

Article

# An Interdisciplinary Research on Students' Employability in Technology Education to Advance Higher Education Enrollment Sustainability

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**Abstract:** Nowadays, with respect to the rapid development of technology education, the rigorous issue of students' employability, and the swift awareness of University Social Responsibility (USR), a majority of higher education institutions have necessarily dedicated themselves to discovering the most effective sustainable strategies in order to survive in the current hyper-competitive and low birthrate era. Therefore, this research creatively employed the Social Cognitive Theory (SCT) to interdisciplinarily and mutually assay the correlations among technology education, students' employability, and institutions' developmental sustainability. Further, it also cross-applied and consolidated the Factor Analysis (FA) approach and the Entropy Analysis (EA) model to comprehensively probe in-depth into the results from a large-scale questionnaire completed by various experts in order to delve into the most critical determinants of students' employability in technology education to advance higher education enrollment sustainability. As a result, the most valuable finding of this research is to directly point out "poverty, unemployment, and educational equitability" as the three most materially considered factors by students during their higher education institution selection process. As a result, higher education institutions have necessarily developed the Concurrent Usages Convenience Technological Feature (CUCTF), Information Immediacy Usability Openness Technological Feature (IIUOTF), Course-Professionalization Technology Assessment (CPTA), and Course-evaluation Technology Analysis System (CTAS) of technology education to strengthen the covered Self-control Capability (SCC), Communication Expression Ability (CEA), Active Attitude and Ambition (AAA), and Problem-solving Ability (PSA) of students' employability to interdisciplinarily explore the most critical determinants of students' employability in technology education to advance higher education enrollment sustainability.

**Keywords:** social cognitive theory (SCT); technology education; students' employability; higher education enrollment sustainability

## 1. Introduction

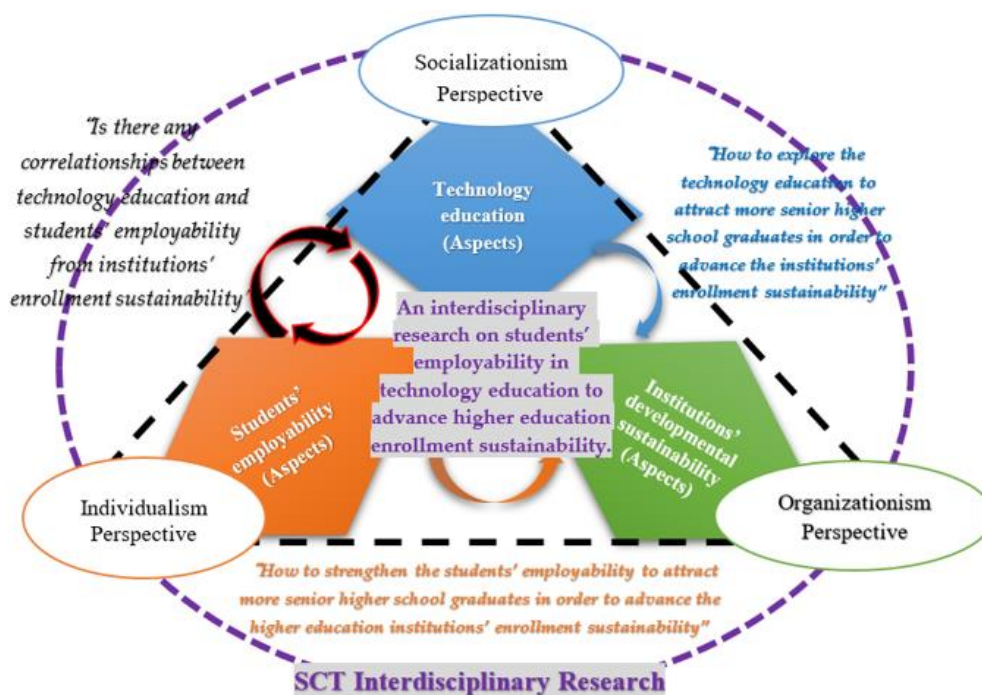
Nowadays, due to the rigorous lower global birthrates, many higher education institutions are confronting a survival ordeal. According to the 2019 annual report of U. S. News & World Report, the number of senior high school graduates in the USA is projected to decrease by 160,000, or 11% of the current total number of high school graduates. In Japan, the impact of the low-birthrate crisis is very severe with the number of registered students in Japanese private higher education institutions having decreased by 40% according to the Japanese Ministry of Education, Culture, Sports, Science

