Building Inclusive Student Innovation Competitions, Exhibitions, and Training Programs

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Abstract

There has been an emerging trend of expanding entrepreneurship educational programs/events to broader student populations. Similarly, the focus of this paper is broadening participation in student innovation competitions, exhibitions, and training programs. Therefore, through student surveys, factors and barriers affecting student participation in these co-curricular programs were explored, with a particular interest being students who are underrepresented in entrepreneurship. The survey items were crafted based on the known scales and theories in the literature, such as the Expectancy-Value-Cost Scale and Self-Determination Theory. The findings revealed that the time commitment and lack of awareness were significant barriers to participation in these activities. To make student innovation competitions, exhibitions, and training programs more accessible and relatable to all students, higher education institutions should consider reframing these events and developing them, requiring less time commitment. The Expectancy-Value-Cost-based framework used in this study is also promising to study students' engagement with entrepreneurship and innovation-focused co-curricular activities.

Keywords: innovation competitions, exhibitions and training programs, participation, factors, expectancy-value-cost.

1. Introduction

In the last three decades, entrepreneurial education has rapidly expanded, first in the USA and later worldwide. By 1986, 253 universities offered entrepreneurship classes (Vesper, 1993). By early 2000, the number grew to more than 1,600 schools and colleges (Katz, 2003). Entrepreneurship education is available in over 5,000 schools and colleges through about 5,500 courses (Foundation, 2019). This rapid expansion has been encouraged by governments at various levels, non-profit foundations, and private entities because of the well-established relationship between entrepreneurial activities and economic development. As entrepreneurship education provides skills and experience to turn knowledge and research into practice, higher education institutions have embraced entrepreneurship as a catalyst in achieving their mission of advancing the well-being of society through transdisciplinary knowledge generation. Many colleges established entrepreneurship centers and special programs to facilitate this process.

With these unique aspects, entrepreneurship programs have always emphasized experiential learning from the beginning (Pittaway & Cope, 2007) and taken an ecosystem approach to education. Student innovation competitions and programs are essential to entrepreneurship ecosystems (Liu et al., 2021a). Historically, student competitions have been prevalent in engineering and business programs. Today, student competitions target all academic programs with increased attention to entrepreneurship and innovation. With this increased attention to entrepreneurship and innovation, higher education institutions have expanded their offerings of co-curricular, non-credit programs to recruit and support student innovators. These competition-like programs include start-up incubator competitions, social entrepreneurship challenges, design challenges, boot camps, customer discovery labs, and accelerator programs. Therefore, such innovation competitions, exhibitions, and training programs (ICETs) increasingly play roles in educating the next generation of innovators and critical thinkers. Students participating in ICETs can expand their experience and knowledge, improve employability, and gain access to recruiters (Damnjanovic & Mijatovic, 2017; Senior & Holt, 2014).

With the briefly summarized trends of expanding ICETs to broader student populations, the main research questions in this paper are (*i*) what factors are associated with students' participation in ICETs and (*ii*) what barriers students face to ICET participation. In particular, we aimed to answer these questions for underrepresented students in entrepreneurship. Currently, a very small percentage of underrepresented students take advantage of entrepreneurship programs (Bryant et al., 2012; Htun, 2019; Wilson et al., 2007). As the center of gravity in higher education moves outside the classroom and employers look for more diverse and distinctive activities on students' resumes, this low participation of underrepresented groups may put them in a disadvantaged position in their career development. Although the number of minority entrepreneurs has increased in the last decade, there is still a disparity in involvement with entrepreneurship activities and opportunities for minority students (Singh & Crump, 2007). While the literature has identified the benefits of ICETs for students' academic, professional, and entrepreneurial development (Gadola & Chindamo, 2019; Kulkarni, 2019; Lindbloom, 2019; Walden et al., 2015), hardly any work has addressed barriers to underrepresented students' participation in such programs. Therefore, there is a need for a systematic investigation of (*i*) the factors that attract students to participate in ICETs and (*ii*) the barriers that underrepresented students face. To answer these two questions, we performed an exploratory empirical study based on the Expectancy-Value-Cost (EVC) model of student motivation (Kosovich et al., 2014) and Relatedness (Ryan & Deci, 2017). To the best of our knowledge, this paper is the first study analyzing students' motivations for and barriers to participating in ICETs based on empirical data. The paper's findings can be used to design interventions to increase participation in ICETs and make them more diverse and inclusive.

