scale development study (McWhirter & McWhirter, 2016) this instrument yielded an internal consistency estimate of α = 0.61, and validity was tested across two studies using exploratory and confirmatory factor analysis, as well as by testing correlations with a measure of vocational outcome expectations, and by testing and finding no differences in scores based on language differences. The present study showed an internal consistency estimate of α = 0.82 (pretest) and α = 0.85 (posttest), with a pretest scale mean of 7.82 (*SD* = 2.71) and posttest scale mean of 8.9 (*SD* = 2.63). A moderately strong pretest correlation with a measure of a similar construct (civic participation) and non-significant correlation with a measure of a distinct construct (technology optimism) provide evidence of construct validity (see Table 1).

4.3.6. Technology optimism

Technology Optimism was measured with a 10-item scale using the Technology Readiness Index (TRI) (Parasuraman, 2000). Using a 5-point Likert scale, participants were asked to rate their agreement with the statement, ranging from 1 (Strongly disagree) to 5 (Strongly Agree). A specific item on the scale is “Technology gives people more control over their daily lives”. This instrument was developed across two studies (Parasuraman, 2000), in which the Cronbach's alpha for the final scale was α = 0.81, and validity was established using factor analysis, while content validity was derived from a qualitative study, and construct validity was tested by associations of this scale with questions about perceptions of technology. The present study showed an internal consistency estimate of α = 0.91 (pretest) and α = 0.91 (posttest), with a pretest scale mean of 24.94 (*SD* = 3.05) and posttest scale mean of 42.8 (*SD* = 6.7). In this study, negative and non-significant correlations with measures of distinctly different constructs at pretest (see Table 1) provide further evidence of construct validity.

4.3.7. Technology innovativeness

Technology innovativeness was measured with a 10-item scale using the Technology Readiness Index (TRI) (Parasuraman, 2000). Using a 5-point Likert scale, participants were asked to rate their agreement with the statement, ranging from 1 (Strongly disagree) to 5 (Strongly Agree). A specific item on the scale is “It seems your friends are learning more about the newest technologies than you are”. Prior to running analysis, we reversed coded the negatively worded items. In a study by Parasuraman (2000), the scale had an internal consistency estimate of α = 0.80, and evidence for validity was established across two factor analyses studies and a qualitative one described in the prior section on Technology Optimism. The present study showed an internal consistency estimate of α = 0.80 (pretest) and α = 0.81 (posttest), with a pretest scale mean of 25.20 (*SD* = 5.06) and posttest scale mean of 26.5 (*SD* = 5.06). In this study, non-significant correlations with measures of distinctly different constructs at pretest (see Table 1) provide further evidence of construct validity (see Table 1).

4.4. Analyses

In order to investigate our research questions, we first conducted a set of one-way ANOVAs to test for any differences on pretest measures based on race/ethnicity, gender, and immigration. The main analyses addressing H1 consisted of paired samples *t*-tests to assess the overall effects of the program pretest to posttest on the variables of interest. To protect form Type I error, we applied the Bonferroni correction ($\alpha' = \alpha/k$) when establishing significance by dividing the alpha (0.05) by the number of *t*-tests (6), for a corrected alpha of 0.008. We computed Cohen's *d* in order to assess the effect size of the program on each measure, using Borenstein's (2009) formulas for standardized mean differences pretest to posttest. To address H2, we then calculated a set of repeated measures mixed-design ANOVAs to test the moderating effect of race/ethnicity, gender, and immigration on pretest to posttest changes across variables.

5. Results

Addressing underrepresented students' challenges in accessing education and career pathways in entrepreneurship related to science, technology, engineering, and math (STEM), we conducted a study is to examine the effectiveness of a five-week culturally-responsive educational intervention program (i.e., Poder), on culturally underrepresented community college students. Correlation analyses among variables at pretest and posttest are presented in Table 1. In order to test differences on outcome variables at pretest based on race/ethnicity, gender, and immigrant origin, we conducted three one-way ANOVAS for each of the six outcome variables (entrepreneurship self-efficacy, entrepreneurship skills, civic participation, critical behavior, technology optimism, and technology innovation). Results from these analyses are displayed on Table 2, and they revealed no significant differences on any of the variables

Table 2
Variable means, time by condition interactions, *t*-test results and Cohen's D.