and Technology's 2018 official report. Similarly, the low birthrate shock in South Korea has further resulted in not only 43 higher education institutions that are predictably going to be shut down by 2022, but up to 73 comprehensive four-year universities are also forecasted to be closed by 2024, according to the 2019 annual report of the Ministry of Education in South Korea. According to the latest annual higher education statistic report from the Taiwanese Ministry of Education, not only were up to 151 departments at public and private universities not able to recruit any senior high school graduates, but the registration rate of 268 departments was 30% lower in 2019. Significantly, the recruiting in graduate programs is more like a baptism of fire because up to 64 graduate programs had a registration rate of zero. Furthermore, seven of these graduate programs, including art, drama, human society, ecology, creature evolution, translation, and social work are affiliated with National Taiwan University, which is the top ranked university in Taiwan. With respect to the foreign higher education recruiting challenge, the national higher education graduate employment austerity, and a rapid declining birthrate, a majority of higher education institutions have started to confront the recruiting insufficiency as unprecedented and unrepeatable threats. As a result, more and more talented students are choosing to study in well-known Asian branches of American universities such as New York University at Shanghai Campus, Kean University Campus in Wenzhou, Duke Kunshan University at Wuhan University, Bryant University-Beijing Institution of Technology at Zhuhai, Sichuan University-Pittsburgh Institution, John Hopkins School of Advanced International Studies at Nanjing Campus, University of Michigan-Shanghai Jiaotong University Joint Institution, or at higher international ranking universities such as University of Hong Kong, University of Singapore, Tsinghua University, Peking University, and so forth. According to the official Taiwanese Ministry of Education 2019 report, due to the impact of a rapid declining birthrate, the number of graduating high school students is predicted to be 157,000 in 2028, or a decline of 112,000 graduated high school students from 2015's level of 269,000. In order to supply this enrollment insufficiency in Taiwanese higher education institutions, the Ministry of Education has instituted a series of educational strategies as documented in the New Southbound Policy for attracting foreign students. Presently, there are approximately 13,000 college freshmen from Malaysia, 7800 college freshmen from Vietnam, 7700 college freshmen from Hong Kong, 7300 college freshmen from Indonesia, and so on. Momentously, the registered number of complete Taiwanese higher education institutions was on average 83.9% in 2019, which means there are 16.1% (approximately 42,000 senior high graduates) that choose to register and study in foreign universities or that more and more senior high graduates did gradually deem that the higher education was not apparently able to cultivate and obtain for them enough employability after acquiring a higher education diploma.

In the past, a majority of administering authorities, professors, lecturers, faculties, and even government officers have traditionally and generally considered a higher education institution's social impression, such as international ranking, to be able to not only directly and positively recruit outstanding student talent, but to also indirectly and proactively attract middle-level students. However, the majority of contemporary high school graduates are more focused on employability than an institution's social impression when selecting a higher education institution to apply for. For the reason, "How to strengthen the students' employability to attract more senior high school graduates in order to advance the higher education institutions' enrollment sustainability" has been a consistent topic of life and death for many higher education institutions in this era of a swift declining birthrate [1–3]. Remarkably, there were 114,863 (41.75%) senior high school graduates registered in technology related departments, such as the department of information management, department of technological management, department of information engineering, and so on, at higher education institutions. The number of senior high school graduates who registered in technology-related departments increased to 171,648 (54.6%) in 2019. The reason is that contemporary high school students are already accustomed to and dependent on technological channels to obtain news, information, and knowledge through manipulating 3C (Computer, Communication, Consumer electronics) electronic devices with technological functional platforms, such as the Google search-engine, YouTube videos,

Facebook, Instagram, and so forth, due to the expeditious hardware and software developments of telecommunication and wireless technologies. Further, the Ministry of Education has also instituted a series of “technology education” programs, such as STEM (Science, Technology, Engineering and Math), in the Curriculum Guidelines of 12-Year Basic Education General Guidelines in order to cultivate higher employability among university and college students. Critically, in order to investigate this dramatic tendency of senior higher school graduates, “How to explore the technology education to attract more senior higher school graduates in order to advance the institutions’ enrollment sustainability” and “Is there any correlations between technology education and students’ employability from institutions’ enrollment sustainability” have been empirical and important issues for the current higher education institutions.

After reviewing a series of comprehensive published studies on the relative research topics of technology education, students’ employability, and higher education enrollment sustainability, some research [4–7] indicated that curriculum content and evaluation [8] and University Social Responsibility (USR) [9] are the two most critical factors for higher education institutions’ enrollment sustainability. Some researches induced that students’ organizational ability [10,11], planning techniques [12], and presentative skills were the three most crucial individual competences for employment [13]. However, no researcher has directly been able to complete an in-depth and in-detail assay of the cross-analytical relationships among these three research fields: technology education [14–18], students’ employability [19–24], and institutions’ enrollment sustainability in order to induce the best solution of the above-listed three mainstream research questions of current higher education enrollment sustainability. In order to effectively and interdisciplinarily explore the interactive relationships among technology education, students’ employability, and institutions’ developmental sustainability, this research comprehensively employed the essential core perspectives (individualism, organizationism, and socializationism) of the Social Cognitive Theory (SCT) to comprehensively assay the interactive dependences and influences among technology education, students’ employability, and institutions’ developmental sustainability (as shown in Figure 1). This approach was performed because (1) individualism (students) was able to directly affect the organizationism (higher education institutions) and socializationism (society) perspective as the individual was the basic unit for organization and society; (2) organization indirectly impacted the individual and society as it is necessary for humans to live in groups and majority decisions exist in society; (3) socializationism reversely influences an organization and the individual since majority rule always dominates individual thinking and organizational development [25]. Therefore, students’ employability presents the individual competences in employment that belongs to the individualism perspective of SCT, the organizationism perspective of SCT was applied to discuss institutions’ developmental sustainability, and the socializationism perspective of SCT was able to illustrate socialization media technology in higher education. Subsequently, not only was the Factor Analysis (FA) approach of quantitative analysis able to be first employed in the appraised execution of large-scale, weighted results from questionnaires completed from random university and college students and faculties with higher research validity and representativeness [26,27], but the Entropy Analysis (EA) model of qualitative analysis was also able to be secondly applied in the evaluated implementation of professional weighted results from the questionnaires completed from interdisciplinary experts in students’ employability, institutions’ developmental sustainability, and technology education [28,29] to enhance the research reliability, reproducibility, and accuracy, as illustrated in Figure 1.



