THE INFLUENCE OF COLLEGE STUDENTS' PARTICIPATION IN OFF-CAMPUS INTERNSHIP ON THEIR ENTREPRENEURSHIP COMPETENCIES

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Abstract— Through the secondary-data analysis method, the impact of university of science and technology electrical engineering and computer science students' participation in off-campus internship on their entrepreneurial ability was explored in this study. From the secondary-data, 372 students enrolled in the second year through the fourth year from 4-year electrical engineering and computer science departments (day school) of eight universities of science and technology that participated in off-campus internships were research participants for analysis. Research results show that, for the universities of science and technology electrical engineering and computer science students, "innovation and entrepreneurship programs were taken" had a significantly positive impact on their entrepreneurial ability. Compared to senior students, whether or not the sophomore and Junior students university of science and technology electrical engineering and computer science students took up innovation and entrepreneurship programs had less impact on their entrepreneurial ability. In particular, internship over 320 hours in total, internship at SMEs, and serving as a project planner have positive impact on students' entrepreneurial ability; serving as an exhibition venue assistant has less impact on students' entrepreneurial ability.

Keywords: Off-Campus Internship, Entrepreneurship Education, Entrepreneurship Competency

I. INTRODUCTION

Under the influence of the social knowledge economy and globalization, creativity, innovation, and entrepreneurship have become issues of attention in management education and academic research [1]. Following the Taiwan government's promotion of "University-based Innovation and Entrepreneurship Program (EC-SOS), more and more schools have commenced innovation entrepreneurship related courses. According to statistics, among the 87 vocational and technological colleges and universities in Taiwan, 80 schools commenced 1,225 entrepreneurship education related courses in 2016, with course attendees reaching 50,694 persons [2], an indication of the academic community's emphasis for innovation and entrepreneurship education with a considerable development scale. In order to implement pragmatic technical and vocational education in Taiwan and promote vocational and technological colleges and universities' engagement in application technology related R&D and innovation targeting the industrial needs, the Ministry of Education (MOE) has actively promoted relevant industrial cooperation matters [3]. Clearly, Taiwan's technical and vocational education emphasizes cultivating students' spirit to innovate and start a business and perfecting the environment for innovation, entrepreneurship and industry-academia cooperation. In order to shorten the industry-academia gap and enhance the employability of graduates, the "Student Off-campus Internship Course Implementation" has been set as one of the important educational strategies. This way, the resources of the schools and industry can be integrated to facilitate students' engagement in career exploration as soon as possible, thereby optimizing manpower development [4]. Hsiao, Chang, & Change found from their study that off-campus internship is a good tool for entrepreneurship education, as it can effectively help students look up business opportunities during the internship period, thus enhancing their business start-up intentions [5]. Tien Yen-Chia [6] pointed out that students' participation in off-campus internship can cultivate students' entrepreneurial spirit and entrepreneurial knowledge.

In view of the importance of off-campus internship on students' entrepreneurial ability, the secondary-data analysis method was adopted in this study to gain insight into the personal background variables of university of science and technology electrical engineering and computer science students as well as the impact of the off-campus internship situation on their entrepreneurial ability.

II. LITERATURE REVIEW

A. Off-Campus Internship

The origin of the concept of off-campus internship can be traced back to the Sandwich Courses in the United Kingdom in 1880. The "theory-practice-theory" alternating approach was employed, placing practical work in theoretical courses [7]. Participation in off-campus internship is of great importance as far as the enhancement of students' future employment competitiveness is concerned. Through off-campus internship, students' implementation and innovation ability can be effectiveness strengthened, enabling students to understand the market context and foster their ability to enter the workplace in the future, which have

positive impact on their future career development [8], [9], [10]. Through participation in off-campus internship, the school can improve its teaching quality and cultivate talents that meet the needs of enterprises through the practical experiences of students and teachers while in the industry [11].