Variable	Time 1	Time 2	F^a			*t*-Test
	M(*SD*)	*M*(*SD*)				
	Cohen's D	Cohen's D	Time *Eth	Time *Gender	Time *Cityborn	
ENTSE	4.85 (2.39)	7.81 (2.05)	2.27	0.33	0.15	13.47**
	d = 1.32 [1.06, 1.59]*		η_p^2 = 0.07	η_p^2 = 0.004	η_p^2 = 0.002	
ENTSKILL	3.40 (0.66)	3.78 (0.61)	0.22	1.03	1.74	7.24**
	d = 0.58 [0.42, 0.76]*		η_p^2 = 0.007	η_p^2 = 0.01	η_p^2 = 0.02	
CIVICPART	4.43 (0.55)	4.53 (0.50)	0.78	0.002	0.08	2.00*
	d = 1.84 [0.001, 0.37]*		η_p^2 = 0.03	η_p^2 = 0.00	η_p^2 = 0.001	
CRITBETH	2.60 (0.91)	2.95 (0.87)	0.99	0.065	0.002	4.19**
	d = 0.40 [0.21, 0.60]*		η_p^2 = 0.03	η_p^2 = 0.001	η_p^2 = 0.00	
TECHOPT	2.48 (0.32)	4.28 (0.67)	1.23	0.06	3.21	22.45**
	d = 3.57 [2.72, 4.41]*		η_p^2 = 0.04	η_p^2 = 0.001	η_p^2 = 0.04	
TECHINN	3.18 (0.33)	3.80 (0.72)	0.61	0.55	0.035	7.51**
	d = 1.13 [−1.50, −0.75]*		η_p^2 = 0.02	η_p^2 = 0.01	η_p^2 = 0.00	

Note. $P < .05$* and $P < .008$**.

of interest at pretest. These results suggest that initial equivalence among all subgroups on all measures can be assumed at pretest.

We then proceeded to evaluate our first hypotheses about the overall effects of the program pretest to posttest. To do this, we conducted paired samples *t*-tests on all outcome measures (see Table 2). These results suggested significant changes pretest to posttest on all the six outcomes, $p < .008$, on all variables expect for civic participation. The *t*-test for civic participation was however significant at the standard alpha value before Bonferroni correction (0.05). We calculated Cohen's *d* effect sizes in order to examine the direction and size of the effects of the Poder program by following Borenstein's (2009) formulas, including pretest to posttest mean differences, standard deviation differences, and correlations. Large effect sizes were detected in entrepreneurship self-efficacy (Cohen's $d = 1.32$), in technology optimism ($d = 3.57$), and in technology innovation ($d = 1.13$). Additionally, moderate effect sizes were detected for entrepreneurship skills ($d = 0.59$) and for critical behavior ($d = 0.40$). Lastly, a small effect size was detected in civic participation ($d = 0.18$). These results, along with corresponding means and confidence intervals, are presented in Table 2. Taken together, these tests support our first hypothesis that the Poder program would produce significant increases outcome variables in the study, as these increases were detected for five of six variables using a corrected alpha.

Our second hypothesis focused on examining whether any effects of the Program would be moderated by race/ethnicity, gender, and immigrant origin. To address this hypothesis, we conducted a set of repeated measures mixed-design ANOVAs, specifying time (pretest and posttest) as the within-subjects factor, and where between-subjects factors included race/ethnicity (Latinx, White, Black, other), gender (male, female), and immigrant origin (US born, immigrant). Results are displayed in Table 2, and they suggest no significant interactions between time (pretest to posttest) and any of the grouping variables (race/ethnicity, gender, or immigration) on any of the outcome variables, $p > .05$. These results support our second hypothesis that the effects of the program are equitable across race/ethnicity, gender, and immigration origin. In sum, these sets of results suggest that there were no pretest differences on any of the variables, that there were significant increases on five out of six variables pretest to posttest using a Bonferroni corrected alpha value, that there were positive effect sizes ranging from small to large, and that these effects were not moderated by race/ethnicity, gender, or immigration.

6. Discussion

Overall, results from our analyses were encouraging and supported both of our hypotheses. Analyses on pretest to posttest changes suggest that there were associations between the Poder program and higher entrepreneurship self-efficacy, entrepreneurship skills, critical behavior, and technology readiness (i.e., optimism and innovation) among a group of community college students who were diverse in terms of racial/ethnic, gender, and immigrant makeup. This pretest to posttest change was not detected for civic participation at the Bonferroni corrected alpha value (0.008), though it was detected at the conventional alpha value (0.05). Additionally, we found that effect sizes were large for entrepreneurship self-efficacy and technology readiness measures (i.e., optimism and innovation), moderate for entrepreneurship skills and critical behavior, and small for civic participation. Finally, results from our analyses suggest that pretest to posttest effects were not moderated by cultural factors along race/ethnicity, gender, or immigrant status. These findings suggest that the Poder program is effective as a brief (i.e., 5-week duration), non-credit curriculum for underrepresented college students, who reported higher social-cognitive, critical consciousness, and technology readiness after the program. Importantly, we believe that the reason these outcomes were not moderated by cultural factors is due to Poder's design as a culturally responsive educational program, where students' cultural backgrounds were seen as assets and not deficits (Harper, 2010), where critical issues impacting students' communities were acknowledged and discussed collectively, and where students

were guided in creating social ventures that leveraged technology to stimulate positive social change.