**Figure 1.** Interdisciplinary Research Concept. Abbreviation: SCT, social cognitive theory.

## 2. Literature Reviews

### 2.1. Literature on Main Concepts

Specially, based on Figure 1, the brief analytical aspects (students' employability, technology education, and institutions' developmental sustainability) were consolidated into the SCT theory in order to assay the research topic, and thus, students' employability, technology education, and institutions' developmental sustainability were discussed in this session.

#### 2.1.1. Students' Employability

As a series of rigorous unemployment issues for higher education graduates, most higher education institutions have commenced to not only encourage college graduates to take jobs at the primary level, but also commit to executing a series of student employment assistance plans, literacy classes, and a professional credit courses to facilitate students' employability [30,31]. With reference to the latest 2018 official empirical large-scale survey of corporate preferences for higher education graduates by Global Views Monthly in Taiwan, there are ten top employability characteristics of higher education graduates that were induced from the valid 517 (30.9% of valid return rate) questionnaires from 1675 managers from listed companies in the stock exchange, both over-the-counter and emerging stock markets. The top ten employability characteristics considered as the core criteria of students' employability were Active Attitude and Ambition (AAA, 68.3% interviewee's agreement), Aggressive Learning and Adaptability (ALA, 66.7% interviewee's agreement), Stress-resistance and Emotion-control Capability (SEC, 54.3% interviewee's agreement), Self-responsibility and Self-control Capability (SSC, 53.7% interviewee's agreement), Communication Expression Ability (CEA, 51.7% interviewee's agreement), Professionalism and Competency (PC, 49.7% interviewee's agreement), Team-working Capability (TC, 42.3% interviewee's agreement), Executive-power and Problem-solving Ability (PSA, 38% interviewee's agreement), Positive Thinking Personality (PTP, 34.7% interviewee's agreement), and Good Moral Integrity (GMI, 28.3%).

### 2.1.2. Technology Education

With reference to the rapid development of telecommunication and internet technologies, current students have started to not only download and surf the news, but also interactively upload and edit individual comments and information onto the internet through various platforms (such as Instagram, blogs, picture-sharing, vlogs, wall-postings, email, instant messaging, crowdsourcing, etc.). Extraordinarily, in order to stimulate the students' school-studying interest and self-learning consciousness, more and more teachers, lecturers, and professors have started to apply various technological applications into their teaching, education platforms, and processes because technology education has been the students' most common way to obtain the news and information. This is due to the six essential features of technology education [32,33]: (1) multiple-users with concurrent usages feature: multiple users can surf one-way and edit two-way at the same time in technology education; (2) friendly-operation feature: the majority of users were able to easily operate technology education websites (such as surfing, uploading, downloading, etc.); (3) various content features: various internet documents, video, and instantaneous content have been used in technology education; (4) wide-spreading hardware accessibility feature: diversified hardware (such as personal computer, smart-phone, iPad, etc.) is able to be accessibly utilized in technology education; (5) information perpetual record feature: all uploaded information is permanently stored in technology education; and (6) information immediacy usability feature: each technology education participant always uploads and downloads news and information instantaneously, anytime and anywhere. As for the comprehensive acquirement of technology education into education functions based on a series of surveys on various technology education applications, not only six essential features of social technology, but also three basic characteristics of digital education were both able to be categorized as the most core assessable criteria of technology education [34,35]. Significantly, these were (1) Concurrent Usages Convenience Technological Feature (CUCTF), (2) Feedback Friendly-operation Technological Feature (FFTF), (3) Content Aggregation Technology Feature (CATF), (4) Wide-spreading Hardware Accessibility Openness Technological Feature (WHAOTF), (5) Information Perpetual Record Re-purposing Technology Feature (IPRRTF), (6) Information Immediacy Usability Openness Technological Feature (IIUOTF), (7) Course-completion Technological Record Rate (CTRR), (8) Course-evaluation Technology Analysis System (CTAS), and (9) Course-professionalization Technology Assessment (CPTA).

### 2.1.3. Higher Education Enrollment Sustainability

In this era of a swift declining birthrate, many higher education institutions are confronting a grave survival issue because the number of high school graduates has been rapidly declining. Therefore, following the awareness of educational social responsibility of many students, many higher education institutions have started to consider how to utilize higher social impression of USR to advance higher education enrollment sustainability; especially that many higher education institutions have obtained government education subsidies and non-profit organizational supports which means higher education institutions' higher international ranking was entirely the result from society's resources. In addition, in association with the USR of United States and Canada, many renowned higher education institutions, including Harvard University, Yale University, University of Cambridge, University of London, and so forth, have begun to develop a series of "Green Energy Plans" in their academic research centers in order to stimulate students' and faculties' attentions on USR and its relative issues. Ultimately, according to the official higher education enrollment sustainability report by the Taiwanese Ministry of Education in 2019, the main ten Sustainable Development Goals (SDGs) of USR [36] have comprehensively been integrated to be utilized to estimate and assess the higher education enrollment sustainability. As a result, these ten SDGs were directly categorized as the evaluated sub-criteria for assessing and estimating the higher education enrollment sustainability in this research. These SDGs are the Diminishing Poverty (DP), Promoting Food and Agriculture (PFA), Advancing Health and Wealth (AHW), Making Education More Equitable (MEME), Making Gender More Equality (MGME), Facilitating Employment and Economy (FEE), Promoting Green Energy (PGE), Strengthening Water



Quality and Hygiene (SWQH), Forcing Industrial Infrastructure Innovation (FIII), and Endeavoring Equity Rights (EER).

