Journal of Posthumanism

2025
Volume: 5, No: 1, pp. 1128–1148
ISSN: 2634-3576 (Print) | ISSN 2634-3584 (Online)
posthumanism.co.uk

DOI: https://doi.org/10.63332/joph.v5i1.651

Sustainable Recruitment Strategies in Technological and Vocational Education: Admission Scores and Enrollment Challenges under Taiwan's Joint Registration and Distribution System

Wen-Ben Lin[1], Chao-Ming Yang[2],

Abstract

This study investigates enrollment trends in Taiwan's technological and vocational colleges under the Joint Registration and Distribution (JRD) System, comparing national and private institutions and analyzing school and department changes from 2021 to 2024. Results indicate that some private institutions opt out of JRD admissions, reflecting both enrollment challenges and strategic flexibility. The emergence of new disciplines has led to notable shifts in application-to-admission ratios. While most national institutions maintain near-full enrollment, only four private institutions achieve similar results. Departmental shifts in admission groups reduced vacancies in 37.3% of cases, but premature changes had limited impact, highlighting recruitment complexities. An analysis of historical admission scores shows that 85% of national and 3.8% of private institutions have over half of their programs ranking in the top 50%. To stabilize first-year enrollment, institutions should closely monitor admission trends and adjust recruitment strategies accordingly.

Keywords: *Sustainable Recruitment, Admission Score Analysis, Institutional Research, Technological And Vocational Education, Higher Education Policy*

Introduction

Taiwan's technical and vocational education (TVE) system has undergone considerable changes because of demographic shifts, particularly the declining birth rate. In response, the government and higher education institutions have introduced diverse admission pathways to enhance enrollment performance and sustain institutional operations (Chang, 2022). Figure 1 presents the number of first-year students in general universities and universities of science and technology in Taiwan from 2014 to 2023, along with the birth cohort sizes of these students (born between 1996 and 2005) and the proportion of first-year students relative to their respective birth cohorts. The data indicate that between 2014 and 2023, the enrollment gap between general universities and universities of science and technology nearly doubled while the number of births declined by 37%. A further analysis of the birth cohorts corresponding to first-year university students from 2025 to 2041 (born between 2007 and 2023) indicates that between 2025 and 2035, cohort sizes remained between 190,000 and 200,000, except for the 2028 cohort, which dropped sharply to 167,000. From 2036 to 2041, the cohort size declined by approximately 8,000 annually, reaching only 136,000 for the cohort entering university in 2041 (born in 2023). This downward trend poses an increasingly severe enrollment challenge for higher education institutions. Although the proportion of first-year students relative to total births rose from 65.4% in 2014 to

[1] Assistant Researcher of Institutional Research Center, Ming Chi University of Technology, New Taipei City, Taiwan. E-mail: wblin@mail.mcut.edu.tw.
[2] Professor in the Department of Visual Communication Design, Ming Chi University of Technology, New Taipei City, Taiwan. E-mail: yangcm@mail.mcut.edu.tw. (Corresponding Author)

76.9% in 2023, universities of science and technology continue to face greater enrollment pressure compared to general universities. These institutions must develop more refined recruitment strategies in advance to ensure a stable student intake.

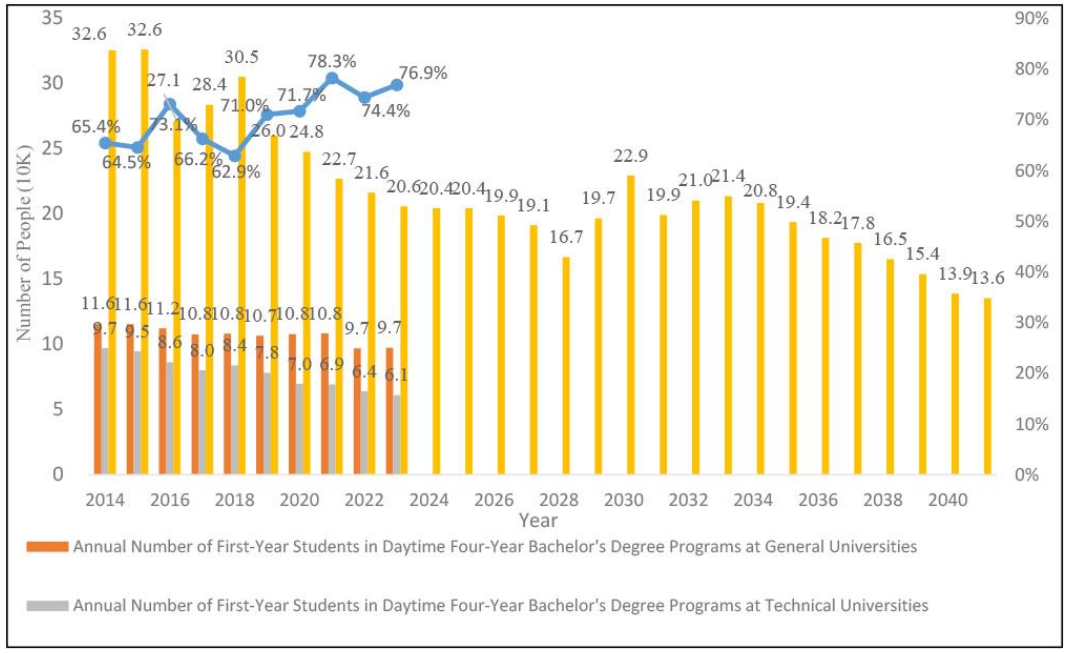

Figure 1. Annual Births and First-Year Enrollment in General and Technical Universities in Taiwan

The primary admission pathways for Taiwan's universities of science and technology include application-based admission, selective admission, and joint registration and distribution (JRD), which together account for approximately 90% of total enrollments in four-year and two-year programs. Among these, the JRD process occurs the latest, with available slots covering vacancies from other admission pathways. Therefore, JRD serves as a key indicator of institutional enrollment performance and directly affects the freshman enrollment rate. JRD is based entirely on the results of the TVE Joint College Entrance Examination and assigns students according to their test scores and ranked preferences. Each department can determine the weighting of exam subjects to align with the specific requirements of its academic discipline. Each year, the Joint Commission of Technological and Vocational Collage Admissions Committee publishes a reference table displaying score brackets and corresponding applicant numbers under different weighting combinations. Using these data, institutional enrollment offices can calculate vacancies, analyze score distributions, and assess both the academic quality and the number of remaining eligible candidates (Chen, 2024). Furthermore, enrollment trends in the JRD pathway serve as a key reference for institutions to refine their recruitment strategies. Many universities and colleges adjust admission quotas on the basis of student application preferences, enrollment competitiveness, and the development of academic disciplines. Some even transfer their admission groups in JRD pathway to improve acceptance rates and institutional competitiveness. In the future, integrating additional data, such as high school learning records and graduate employment tracking, could help establish a more comprehensive

evaluation framework, enhancing the understanding of student learning effectiveness and the sustainability of enrollment (Lin, 2015; Chen, 2020).