B. Entrepreneurship Education

Taiwan has included entrepreneurship education as one of the important educational goals, in the hope of equipping students with innovation and entrepreneurship knowledge and an entrepreneurial spirit, and enabling them to not only seek employment but also implement the entrepreneurial spirit and concept in their future career, thereby taking the perspective of an innovative entrepreneur should they decide to start their own business and promoting overall national development [12]. Scholars believe that innovation education can foster students with creativity and an innovative mindset, ultimately enabling them to possess entrepreneurial ability [13] [14]. Scholars found from their experimental teaching that the entrepreneurial courses provided by the school indeed enhanced students' entrepreneurial tendencies as well as the entrepreneurial feasibility [15]. Entrepreneurship education can also effectively enhance students' entrepreneurial intentions, and thus enhancing the possibility of future entrepreneurship [16].

C. Entrepreneurship Competency

Entrepreneurship refers to the process of an individual or team that integrates resources from all sides to provide products and services after a business opportunity is discovered and identified in order to create new product values [17]. In order to become a successful entrepreneur, one has to possess entrepreneurial ability in all aspects. Change Ren-Chia et al., based on the three entrepreneurship dimensions of U.S. "National Content Standards for Entrepreneurship Education", namely, entrepreneurial skills, ready skills, and business functions as well as 15 entrepreneurial core competencies, compiled abilities required for the information service industry and entrepreneurship in the field of electrical engineering and computer science through expert interviews followed by analyses and categorization. They include: entrepreneurial skills (entrepreneurship process cognitive ability, entrepreneur traits), ready skills (basic business ability, communication ability digital ability, and professional innovative ability), and business function (financial management ability, human resources ability, marketing management ability, business operational ability, and risk management ability) [18]. In this study, the three categories were adopted as the variables of entrepreneurial ability to explore the impact of electrical engineering and computer science students' participation in off-campus internship on their entrepreneurial ability.

III. RESEARCH METHOD

D. Research Framework

This study explores the impact of electrical engineering and computer science students' participation in off-campus internship on their entrepreneurial ability, with the students' personal background variables and off-campus internship situations as the independent variables and the entrepreneurial abilities as the dependent variables. The research framework is as shown in Fig. 1.

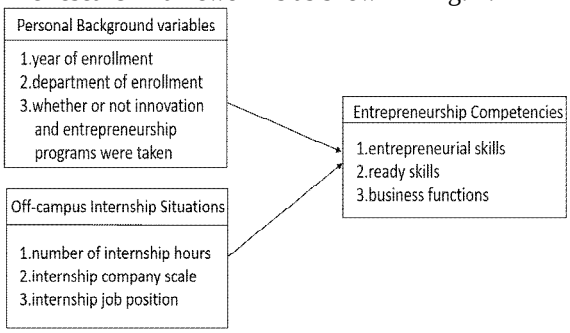


Fig. 1 Research Framework

E. Research Tools

The secondary-data analysis method was adopted in this study. The "questionnaire survey on university of science and technology electrical engineering and computer science department students' entrepreneurial ability" in the Ministry of Science and Technology's program "Study of entrepreneurship-oriented off-campus course planning and teaching experiments of vocational and technological colleges and universities' electrical engineering and computer science department" hosted by Chang Ren-Chia [19] [20] was adopted as the research tool for secondary-data analysis. The questionnaire content comprises three parts: 1. Personal background variables (year of enrollment, department of enrollment, if entrepreneurship related programs commenced by the school has been taken up); 2. Off-campus internship situation (number of internship hours, internship company scale, internship job position); 3. Entrepreneurial ability (entrepreneurial skills, ready skills, business functions).

F. Research Participants

Through the secondary-data, insight was gained into the impact of electrical engineering and computer science department students' participation on their entrepreneurial ability. For the secondary-data samples par, 667 students from electrical engineering and computer science departments of eight public and private universities of science and technology in Taiwan were selected as research participants through cluster analysis, stratified proportional sampling, and random sampling. After obtaining the secondary-data, 372 students from "participated in off-campus internship" were adopted as the research participant for result analysis and discussion.

