

Quality of Accreditation Services for Engineering Programs*

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Accreditation of degree-granting engineering programs has been conducted for a decade in Taiwan and has contributed to raising the quality of engineering education. While quality is closely linked to stakeholders' satisfaction, this study aimed to answer how the accreditation stakeholders consider the quality of accreditation services. We employed a PZB model comprising five service gaps and five constructs to analyse service quality, and surveyed 230 program supervisors that applied for accreditation (consumers) and 218 accreditation assessors (service providers). Consequently, the following gaps are found in the PZB (Parasuraman, Zeithaml and Berry) model: (1) There is a gap between the assessors' "perceived consumer expectations" and the program supervisors' "expected services"; in particular, the two-group gaps on "IEET accreditation increases graduates international recognition and generates substantial benefit" and "assessors show respect for others while undertaking their accreditation tasks" are large. (2) There is a gap between the assessors' "perceived service quality specification" and "the provision of service" (i.e. Gap 3 exists); and the most influential construct is "Reliability". (3) There is a gap between the program supervisors' "expected services" and "perceived services" (i.e. Gap 5 exists); in particular, the two-side gaps on the "IEET accreditation criteria reflect international trend" and "IEET reviews help programs improve the quality of education" are large and it indicates that the quality of accreditation services have not yet met the expectations of the assessed programs. (4) Insufficient confidence in the reliability of accreditation criteria and the provision of services. The results can be used for reference to improve engineering program accreditation practices, especially under the Washington Accord, and the process of which this study employed can be used to examine the service quality of other institutional and program accreditation.

Keywords: SERVQUAL scale; PZB model; service quality; program accreditation; meta-evaluation

1. Introduction

Educational accreditation is a process by which institutions or programs are certified as meeting pre-established criteria. Accreditation contributes to improving educational quality and attracting public confidence. It is usually a voluntary process conducted by a third-party accrediting body using peer review [1, 2]. However, accreditation has been criticized for over-emphasizing uniformity and standardization, and neglecting individual performance and creative thinking [3]. Preparing for accreditation may require a great deal of work [4], selecting experts is difficult [5], various costs are incurred [5–7] and inputs (such as facilities and faculty) are prioritized in place of outputs (such as learning outcomes) [6, 8]. Therefore, Kevin Carey proposed that "accreditors should offer multiple tiers of accreditation to convey differences in quality, and documents from the accreditation process should be made public" [8].

Accreditation of engineering programs aims to promote continual improvement, protect and enhance educational quality, and demonstrate per-

formance obligations. However, all accrediting bodies must also continuously improve their services in order to enhance customer satisfaction and maintain confidence in the quality of their work. That is, accreditation stakeholders expect quality accreditation services.

The accreditation of degree-granting programs in the field of engineering in Taiwan is mainly conducted by the Institute of Engineering Education Taiwan (IEET), which is a non-government and non-profit body, as well as a signatory of the Washington Accord (WA). As of 2015, a total of 546 programs in more than 84 universities and colleges have been accredited by the IEET. Accreditation by the IEET is essentially a service that puts its emphasis on customer value. Parasuraman, Zeithaml & Berry [9] pointed out that service providers attract customers through the quality of their services. The closer service quality meets customer expectations, the more satisfied customers are and the stronger their brand loyalty is. This is how consumers are encouraged to make repeat purchases and recommend products to others. According to the customer relationship life cycle

model, the key element to long-term and successful customer relationships is perceived service quality.

In the process of accreditation, the role of assessors is to certify quality and convey the principles of such certification. This study assumed that the IEET is able to provide satisfactory service to the interaction between assessors and stakeholders, such as IEET management, faculty, students, parents of students, and employers of graduates. The PZB model has been used to evaluate the quality and performance of school facilities and educational services, but has not been used to analyse the quality of accreditation services. Our aim was to understand the quality of accreditation services provided to universities and colleges in Taiwan with engineering degree programs. Our subjects were the program supervisors under review (consumers) and IEET assessors (service providers). We explored their expectations and perceptions of service quality, which was evaluated based on the distance between expected and perceived quality. The results can serve as reference for improving the quality of accreditation services not just for engineering programs but also other degree-accrediting programs.