### 2.2. Literatures on Academic Theory

As for the main concepts, the main theory of SCT, the basic concept of technology education and the brief issue of higher education development sustainability are systematically discussed in this section. In terms of the original concept and consumption of SCT, the social learning theory (SLT) was an initial theoretical source of SCT for assaying the complicated educational relationships in the entire society from the three essential elements, including the individual behaviors, group conditions, and societal development and tendency. Furthermore, the individual behaviors are formed as “Individualism”, the group conditions are developed as “Organizationalism”, and the society development and tendency are instituted as “Socializationism”, as described in Figure 2.

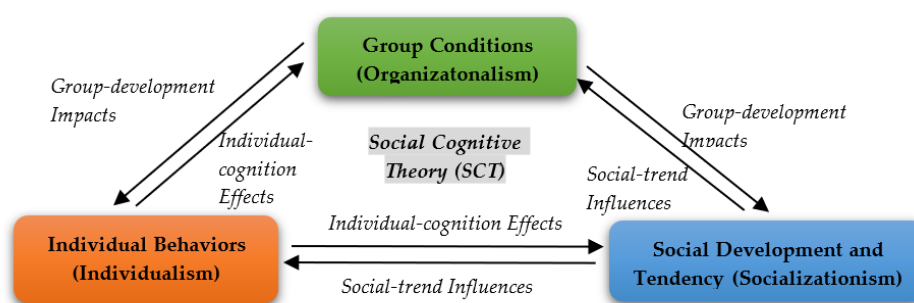


Figure 2. The conceptual interactive relationships of SCT theory.

In Figure 2, there are three critical explanations of the three interactive-circle influenced relationships among individualism, organizationalism, and socializationism: (1) the individual was the essential unity in each organization and society, and thus individual behavior has not only naturally formed an organizational condition, but also played a directly decisive role on the social development and tendency; (2) the group was formed by each individual and hence, group condition was able to indirectly impact each individual behavior; the society is moderately instituted by each group and obviously, group condition is able to directly affect the social development and tendency; and (3) in the entire social group, a final expression of individual behavior and group condition integration, and therefore social development and tendency are able to comprehensively influence and lead to each individual and group.

### 2.3. Assessed Statistic Methods

#### 2.3.1. Factor Analysis of Quantitative Analysis

In terms of the increment of research representativeness and validity in the appraised measurements of surveyed questionnaires, the FA approach of quantitative analysis was systematically employed for identifying and refining the communities and connections among each appraised criterion because the FA approach was initially created to deal with measurements of evaluated criteria. The dependent variables (direct observed impact-measured factors) were defined as  $Y(y_1, y_2, \dots, y_k)$ , independent variables (direct unobserved influenced factors) were presented as  $X(x_1, x_2, \dots, x_k)$ , and weighted constants are outlined as  $W(W_{ij})$ , which presents as the evaluated variable loading and variable-weights of overall appraised factors under linear combination Equation (1) [37] as

$$X_1 = \lambda_{11}Y_1 + \lambda_{12}Y_2 + \dots + \lambda_{1k}Y_k$$

$$(1)\text{s.t. } 1 : Y_- = P^1 X_-, X_- = P^1 Y_-$$

s.t. 2: standardize intersection of variance to be 1 (Max)

$$\begin{aligned} \text{If maximization : } X_k - u_k &= \lambda_{k1}f_1 + \lambda_{k2}f_2 + \dots + \lambda_{km}f_m + e_k \\ (\text{s.t. } (X - u)_{-k \times 1} &= \wedge_{m \times m} f_{m \times 1} + e_{-k \times 1}) \end{aligned}$$

Variance-Covariance matrix presents as

$$\Sigma = \wedge \Phi \wedge^1 + \Psi, \Psi = \text{diag}(\Psi_1, \Psi_2, \dots, \Psi_m) \quad (\text{s.t. } \Phi = I_{m \times m}) \quad (1)$$

### 2.3.2. Entropy Model of Qualitative Analysis

In order to strengthen the research accuracy and reliability to identify the correlations between three brief research questions: “How to strengthen the students’ employability to attract more senior higher school graduates in order to advance the higher education institutions’ enrollment sustainability”, “How to explore the technology education to attract more senior high school graduates in order to advance the institutions’ enrollment sustainability”, and “Is there any correlations between technology education and students’ employability from institutions’ enrollment sustainability”, the ET model of qualitative analysis has been applied to identify, detect, and refine the evaluated measurement of three analytical aspects (technology education, students’ employability, and higher education institutions’ sustainability) after executing the FA approach of quantitative analysis. As for the concept of EM in qualitative analysis, the EM model of qualitative analysis was pioneered to measure the relationship-compared measurements between assessed criteria by means of pairwise comparisons. In a statistic, the “discrete probability connections” of relationship-compared measurements was presented as  $(P_1, P_2, \dots, P_k)$ , and furthermore, the equation of the EM model of qualitative analysis was described as

$$E(P_1, P_2, \dots, P_k) = -\varnothing_k \sum_{i=1}^k P_i \ln(P_i) \quad (2)$$

s.t.  $\varnothing_k = 1/I(k)$  is the normal quantity and  $0 \leq E(P_1, P_2, \dots, P_k) \leq 1$ . Peculiarly, the number of  $E(P_1, \dots, P_k)$  is oppositely relative with the relationships between each assessed criterion.