Literature Review

Overview of the Development of Vocational Education in Taiwan

Taiwan's vocational education system traces its origins to the Japanese colonial period, when it was referred to as "industrial education"—a term derived from the Japanese education system. During this time, vocational education for Taiwanese students was primarily offered through industrial schools and simplified industrial schools. With the implementation of the New Taiwan Education Ordinance in 1922, Taiwan's vocational education officially aligned with Japan's Industrial Education Ordinance, gradually establishing a vocational education system that was integrated with Japan's (Fan, 2016; Hsu, 2013). On this foundation, simplified industrial schools were progressively restructured into industrial supplementary schools, aligning with Japan's system. By 1944, a year before Taiwan's retrocession, the island had 27 industrial schools and 90 industrial supplementary schools (Hsu, 1994). After Taiwan's retrocession, the government restructured the vocational education system, converting some vocational supplementary schools (formerly industrial supplementary schools under Japanese rule) into general junior high schools. Other schools were reorganized into provincial or municipal senior and junior vocational schools, depending on local educational needs (Hsu, 1994).

Since 1955, the Taiwanese government has implemented a series of vocational education reforms, adjusting existing vocational schools to align with social and industrial demands. As part of these reforms, junior vocational schools were phased out, with institutions either transitioning to senior vocational schools or being restructured into five-year vocational schools, covering grades seven through eleven (Hsu, 1994). In 1967, with the introduction of nine-year compulsory education, the government further discontinued junior vocational schools and five-year vocational programs, replacing them with three-year vocational high schools that admitted junior high school graduates for a three-year course of study. By the 1990s, the government promoted the advancement of vocational education, gradually phasing out three-year junior colleges and facilitating their transition into institutes of technology or technological and vocational colleges. Beginning in 1996, the government encouraged outstanding junior colleges to upgrade to institutes of technology, while retaining their junior college divisions. Many of these institutes later rebranded as universities of science and technology, marking the formal development of higher education within Taiwan's technical and vocational education system (Ministry of Education, 2024).

Separation of Entrance Examinations and Admissions—Diversified Admission Pathways

In 2001, Taiwan officially implemented the separation of entrance examinations and admissions system, replacing the previous TVE Unified Entrance Examination with a diversified admission scheme to enhance fairness in enrollment and expand students' choices. By 2024, admission pathways for technological and vocational colleges had evolved into seven major categories: (1) Joint Special Talent Selection for TVE Programs, (2) Star Project for Technological Universities, (3) Application-Based Admission for Four-Year Day Programs (joint admission for high school graduates), (4) TVE Guaranteed Admission, (5) TVE Screening-Based Admission, (6) TVE Selective Admission, and (7) TVE Joint Registration and Distribution (JRD). Among these, JRD is a primary admission channel for technological and vocational

colleges. As it reallocates unfilled slots from other admission pathways, it serves as a key indicator of institutional enrollment performance and student quality. Furthermore, after the JRD results are announced, institutions may conduct independent admissions to provide additional educational opportunities. These independent admission pathways encompass General Independent Admission for Technological and Vocational Day Programs, Independent Admission for Technological and Vocational Continuing Education Programs, Admission for In-Service Special Programs, Independent Admission for Arts Programs, Admission for Students with Disabilities, Admission for Student Athletes with Outstanding Performance, and Admission for Industry–Academia Collaboration Programs (Multiple Entrance Admission Guide for Technological and Vocational Education, 2024). Through these diversified admission mechanisms, technological and vocational colleges can adjust their recruitment strategies more flexibly to accommodate different student groups while enhancing the accessibility and diversity of TVE (Multiple Entrance Admission Guide for Technological and Vocational Education, 2024).

Admission Vacancies and Score Cutoffs in the JRD System

Several admission prediction tools are available to help students in Taiwan select their preferred programs according to their TVE Joint College Entrance Examination scores and estimate their likelihood of acceptance. Platforms such as the 1111 Job Bank Admission Predictor and the Cross-Reference Admission Predictor provide admission probability estimates on the basis of historical enrollment data. Relevant research also compared the accuracy of different admission prediction methods and platforms (Wu, 2022). Another study developed statistical models to predict admission probabilities using the minimum weighted total score for acceptance in each program (Zen et al., 2005). Additionally, other studies have explored the use of mock exam scores from senior high school students to predict TVE Joint College Entrance Examination results (Huang, 2014; Hsieh, 2020), examined the correlation between entrance examination scores and high school academic performance (Lu, 2006), and analyzed the influence of subject-specific entrance examination scores on students' university academic performance (Chen, 2020).

The Committee of Recruitment Policy for Technological Colleges and Universities commissioned Professor Fu Yuan-chih to analyze the relationship between TVE Joint College Entrance Examination scores and the selective admission pathway across institutions (Committee of Recruitment Policy for Technological Colleges and Universities, 2024). Additionally, the Admissions Office of Southern Taiwan University of Science and Technology conducted an analysis of the JRD System for a specific year. Using linear interpolation, the study calculated the highest and lowest admission score rankings across different admission groups for each department. Percentile rank was also employed to estimate the remaining available slots, enabling the university to adjust departmental quotas across different admission groups accordingly (Chen, 2024). However, a comprehensive national-level study on historical trends in admission vacancies and cutoff scores within the JRD system for all technological and vocational colleges remains lacking. This presents a critical area for future research.

Research Methods

Data Sources, Participants, and Analytical Framework

The present study utilized five secondary external data sources to analyze enrollment trends and

cutoff scores in Taiwan's JRD System for technological and vocational colleges: (1) demographic statistics from the Department of Household Registration, Ministry of the Interior, providing birth population data categorized by citizen status; (2) higher education student statistics from the Ministry of Education, covering nationwide student enrollment figures in higher education institutions; (3) annual JRD admission statistics for four-year TVE day programs (2021–2024), which document the annual JRD admission outcomes for technological and vocational colleges; (4) Higher Education Institutional Data Transparency Platform, Ministry of Education (2021–2023), offering first-year student registration rates (including international students) across departments; (5) Annual Reports on TVE Admission Pathways (2021–2024), detailing the historical development and adjustments of various admission pathways for technological and vocational colleges. As students with "other statuses" (such as international students or those with special status) account for only 0.5%–1.3% of JRD admissions each year, their influence is limited.