Overall, our objective was to explore the following issues:

- Differences between program supervisors and assessors in their expectations of service quality;
- Differences between assessors' expectations and their satisfaction with accreditation services;
- Difference between the expectations of program supervisors prior to accreditation and their satisfaction with service quality after accreditation;
- The extent to which the five constructs of service quality are correlated.

2. Literature review

2.1 IEET following Washington Accord and accrediting engineering education programs

Quality assurance systems are established with specific processes and criteria that are guided by the principles of higher education. Expert organizations review, audit, and control certain elements in order to guarantee the quality of higher education in both theory and practice. Quality assurance processes have come to be seen as an extension of government authority, an instrument of management that is easily manipulated [10]. Regardless of whether accreditation in higher education is a quality assurance system, a mechanism of authority or a management tool, its basic principle is to raise the teaching and research standards of universities, protect the interests of parents and teachers, and

lead universities to contribute to social and economic development [2].

All nations agree on the importance of quality in higher education and each has established specific organizations to monitor and ensure improvement of educational quality. Accrediting bodies in the field of engineering include the U.S. Accreditation Board for Engineering and Technology (ABET), the Canadian Engineering Accreditation Board, and the Engineering Council UK. In 1989, accreditation bodies responsible for degree-granting engineering programs in the U.S., Canada, England, Ireland, Australia and New Zealand signed the WA, which recognizes the substantial equivalency of programs accredited by signatory bodies. Graduates of programs recognized by the WA are considered to be equipped with the fundamental knowledge and education needed to work in the engineering profession [11].

The IEET was founded in 2003 and became a signatory to the WA in 2007. Graduates of IEET-accredited programs have a qualification that is internationally recognized and can apply for professional licenses from other countries. Institutes offering accredited programs can attract both domestic and international students, and also develop dual degree programs. Through accreditation, the IEET can continuously monitor and improve programs' systems and processes, as well as assist universities in enhancing their educational quality.

The IEET accreditation is a non-government, peer-review process with an outcome-based assessment on student learning. The purpose of it is to determine if a degree-granting program meets certain standards of quality. The IEET examines the content and delivery of engineering degree programs. The three key areas reviewed are as follows: (1) Achievement of education objectives in relation to the core capabilities of students; (2) Courses offered in program; and (3) Demonstration of continuous improvement. Programs seeking to apply for accreditation must submit a self-evaluation report in accordance with the accreditation criteria to the IEET, assessors then assess the report and determine whether to accredit the program or not. Universities and colleges in Taiwan approved by the Ministry of Education (MOE) to offer degree-granting programs at the undergraduate, master's or doctoral level in engineering and technology are eligible to apply to the IEET for accreditation. Accreditation is granted for up to six years and the review process is divided into two types: periodic review and mid-term review.

Seeking to encourage universities and colleges to take initiative in establishing self-evaluation mechanisms or participate in accreditation processes similar to those of the IEET, the MOE

announced that starting from 2010, engineering programs accredited by the IEET are exempted from the MOE program evaluation. Starting from 2012, engineering technology programs in universities or colleges of technology accredited by IEET were also exempted from the program evaluation by the MOE [12]. Accreditation of engineering and technology education began in 2004 with the establishment of the Engineering Accreditation Criteria (EAC), which was joined in 2012 by the Computing Accreditation Criteria (CAC), Technology Accreditation Criteria (TAC), Architecture Accreditation Criteria (AAC), and Design Accreditation Criteria (DAC).

Engineering and engineering technology programs are widely offered in public and private universities in Taiwan. The programs titles and the education offered in these programs are similar to those in the United States and the students enrolled in these fields are over a quarter of all undergraduates in Taiwan. In terms of the number of undergraduate enrollment in these fields, electrical engineering, mechanical engineering and information engineering are the top three departments.

Although much research on accrediting engineering programs has been done, most have focused on accreditation criteria [1, 13–18], subsequent improvement [19], the effects of change to accreditation criteria [7], learning and course delivery [20–27], and the professional capabilities of students [28–30]. Few studies have examined the quality of accreditation services. Some research has pointed out that assessors must prepare adequately for a site visit in order to facilitate successful communication, cooperation, and coordination, as well as smooth the way for follow-up procedures [31].