2. Background

More and more universities are adding entrepreneurship centers to their entrepreneurship ecosystems and organizing competition-like programs to attract students working on innovative projects and cultivate an entrepreneurial culture with the anticipation that these student projects will turn into start-ups. These programs vary from idea competitions, where students only pitch their ideas, to summer start-up boot camps, where students receive extensive training and mentoring. Most of the papers published on ICETs focus on introducing these programs and summarizing student projects (e.g., (Brentnall et al., 2018; Govern & Marsch, 2001; Htun, 2019; Richard et al., 2015; Wankat, 2005)). These studies are very macro, using experience introduction or narrative, and the conclusion is that ICETs positively affect participants. The educational benefits of ICETs can be summarized as follows: experiencing teamwork, peer interactions, and leadership (Bigelow et al., 2013); gaining self-efficacy and enthusiasm; working on real-world applications; accessing informal mentorship; and connecting with employers (Adorjan & Matturro, 2017; Buchal, 2004; Schuster et al., 2006; Sirianni et al., 2003); engaging students in further design activities that go beyond the curriculum; building entrepreneurial mindsets; providing practices for critical thinking skills; fostering innovation and creativity; providing valuable experience that lasts long; improving students' resumes and employability (Damnjanovic & Mijatovic, 2017; Shah et al., 2015; Sirianni et al., 2003).

Meanwhile, a few papers also noted the negative psychological costs of student competitions based on anecdotal evidence such as a feeling of frustration, anxiety, or inferiority by low-performing students/teams (Cheng et al., 2009); focusing too much on winning instead of learning (Schuster et al., 2006) and social responsibility (Labossière & Bisby, 2009), excessive time spent (Wankat, 2005). A few studies (Brentnall et al., 2018; Walden et al., 2015) reported that participation in competition teams did not always transfer to learning, and some students failed to gain critical professional skills. Cultural and social barriers to participation may prevent students from gaining essential skills. According to Wankat's findings (Wankat, 2005), institutional support and competition legacy are important factors affecting the outcomes of participating student teams. Although several authors indicate difficulties in supporting diversity in ICETs (Htun, 2019; Richard et al., 2015; Taylor & Clarke, 2018; Walden et al., 2015; Walden et al., 2016), the literature has still insufficiently explored strategies for increasing participation and diversity in ICETs.

Grounded in the Expectancy-Value (EV) theory of motivation (Atkinson, 1957), various Expectancy-Value models have been used to study students' academic choices and behaviors (Eccles & Wigfield, 1995). The EV theory posits that students' decisions regarding taking on a task are directly influenced by their relative expectancies of succeeding in the task and the subjective value of the task with respect to other options. According to (Eccles et al., 1983), a student must answer positively to two questions: "Can I do the task?" and "Do I want to do the task?" to take on a task. The first question reflects a belief in having an expectancy to achieve the task, and the second one captures having a value in performing the activity. Expectancy and value are subjective beliefs shaped over time by previous experiences, personal and family demographics, and other external factors. Expected values are typically conceptualized under three categories: (*i*) intrinsic value, the expected enjoyment of a task or interest in a domain; (*ii*) attainment value, the perceived importance of a task to one's identity; and (*iii*) utility value, the subjective value of a task for attaining an extrinsic goal such as a career goal. A cost dimension was added to the EV model to capture student perceptions about (*i*) effort cost, the amount of effort required to be successful in the task; (*ii*) opportunity cost, the opportunity cost of missing out on other activities; and (*iii*) psychological costs, negative results or anxiety resulting from struggle or failure in the task (Eccles et al., 1983).