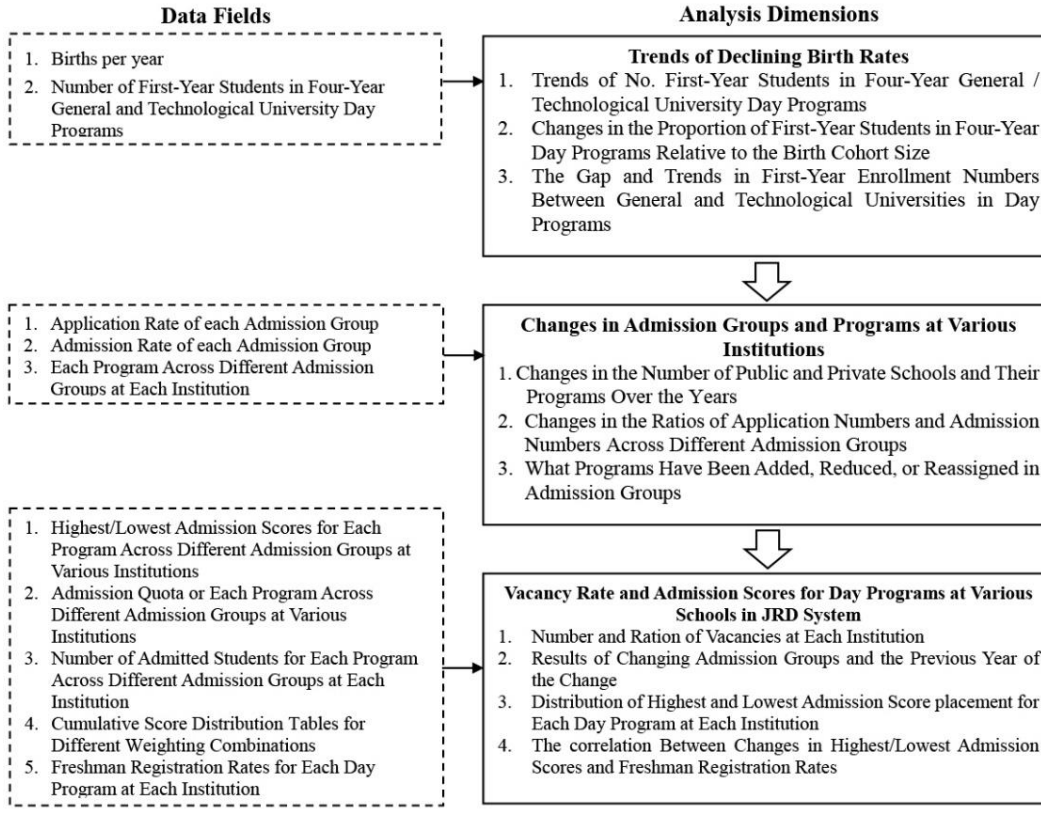

Figure 2. Research Framework Diagram

Therefore, this study focused solely on "General Students" in the JRD admission pathway for day programs. Data processing and visualization analyses were conducted using Microsoft Excel and Python to ensure the interpretability and accuracy of the findings. Regarding the research framework, this study established three core research dimensions on the basis of the research objectives and literature review: (1) The Impact of Taiwan's Declining Birthrate on Technological and Vocational Colleges, analyzing changes in Taiwan's birthrate and their

effects on the number of technological and vocational colleges; (2) The Impact of Declining Birthrates and the Development of Emerging Disciplines on Enrollment and Admission Numbers across Different Groups, analyzing how emerging industries influence academic discipline development and students' choices; (3) Admission Vacancies and Student Quality in the JRD pathway, as well as the Effectiveness of Transitioning to Different Admission Groups, assessing the enrollment pressures and competitiveness of students across institutions and programs and the vacancy rate in the year prior to switching admission groups(Figure 2). Through these analyses, this study aims to provide more specific empirical data to support future decision-making regarding enrollment strategies and academic planning for technological and vocational colleges.

Calculation of the Highest, Lowest, and Average Admission Scores for Each Department

Since 2019, each department or program in Taiwan has been allowed to set its own subject weightings for the TVE Unified Entrance Examination, replacing the previous national uniform weighting design. According to current regulations, the weight range for common subjects (Chinese, English, and Mathematics) is from 1 to 2 times, whereas the weight range for Professional Subject I and Professional Subject II is from 2 to 3 times, with a weight increment of 0.25. By 2024, each admission group has resulted in between 2 and 51 different "cumulative score distribution tables for different weighting combinations," making the calculation of admission score cutoffs more complex. To calculate the admission score cutoff for each department, the relevant cumulative score distribution table corresponding to the subject weightings set by the department for each admission group must first be identified. This allows for the calculation of the minimum or maximum admission score placement. However, this process presents two major challenges: first, how to calculate the admission score cutoffs for different admission groups; and second, if a department recruits students from multiple admission groups, each with its own highest (or lowest) admission score cutoff, how to reasonably consolidate the cutoffs from different groups to facilitate benchmarking across institutions and departments.

Figure 3, sourced from the 2024 year's JRD System for the "Electrical and Electronics Engineering Group (Information Technology and Electronics Category)," presents the cumulative score distribution table (D33) corresponding to the most commonly used subject weighting combinations by institutions. On the basis of this, the distribution curve for the group's enrollment numbers was plotted. The distribution exhibits a right-skewed normal distribution, and the Joint Commission of Technological and Vocational Collage Admissions Committee divides the total score range of 0–700 into 40 equal intervals (each interval spanning 17.5 points). Given that the curve for each interval in the figure closely approximates a straight line, this study employed linear interpolation to calculate the admission score cutoff, ensuring it falls precisely within each interval.

For the second issue, using the highest (or lowest) admission score cutoff from a single admission group as the representative score for a department is unreasonable. This is because the number of admitted students may vary across different admission groups, and the admission groups for different departments may also overlap. When conducting benchmarking across institutions or departments, simply averaging the admission score cutoffs from different groups is not appropriate. Therefore, this study adopted the weighted average method, where the proportion of admitted students in each category served as the weight. The weighted score

cutoffs were then calculated by multiplying each admission group's highest (or lowest) score cutoff by the respective weight and summing the results, as shown in Equation (1).

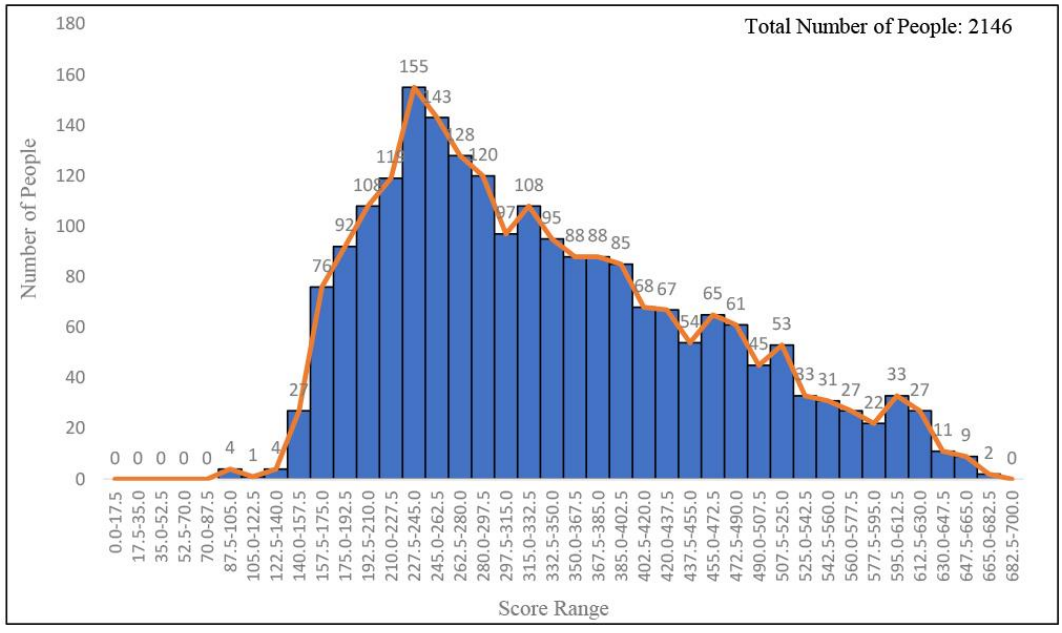

Figure 3. 2024 Admissions for Tech and Junior College Programs in Taiwan's JRD System (D33 Score Summary)

$$X^{i,r} = \sum_j W_j^{i,r} \times L_j^{i,r} \quad (1)$$

Notes:

$X^{i,r}$: Highest (or lowest) admission score cutoff for department (i) in year (r).

$W_j^{i,r}$: Proportion of admitted students in admission group (j) for department (i) in year (r) relative to total number of students admitted across all admission groups.

$L_j^{i,r}$: Highest (or lowest) admission score cutoff for department (i) in admission group (j) in year (r).