IV. DATA RESULTS AND ANALYSIS

G. Research Sample Background Data Analysis

The valid samples in this study consist of 372 electrical engineering and computer science students, of which "senior students" comprise the majority, accounting for 53.8% of the total; in terms of department of enrollment, "the electrical engineering department" students comprise the majority, accounting for 35.5% of the total; in terms of whether or not innovation and entrepreneurship programs were taken, more students fell under "no innovation and entrepreneurship programs taken", accounting for 56.5% of the total; in terms of number of internship hours, more students fell under "internship 320 hours or higher", accounting for 53% of the total; in terms of internship company scale, students engaging in internship in "small and medium enterprises" comprise the majority, accounting for 55.9% in total; in terms of internship affairs, students "serving as a department assistant in the company" comprise the majority, accounting for 47% of the total.

H. Analysis of Predictive Power of Different Personal Background Variables and Off-campus Internship Situations on Student Entrepreneurial Ability

This study explores the predictive power of electrical engineering and computer science students' personal background variables and off-campus internship situations on entrepreneurial ability. Since the personal background variables and off-campus internship situations are nominal variables, the researcher first converted the personal background variables and off-campus internship situations into dummy variables prior to the regression analysis. Then the step-wise regression was employed to predict the impact of the personal background variables and off-campus internship situations on students' entrepreneurial ability.

1) Analysis of the Predictive Power of Personal Background Variables on Entrepreneurial Ability

In this study, three background variables, namely, the students' "year of enrollment", "department of enrollment", and "whether or not innovation and entrepreneurship programs were taken" were included as predictive variables. Then, based on the multiple step-wise regression analysis, the results are as shown in Table 1. It shows that "sophomore students" and "junior students" students produced significant predictive power on entrepreneurial ability.

The regression equation in Table 1 shows that the sophomore, junior, and senior students produced positive impact on entrepreneurial ability. The unstandardized regression coefficient (*B*) shows that the regression coefficients of the sophomore students and junior students are both negative values. Therefore, it shows that compared to the senior students, the second and junior students' produced less impact on entrepreneurial ability.

Table 1 Analysis of predictive power of personal background variables on entrepreneurial ability

Variable	*R*	R^2	ΔR^2	F	B	β
(Constant)					3.739	
Junior	.235	.055	.055	21.691***	-.183	-.284
Sophomore	.322	.104	.049	21.388**	-.284	-.226
Regression equation： entrepreneurial ability= 3.739－ .183 ×(Junior)*** －.284 ×(Sophomore)**						

***p*< .01, ****p*< .001*

2) The Impact of Innovation & Entrepreneurship Programs were Taken on Students' Entrepreneurial Ability

This study further explored the impact of electrical engineering and computer science students who took innovation and entrepreneurship programs on entrepreneurial ability. The results are as shown in Table 2. The regression equation shows that the second, third, and senior students who took innovation and entrepreneurship programs had positive impact on their entrepreneurial ability. The unstandardized regression coefficient (*B*) shows that the regression coefficients of the Sophomore students and Junior students are negative values, an indication that compared to the senior students who took innovation and entrepreneurship programs, the Sophomore students and Junior students who took up innovation and entrepreneurship programs had less impact on their entrepreneurial ability.

Table 2 Analysis of the predictive power of students who took innovation and entrepreneurship programs on entrepreneurial ability

Variable	R	R^2	ΔR^2	F	B	β
(Constant)					3.753	
Junior	.330	.109	.109	19.528***	-.233	-.371
Sophomore	.419	.176	.067	16.964***	-.356	-.262
Regression equation： entrepreneurial ability= 3.753－ .233×(Junior)*** －.262×(Sophomore)**						

***p*< .01, ****p*< .001*

3) Analysis of Predictive Power of Off-campus Internship Situation on Entrepreneurial Ability

In this study, "number of internship hours", "internship company scale", and "internship job position" were included as the predictive variables. In addition, according to the multiple stepwise regression analysis, the results are as shown in Table 3. It shows that students falling under "internship 320 hours", "internship exceeding 320 hours", "serving as an exhibition venue assistant", "internship in a small and medium enterprise", "serving as a project planner", "internship 240 hours", "internship 160 hours", "serving as an internal assistant in the company" had significant predictive power on entrepreneurial ability.