The Expectancy-Value-Cost (EVC)-based models have been extensively applied in various academic domains such as selecting majors, persistence in a domain, and dropping out of college (Schnettler et al., 2020). However, its applications in entrepreneurship education have been limited to predicting entrepreneurship intentions (Barkoukis et al., 2010; Hsu et al., 2014; Li, 2017), which is broadly defined as individuals' intentions to create a new venture or engage in entrepreneurship activities. Scales to predict entrepreneurial intentions are mainly based on the Theory of Planned Behavior (Ajzen & Fishbein, 1980) (e.g., Entrepreneurial Intention Scale (Liñán & Chen, 2009)) or the Entrepreneurial Event Model (Shapero & Sokol, 1982). Although the relationship between entrepreneurial intentions and students' participation in ICETs has not been empirically studied, one can easily assume that students with entrepreneurial intentions will be more likely to participate in ICETs. Nonetheless, the target population in this study is students who have not participated in any ICETs. Our description of ICETs also involves innovative experiential learning activities without competition. Therefore, in this study, we opted for a motivational framework (i.e., EVC) rather than an entrepreneurial intention-based one to explore our research questions.

3. Research Methods

3.1. Participants

Participants in this study were undergraduate students (*n*=249) enrolled in various programs at a land-grant university in the Northeastern United States. Participants were recruited by directly emailing students in target academic programs and student clubs. Overall, males and females constituted 41.8% and 58.2% of participants, and other gender identities were excluded from the study due to the minimal number of samples. In terms of academic standing, the participants were divided into two groups based on their class standing, Lower Level (45.4%) (first and second-year students) and Upper Level (54.6%) (third- and fourth-year academic standing).

Some of these are race-based descriptors, and others are ethnicities. What about something like: "Given our overarching purpose, students representing diverse racial or ethnic backgrounds were purposefully recruited to participate in this study. Students identified as: 13.3% Asian, 12.3% Black or African American, 18.5% Hispanic or Latino, 28.5% White, and 27.3% more than one race. Participants of other ethnicities were excluded from the analysis due to the low percentage of representation. The distribution of the participants was more diverse than the population of students in the target university since the study specifically targeted underrepresented groups. The participants were from all majors and programs in the university because most ICETs had a multidisciplinary focus, and the university's entrepreneurship and innovation centers adopted a transdisciplinary approach.

For analysis, academic majors were grouped into Professional Majors (Engineering, Information Sciences and Technology, and Business programs) and Arts/Sciences Majors (all Science, Arts, Liberal Arts, Education, and Social Sciences programs). Of the participants, the Professional and Arts/Sciences majors were 55% and 45%, respectively. The participants without an entrepreneurial family member were 60.6%, and the others indicated having at least one family member with an entrepreneurial background. Finally, 50.2% of the participants had a GPA lower than 3.5.

3.2. Measures

We designed Expectancy-Value-Cost (EVC) items of student motivation based on the Expectancy-Value-Cost scale (Kosovich et al., 2014) to understand students' motivation for participating in ICETs and possible barriers to their participation. In addition, we crafted items based on the Relatedness construct of the Self-Determination Theory (Ryan & Deci, 2000). All survey items used the five-level Likert Scale (1: Strongly Disagree, 2: Somewhat Disagree, 3: Neutral, 4: Somewhat Agree, 5: Strongly Agree). Finally, the survey included items to measure participants' Awareness, open-ended questions about reasons for not participating in ICETs, how to increase participation in these activities, and demographical/background questions. The survey asked students whether they participated in a list of sample ICETs and other events, and the survey questions were differentiated based on their participation.

3.3. Exploratory Factor Analysis

Since we created new EVC items specifically for ICETs, we performed an exploratory factor analysis (EFA) to discover whether any underlying structure existed within the new items developed and to identify unreliable items. For the presentation brevity, the reliability and internal consistency statistics of the extracted latent variables were given in Table 1 without the details of the EFA.

Expectancy represents students' belief that they can perform well in ICETs if they participate. Expectancy was measured by four questions, which were loaded on a single factor. The survey included 13 items for measuring Value, loaded with two factors in the EFA with 67% of the total variance explained. The extracted two factors were named Utility Value and Attainment Value. Utility Value items represented the degree to which participating in ICETs would benefit students in the short or long term. Attainment Value items measured the degree to which students believed participating in ICETs was essential to their identity and would be an enjoyable experience for them. Utility Value was measured by eight items. Attainment Value was measured by four items, after dropping one item with the lowest communality.