$L_j^{i,r}$ is calculated based on the cumulative score distribution table (t) corresponding to the subject weightings set by department (i) for admission group (j) in year (r), using linear interpolation. The equation is shown in (2):

$$L_j^{i,r} = \frac{[(R_{j,t}^{i,r} \times C_{j,t}^{i,r}) - ((S_j^{i,r} - T_{j,t}^{i,r}) \times N_{j,t}^{i,r})]/R_{j,t}^{i,r}}{O_{j,t}^{i,r}} \quad (2)$$

Notes:

$R_{j,t}^{i,r}$: Table (t) for admission group (j) corresponding to department (i) in year (r).

$C_{j,t}^{i,r}$: Cumulative number of students in interval containing the highest (or lowest) admission score in table (t) for department (i) in year (r).

$S_{j}^{i,r}$: Highest (or lowest) admission score for department (i) in admission group (j) in year (r).

$T_{j,t}^{i,r}$: Tail score of interval containing the highest (or lowest) admission score in cumulative score distribution table (t) for department (i) in year (r).

$N_{j,t}^{i,r}$: Number of students in interval containing the highest (or lowest) admission score in table (t) for department (i) in admission group (j) in year (r).

$O_{j,t}^{i,r}$: Total number of students all intervals in table (t) for department (i) in year (r).

For example, in Table 1, the "Highest Admission Score" column shows the highest admission scores for the Department of Electrical Engineering at a certain university from 2021 to 2024 across three admission groups. The highest admission score for the "Power Machinery Group (02)" in 2021 is as follows:

$$L(\text{highest})_{02\ Power\ Machinery\ Group}^{Department\ of\ EE,2021} = \frac{\left[(25 \times 92) - \left((682.38 - 675) \times 17\right)\right]/25}{950} = 9.2\%$$

Next, using Equation (1), the highest admission score cutoffs for the different admission groups in 2021 are consolidated as follows:

$$X(\text{highest})^{Department\ of\ EE,2021} = (9.2\% \times \frac{4}{35}) + (18.3\% \times \frac{24}{35}) + (9.0\% \times \frac{7}{35}) = 15.4\%$$

Similarly, the highest admission score cutoffs for 2021 to 2024 are consolidated according to Equation (3) as follows:

$$Y(\text{highest})^{Department\ of\ EE} =$$

$$15.4\% \times \left(\frac{35}{128}\right) + 18.6\% \times (\frac{27}{128}) + 20.6\% \times \left(\frac{37}{128}\right) + 20.5\% \times \left(\frac{29}{128}\right) = 18.7\%$$

$$Y^{i} = \sum_{r} V^{i,r} \times X^{i,r} \quad (3)$$

Notes:

Y^{i}: Lowest (or highest) admission score cutoff for department (i).

$V^{i,r}$: Proportion of admitted students in department (i) in year (r) relative to the total number of students admitted over years.

$X^{\mathrm{i,r}}$: Lowest (or highest) admission score cutoff for department () in year (r).

Table 1. Highest Admission Scores and Percentiles (2021–2024) for Electrical Engineering, Taiwan JRD, Three Admission Groups

Year	Admission Group	Number of Applications	Table	Highest Score	Highest Score Percentile	Consolidation of High Score Percentiles
2021	02	4	B8	682.38	9.2%	15.4%
	03	24	C10	747.75	18.3%	
	04	7	D8	802.25	9.0%	
2022	02	3	B10	440.63	38.8%	18.6%
	03	19	C9	729.5	14.0%	
	04	5	D9	608.25	23.7%	
2023	02	2	B10	561.25	13.8%	20.6%
	03	30	C9	651.25	20.9%	
	04	5	D8	647.5	21.7%	
2024	02	5	B9	535.5	21.2%	20.5%
	03	23	C7	762.75	19.4%	
	04	1	D6	477.75	42.8%	
Total (2021~2024)		128				18.7%

Notes: 02 is Power Machinery Group; 03 is Electrical Engineering Group; 04 is Electrical and Electronic Engineering and Information Technology Group.

Research Findings

Overview of Institutional, Departmental, and Admission Group Developments

Table 3 presents statistics on the changes in the number of public and private technological and vocational colleges, as well as their academic departments, within Taiwan's JRD System from 2021 to 2024. The number of public technological and vocational colleges remained unchanged, but the number of academic departments increased. Most other public technological and vocational colleges introduced new programs, contributing to an overall increase in the number of departments. By contrast, private technological and vocational colleges exhibited a declining trend in both the number of institutions and academic departments. Private institutions experienced ongoing reductions in their departments, with some repeatedly appearing on the department reduction list for consecutive years. Notably, Table 2 does not include departments that were renamed or merged but continued admissions, nor does it account for newly established departments. Thus, the table primarily reflects the actual contraction of enrollment in Taiwan's TVE sector.

Table 3 summarizes the application-to-admission ratios of "General Student" candidates across

different admission groups in Taiwan from 2021 to 2024. The analysis indicated that admission trends remained relatively stable across groups. The top five admission groups with the highest admission ratios were, in order: Business and Management Group (09), Mechanical Engineering Group (01), Electrical and Electronic Engineering and Information Technology Group (04), Design Group (07), and Hospitality and Tourism Group (17). However, compared to 2021, the admission groups with the highest growth in admission ratios by 2024 were the Electrical Engineering Group (03), Mechanical Engineering Group (01), Design Group (07), Agriculture Group (14), and Business and Management Group (09). Notably, the Hospitality and Tourism Group (17) experienced the greatest decline in admission ratio, suggesting a potential decrease in the field's appeal to prospective students. Additionally, 82 new departments were established in 2024 compared to 2021. Among them, 24 (29%) included keywords such as "Smart," "Artificial Intelligence," "Semiconductor," "Digital," "Digital Marketing," "Big Data," and "Long-Term Care" in their names, reflecting the influence of emerging technologies and industries on the development of academic programs in Taiwan's TVE sector. These newly established departments all belong to the four admission groups with the highest growth in admission ratios, indicating that Taiwan's TVE system is gradually adjusting its recruitment strategies to align with trends in emerging technologies and industries.

Table 2. Number of Schools and Programs in Taiwan's JRD System (2021–2024, Four-Year Tech & Two-Year Junior College)

Year	National Schools	Private Schools	Departments/Programs offered by National Schools	Departments/Programs offered by Private Schools
2021	20	53	285	685
2022	20	51 *Decreased*: CCUT, TTC	290 *Increased*: NCUT (2), NPUST (1), NYUST (1), NKUST (1), *Decreased*: NIU (1)	653 *Decreased*: TTC (6), CCUT (5), TU (4), TSUST (4), YDU (2), SJU (2), JUST (2), CTUST (1), HUST (1), UCH (1), NIT (1), STUST (1), TUMT (1), TFU (1), MU (1), TPOCU (1), HHUT (1), VU (1)
2023	20	47 *Decreased*: TU, HHUT, TFU, TSUST	293 *Increased*: NTC (1), NYUST (1), NKUST (1)	594 *Decreased*: HHUT (9), TU (9), TSUST (9), TFU(6), TNU (4), CTBCUT (3), YUMT (3), CTU (3), CUST (3), TUMT (2), WFU (2), TJU(2), DYHU(2), SJU (2), HUST (1), HWAI(1), OCU (1), NKUT(1), TCU(1), JUST (1), YDU (1)
2024	20	49 *Increased*: SMC, TSUST	293	590 *Decreased*: HDUT (3), TUMT (2), CTBCUT (2), CTUST (1), HUST (1), NIT