Based on the unstandardized regression coefficient (*B*), the results show that in terms of students' internship hours, the students falling under "internship 240 hours", "internship 160 hours", "internship 320 hours", and "internship exceeding 320 hours" produced positive impact on their entrepreneurial ability; in terms of internship company scale, the students falling under internship in "small and medium enterprises" produced positive impact on

their entrepreneurial ability; in terms of students' internship job positions, the students falling under "serving as a project planner", "serving as an internal assistant in the company" produced positive impact on their entrepreneurial ability. The unstandardized regression coefficient (*B*) of the exhibition assistant is a negative value, indicating the students falling under "serving as an exhibition venue assistant" produced relatively less impact on their entrepreneurial ability.

Table 3 Analysis of predictive power of off-campus internship situations on entrepreneurial ability

Variable	R	R^2	ΔR^2	F	B	β
(Constant)					3.210	
Internship 320HR	.315	.099	.099	40.839***	.422	.669
Internship exceeding 320HR	.503	.253	.153	62.369***	.718	.526
Exhibition venue assistant	.540	.292	.039	50.500***	-.093	-.112
Small and medium enterprise	.556	.309	.017	41.009***	.110	.171
Project planner	.581	.337	.028	37.227***	.245	.209
Internship 240HR	.593	.351	.014	32.924***	.223	.281
Internship 160HR	.607	.369	.017	30.359***	.181	.193
Internal assistant in the company	.616	.380	.011	27.776***	.079	.126

Regression equation： entrepreneurial ability=
3.210＋ .422 × (Internship 320HR)***
＋ .718 × (Internship exceeding 320HR)***
－ .093 × (Exhibition venue assistant)***
＋ .110 × (Small and medium enterprise)***
＋ .245 × (Project planner)***
＋ .223 × (Internship 240HR)***
＋ .181 × (Internship 160HR)***
＋ .079 × (Internal assistant in the company)***

****p< .001*

4) The Impact of Personal Background variables and Off-campus Internship Situations on Students' Entrepreneurial Ability

In this study, the students' six variables, namely, "year of enrollment", "department of enrollment", "whether or not innovation and entrepreneurship programs were taken", "number of internship hours", "internship company scale', and "internship job position" were included as predictive variables. In addition, according to the multiple regression analysis, the results are as shown in Table 4. It shows that the students falling under "internship 320 hours", "internship exceeding 320 hours", "internship in a small and medium enterprise", "serving as a project planning', "internship 240 hours", internship 160 hours", "serving as an internal assistant in the company", " sophomore students", and "junior students" produced significant predictive power on entrepreneurial ability.

Based on the unstandardized regression coefficient (*B*), the results show that, in terms of students' number of internship hours, the students falling under "internship 320 hours", "internship exceeding 320 hours", "internship 240 hours", and "internship 160 hours" produced positive predictive power on entrepreneurial ability. Hence, it show that the students falling under "internship 320 hours", "internship exceeding 320 hours", "internship 240 hours", and "internship 160 hours" produced positive impact on their entrepreneurial ability. For the students' year of enrollment part, since the unstandardized regression coefficients (*B*) show that the regression coefficients of second and Junior students are negative values, it means compared to the senior students, the second and Junior students had less impact on their entrepreneurial ability; as for the students' internship company scale, the students falling under "internship in a small and medium enterprise" produced positive predictive power on entrepreneurial ability. Therefore, the students falling under "internship in a small and medium enterprise company" produced positive impact on entrepreneurial ability; for the students' internship job positions, the students falling under "serving as a project planner" and "serving as an internal assistant in the company" produced positive predictive power on their entrepreneurial ability. Hence, the students falling under "serving as a project planner" and "serving as an internal assistant in the company" produced positive impact on their entrepreneurial ability. The unstandardized regression coefficient (*B*) of "serving as an exhibition venue assistant" is a negative value, indicating the students falling under "serving as an exhibition venue assistant" produced less impact on their entrepreneurial ability.