Six items were developed for measuring the cost of participating in ICETs. These six items were loaded on two factors, Time Cost and Team Cost, with 65% of the total variance explained. Two Time Cost items reflected students' concerns about the time commitment for ICETs, and four items represented possible problems related to forming/running a successful team. Although some of the cost items had low communalities, they were included in the measurement model because of their importance to the research questions.

In addition to the Expectancy, Value, and Cost items, the survey included several items to measure students' Awareness, Perceived Relatedness, and Support that they would receive if they had chosen to participate in ICETs. We ran an EFA for these items independently from the cost and value items. The items were loaded in two factors, Awareness and Relatedness/Support (6 items after deleting an item with low communality), with 55% of the total variance explained.

3.4. Confirmatory Factor Analysis and Invariance Testing of Measurement Model

After the EFA, the measurement model included the latent variables given in Table 1. The results of the EFA were very close to our expectations about the EVC model as the items were logically loaded on the anticipated factors. We used confirmatory factor analysis (CFA) to study the internal reliability and convergent validity of the latent variables and to test whether the dataset fitted the measurement model. First, we run the CFA for the entire dataset. Table 1 summarizes Cronbach's Alpha (α), Composite Reliability (*CR*), and Average Variance Extracted (*AVE*) of the latent variables. The measurement model for the whole data set had degree-of-freedom (*df*)=402, χ^2=666.96, χ^2/df =1.63 (<3, acceptable fit) and Root Mean Square Error of Approximation measure (RMSEA) =0.065 ($\leq$ 0.08, acceptable fit), Comparative Fit Index (CFI)=0.912, (>0.90). Overall, these fit measures supported that the measurement model had an acceptable but not a close fit to the data (*pclose*=0.004).

In the CFA, all standardized factor loadings of the latent variables exceeded 0.5 and were significant ($p <$ 0.001). The individual factor loadings and p values are not provided for the brevity of the presentation. Excluding Awareness, all CR and α values were greater than 0.7 for all latent variables, indicating an acceptable level of internal reliability of these latent variables. Awareness had CR and α values of 0.719 and 0.683, respectively, which was very close to 0.7.

The *AVE* values of the latent variables, excluding Team Cost and Awareness, were larger than 0.5, indicating their convergent validity. Team Cost and Awareness had low convergent validity, caused by the relatively high variability of these two latent variables. These results suggested that some cases could be dropped from the analysis to improve *AVE*. However, we opted for maintaining all cases because the variability in data was due to our non-homogeneous target population.

Since the research questions involved comparing the latent variables across various participant groups, we tested the measurement model's configural, metric, and scalar invariance across various groups on the dataset using confirmatory factor analysis. We run the configural, metric, and scalar invariance tests for gender, family background, class standing, major, and GPA group. These tests ensured unequivocal interpretations of the results for the groups compared. Invariance tests could not be applied due to the limited number of samples in each ethnicity subgroup.

Table 2 summarizes the results of the configural, metric, and scalar invariance tests. We tested configural invariance using multi-group CFA in AMOS. All tested configural invariance models had χ^2/df $\leq$ 3 and RMSEA< 0.06, indicating acceptable model fit. The CFI values became lower than 0.90, but they were close to 0.90. In summary, the configural invariance tests proved that the measurement model's structure was acceptable for all subgroups.

Table 1. Cronbach's Alpha (*α*), Composite Reliability (*CR*), and Average Variance Extracted (*AVE*) of the latent variables.

Latent Variable	*α*	*CR*	*AVE*
Expectancy	0.898	0.887	0.670
Attainment Value	0.927	0.840	0.571
Utility Value	0.833	0.944	0.679
Time Cost	0.708	0.719	0.571
Team Cost	0.737	0.748	0.429
Awareness	0.683	0.719	0.460
Relatedness/Support	0.844	0.874	0.538

Next, metric invariance was tested by setting identical factor loadings across the subgroups. The changes in χ^2 ($\Delta\chi^2$) and associated *p*-values supported metric invariance for all models, i.e., the changes from the configural models to the metric models were not statistically significant, as given in Table 2. Furthermore, the CFI values did not change very much, indicating the loadings of the compared subgroups were close enough.