				(1), HHUT (1), JUST (1), TNU (1), CSU(1), YDU(1), LIT(1)

Table 3. Application and Admission Rate Trends by Group in Taiwan's JRD System (Four-Year Tech & Two-Year Junior College, General Students)

Admission Group (General Students)	Difference between Application Rate (2024 – 2021)	Difference between Admission Rate (2024 – 2021)
01 Mechanical Engineering Group	+1.7%	**+1.7%**
02 Power Machinery Group	+0.1%	-0.1%
03 Electrical Engineering Group	+2.0%	**+1.7%**
04 Electrical and Electronic Engineering and Information Technology Group	-1.9%	-1.1%
05 Chemical Engineering Group	+0.6%	-0.5%
06 Civil Engineering and Architecture Group	+0.4%	-0.3%
07 Design Group	+1.6%	**+1.3%**
08 Engineering and Management Group	—	-0.1%
09 Business and Management Group	+0.7%	**+0.5%**
10 Health and Nursing Group	-0.8%	-1.0%
11 Food Science Group	-0.1%	—
12 Home Economics and Early Childhood Education Group	—	+0.1%
13 Home Economics and Applied Living Group	-0.6%	-0.3%
14 Agriculture Group	+0.8%	**+0.7%**
15 Foreign Languages and English Group	-0.3%	-0.3%
16 Foreign Languages and Japanese Group	-0.2%	-0.1%
17 Hospitality and Tourism Group	-3.0%	-3.3%
18 Marine Technology Group	—	—
19 Fishery Group	-0.1%	-0.1%
20 Arts and Film Studies Group	-0.5%	-0.4%
51 Electrical Engineering and Electronic Engineering Group	-0.8%	
52 Home Economics Group	+0.1%	
53 Business Administration and Foreign Languages Group (I)	+1.1%	
54 Business Administration and Foreign Languages Group (II)	+0.1%	
55 Business Administration and Foreign Languages Group (III)	—	

56 Business Administration and Foreign Languages Group (IV)	-0.1%	
Total number of people	-5950	-5069

Admission Quotas, Actual Admission Numbers, and Vacancy Rates

The admission quotas for the JRD pathway include vacancies carried over from other admission channels. Analyzing the gap between JRD admission quotas and actual admission numbers helps assess the enrollment performance of various institutions and departments across Taiwan. According to statistics from 2021 to 2024, a total of 74 Taiwanese technological and vocational colleges participated in JRD admissions, including 20 national ones and 54 private ones (five of which have since ceased enrollment). This study identified institutions with JRD vacancy rates below 40% over the four-year period, as summarized in Table 4. The findings show that among the 54 private institutions, 17 (approximately 31.5%) had vacancy rates below 40%, indicating that these institutions maintained a certain level of attractiveness in student recruitment. Among the 20 national institutions, all departments had vacancy rates below 60%, except for the Horticulture and Landscape Architecture Department at National Taitung Junior College, which exceeded this threshold.

A further analysis revealed that only eight private technological and vocational colleges in Taiwan had a total four-year vacancy rate below 60%. Among them, Chihlee University of Technology and Ming Chi University of Technology achieved full enrollment in the past two years. Additionally, excluding junior colleges and technological and vocational colleges located on outlying islands, most national technological and vocational colleges in Taiwan were either near full enrollment or had no vacancies, whereas private institutions generally faced enrollment shortfalls. Therefore, institutions can calculate the minimum admission score cutoff for each department and estimate the remaining available slots on the basis of the total number of applicants within each admission group. This approach can serve as a reference for admission quota allocation decisions in admission groups and provide valuable insights for adjusting department-level admission strategies to improve enrollment outcomes and reduce vacancy rates (Chen, 2024).

Table 4. Admission Quotas and Vacancy Rates (2021–2024) – Taiwan JRD Day Programs

University	Admission Quota	Vacancy Ratio
Shu-Te University (STU)	2570	1008 (39.2%)
Hsiuping University of Science and Technology (HUST)	740	289 (39.1%)
Yu Da University of Science and Technology (YDU)	539	194 (36.0%)
National Taitung Junior College (NTC)	1048	374 (35.7%)
Chungyu University of Film and Arts (CUFA)	136	48 (35.3%)
Tajen University (TJU)	609	204 (33.5%)
Minghsin University of Science and Technology (MUST)	2824	925 (32.8%)
Asia Eastern University of Science and Technology (AEUST)	1995	621 (31.1%)
Lunghwa University of Science and Technology (LUST)	3002	917 (30.5%)
Wenzao Ursuline University of Languages (WZU)	1856	560 (30.2%)
Overseas Chinese University (OCU)	2797	820 (29.3%)

Ling Tung University (LTU)	3052	842 (27.6%)
National Tainan Junior College of Nursing (NTIN)	69	18 (26.1%)
Southern Taiwan University of Science and Technology (STUST)	5741	1000 (17.4%)
Hungkuang University (HKU)	2439	371 (15.2%)
National Quemoy University (NQU)	223	23 (10.3%)
Chang Gung University of Science and Technology (CGUST)	506	49 (9.7%)
National Penghu University of Science and Technology (NPU)	1504	136 (9.0%)
Ming Chi University of Technology (MCUT)	1276	28 (2.2%)
Chaoyang University of Technology (CYUT)	3625	37 (1.0%)
National United University (NUU)	1140	10 (0.9%)
National Ilan University (NIU)	548	3 (0.5%)
National Pingtung University of Science and Technology (NPUST)	3122	14 (0.4%)
National Kaohsiung University of Science and Technology (NKUST)	6220	21 (0.3%)
National Kaohsiung University of Hospitality and Tourism (NKUHT)	904	2 (0.2%)
National Formosa University (NFU)	3326	6 (0.2%)
National Taiwan Normal University (NTNU)	197	0 (0.0%)
National Taipei University of Technology (NTUT)	1859	0 (0.0%)
National Taipei University of Business (NTUB)	699	0 (0.0%)
National Changhua University of Education (NCUE)	216	0 (0.0%)
National Pingtung University (NPTU)	866	0 (0.0%)
National Chin-Yi University of Technology (NCUT)	2348	0 (0.0%)
National Taichung University of Science and Technology (NTCUST)	2062	0 (0.0%)
Chihlee University of Technology (CLUT)	1823	0 (0.0%)
National Yunlin University of Science and Technology (NYUST)	1620	0 (0.0%)
National Taipei University of Nursing and Health Sciences (NTUNHS)	892	0 (0.0%)
National Taiwan University of Science and Technology (NTUST)	1647	0 (0.0%)

Admission Group Transfers of Departments

Transferring admission groups is a strategy adopted by many technological and vocational colleges in Taiwan to address enrollment challenges. This study examined departments that first appeared in the JRD System between 2021 and 2024, tracking whether they changed their admission group in the following year. The transfer year and the number of transfers were recorded for analysis. Among the 445 department-level transfers analyzed, 166 departments (37.3%) experienced a reduction in their vacancy rate after switching admission groups, 199 departments (44.7%) saw an increase in their vacancy rate, and 80 departments (18%) remained

unchanged.