2.2 PZB model widely used in evaluating service quality

Service quality is an abstract concept that is difficult to quantify. Without objective criteria, we can only measure the customers’ subjective perception of service quality, otherwise termed perceived service quality [32]. Service quality is a conceptual model of the difference between expected service (ES) and perceived service (PS) [32]. They identified ten determinants used to measure possible gaps between expected and perceived service quality, which together form the PZB model (see Fig 1). The five potential gaps are as follows:

- Gap 1: Difference between services expected by consumers and how management perceives consumer expectations;
- Gap 2: Difference between management perception of customer expectations and service quality specifications;
- Gap 3: Difference between service quality specifications and service delivery;
- Gap 4: Difference between services delivered and external communication;
- Gap 5: Difference between customer expectations (based on word of mouth, individual demands and/or past experience) and perceived service quality.

Gaps 1–4 refer to gaps in service delivery. The last gap refers to service consumption but is the most comprehensive one of the five gaps; in other words, $Gap\ 5 = f(Gap\ 1, Gap\ 2, Gap\ 3, Gap\ 4)$, with $f =$ function.

Parasuraman et al. developed the ten elements of service quality into SERVQUAL, which is a quality

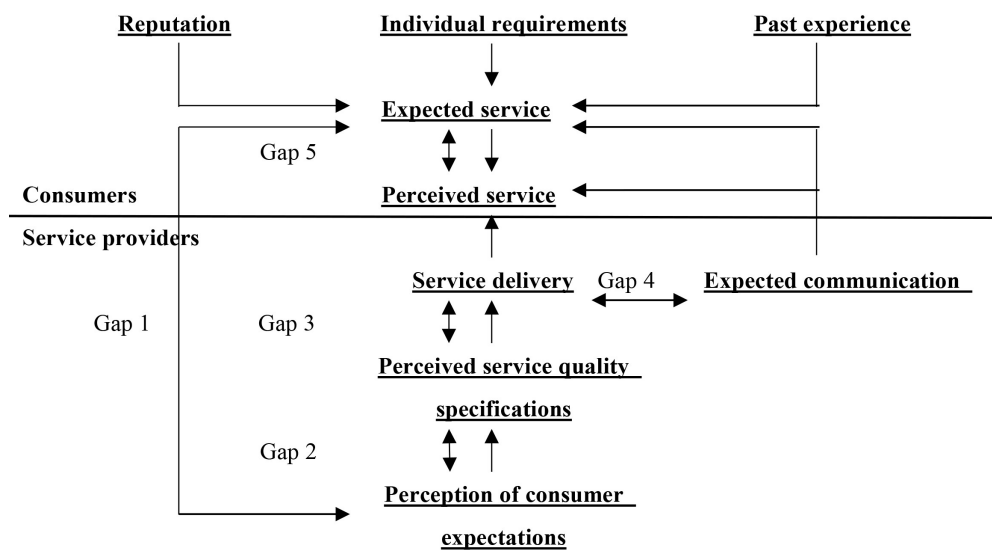


Fig. 1. PZB model.

management framework based on the gaps model. In other words, service quality is determined by the gaps between expected and perceived service quality in relation to the following five constructs: (1) Reliability: Ability to accurately and dependably deliver the promised service; (2) Responsiveness: Ability to quickly resolve customer issues and provide prompt service; (3) Assurance: the professional knowledge and courtesy of staff and their ability to convey confidence and reliability; (4) Empathy: The ability of staff to put themselves in the shoes of customers and provide individualized, compassionate service; and (5) Tangibles: The physical appearance of services (including facilities, equipment, documents, and the personal appearance of staff) [33].

These five constructs have been developed into the 22-item SERVQUAL scale. Each item is used to measure expectations (E) and perceptions (P), which are expressed as numerical scores. The smaller the gap between the scores, the higher the service quality (Q) is; meaning that $Q = P - E$. In 1991, Parasuraman et al. further evaluated and improved SERVQUAL so that it could be applied to different industries [34]. Referring to the SERVPERF scale developed by Cronin and Taylor [35], Parasuraman et al. stated that management should focus on customers' long-term response to service quality [36]. As SERVQUAL is a comprehensive instrument, many studies have utilized it (with slight adaptations) to measure service quality [37–38].