Finally, we tested scalar invariance by setting equivalent factor loadings and intercepts across the subgroups compared. In Table 2, $\Delta\chi^2$ and ΔCFI values represent the changes in these indices from the metric invariance models to the scalar invariance model. For Family, Gender, and GPA subgroups, scalar invariance was supported (p>0.05). For Class Standing and Major, the changes in the models were significant, and scalar invariance was not supported, although ΔCFI was small. The literature suggests that a full scalar invariance is a very stringent requirement and tends to fail frequently in cases with real-life data (Baumgartner & Steenkamp, 1998).

Table 2. Fit metrics of the configural, metric, and scalar invariance of the measurement model

Family	χ^2	df	χ^2/df	CFI	RMSEA	pclose	Δdf	$\Delta\chi^2$	P	ΔCFI
Configural	1411.806	822	1.718	0.864	0.054	0.089	-	-	-	-
Metric	1441.846	846	1.704	0.863	0.053	0.117	24	30.04	0.183	0.001
Scalar	1478.334	877	1.686	0.861	0.053	0.169	31	36.488	0.229	0.002
Gender										
Configural	1468.754	822	1.787	0.852	0.056	0.013	-	-	-	-
Metric	1495.524	846	1.768	0.851	0.056	0.021	24	26.77	0.315	0.001
Scalar	1537.133	877	1.753	0.849	0.055	0.031	31	41.609	0.097	0.002
Major										
Configural	1401.147	822	1.705	0.866	0.053	0.12	-	-	-	-
Metric	1427.325	846	1.687	0.866	0.053	0.169	24	26.178	0.344	0
Scalar	1478.028	877	1.685	0.861	0.053	0.171	31	50.703	0.014	0.005
Class Standing										
Configural	1395.756	822	1.698	0.865	0.053	0.138	-	-	-	-
Configural	1419.088	846	1.677	0.865	0.052	0.204	24	23.332	0.5	0
Metric	1464.817	877	1.67	0.862	0.052	0.228	31	45.729	0.043	0.003
GPA Group										
Configural	1441.325	822	1.753	0.858	0.055	0.035	-	-	-	-
Metric	1458.552	846	1.724	0.86	0.054	0.073	24	17.227	0.839	-0.002
Scalar	1492.095	877	1.701	0.859	0.053	0.121	31	33.543	0.345	0.001

4. Results

The average scores of the items related to each latent variable were used to measure the latent variables, and Multivariate Analysis of Variance (MANOVA) was conducted to compare the latent variable means across the participant subgroups. First, we ran a preliminary MANOVA using the latent variables as independent variables and Family Background (Y: entrepreneurs in the family, N: no entrepreneurs in the family), Gender (F: female, M: male), Class Standing (L: first two years, U: last two years, GPA (L: <3.5, H: ≥ 3.5), Major (P: professional, A: arts, liberal arts, sciences), and Ethnicity as factors. GPA (p=0.348 Wilks' Lambda) and Ethnicity (p=0.153 Wilks' Lambda) were removed from further analysis since they were identified as nonsignificant for all dependent variables. In the following tables, the mean (*M*), variance (*Var*), first quartile (Q1), and third quartile (Q3) of the latent variables are provided for each level (given in column *L*) of the factors (independent variables) and the whole dataset. In addition, *F* statistics, *p*-value, and effect size (Cohen's *d* value) are provided for the final MANOVA comparing the means of the latent variables across the factor levels.

Table 3 presents the comparisons for Expectancy. Family (p=0.018) and Major (p<0.001) were statistically significant factors for Expectancy. Participants in the Professional majors rated their Expectancy about 0.40 higher than those in the Art/Sciences majors with d=0.47, indicating a medium effect. The effect size of Family on Expectancy was between small and medium.