Subsequently, the expected relationships of the statistic duality equation of conditional entropy is already utilized in the measurement-conditional entropy ( $H(Y|X)$ ) expressed as

$$\begin{aligned} H(Y|X) &= \sum_{x \in X} p(x) * H(Y|X = x) \\ &= - \sum_{x \in X} p(x) * p(y/x) \log p(y/x) \\ &= - \sum_{x \in X} \sum_{y \in Y} p(x, y) \log p(y/x) \\ &= - \sum_{x \in X, y \in Y} p(x, y) \log p(y/x) \\ &= - \sum_{x \in X, y \in Y} p(x, y) \log(p(y/x)/p(x)) \\ &= \sum_{x \in X, y \in Y} p(x, y) \log(p(x)/p(x, y)) \end{aligned} \quad (3)$$

In summary, the comprehensive equation of the most critical determinants of technology education and student-employability to advance higher education sustainability were the multipliers of the consolidated Equation (1) of the FA approach and Equation (3) of the EA model [38,39].

### 3. Research Design

#### 3.1. Questionnaire Collection

In order to increase the research validity and reliability of the questionnaire results, the 5-Likert's scale was utilized in the design of the questionnaire that was completed by 160 participants by employing the FA approach of quantitative analysis for measuring the 29 criteria (the 9 appraised criteria of technology education, 10 assessed criteria of students' employability, and 10 SDGs evaluated criteria of USR). Subsequently, the two-way positive and negative 5-Likert's scale was further applied in the pairwise comparisons of the questionnaire data using the EM model of qualitative analysis for testifying and refining the measured consequences of the FA approach of quantitative analysis.

#### 3.2. Questionnaire Interviewees

As concerns regarding advancement of research reliability and representativeness, 80 high school students and 80 higher education institutions' students were randomly surveyed on the systematic measurements of the FA approach of quantitative analysis. These 160 questionnaires were collected by a random and in-person interview from students from Taipei (northern region), Taichung (western region), Kaohsiung (southern region), and Hualien (eastern region) cities in Taiwan. In consideration of the facilitation of research validity, 20 professional experts were collected for the appraised pair-wise compared matrix of the EA model of qualitative analysis. The first group of five professional experts (3 professors and 2 scholars) with over 10 years' experience in SCT development research fields; second group of five professional experts with over 10 years' experience in technology education and relative research fields; third group of five professional experts with over 10 year experience in students' employability relative research fields; as well as forth group of five professional experts with over 5 years' experience in USR of higher education institutions and relative research fields.

#### 3.3. Main Research Process

Conclusively, the three essential and analytical aspects of technology education, students' employability, and institutions' development sustainability from Figure 1 were further expanded, and thus the 9 appraised criteria of technology education, 10 assessed criteria of students' employability, and 10 SDGs evaluated criteria of USR were completely utilized into the evaluated measurements of the FA approach of quantitative analysis and the EA model of qualitative analysis in Figure 3.