Table 4 Analysis of predictive power of personal background variables and off-campus internship situations on overall entrepreneurial ability

Variable	*R*	R^2	ΔR^2	F	B	β
(Constant)					2.969	
Internship 320HR	.315	.099	.099	40.839***	.587	.930
Internship exceeding 320HR	.503	.253	.153	62.369***	.876	.642
Exhibition venue assistant	.540	.292	.039	50.500***	-.032	-.039
Small and medium enterprise	.556	.309	.017	41.009***	.113	.176
Project planner	.581	.337	.028	37.227***	.332	.283
Internship 240HR	.593	.351	.014	32.924***	.288	.364
Internship 160HR	.607	.369	.017	30.359***	.230	.245
Internal assistant in the company	.616	.380	.011	27.776***	.157	.249
Sophomore	.623	.389	.009	25.561***	-.287	-.228
Junior	.635	.403	.015	24.393***	-.129	-.201

Regression equation： entrepreneurial ability=
2.969＋ .587 × (Internship 320HR)***
＋ .876 × (Internship exceeding 320HR)***
－ .113 × (Exhibition venue assistant)***
＋ .332 × (Small and medium enterprise)***
＋ .288 × (Project planner)***
＋ .230 × (Internship 240HR)***
－ .157 × (Internship 160HR)***
＋ .157 × (Internal assistant in the company)***
－ .287 × (sophomore)***
－ .129 × (junior)***

****p< .001*

CONCLUSIONS AND RECOMMENDATIONS

I. Conclusions

1) Electrical engineering and computer science students who took innovation and entrepreneurship programs produced positive impact on their entrepreneurial ability. Compared

to senior students, second and Junior students electrical engineering and computer science students had less impact on their entrepreneurial ability regardless of whether or not innovation and entrepreneurship programs were taken

According to the research results, it shows that the electrical engineering and computer science students who took innovation and entrepreneurship programs had significantly positive impact on their entrepreneurial ability. Compared to senior students, the second and junior students' electrical engineering and computer science students had less impact on their entrepreneurial ability. Moreover, regardless of whether or not the second and junior students took innovation and entrepreneurship programs, the enhancement of entrepreneurial ability fell short compared to the senior students. It is speculated in this study that "mentality" may be a possible reason for this outcome. The senior students were facing immediate employment; therefore, it was natural for them to more actively attempt to learn new things during the internship process, which indirectly led to their enhanced ability needed to start their own business. The second and junior students, on the other hand, still have time before entering the workplace. Compared to the senior students, they had a different learning mentality during the internship period, since their intention was only to complete credits required by the school. As a result, the sophomore students and junior students had less impact on their entrepreneurial ability.

2) Internship exceeding 320 hours, internship in small and medium enterprises, and serving as a project planner produce positive impact on students' entrepreneurial ability; serving as an exhibition venue assistant has less impact on students' entrepreneurial ability

In terms of number of internship hours, the research results show that the number of internship hours for electrical engineering and computer science students' participation in off-campus internship learning effectively and positively predicted entrepreneurial ability. However, students with internship exceeding 320 hours produced the best result on their entrepreneurial ability. Other studies show that most students are convinced the longer the internship time, the more profound their understanding of the corporate culture and operational approaches, leading to more professional skills and knowledge learned and improved interpersonal relationships [21]. The Ministry of Education, Taiwan (R.O.C.) clearly stipulates the principle of off-campus internship hours "not lower than 320 hours" in the Technical and Vocational Education Restructuring Plan, which coincides with the results in this study.