Table 3. Expectancy

Variable, (F, *p*, *d*)	*L*	*M*	*Var*	Q1	Q3
Family	N	3.16	0.85	2.75	4.00
(5.642, 0.018, 0.292)	Y	3.42	0.68	3.00	4.00
Gender	M	3.32	0.92	2.75	4.00
(0.137, 0.711, 0.116)	F	3.22	0.72	3.00	3.75
Class Standing	L	3.21	0.79	2.75	3.75
(0.942, 0.333, 0.108)	U	3.31	0.81	3.00	4.00
Major	A	3.04	0.82	2.50	3.75
(13.840, 0.000, 0.472)	P	3.45	0.72	3.00	4.00
Overall		3.26	0.80	2.75	4.00

Tables 4 and 5 present the results for Attainment and Utility Value comparisons, respectively. Family (p=0.027) and Major (p=0.015) were statistically significant factors for Attainment Value, but only Family was a significant factor for Utility Value (p=0.031). Major had a small effect on Utility Value with a statistical significance at a level of p=0.06. All groups rated Utility Value high, with an average of 4.07 (corresponding to somewhat agree). Comparatively, Attainment Value was rated lower with an average of 3.38 (corresponding to neutral).

Table 4. Attainment Value

Variable, (F, *p*, *d*)	*L*	*M*	*Var*	Q1	Q3
Family	N	3.29	0.78	3.00	4.00
(4.934, 0.027, 0.288)	Y	3.52	0.57	3.00	4.00
Gender	M	3.33	0.71	3.00	4.00
(1.550, 0.214, 0.107)	F	3.42	0.70	3.00	4.00
Class Standing	L	3.43	0.50	3.00	4.00
(0.949, 0.331, 0.119)	U	3.33	0.88	3.00	4.00
Major	A	3.25	0.67	3.00	4.00
(6.048, 0.015, 0.282)	P	3.49	0.71	3.00	4.00
Overall		3.38	0.71	3.00	4.00

Table 5. Utility Value

Variable, (*F*, *p*, *d*)	*L*	*M*	*Var*	Q1	Q3
Family	N	4.00	0.57	3.63	4.63
(4.727, 0.031, 0.283)	Y	4.19	0.30	3.88	4.63
Gender	M	4.00	0.57	3.63	4.63
(3.103, 0.079, 0.182)	F	4.13	0.40	3.88	4.63
Class Standing	L	4.14	0.41	3.88	4.63
(2.396, 0.123, 0.185)	U	4.02	0.52	3.75	4.50
Major	A	4.00	0.38	3.75	4.50
(3.573, 0.060, 0.200)	P	4.14	0.54	3.88	4.75
Overall		4.07	0.47	3.75	4.63

Tables 6 and 7 present the results for Time Cost and Team Cost comparisons, respectively. Gender (p=0.048) and Class Standing (p=0.022) were statistically significant factors for both latent cost variables. However, participants were more concerned with time commitment, with a mean of 3.34, than efforts related to forming a successful team, with a mean of 2.76 (corresponding between somewhat disagree and neutral).

Table 6. Time Cost

Variable, (F, *p*, *d*)	*L*	*M*	*Var*	Q1	Q3
Family	N	3.34	1.13	3.00	4.00
(0.102, 0.750, 0.021)	Y	3.32	1.18	3.00	4.00
Gender	M	3.19	1.33	2.50	4.00
(3.933, 0.048, 0.235)	F	3.44	1.00	3.00	4.00
Class Standing	L	3.16	1.17	2.50	4.00
(5.326, 0.022, 0.295)	U	3.48	1.09	3.00	4.00
Major	A	3.28	1.12	3.00	4.00
(1.566, 0.212, 0.099)	P	3.38	1.17	2.50	4.00
Overall		3.34	1.15	3.00	4.00

Table 7. Team Cost

Variable, (*F*, *p*, *d*)	*L*	*M*	*Var*	Q1	Q3
Family	N	2.78	0.82	2.25	3.25
(0.618, 0.433, 0.065)	Y	2.72	0.77	2.25	3.25
Gender	M	2.54	0.88	2.00	3.00
(8.672, 0.004, 0.415)	F	2.91	0.69	2.50	3.50
Class Standing	L	2.62	0.95	2.00	3.25
(4.155, 0.043, 0.272)	U	2.87	0.65	2.25	3.25
Major	A	2.87	0.75	2.50	3.25
(1.319, 0.252, 0.227)	P	2.66	0.82	2.00	3.25
Overall		2.76	0.80	2.25	3.25

Tables 8 and 9 present the results for Relatedness and Awareness comparisons, respectively. Major was a significant factor for both Relatedness (p=0.004) and

Awareness (*p*=0.006). Class Standing was a significant factor for Relatedness (*p*=0.028).