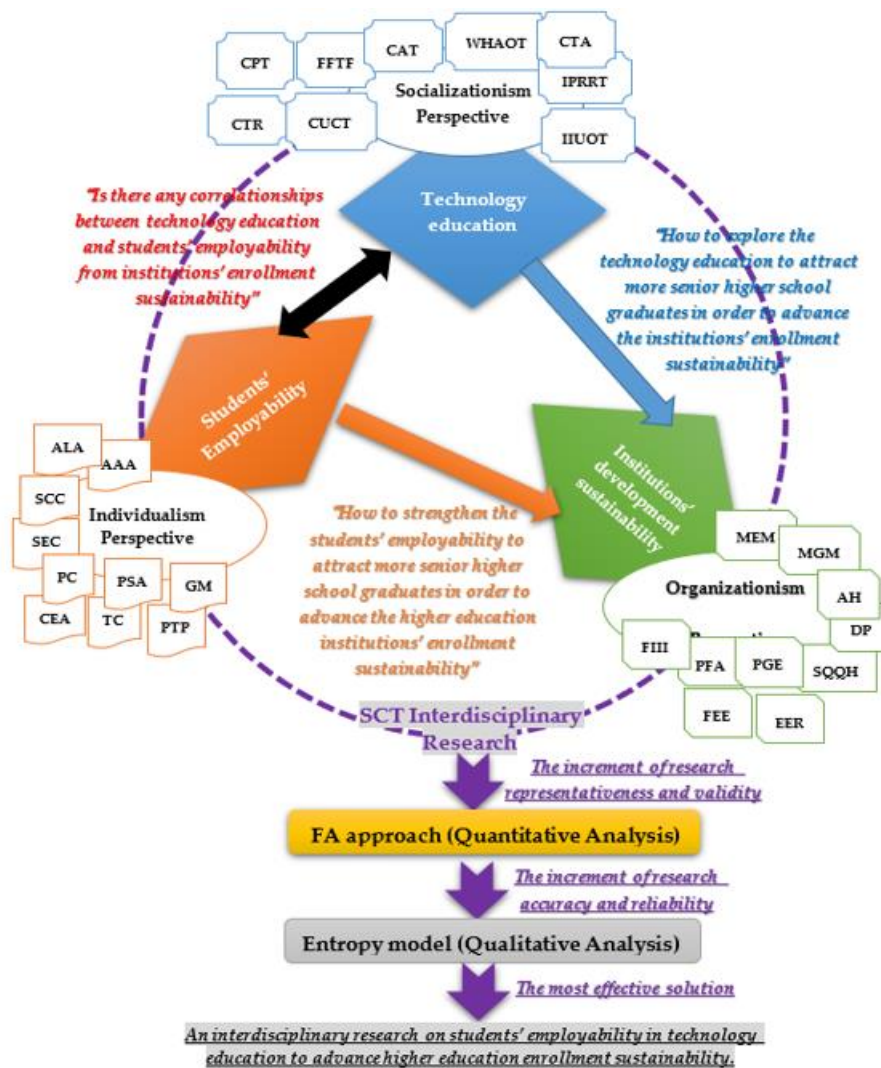


Figure 3. Main Research Design.

#### 4. Research Measurements

##### 4.1. FA approach of Quantitative Analysis

Firstly, the 160 weight-questionnaires were designed to collect data from 80 senior high school graduates and 80 higher education institution students by means of the random and in-person interviews collection way in Taipei (northern area), Taichung (western area), Kaohsiung (southern area) and Hualien (eastern area) cities in Taiwan. The valid collected number of these random interviewed questionnaires was 147 questionnaires. The valid retrieved of these weight-questionnaires was up to 91.875%. The descriptive statistic of these 147 valid weight-questionnaires is described in Table 1.

**Table 1.** The descriptive statistic of FA approach.

Gender	Male: 84 (56%)			Female: 63 (44%)	
Geography	Northern Taiwan <sup>1</sup> : 45 (30.62%)	Middle Taiwan <sup>2</sup> : 42 (28.57%)		Southern Taiwan <sup>3</sup> : 31 (21.08%)	Eastern Taiwan <sup>4</sup> : 28 (19.73%)
Use of Internet hours/per day	One hour: 13 (8.54%)	Two hours: 57 (38.77%)	Three hours: 41 (27.89%)	Four hours: 28 (19.04%)	Over four hours: 8 (5.76%)
Will you have experience on the various technology education applications on school-studying?				Yes: 132 (89.79%)	No: 15 (10.21%)
Will you have experience on the various technology education applications on self-learning?				Yes: 141 (95.91%)	No: 6 (4.09%)
Will you surf or download the news, information and knowledge from technology education websites?				Yes: 129 (87.75%)	No: 18 (12.25%)

<sup>1</sup> Chilung, Taipei, New Taipei, Taoyuan and Hsinchu cities. <sup>2</sup> Miaoli county, Taichung city, Changhua, Nantou and Yunlin counties <sup>3</sup> Chiayi city and county, Tainan and Kaohsiung cities, Pingtung and Penghu counties <sup>4</sup> Hualien and Taitung counties.

According to Equation (1) of the FA approach of quantitative analysis, not only the assessed numbers of the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.718, which was higher than 0.7, but the assessed numbers of significance of the Kaiser-Meyer-Olkin measure and Barlett test of was also 0 . . . . , which was lower than 0.05 in Table 2. Obviously, the FA approach was definitely applied to measure the valid weighted results of the 147 completed questionnaires.

**Table 2.** The KMO and Bartlett's Test of FA approach.

<b>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</b>	<b>0.718</b>	
Bartlett Test of Sphericity	Chi-squared test	1131.14
	df	406
	Significance	0 . . . .

In succession, Table 3 expresses the commonality of each assessed criterion in the FA approach and the SCC (0.806), AAA (0.805), PC (0.802), CEA (0.773) and PSA (0.729), of students' employability; CATF (0.787), CPTA (0.774), WHAOTF (0.761), CUCTF (0.758), IIUOTF (0.746) and CTAS (0.727) of technology education as well as AHW (0.798) and MGME (0.776), EER (0.76), DP (0.728), FEE (0.719), SWQH (0.702) of USR were higher than 0.7, which means these 17 assessed criteria were better explained relationships of the research topic and goal. Subsequently, PTP (0.677), TC (0.666), GMI (0.624), SEC (0.614), and ALA (0.526) of students' employability; FFTF (0.597), IPRRTF (0.556), and CTRR (0.547), and of technology education as well as, PGE (0.609), FIII (0.575), MEME (0.573), and PFA (0.563) of USR were lower than 0.7, which means these 12 assessed criteria were had lower explained relationships with the research topic and goal. As a result, the 29 original evaluation criteria were not only refined, but also reduced as 17 core evaluated criteria by means of the FA approach of quantitative analysis with higher research representativeness and validity.