SERVQUAL has already been applied to different areas, such as restaurant and hotel services [39–41]; healthcare [42, 43]; hospital quality [44], water quality services [45], and other service industries [46–48] including higher education [49–57]. In the education sector, SERVQUAL has mainly been used to evaluate the quality and performance of school facilities and educational services. No previous research has utilized SERVQUAL to assess the quality of accreditation services.

3. Methods

3.1 Research hypotheses and instruments

We assumed that Gaps 1, 3 and 5, as shown in Fig. 1, exist in the engineering program accreditation (this is because in the questionnaire development and the IEET interview stages, we combined Gap 2 with Gap 1 for analysis purposes. As far as Gap 4, external communications are somewhat indirect, so we decided to leave this gap for future research). We also assumed that the perceptions of assessors in respect of the five constructs are positively correlated. Referring to the “modified SERVQUAL scale” of Parasuraman,

Zeithaml & Berry, we adjusted SERVQUAL to suit the characteristics of the IEET services and conducted a questionnaire survey. The PZB model has mainly been applied to for-profit service industries and there are no references of its application to accreditation services. Therefore, we interviewed the IEET management while developing the questionnaire and made adjustments based on their inputs. We also interviewed three experts with experience in PZB and academic accreditation, and necessary amendments were made. Afterwards, the questionnaire was sent to 50 programs supervisors and 50 assessors for pretesting. The finalized questionnaire comprises 23 questions covering the five PZB constructs, using a five point Likert scale. Online questionnaires on SurveyMonkey platform were employed and respondents were not required to provide personally identifiable information.

It should be noted that the PZB's five constructs stated earlier were substantially considered when developing questionnaire items. For example, both “attaining program education objectives” and “preparing program graduates with core competencies” are promised services of the programs being accredited. Thus, “Number 6. Assessors can help program supervisors clarify their education objectives” and “Number 7. Assessors can help program supervisors clarify the core competencies of graduates” were developed in the PZB's construct “Reliability”. For another example, when conducting evaluations, the assessors are required to speak moderately and earnestly as well as listen to and respect the assesses' explanations. Thus, “Numbers 16 and 17. When conducting evaluations, assessors act as ‘questioners’ and ‘listeners’” were developed in the PZB's construct “Empathy”.

3.2 Respondents

The respondents were program supervisors and assessors. We sampled the program supervisors of 347 programs (157 programs from 55 universities/colleges that had been accredited in 2012 [58] and 190 programs from 52 universities/colleges that had been accredited in 2013) [59]. Some respondents supervised more than one program but were only permitted to fill out a single questionnaire; therefore, the final number was 344.

We sampled 351 assessors who had undertaken the accreditation process during 2012–2013. Questionnaires were distributed via email and collected via online platform. After eliminating those with incomplete answers, we obtained 230 valid questionnaires from program supervisors, achieving a return rate of 66.9%, and 218 from assessors, achieving a return rate of 61.4%.

4. Results

4.1 Reliability tests show questionnaire internal consistency

According to Develis, Cronbach's $\alpha > 0.6$ means the construct in question has a specific level of reliability [60]. As shown in Table 1, the Cronbach's α for all constructs exceeded 0.7, with overall reliability reaching 0.935.

4.2 Significant differences between the service expectations of assessors and program supervisors

The purpose of testing Gap 1 was to determine whether there are significant differences in the service expectations of assessors and program supervisors. As shown in Tables 2 and 3, significant differences were shown in all 23 questions. The expectations of assessors were higher than those of program supervisors, demonstrating a clear difference in the supply-demand of accreditation services. To some extent, this difference simply reflects the gap between idealism and reality.

The gaps were most significant in responses to the following two questions: "IEET accreditation gives graduates international advantage and results in real benefit"; and "Assessors respect others in undertaking their accreditation tasks." These two items were strongly emphasized by assessors but not program supervisors.

4.3 Assessors' expectations higher than their satisfaction with service quality

We tested for the existence of Gap 3, being any significant difference between the expectations of assessors and their satisfaction with service quality. As shown in Tables 2 and 3, all items but one showed significant differences: "Assessors maintain confidentiality with respect to the application material and outcome of review". The expectations score was significantly higher than the satisfaction score, indicating that assessors have high expectations of service quality, which do not match up to their levels of satisfaction. The five questions that showed the greatest differences all related to reliability, leaving some doubt as to the dependability of accreditation criteria. In contrast, the question "Assessors main-

tain confidentiality with respect to the application material and outcome of review" produced a minimal difference, indicating that assessors have high expectations of themselves with respect to professional ethics and are satisfied with their performance.