Table 8. Relatedness

Variable, (*F*, *p*, *d*)	***L***	***M***	***Var***	**Q1**	**Q3**
Family	N	3.44	0.59	3.00	4.00
(0.380, 0.538, 0.049)	Y	3.48	0.38	3.00	4.00
Gender	M	3.54	0.61	3.17	4.00
(0.900, 0.344, 0.199)	F	3.40	0.42	3.00	3.83
Class Standing	L	3.57	0.48	3.17	4.00
(4.897, 0.028, 0.297)	U	3.36	0.51	3.00	3.83
Major	A	3.30	0.48	2.83	3.75
(8.352, 0.004, 0.407)	P	3.58	0.49	3.17	4.00
Overall		3.46	0.50	3.00	4.00

Table 9. Awareness

Variable, (*F*, *p*, *d*)	***L***	***M***	***Var***	**Q1**	**Q3**
Family	N	2.50	1.00	1.67	3.00
(0.027, 0.869, 0.035)	Y	2.47	0.77	1.67	3.00
Gender	M	2.56	0.91	2.00	3.33
(0.156, 0.693, 0.121)	F	2.44	0.91	1.67	3.00
Class Standing	L	2.50	0.92	1.67	3.00
(0.004, 0.948, 0.027)	U	2.48	0.90	1.67	3.00
Major	A	2.30	0.89	1.33	3.00
(7.625, 0.006, 0.371)	P	2.65	0.88	2.00	3.33
Overall		2.49	0.91	1.67	3.00

5. Limitations, Discussions & Practical Implications

Before discussing the findings, the limitations of the study can be summarized as follows. The data in this study included only the responses of undergraduate students who did not participate in ICETs. Only 4% of survey respondents indicated that they participated in ICETs. Therefore, the responses of the students who did and did not participate in ICETs could not be compared. Not all academic programs and majors were equally represented in the sample, limiting the generalizability of findings. Although the participants attended face-to-face programs, the data was collected during the first semester after the university fully returned to face-to-face instruction. The effects of online instruction and other stressors stemming from the COVID-19 pandemic may introduce bias. Finally, participants were self-selected.

Overall, all participant subgroups reported a low level of Awareness, with a mean score of 2.49, corresponding between somewhat disagree and neutral, and 75% of the scores were less than 3.00 (Neutral). This finding indicated that students were not well informed and aware of ICETs. In particular, participants in Arts/Sciences majors had a mean awareness score of 2.30. Supporting these findings, many participants responded to an open-ended question about reasons for their decision not to participate in ICETs with answers such as "*I did not really know they existed or where to start*" and "*I have not heard about them until now*." In the target university, ICETs were canceled in the Spring and Fall semesters of 2020 due to COVID-19, and some continued in virtual settings in the following semesters. The data were collected in the first semester when the university resumed face-to-face instruction. Hence, COVID-19 interruptions might have affected the reported low levels of Awareness. Nonetheless, lack of Awareness seemed to be the most critical barrier for all groups of students.

Overall, all participants were more concerned about the Time Cost of ICETs than the Team Cost. Especially, female participants indicated higher levels of Time Cost (*p*=0.048) and Team Cost (*p*=0.004) than the male participants. Previous studies reported that male students tended to exhibit higher entrepreneurial intentions than female students. In the literature, this outcome was attributed to differences in perceived self-efficacy and perceived feasibility between the genders, with some reservations (see (Dabic et al., 2012; Haus et al., 2013; Liñán & Fayolle, 2015) for reviews on gender attitudes toward entrepreneurship). In this study, however, we did not observe any difference between the genders regarding their Expectancy (*p*=0.711) and Relatedness (*p*=0.344). Note that female participants also rated Utility and Attainment Value slightly higher than male participants, albeit the difference was not statistically significant. These findings suggested that opportunity cost was a barrier to female students' participation. Based on this observation, a strategy to increase female participation would be better integrating ICETs with academic work. Supporting this intervention, Dzombak et al. (2016) noted that female students more frequently cited academic motivations (e.g., becoming a global professional and catalyzing their careers through participation in the course) than male students, who cited non-academic motivations (e.g., interest in travel) for participating in a technology-based social entrepreneurship-program.