**Table 3.** The commonality of each assessed criterion in the FA approach.

Criteria	Initial	Extraction
AAA	1	0.805
ALA	1	0.526
SEC	1	0.614
SCC	1	0.806
CEA	1	0.773
PC	1	0.802
TC	1	0.666
PSA	1	0.729
PTP	1	0.677
GMI	1	0.624
CUCTF	1	0.758
FFTF	1	0.597
CATF	1	0.787
WHAOTF	1	0.761
IPRRTF	1	0.556
IUOTF	1	0.746
CTRR	1	0.547
CTAS	1	0.727
CPTA	1	0.774
DP	1	0.728
PFA	1	0.563
AHW	1	0.798
MEME	1	0.573
MGME	1	0.776
SWQH	1	0.702
PGE	1	0.609
FEE	1	0.719
FIII	1	0.575
EER	1	0.76

#### 4.2. EA Model of Qualitative Analysis

After executing FA of quantitative analysis, the EA model of qualitative analysis was further applied to measure the 20 professional experts' weight-questionnaires to synthetically and thoroughly discuss and extensively assay the relationships between the 17 assessed criteria that were refined from the FA approach of quantitative analysis. The 20 professional experts' weight-questionnaires measured consequence of the EA model of qualitative analysis and is illustrated in Table 4.

**Table 4.** 20 professional expert's weight-questionnaires measured consequence of EA model.

Students' Employability					Higher Education Institutions' Sustainability	Technology Education					
SCC	AAA	CEA	PC	PSA		CATF	CPTA	WHAOTEUCTF	IUOTF	CTAS	
0.2874	0.4112	0.2263	0.3814	0.2586	AHW	0.2754	0.1611	0.3628	0.2263	0.0361	0.3554
0.1663	0.2874	0.176	0.4858	0.2204	MGME	0.1041	0.1658	0.2648	0.2211	0.2757	0.4542
0.0602	0.2204	0.1059	0.2874	0.2411	EER	0.076	0.1822	0.0791	0.1722	0.1815	0.2765
0.3968	0.0602	0.4112	0.1578	0.176	DP	0.2068	0.1377	0.403	0.2977	0.3314	0.2765
0.2005	0.502	0.3842	0.3842	0.3842	FEE	0.2508	0.3632	0.3181	0.2296	0.2477	0.0438
0.1903	0.0361	0.2754	0.0201	0.0429	SWQH	0.0567	0.0646	0.0439	0.2665	0.0651	0.1749

Table 4 is an interim summary of the relationships between students' employability and higher education institutions' sustainability. As shown, AAA (0.502) of students' employability was able to accelerate FEE of higher education institutions' sustainability, PC (0.4858) of students' employability was able to advance MGME of higher education institutions' sustainability, CEA (0.4112) of students' employability was able to accelerate DP of higher education institutions' sustainability, SSC (0.3968) of students' employability was able to accelerate DP of higher education institutions' sustainability, and PSA (0.3842) of students' employability was able to accelerate FEE of higher education institutions' sustainability. Subsequently, CTAS (0.4542) of technology education was able to promote MDME of higher education institutions' sustainability, WHAOTF (0.403) of technology education was able to promote DP of higher education institutions' sustainability, CPTA (0.3632) of technology education was able to promote FEE of higher education institutions' sustainability, IUOTF (0.3314) of technology education was able to promote DP of higher education institutions' sustainability, CUCTF (0.2977) of technology education was able to promote DP of higher education institutions' sustainability, and CATF (0.2754) of technology education was able to promote AHW of higher education institutions' sustainability.

#### 4.3. Consolidating FA approach of Quantitative Analysis and EA Model of Qualitative Analysis

Furthermore, each commonality of 17 evaluated criterion from the FA approach of quantitative analysis were directly consolidated into the measured consequences of EA model of qualitative analysis as demonstrated in Table 5.

**Table 5.** Consolidated results of FA approach and EA model.

Students' Employability					Higher Education Institutions' Sustainability	Technology Education					
SCC (0.806)	AAA (0.805)	CEA (0.802)	PC (0.773)	PSA (0.729)		CATF (0.787)	CPTA (0.774)	WHAOTEUCTF (0.761)	IUOTF (0.758)	CTAS (0.746)	CTAS (0.727)
0.1848	0.2642	0.1448	0.2353	0.1504	AHW (0.798)	0.1366	0.0995	0.2203	0.1369	0.0215	0.2062
0.104	0.1795	0.1095	0.2914	0.1247	MGME (0.776)	0.057	0.0999	0.1483	0.1296	0.1913	0.2691
0.0369	0.1348	0.0645	0.1688	0.1336	EER (0.76)	0.0399	0.1087	0.0386	0.0958	0.1157	0.1464
0.2329	0.0353	0.2401	0.0888	0.0934	DP (0.728)	0.1137	0.0763	0.2278	0.1715	0.2233	0.1402
0.1103	0.0209	0.1588	0.0112	0.0225	FEE (0.719)	0.0278	0.0335	0.0198	0.1488	0.0358	0.0825
0.1135	0.2837	0.2163	0.2085	0.1966	SWQH (0.702)	0.173	0.2234	0.166	0.1224	0.1527	0.0184

As shown in Table 5, not only CEA (0.2401) and SCC (0.2329) of Students' employability and WHAOTF (0.2278), IUOTF (0.2233), and CUCTF (0.1715) of technology education were directly able to advance DP of higher education institutions' sustainability but AAA (0.2837) and PSA (0.1966) of students' employability and CPTA (0.2234) and CATF (0.173) of technology education were also directly able to facilitate SWQH of higher education institutions' sustainability. Continuously, PC (0.2914) of students' employability and CTAS (0.2691) of technology education were positively able to promote MGME of higher education institutions' sustainability.