4.4 Program supervisors expectations higher than their satisfaction with service quality

We tested for the existence of Gap 5; in other words, whether there is a significant difference between the expectations of program supervisors before accreditation and their satisfaction with service quality. As shown in Tables 2 and 3, there are significant differences between pre-accreditation expectations and post-accreditation satisfaction. The expectations score was higher than the perceptions score, indicating that program supervisors place high importance on the quality of accreditation services and that the current level of quality does not meet their expectations. The item showing the greatest difference was "IEET accreditation criteria reflect international trends", followed by "IEET review helps schools to improve their educational quality", meaning that schools still have questions about the international relevance and quality assurance of accreditation criteria.

4.5 The five constructs of service quality were positively correlated

We used the PZB model to conduct correlation analysis. As shown in Table 4, the five constructs were significantly and positively correlated. This shows that service quality must be maintained and enhanced as a whole, with equal attention given to each of the five constructs. Any bias will lead to gaps, which affect overall levels of service quality.

5. Discussions

The above results can be discussed as follows:

5.1 Causes of differences in the service expectations of assessors and program supervisors should be investigated

To reduce Gap 1, the IEET should investigate the causes of the service expectations of assessors and

Table 1. Reliability analysis of questionnaire constructs

Construct	Questions	Assessors		Program supervisors	
		Expectations	Perceptions	Expectations	Perceptions
Reliability	1–5	0.855	0.872	0.94	0.94
Assurance	6–10	0.819	0.789	0.97	0.96
Responsiveness	11–14	0.870	0.827	0.93	0.94
Empathy	15–19	0.929	0.906	0.96	0.96
Tangibles	20–23	0.805	0.770	0.95	0.93

Table 2. Testing of Gaps 1, 3 and 5

Items	Mean expectations			Mean of assessors			Mean of program supervisors			Rank		
	Assessors	Program supervisors	Gap 1 Assessor-Supervisor	Expectations	Satisfaction	p	Rank	Expectations	Satisfaction		p	
1. The principles and criteria of IEET accreditation are in line with industry personnel requirements	4.39	4.12	0.27	4.39	3.89	0.50	1	4.12	3.96	0.16	0.000	8
2. IEET accreditation criteria reflect international trends	4.41	4.13	0.28	4.41	3.94	0.48	2	4.13	3.93	0.20	0.000	1
3. IEET review helps schools to improve their educational quality	4.53	4.21	0.32	4.53	4.06	0.47	3	4.21	4.03	0.18	0.000	2
4. IEET accreditation is a prudent process	4.56	4.28	0.28	4.56	4.21	0.35	5	4.28	4.16	0.12	0.000	15
5. IEET accreditation increases graduates international recognition and generates substantial benefit	4.34	3.94	0.40	4.34	3.91	0.43	4	3.94	3.76	0.18	0.000	3
6. Assessors can help program supervisors clarify their education objectives	4.34	4.21	0.13	4.34	4.09	0.26	22	4.21	4.08	0.13	0.000	12
7. Assessors can help program supervisors clarify the core competencies of graduates	4.28	4.15	0.13	4.28	3.97	0.30	7	4.15	4.00	0.15	0.000	10
8. Assessors maintain confidentiality with respect to the application material and outcome of review	4.80	4.49	0.31	4.80	4.79	0.01	6	4.49	4.46	0.03	0.035	23
9. Assessors evaluate programs in accordance with accreditation criteria	4.74	4.40	0.34	4.74	4.61	0.12	3	4.40	4.28	0.12	0.000	16
10. Assessors are professionally qualified to undertake accreditation work	4.70	4.42	0.28	4.70	4.58	0.12	12	4.42	4.30	0.08	0.000	20
11. Assessors carefully weigh the supporting evidence provided by schools	4.60	4.35	0.25	4.60	4.39	0.21	14	4.35	4.22	0.13	0.000	13
12. Assessors are able to gain an in-depth understanding of school administration	4.40	4.23	0.17	4.40	4.09	0.31	19	4.23	4.05	0.18	0.000	4
13. Assessors communicate with program supervisors about any questions they may have	4.57	4.40	0.17	4.57	4.47	0.10	20	4.40	4.24	0.16	0.000	9
14. Assessors deliberate over the opinions of program supervisors when writing relevant reports	4.58	4.29	0.29	4.58	4.52	0.06	8	4.29	4.11	0.18	0.000	5
15. Assessors show respect for others while undertaking their accreditation tasks	4.78	4.43	0.35	4.78	4.71	0.06	2	4.43	4.31	0.12	0.000	17
16. When conducting evaluations, assessors act as questioners	4.64	4.35	0.29	4.64	4.50	0.13	9	4.35	4.24	0.11	0.000	18
17. When conducting evaluations, assessors act as listeners	4.67	4.34	0.33	4.67	4.58	0.10	4	4.34	4.17	0.17	0.000	6
18. Assessors objectively review material and give schools the opportunity to explain and respond to any queries	4.68	4.37	0.31	4.68	4.64	0.04	7	4.37	4.23	0.14	0.000	11
19. Assessors express themselves fairly and reasonably when writing their opinions	4.68	4.39	0.24	4.68	4.56	0.11	15	4.39	4.22	0.17	0.000	7
20. The IEET website is easy to operate and understand	4.43	4.22	0.21	4.43	4.27	0.16	17	4.22	4.09	0.13	0.000	14
21. The information published by IEET is clear and up to date	4.50	4.27	0.23	4.50	4.43	0.07	16	4.27	4.19	0.08	0.000	21
22. Assessors are agreeable and personable when conducting interviews	4.73	4.55	0.18	4.73	4.68	0.06	18	4.55	4.48	0.07	0.004	22
23. Assessors express themselves clearly and articulately when conducting interviews	4.67	4.53	0.14	4.67	4.57	0.10	21	4.53	4.46	0.10	0.002	19