In terms of internship company scale, the research results show that the internship company scale of electrical engineering and computer science students can positively predict students' entrepreneurial ability. Additionally, it was found that the students engaging in internship in small and medium enterprises produced the best result on their entrepreneurial ability. This study speculates that, in large enterprises, students only engaged in single or minor tasks, resulting in a narrow range of learning opportunities and the resulting abilities cultivated. Internship in small and medium enterprises, on the other hand, involves a wider range of learning and more opportunities for cross-departmental training, leading to more practical experience [22].

In terms of internship job positions, the research results show that the internship job positions of electrical engineering and computer science students can positively predict students' entrepreneurial ability. Additionally, it was found that serving as a project planner produced the best result on their entrepreneurial ability. This study speculates that possibly, while serving as a project planner at the exhibition venue, the work coverage was more extensive, thus the need for project topic sensitivity, the ability to communicate with supervisors and clients, innovation skills, document processing such as writing projects, and digital information competency that require a series of learning. Therefore, compared to other job titles, serving as a project planner can enhance the entrepreneurial ability [23]. On the other hand, students serving as exhibition assistants had less impact on entrepreneurial ability. It is speculated that possibly the exhibition venue assistants only engaged in work contents in the company exterior, thus the inability to gain in-depth understanding of the actual company operations. Therefore, they were less helpful in substantially enhancing entrepreneurial ability.

It was found in this study that during students' participation in off-campus internship, the number of internship hours, the internship company scale, and the internship job position alike indeed affected entrepreneurial ability. Therefore, schools should encourage students to choose the most helpful means to derive at the greatest benefits during the off-campus internship process.

J. Recommendations

1) Students who wish to develop entrepreneurial ability must accumulate more off-campus internship hours

According to the research results, the students with internship exceeding 320 hours obtained the best entrepreneurial ability. Therefore, in addition to requiring off-campus learning hours regulated by the school, this study recommends students choose internship jobs related to their learning as much as possible and within their capabilities, so as to not only accumulate internship hours, internship experience, and entrepreneurial ability but also build up personal connections and pave the way for starting a business in the future.

2) Small and medium enterprises are the top choices for students who wish to cultivate entrepreneurial ability when choosing a off-campus internship company

The research results show that students engaging in internship in small and medium enterprises obtain better entrepreneurial ability compared to students engaging in internship in companies of other scales. Therefore, this study recommends that, when choosing the internship company scale, off-campus, small and medium enterprises be prioritized. Small and medium enterprises' more flexible work management approach will leave more room for students to display creativity and express their opinion. They can also engage in cross-departmental learning and communication and have more opportunities to absorb the qualities of successful entrepreneurs, thereby enhancing their entrepreneurial ability.

3) For students who wish to develop entrepreneurial ability, serving as a project planner is prioritized when choosing the off-campus internship unit

It was found in this study that, for students serving as project planners, the students' entrepreneurial skills, ready skills, and business functions under entrepreneurial ability were superior to those of students serving other job positions. Therefore, this study recommends that, when choosing the off-campus internship unit, students can prioritize "serving as a project planner in order to enhance their entrepreneurial ability cultivation". Students led by their supervisors should engage in project planning, learn from the supervisor how to lead rookies, and integrate and apply knowledge learned in projects, thereby eliciting creativity, laying a solid foundation in terms of entrepreneurial ability, and seizing the opportunity to achieve entrepreneurship.

4) Recommendations for Follow-up Researchers

It was found in this study that students engaging in internship in small and medium enterprises develop better entrepreneurial ability, but the reason behind has not been brought into discussion. Therefore, this study recommends follow-up researchers conduct further surveys targeting students engaging in internships in small and medium enterprises in order to find the real reason affecting the entrepreneurial ability of students engaging in internships in small and medium enterprises. In addition, it was found in this study that regardless of whether or not innovation and entrepreneurship programs were taken by students, the students' entrepreneurial skills showed no variation. However, the students who took innovation and entrepreneurship programs showed superior ready skills and business functions compared to the students without taking innovation and entrepreneurship programs. Hence, it is suggested that follow-up researchers explore the reason behind, which will certainly prefect the research results.

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