Figure 4 illustrates changes in vacancy rates before and after the admission group transfers of 445 departments. Further analysis revealed that departments with reduced vacancy rates typically switched admission groups only after their vacancy rate reached approximately 45% or higher. By contrast, those with increased vacancy rates tended to switch when their vacancy rate was only approximately 16%, suggesting that premature transfers may not effectively enhance enrollment outcomes. Additionally, departments with unchanged vacancy rates were predominantly national technological and vocational colleges, with a consistent 0% vacancy rate before and after the transfer. This indicated that their admission group changes were likely driven by academic development or policy adjustments rather than vacancy concerns. However, some private technological and vocational colleges maintained vacancy rates between 70% and 100%, and despite switching admission groups, saw little improvement. This suggests that the effectiveness of enrollment strategy adjustments remains influenced by institutional type and overall recruitment conditions.

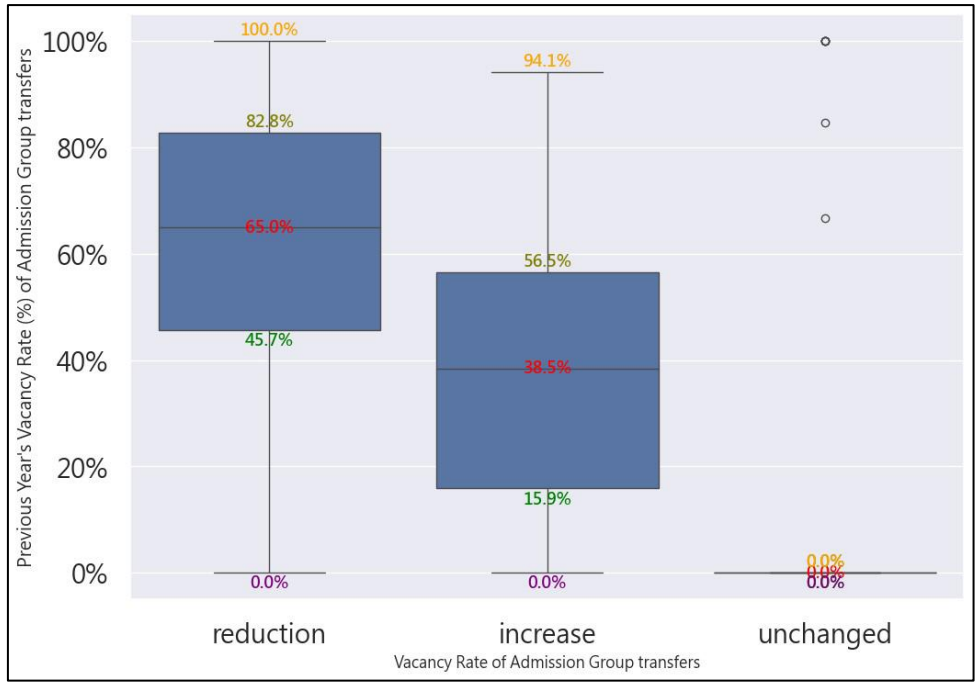

Figure 4. Vacancy Rates and Score Cutoff Distribution Before Group Transfers

This study compiled and consolidated the highest and lowest admission score cutoffs for each department from 2021 to 2024. The score cutoffs were categorized into four quartiles: (0%–25%), (25%–50%), (50%–75%), and (75%–100%), where a lower quartile value indicates higher academic performance among admitted students. On the basis of enrollment data, the proportion of departments within each quartile for both the highest and lowest admission score cutoffs was calculated, followed by an overall analysis of the distribution of departments across institutions. Institutions where the proportion of departments with both highest and lowest admission score cutoffs falling above the 50% threshold (indicating lower-performing admitted students) remained below 0.5 were listed in Appendix. The results showed that among the 20 national

technological and vocational colleges, 17 met this criterion, whereas only 2 out of 53 private technological and vocational colleges qualified. This suggests that national technological and vocational colleges generally admit students with stronger academic performance, whereas most private institutions face greater challenges in student recruitment.

Admission Score Cutoff Trends and Their Correlation with Enrollment

As shown in Table 5 and Appendix (Table 6), the highest or lowest admission score cutoffs for most private technological and vocational colleges tend to be concentrated in the middle to lower score ranges, and their vacancy rates are higher, resulting in lower enrollment rates compared to public technological and vocational colleges. Therefore, the significant correlation between admission score cutoffs and enrollment rates is understandable. However, this information remains insufficient, and further investigation is needed to explore whether fluctuations in the highest (or lowest) admission score cutoffs influence the enrollment rate of the respective departments. Enrollment rate data from 2021 to 2023, as well as the highest and lowest admission score cutoffs from 2021 to 2024 were examined as longitudinal data for analysis (Chen, 2002). According to existing literature, key factors influencing students' selection of departments include campus environment, scholarships, unique programs, faculty quality, teaching standards, curriculum design, employment opportunities and development, as well as the institution's reputation and image (Tao, 2004; Lin, 2010; Ker et al., 2017; Austin, 2000; Drewes & Michael, 2006). However, the changes in these departmental characteristics over time are not readily apparent and are mostly unobservable, yet they clearly have a significant impact on enrollment rates. Therefore, the present study utilized a fixed effects regression model (OLS) to analyze the long-term relationship between trends in admission score cutoffs and departmental enrollment rates, further investigating whether fluctuations in admission score cutoffs influence the stability of enrollment in technological and vocational colleges.

$$y_{it} = \beta X_{it} + \alpha_i + \varepsilon_{it}, \quad E(X_{it}\alpha) \neq 0 \ (4)$$

Notes:

y_{it}: Enrollment rate of department (i) at year (t).

X_{it}: Highest (or lowest) admission score cutoff of department () at year (t).

α_i: Unobserved, time-invariant characteristic factors of department (i), which differ across departments.

ε_{it}: Error term for department (i) at year (t).

Further analysis of departments where the highest (or lowest) admission score cutoffs have improved or declined consecutively for three years was conducted to explore the impact on enrollment rates. The results are summarized in Table 5. The findings indicated that when the highest or lowest admission score cutoff improved consecutively for three years, no significant correlation was discovered between the cutoff scores and the enrollment rate. In other words, even with rising admission scores, the enrollment rate did not significantly increase. However, when the highest or lowest admission score cutoff declined consecutively for three years, a significant negative correlation was observed between the cutoff scores and the enrollment rate, implying that as the admission scores decrease, the enrollment rate also drops. This result suggests that avoiding a continuous decline in the highest or lowest admission score cutoff can

at least maintain the department's new student enrollment rate, thereby enhancing enrollment stability.

Table 5. Correlation Between 3-Year Admission Score Trends and Freshman Enrollment Rates

Consecutively Improved or Decline	Highest Admission Score Percentile	Lowest Admission Score Percentile
Consecutively Improvement for 3 Years	P-value=0.741 (45 Obs.)	P-value=0.616 (86 Obs.)
Consecutively Decline for 3 Years	P-value=0.025 (225 Obs.)	P-value=0.001 (194 Obs.)