Note: Level of significance - $p < .05$.

Table 3. Testing constructs in Gaps 1, 3 and 5

Construct	Program supervisor expectations B				Assessor expectations A				Assessor perceptions C				Course supervisor expectations B				Course supervisor perceptions D							
	Assessor expectations A		Standard deviation		Gap 1 A-B		p		Mean		Standard deviation		Gap 3 A-C		p		Mean		Standard deviation		Gap 5 B-D		p	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Reliability	4.45	0.49	4.14	0.59	0.31	0.000	4.45	0.49	4.00	0.57	0.45	0.000	4.14	0.59	3.97	0.62	0.17	0.000						
Assurance	4.57	0.41	4.33	0.57	0.24	0.000	4.57	0.41	4.41	0.43	0.16	0.000	4.33	0.57	4.22	0.62	0.11	0.000						
Responsiveness	4.54	0.47	4.32	0.61	0.22	0.000	4.54	0.47	4.37	0.49	0.17	0.000	4.32	0.61	4.16	0.73	0.16	0.000						
Empathy	4.69	0.41	4.38	0.56	0.31	0.000	4.69	0.41	4.60	0.44	0.06	0.000	4.38	0.56	4.23	0.72	0.14	0.000						
Tangibles	4.58	0.42	4.39	0.62	0.19	0.000	4.58	0.42	4.49	0.43	0.09	0.000	4.39	0.62	4.31	0.60	0.08	0.000						

Note: Level of significance— $p < 0.05$.

Table 4. Correlation of the five service quality variables

Construct	Reliability	Assurance	Responsiveness	Empathy	Tangibles
Reliability	—				
Assurance		0.702*			
Responsiveness			0.526*		
Empathy				0.403*	
Tangibles					0.566*

* $p < 0.001$.

program supervisors. Assessors' expectations reached an average of 4.506. It indicates that the IEET has strived to promote accreditation and assessors are highly motivated. These could lead to good quality. However, from the perceptions of program supervisors, the service quality should be delivered "down to the earth."