Findings from the current study advance inquiry pertaining to social cognitive career theory (SCCT; Lent et al., 1994) and critical consciousness theory (Freire, 1973; Watts et al., 2011), and their integration for the creation and implementation of educational interventions aimed at addressing and closing educational and vocational attainment gaps (Cadenas, Cantú, et al., 2018). Our results provide evidence supporting the effectiveness of integrating SCCT and critical consciousness in applied educational programming. Our framework is a response to calls from researchers who have argued for expanding the conceptualization of entrepreneurship self-efficacy beyond social cognitive theories (Newman et al., 2018). By expanding the conceptualization of entrepreneurial social-cognitive outcomes to include critical consciousness dimensions, we believe that we are also creating room for the experiences and realities of underrepresented and marginalized individuals to enter theory and practice at institutions of higher learning.

The finding that this sample of college students, who historically have been underrepresented, reported higher entrepreneurial self-efficacy post-program is significant. This is of important given the documented predictive paths between entrepreneurial self-efficacy and entrepreneurial intentions, entrepreneurial emotions (e.g., resilience, entrepreneurial passion), entrepreneurial behavior (e.g., task effort, goal commitment, persistence), venture creation, performance, and career intention (Boyd & Vozikis, 1994; Newman et al., 2018; Tolentino, Sedoglavich, Lu, Garcia, & Restubog, 2014; Wilson, Kickul, & Marlino, 2007). This outcome was accomplished using a combination of integrative interventions: lectures, discussions, scaffolding in developing a social venture project, mentoring, online content, and student preparation for pitching their venture projects to an audience of judges and community members for potential seed funding. That students' also reported increases in perceived entrepreneurial skills is also considerable, particularly taking into account the moderate relationship between entrepreneurial skills and entrepreneurial career prospects (Schmitt-Rodermund, 2004). Empowered with higher confidence and skills in their entrepreneurial ability, students who participated in Poder may be better positioned with competencies to continue pursuing vocational pathways that include entrepreneurship in some form (Kyndt & Baert, 2015; Obschonka et al., 2017; Obschonka, Silbereisen, Schmitt-Rodermund, & Stuetzer, 2011).

The Poder program's framework also builds on the literature that highlights the need for critical consciousness development programming to leap beyond critical reflection (i.e., sophisticated analyses of systems of oppression) towards the application of this reflective analysis into critical action that directly addresses systemic issues (Watts & Hipolito-Delgado, 2015). Indeed, results from this study supported our assumption that a social venture project, resourced with social support and educational guidance, would serve as an effective vehicle for students to apply their understanding of entrepreneurship to challenging systemic issues in their communities, and that by working in this project they would experience gains in their critical action and behavior in the community. This is a finding with major theoretical implications given the emerging literature suggesting that critical action plays a role in social mobility, particularly by fostering career expectancies and the attainment of higher-status occupations (Rapa, Diemer, & Bañales, 2018). Furthermore, we believe that our research advances the line of inquiry that integrates critical pedagogy in entrepreneurial education and theory (Calas, Smircich, & Bourne, 2009; Prieto, Phipps, & Friedrich, 2012; Verduijn, Dey, Tedmanson, & Essers, 2014), by providing evidence for the ways in which critical frameworks complement and enhance entrepreneurship curriculum and education.

Lastly, underrepresented students' reporting higher technology readiness after Poder; particularly their experiences of technology optimism and innovativeness, are a noble contribution to theory. These findings suggest that the conceptual design of the program, presenting Internet of Things (IoT) technologies as a tool to maximize the social impact of students' entrepreneurial venture projects, was successful in helping students bring new meaning to the way they view and use these technologies. This is important since research suggests that technology readiness is linked to higher acceptance of technology among employees (Walczuch, Lemmink, & Streukens, 2007), that social-cognitive technology factors are related to employee's behavioral strategies and work outcomes to cope with technological changes (Raghuram, Wiesenfeld, & Garud, 2003), that communication technology flexibility is associated with higher technology use and work satisfaction (Diaz, Chiaburu, Zimmerman, & Boswell, 2012), and that innovative work behavior is related to higher organizational performance (Shanker, Bhanugopan, Van der Heijden, and Farrell (2017). Thus, we believe that the learning that occurs in Poder better prepares students to explore majors and careers in entrepreneurship and STEM fields, and also sets them up to navigate any type of employment that uses communication technology in a way that will be beneficial to their career performance.