Conclusions and Recommendations

Research Findings and Conclusions

This study analyzes the enrollment trends of Taiwan's technological and vocational colleges. On the basis of the estimate that first-year university students in 2023 account for 76.9% of their birth cohort, the findings indicated that up to 2035, the number of first-year students in both universities and technological and vocational colleges will remain at current levels. However, after 2035, this number is projected to decline gradually. By 2041, the number of first-year students may drop to 104,000, indicating that Taiwan's higher education sector will face long-term challenges related to a shrinking student population. In the JRD System, the number of departments in national technological and vocational colleges has not decreased, but the number of departments in private technological and vocational colleges continues to shrink, with some institutions appearing on the enrollment reduction list for three consecutive years, showing that private technological and vocational colleges are facing increasingly severe enrollment pressures. Additionally, according to the development trends of each admission group, the application-to-admission ratios in groups such as "Mechanical Engineering Group (01)," "Electrical Engineering Group (03)," "Design Group (07)," and "Business and Management Group (09)" has significantly increased. Conversely, some traditional engineering departments have gradually exited the "Electrical and Electronic Engineering and Information Technology Group (04)" because of the rise of emerging fields. Likewise, certain departments in fields such as healthcare, food, leisure, hospitality and tourism, management, and foreign languages are no longer enrolling through the "Hospitality and Tourism Group (17)," leading to a noticeable decline in the application-to-admission ratios for that group.

In terms of vacancies, the vacancies in national technological and vocational colleges are primarily concentrated in junior colleges and off-island technological and vocational colleges. Among private technological and vocational colleges, only eight schools had a total vacancy rate of less than 30% over the past four years, indicating that most private institutions are facing enrollment challenges. Regarding the academic performance of admitted students, a total of 17 national and 2 private technological and vocational colleges had more than half of their departments successfully admitting students with highest and lowest admission scores in the top 50%, suggesting that these institutions are still able to attract more qualified students. Additionally, avoiding a continuous decline in the highest or lowest admission score cutoffs for

three consecutive years can effectively maintain freshman registration rates. However, the success rate of addressing vacancies through switching admission groups is only 37.3%. By contrast, 44.7% of departments experienced a worsening vacancy situation after switching admission groups, implying that changing admission groups is not a universally applicable enrollment strategy.

Discussion and Recommendations

This study applied the linear interpolation method to calculate the highest and lowest admission score cutoffs for Taiwan's technological and vocational colleges within each admission group of the JRD System, and analyzed how the fluctuations in these cutoffs affect enrollment rates. However, the number distribution within each range in the "cumulative score distribution tables for different weighting combinations" is not uniform within the range. Therefore, this study also employed the normal distribution rule (68–95–99.7% rule) as an alternative to the linear interpolation method, and compared the results of the two cutoff estimation methods by the cumulative score distribution table D33 in Figure 3. The analysis revealed that, in certain ranges, the differences in calculations between the two methods were between 0% and 1.6%, which is within an acceptable margin. Given that the same linear interpolation method was applied uniformly across all technological and vocational colleges in Taiwan, the admission score cutoffs between different departments remain comparable, thereby confirming the applicability of the linear interpolation method.

Regarding the enrollment trends in Taiwan's technological and vocational colleges, the findings showed that private technological and vocational colleges face more severe vacancy rates, with some institutions experiencing consecutive years of high vacancies. In the future, Taiwan is expected to experience a long-term decline in the domestic student population for higher education, and national technological and vocational colleges may also encounter enrollment challenges. Therefore, whether expanding the recruitment of international students can alleviate the difficulties caused by the shrinking domestic student population warrants further investigation. Additionally, the application-to-admission ratios for groups such as "Mechanical Engineering, Electrical Engineering, Design, and Business and Management" have continued to rise. By contrast, enrollment in traditional engineering programs, such as "Electrical Engineering and Computer Science," as well as in fields such as "Hospitality, Management, and Foreign Languages," has greatly declined. This reflects how industry development trends are influencing the enrollment directions of technological and vocational colleges. Future research could further explore the impact of technological innovation, government policies, or industry shifts on enrollment group choices. For example, does the development of smart manufacturing, green energy, artificial intelligence, or the semiconductor industry affect students' program choices? Has the changing demand for labor in the service sector led to a decline in enrollments in traditional hospitality, health, and related fields?

The long-term relationship between admission score cutoffs and enrollment rates warrants further investigation. This study found that when the highest or lowest admission score cutoffs declined for three consecutive years, enrollment rates dropped significantly. However, when the cutoffs improved for three consecutive years, enrollment rates did not show a significant increase. This suggests that in addition to entrance exam scores, students' choices of technological and vocational colleges may also be influenced by factors such as institutional reputation, graduate employment prospects, tuition subsidies, geographic location, and

government policies. Future research could integrate student choice models to further analyze the key factors influencing students' decisions to enroll in technological and vocational colleges. Additionally, examining the relationship between changes in admission score cutoffs and other variables, such as employment rates, faculty quality, and institutional reputation, could provide more concrete recommendations for enrollment policies. Finally, this study revealed that the success rate of department-level admission group transfers was only 37.3%; 44.7% of departments experienced a worsening vacancy rate after transfer, and 18% saw no change. This indicates that shifting admission groups is not a universally effective strategy for addressing enrollment shortfalls. Future research could further explore the effectiveness of admission group transfers within the same disciplinary field compared to cross-disciplinary transfers. For example, does shifting a mechanical engineering department from the "Mechanical Engineering Group (01)" to the "Power Machinery Group (02)" yield significantly different results from shifting it to the "Electrical and Electronic Engineering and Information Technology Group (04)" in terms of enrollment shortages? Additionally, factors such as institutional branding, industry collaborations, and government subsidies may influence the effectiveness of admission group conversions. Future studies could incorporate these external variables to further evaluate optimal recruitment strategies for different technological and vocational colleges in Taiwan.

References

Chang, R. S. (2022). Improvements in Admissions and Educational Systems for Higher Technical and Vocational Education. *Taiwan Educational Review Monthly, 11*(5), 39-42.

Chen, S. C. (2024). *Institutional Research - Application of Recruitment Strategies* [Keynote speech]. NTUST (Northern District) 2024 Keynote speech, Taipei, Taiwan.

Lin, Y.-S. (2015). *The Impact on Student Performance in Related with Multiple University Entrance Examination* [Masters dissertation]. Tamkang University, New Taipei, Taiwan.

Chen, C.-S. (2020). *The Impacts of Students' Admission Scores on Students' Performance in University Courses: An Institutional Research Study* [Masters dissertation]. National Formosa University, Yunlin, Taiwan.

Fan, Y.-C. (2016). Vocational Education Development in Taiwan during the Japanese Occupation. *Newsletter of Taiwan Studies*, 95, 4-7.

Hsu, P.-H. (2013). Vocational Supplementary Schools in Taiwan during the Japanese Occupation. *Bulletin of Taiwan Historical Research, NTNU*, 6, 101-148. https://doi.org/10.29883/BTHRNTNU.201312_(6).0003

Hsu, Y.-C. (1994). The Evolution and Prospects of Taiwan Industrial Vocational Education Over the Past Forty Years. *Bulletin of the National Institute of Education Resources and Research*,19, 29-48.

Ministry of Education (2024). *The Developmental History of Major Educational Policies in Technical and Vocational Education.* Retrieve from https://history.moe.gov.tw/Policy/Detail/63ed97b1-c9dc-49d2-b1ce-d70b8cbb95e0.

Ministry of Education Republic of China (Taiwan) (2024). *Multiple Entrance Admission Guide for Technological and Vocational Education*. Retrieve from https://www.techadmi.edu.tw/savefile.php?fid=11.

Wu, W.-H. (2022). *Statistical Forecasting and Internet Platform Comparison on the Technological and Vocational Education Joint College Entrance Examinations* [Masters dissertation]. National Taichung University of Education, Taichung, Taiwan.