## 5. Conclusions and Recommendations

Nowadays, with respect to the rapid development of technology education, the rigorous issue of students' employability, and the swift awareness of USR, many higher education institutions have

necessarily devoted themselves to discovering the most effective sustainable strategies to survive this hyper-competitive and low birth rate era. Therefore, this research creatively not only employed SCT to interdisciplinarily and mutually assay the correlations among technology education, students' employability, and institutions' developmental sustainability, but it also applied the FA approach and the EA model to comprehensively perform an in-depth analysis of the results from the large-scale questionnaire administered to experts in order to delve into the most critical determinants of technology education and student-employability to advance higher education sustainability. As a result, three brief research questions were completely solved by the evaluated consequences of the consolidation of the FA approach of quantitative analysis and the EA model of qualitative analysis and then, the three significant interdisciplinary conclusions are described as follows:

- (1) CEA and SCC of WHAOTF, IIUOTF, and CUCTF of technology education were directly able to advance the "Diminishing Poverty (DP)" of higher education institutions sustainability. Therefore, not only CEA and SCC are necessary to be covered into the core cultivating literacies in higher education curriculums, but wide-spreading hardware accessibility openness, information immediacy usability openness, and concurrent usages convenience technological features are also necessary to be designed into the essential operation functions of technology education of higher education institutions for facilitating social impression in order to attract more high school graduates to advance higher education enrollment sustainability. Specifically, the majority of high school and higher education institution students both want the higher education institution to necessarily provide CUCTF and IIUOTF with WHAOTF in its technology education system to SCC and CEA of their graduate employability in order to solve vital societal issues in relation with the increment of "Diminishing Poverty (DP)" of higher education institutions' USR for promising social impression in order to encourage more senior high school graduates to advance higher education enrollment sustainability.
- (2) AAA and PSA of CPTA and CATF of technology education were mutually able to proceed FEE of higher education institutions' sustainability. Precisely, the majority of senior high school and university and college students request that higher education institutions offer CPTA in its technology education structure to nurture AAA and PSA of their graduate employability in order to clear up Employment and Economy material society-problems in connection with the addition of FEE of higher education institutions' USR in order to allure more senior high school graduates to advance higher education enrollment sustainability.
- (3) PC of students' employability and CTAS of MGME of higher education institutions' sustainability. Significantly, the majority of senior high school and higher education institution students commonly accede that higher education institution need to supply CTAS in its technology education design in order to straighten out Education Equitable critical society questions in association with the elevation of MEME of higher education institutions' USR.

The most valuable finding of this research directly addressed that "poverty, unemployment, and educational equitability" have been the three most materially considered issues by students during their higher education institution selection process. Furthermore, higher education institutions necessarily develop CUCTF and IIUOTF, and CPTA and CTAS to strengthen students' employability SCC and CEA, and AAA and PSA to strengthen their graduate's advantages in the employment market for advancing "poverty, unemployment, and educational equitability" of USR in higher education institutions.

Specifically, the most significant contribution of this research was to not only academically resupply the interdisciplinary research with an in-depth and in-detail assay into the interactive relationships among technology education, students' employability, and higher education enrollment sustainability in the future, but also to empirically provide concrete suggestions developing the most core sustainable strategies of higher education institutions. In addition to practically offering valuable research findings to governmental education departments to institute the most effective and useful policies to enable current higher education institutions to delve into the most critical determinants of students'



employability in technology education and to advance higher education enrollment sustainability. Ultimately, as for the research limitations, the number of questionnaire collections in this research was planning to add more evaluated methods, such as multiple criteria decision making (MCDM) methods in correlation with the highest research validity, reliability, accuracy, etc.

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## Abbreviations

SCT	Social Cognitive Theory
FA	Factor Analysis
EA	Entropy Analysis
AAA	Active Attitude and Ambition
ALA	Aggressive Learning and Adaptability
SEC	Stress-resistance and Emotion-control Capability
SCC	Self-responsibility and Self-control Capability
CEA	Communication Expression Ability
PC	Professionalism and Competency
TC	Team-working Capability
PSA	Executive-power and Problem-solving Ability
PTP	Positive Thinking Personality
GMI	Good Moral Integrity
CUCTF	Concurrent Usages Convenience Technological Feature
FFTF	Feedback Friendly-operation Technological Feature
CATF	Content Aggregation Technology Feature
WHAOTF	Wide-spreading Hardware Accessibility Openness Technological Feature
IPRRTF	Information Perpetual Record Re-purposing Technology Feature
IUOTF	Information Immediacy Usability Openness Technological Feature
CTRR	Course-completion Technological Record Rate
CTAS	Course-evaluation Technology Analysis System
CPTA	Course-professionalization Technology Assessment (CPTA)
DP	Diminishing Poverty
PFA	Promoting Food and Agriculture
AHW	Advancing Health and Wealth
MEME	Making Education More Equitable
MGME	Making Gender More Equality
FEE	Facilitating Employment and Economy
PGE	Promoting Green Energy
SWQH	Strengthening Water Quality and Hygiene
FIII	Forcing Industrial Infrastructure Innovation
EER	Endeavoring Equity Rights

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