Perceptions of ICETs by Art/Sciences participants could be a factor in limiting their participation. Art/Sciences participants rated the Utility Value of ICETs relatively higher than the attainment value. The mean difference in Utility Value across Art/Sciences and Professional major participants was not statistically significant (*p*=0.060) but significant in the Attainment Value (p=0.015). Art/Sciences participants acknowledged the benefits of ICETs but did not think participating in ICETs was essential to their identity. In other words, participants did not see ICETs as a means to attain their academic and professional goals. In addition, Art/Sciences Major participants had a lower mean perceived Expectancy level than Professional Major participants (p=0.000) and indicated lower Relatedness levels (p=0.004). Some of the Art/Sciences participants' comments about reasons for not participating were: "*Not sure if it would be helpful for my major*," "*I feel it does not pertain to my major…,*" and "*I participate in undergraduate research and other activities that I believe prepare me better for my future career path than an ICET could*." In other words, this group of students perceived ICETs as being associated with engineering, business, and information technology programs and reported statistically significantly lower mean Relatedness/Support than Professional Majors did. It should be noted that the university offers many ICETs targeting all majors and aims to develop interdisciplinary entrepreneurship and innovation ecosystems. For example, the entrepreneurship minor offered in the university has options for students in arts, liberal arts, and science programs. Despite these efforts, new strategies are needed to reach a broader and more diverse group of students.

Entrepreneurial Family Background had a statistically significant impact on Expectancy (p=0.018), Attainment Value (p=0.020), and Utility Value (p=0.031). These findings paralleled earlier empirical evidence demonstrating the positive effect of entrepreneurial family background on entrepreneurial intentions (Krueger, 1993; Mathews & Moser, 1995; Scherer et al., 1989). Family members can influence students' entrepreneurial intentions by serving as role models and providing resources (Aldrich et al., 1998). Earlier research also showed that mentorship could moderate the positive effect of interventions to increase entrepreneurial self-efficacy and intentions for females (Muldoon et al., 2019). Given the low Awareness levels observed in this study and the impact of Family Background on the perceived value of ICETs, intentional advising and mentoring practices could be another strategy to increase the participation of diverse students in ICETs, especially for ones who lack access to role models.

An interesting finding was that participants in upper-level class standing reported a lower level of Relatedness than those in lower-level class standing (p=0.028), while their Awareness was not statistically different. These findings could be interpreted with this group's concerns about the cost of participating in ICETs. The relationship between entrepreneurial intentions and education is complex. For example, entrepreneurship education may sometimes reduce entrepreneurial intentions when students realize the required commitment (Liu et al., 2020, 2021b). In this study, time commitment seemed to be an important barrier for students who were further along in their academic work. A few student comments supported the issue of time, "*I am in my last semester as of now and working as well, so I have no interest in competing*," "*I am extremely busy, taking 18 credits,….., studying for the GRE, applying for graduate school*". Therefore, it is important to reach out and engage students in ICETs early in their education.

6. Conclusions

This study investigated factors and barriers associated with students' participation in ICETs and provided insights into specific interventions for enhancing the engagement of all groups of students in ICETs. Answering these research questions is essential to increase all student groups' participation in ICETs and make them more inclusive events. The findings suggested that ICETs were perceived differently by academic majors, and the time commitment was a significant barrier to participation in these activities. To make these events more accessible and relatable to all students, higher education institutions should consider reframing these events and developing low-stake ICETs with a limited time commitment that occur early in students' academic trajectories. The Expectancy-Value-Cost-based framework used in this study is also promising to study students' engagement with entrepreneurship and innovation-focused co-curricular activities. Indeed, it was evident in the resulting data that students' perceptions of cost strongly influenced their desire to explore entrepreneurial competitions or to participate. Further research with a larger sample size is required to better understand and further verify the findings in this exploratory research.

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