Zen, M.-M., Chen, Z.-S. & Jhan, C.-H. (2005). Statistical Forecasting after the College Entrance Examination. *Journal of the Chinese Statistical Association*, 43(2), 165-181. https://doi.org/10.29973/JCSA.200806.0005

Huang, X.-H. (2014). *Application of Neural Networks Forecasting on the Scores of Vocational Education College Entrance Exam – A Study of a Kaohsiung Vocational High School* [Masters dissertation]. I-SHOU University, Kaohsiung, Taiwan.

Hsieh, I.-Y. (2020). *Predictive Modeling for Scores on the Technological and Vocational Education Joint College Exam ─A Case Study on Motor and Electronics Group of a High School in Nantou* [Masters dissertation]. National Chung Hsing University, Taichung, Taiwan.

Lu, H.-C. (2006). *A Study on the Relationship Between Scores of Joint Entrance Examination and Vocational High School Academic Performance: A Case Study of Mathematics at The Affiliated Industrial Vocational High School of NCUE* [Masters dissertation]. National Changhua University of Education, Changhua, Taiwan.

Chen, C.-S. (2020). *The Impacts of Students' Admission Scores on Students' Performance in University Courses: An Institutional Research Study* [Masters dissertation]. National Formosa University, Yunlin, Taiwan.

Chen, Y.-F. (2019). Item Analysis of "Specific Subject (1)" of Home Economics Group in the 2017 and 2019 TVE Joint College. *Taiwan Educational Review Monthly*, 8(12), 170-183.

Committee of Recruitment policy for Technological Colleges and Universities (2024). *Workshop on Interpreting Analysis Reports of College Admission by Recommendation and Screening from 2021 to 2024*. Taipei, Taiwan.

Chen, H.-M. (2002). I*nference of Correlation in Mixed Effects Models for Longitudinal Studies* [Masters dissertation]. National Taiwan University, Taipei, Taiwan.

Tao, H.-L. (2004). Do Students Care More about their Major or their University's Reputation? Evidence from Taiwan's Joint College Entrance Examination. *Journal of Taiwan Normal University: Education*, 49(2), 113-132. https://doi.org/10.29882/JTNUE.200410.0006

Lin, Y.-Y. (2010). Some Influential Factors and its Casual Relationships about Undergraduates' College Choices and Major Selections. *Journal of Educational Research and Development*, 6(3), 223-256.

Ker, H.-W., Ho, S.-M. & Chen, C.-Y. (2017). Investigation on Learning Goals of Incoming Students: Using Chihlee University of Technology as an example. *Journal of Chihlee University of Technology*, 37, 161-197.

Austin, S. (2000). *Focus on Your Future: High school Planning for Career / College Choices. Lakewood*, CO: Author.

Drewes, T., & Michael, C. (2006). How do students Choose a University? : An Analysis of Applications to Universities in Ontario, Canada. *Research in Higher Education*, 47(7), 781-800. https://doi.org/10.1007/s11162-006-9015-6

Appendix

Table 6. Admission Score Percentiles and Day Department Proportions in Taiwan JRDS

University	Admission Score	Admission Score Percentile Range			
		(0-25)%	(25-50)%	(50-75)%	(75-100)%
National Taiwan University of Science and Technology	Lowest	100.0% (16)	0.0% (0)	0.0% (0)	0.0% (0)
	Highest	100.0% (16)	0.0% (0)	0.0% (0)	0.0% (0)
National Taiwan Normal University	Lowest	100.0% (7)	0.0%(0)	0.0%(0)	0.0%(0)
	Highest	100.0%(7)	0.0%(0)	0.0%(0)	0.0%(0)
National Taipei University of Technology	Lowest	95.5% (21)	4.5% (1)	0.0% (0)	0.0% (0)
	Highest	100.0% (22)	0.0% (0)	0.0% (0)	0.0% (0)
National Yunlin University of Science and Technology	Lowest	87.0% (20)	13.0% (3)	0.0% (0)	0.0% (0)
	Highest	100.0% (23)	0.0% (0)	0.0% (0)	0.0% (0)
National Changhua University of Education	Lowest	50.0% (1)	50.0% (1)	0.0% (0)	0.0% (0)
	Highest	100.0% (2)	0.0% (0)	0.0% (0)	0.0% (0)
National Taipei University of Business	Lowest	100.0% (10)	0.0% (0)	0.0% (0)	0.0% (0)
	Highest	100.0% (10)	0.0% (0)	0.0% (0)	0.0% (0)
Chang Gung University of Science and Technology	Lowest	20.0% (1)	20.0% (1)	60.0% (3)	0.0% (0)
	Highest	80.0% (4)	20.0% (1)	0.0% (0)	0.0% (0)
National Taipei University of Nursing and Health Sciences	Lowest	66.7% (6)	33.3% (3)	0.0% (0)	0.0% (0)
	Highest	100.0% (9)	0.0% (0)	0.0% (0)	0.0% (0)
National Kaohsiung University of Science and Technology	Lowest	70.5% (43)	23.0% (14)	6.6% (4)	0.0% (0)
	Highest	96.7% (59)	3.3% (2)	0.0% (0)	0.0% (0)
National Tainan Junior College of Nursing	Lowest	0.0% (0)	100.0% (1)	0.0% (0)	0.0% (0)
	Highest	100.0% (1)	0.0% (0)	0.0% (0)	0.0% (0)
National Taichung University of Science and Technology	Lowest	77.3% (17)	22.7% (5)	0.0% (0)	0.0% (0)
	Highest	100.0% (22)	0.0% (0)	0.0% (0)	0.0% (0)
National Pingtung University of Science and Technology	Lowest	13.3% (4)	53.3% (16)	33.3% (10)	0.0% (0)
	Highest	73.3% (22)	26.7% (8)	0.0% (0)	0.0% (0)
National Formosa University	Lowest	18.2% (4)	68.2% (15)	13.6% (3)	0.0% (0)
	Highest	86.4% (19)	13.6% (3)	0.0% (0)	0.0% (0)
National Kaohsiung University of Hospitality and Tourism	Lowest	61.5% (8)	23.1% (3)	15.4% (2)	0.0% (0)
	Highest	92.3% (12)	7.7% (1)	0.0% (0)	0.0% (0)
National Ilan University	Lowest	0.0% (0)	86.7% (13)	6.7% (1)	6.7% (1)
	Highest	73.3% (11)	20.0% (3)	6.7% (1)	0.0% (0)
National Chin-Yi University of Technology	Lowest	4.5% (1)	81.8% (18)	13.6% (3)	0.0% (0)
	Highest	68.2% (15)	31.8% (7)	0.0% (0)	0.0% (0)
National United University	Lowest	0.0% (0)	71.4% (5)	28.6% (2)	0.0% (0)
	Highest	14.3% (1)	85.7% (6)	0.0% (0)	0.0% (0)
Ming Chi University of Technology	Lowest	13.3% (2)	40.0% (6)	46.7% (7)	0.0% (0)
	Highest	60.0% (9)	40.0% (6)	0.0% (0)	0.0% (0)
National Pingtung University	Lowest	12.5% (2)	87.5% (14)	0.0% (0)	0.0% (0)
	Highest	68.8% (11)	31.2% (5)	0.0% (0)	0.0% (0)

Note: (1) Schools are ranked in descending order based on the overall average of the highest admission score percentiles across all departments and programs over the years; (2) Numbers in parentheses indicate the total number of departments and programs at each school.