Our findings also have implications at systemic higher education and community levels. Specifically, the outcomes promoted by the Poder program were made possible by a collaborative partnership between innovative institutions interested in creating specialized programming acknowledging students' unique realities, needs, and strengths. The community college-university-industry partnership delivered a program that would not likely be available otherwise, and that better prepares students to advance in STEM and entrepreneurship pathways. Kisker (2007) discussed how these types of partnerships involving community colleges and universities can increase transfer pathways into more advanced learning opportunities, and thus support and strengthen career pipelines into high-growth jobs. Through Poder, the entrepreneurial ecosystem on multiple community college campuses were expanded and exposed students to new opportunities within and outside of their communities.

6.1. Limitations

We believe that the quasi-experimental, repeated-measures, pretest to posttest design in our study provides many advantages to our inquiry (Bonate, 2000; Dimitrov & Rumrill, 2003; Fraenkel, Wallen, & Hyun, 2011), which allow us to establish initial evidence for the effectiveness of the Poder program. It is equally prudent to acknowledge limitations in this design, such as the inability to establish a control group and conduct a true experiment using random assignment. This lack of a control group is a major limitation

that keeps us from being able to completely control for some threats to validity, such as history and maturation, and rule out alternative hypotheses or the possibility that extraneous factors may have taken place while the program was being delivered. Establishing a control group was not feasible due to logistical and programmatic constraints, given that the program was delivered in partnership with community colleges in settings that were familiar to students, during time frames that would not disrupt the students' or colleges' regular activities, as well as students' limited availability and competing demands (e.g., jobs, family). These challenges are consistent with those documented in the literature on field research in psychology and other fields (e.g., infection control, medical informatics), which advocate for rigorous quasi-experimental design that minimizes threats to validity when randomized controls are not feasible (Eliopoulos, Harris, Lautenbach, & Perencevich, 2005; Harris et al., 2006; McKillip, 1992). Without the control group, our findings should be interpreted as initial evidence, which can be useful to future studies that may replicate our design in an environment that allows for randomized controls.

Attempting to reduce validity threats, findings from pretest measure comparisons give us confidence that there were no background variables that, to our knowledge, influenced results. Additionally, we recruited students widely, from different majors, year in college, and from five campuses where the program was delivered. That recruitment strategy allows us to rule out the possibility of students having common learning experiences outside of the program that may have impacted outcomes. A final limitation is the large amount of missing data at posttest, which reduced the final sample size of matched pretests/posttests for analysis. Certain student accessibility issues (e.g., lack of transportation) persisted beyond our control, even when we worked collaboratively with community college partners to deliver the program to match students' availability. These issues kept students from attending the last session, and should be considered in future research with this population.

6.2. Future research

Future scholarship in this area may expand our findings in a number of directions. While we established that the effects of the program were not moderated by race/ethnicity, gender, or immigration status, it would be important for future research to examine the replicability of these findings and to also test other indicators of identity and social oppression (e.g., socioeconomic status, income, employment status, sexual identity, undocumented immigration status, ability/disability, spiritual beliefs) as moderators in educational program interventions such as Poder. Future research may also use a longitudinal design that extends the pretest to posttest design we used, and follow students' months post-program to examine whether effects are lasting long-term, and whether there are contextual factors sustaining or hindering gains made in the program. Relatedly, future research may also use experimental research design to test the groups of students experiencing the Poder program in contrast to a) control groups, and b) to entrepreneurship education programs that do not place a focus on cultural-responsiveness and critical consciousness development. Lastly, researchers, educators, and industry leaders may wish to collaborate and adapt and test the Poder curriculum in other settings. The program may be adaptable to ongoing classroom instruction at community colleges, universities, K-12 schools, and as part of organizational training and professional development; researchers may wish to study the intervention effects on different groups of students experiencing varying degrees of underrepresentation, marginalization, and different needs.

6.3. Conclusions

Using a repeated measures design, we have established initial evidence for the effectiveness of a program, grounded in SCCT and critical consciousness, in promoting higher entrepreneurship self-efficacy, skill, critical behavior, and technology readiness among community college students who are underrepresented in STEM entrepreneurship fields. The implementation of the program, delivered in a culturally-responsive manner, for a brief duration, within a community college-university-industry partnership, seemed to be effective in promoting outcomes that did not vary based on race/ethnicity, gender, or immigration background of this low-income sample of students. These findings may further illuminate ways of integrating interdisciplinary frameworks, pedagogical approaches, and leadership practices to widely implement and test interventions that have the potential of narrowing gaps in STEM entrepreneurship pathways, and better prepare communities for present and future work opportunities.

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