5.2 Accreditation criteria more helpful for program operations should be developed

Gap 3 is mainly affected by whether assessors act in accordance with the IEET criteria when delivering accreditation services. The mean expectations score for Gap 3 was 4.506. This means that assessors feel that most of the time they act in line with the IEET criteria. However, the mean score for reliability was 4.002, indicating that assessors are not as confident in their ability to accurately, consistently, and dependably provide agreed upon services. Assessors expect to provide high quality services but are impacted by uncertain factors in the review process, such as inadequate supporting material, lack of competency on the part of assessors, lack of clarity of criteria, or sufficient guidance, which leads to Gap 3.

To reduce Gap 3, we must devise accreditation criteria more relevant to program operations, provide adequate guidance, and effectively monitor service delivery. Accreditation criteria must be adjusted with respect to education objectives, the core competencies of graduates, teaching effectiveness and assessment, course content, faculty qualifications, facilities and environment, industry-specific accreditation criteria and continuous improvement. The effectiveness of any specification is demonstrated in its execution, as criteria are static and only become dynamic through operation. Therefore, the key to providing service of satisfactory quality lies in the training, authorizing and monitoring of assessors. To demonstrate functionality and guarantee service quality, accreditation criteria must be clearly and accurately implemented in degree-granting programs.

5.3 Feedback and improvement mechanism should be built up to convert demand into quality

Because Gap 5 is the most compressive gap and reducing any of Gaps 1–4 would reduce Gap 5. Therefore, the IEET should focus on pursuing customer satisfaction, actively gather information on the reasons underlying dissatisfaction, make reasonable changes, and provide feedback to schools (reducing Gaps 1–4 in order to reduce Gap 5). In other words, the IEET should convert course requirements into a service quality loop so that feedback and improvement work hand in hand.

With respect to reliability, program supervisors

are uncertain about the substantial benefits of accreditation in terms of international recognition or educational quality, and there is a significant gap between expectations and satisfaction.

Our survey showed that 90% of schools apply for accreditation to increase the value of their degrees, gain international standing and demonstrate the competitiveness of their students. However, when responding to the item, "IEET accreditation reflects international trends", program supervisors showed a gap between expectations and perceptions, indicating that service quality is not yet up to par. They also expressed some doubt about the statement "IEET review helps accredited programs to improve their educational quality". It seemed that most program supervisors did not consider review processes relevant to the relationship between courses and learning outcomes. Instead, they fixated on navigating the various levels and procedures of accreditation review [61]. This is an issue that should be addressed by accreditation service providers.

5.4 Limitations

As far as research limitations, the PZB model has five gaps and we only tested Gaps 1, 3, and 5 and our subjects were key stakeholders—program supervisors and accreditation assessors. Future studies could expand the scope of research to include other operators or consumers, external customers and other stakeholders (such as the IEET management, faculty, students, parents of students, and employers of graduates), in order to test Gaps 2 and 4. This would allow researchers to more accurately and compressively examine gaps and the factors that influence them, information which could be used to further enhance the quality of accreditation services.

5.5 Lessons learned

Accreditation is a quality assurance process and examining its service quality is a kind of meta-evaluation. Our study is the first to apply the PZB service quality concept to the accreditation of engineering programs. We surveyed program supervisors and assessors, and comprehensively analysed the quality of accreditation services. Currently, based on our findings, gaps in reliability pose the greatest challenge to the service quality of the IEET (particularly in relation to the effects objective and the service delivery criteria). These issues of concern to schools and program supervisors should be given priority by the IEET. Future studies could explore potential solutions to these problems with service quality.

Evaluating service quality, which is intangible, heterogeneous and indivisible (Parasuraman,

Zeithaml & Berry, 1985), is very difficult and requires a model combining both theory and practice. This study employed the widely used PZB model to measure the service quality of the IEET. Our experiences can serve as reference to other accrediting bodies in examining their own service quality.

6. Conclusions

In Taiwan, under Washington Accord, IEET has strived to improve the quality of engineering programs through accreditation mechanisms. However, considered as a kind of meta-evaluation and based on the above discussions, this study concludes that Gap 1 (difference between services expected by consumers and how management perceives consumer expectations), Gap 3 (difference between service quality specifications and service delivery) and Gap 5 (difference between customer expectations and perceived service quality) exist. In order to make a difference to provide better accreditation services, IEET should make efforts to reduce these gaps. In addition, the PZB is suggested to examine the service quality of accreditations other than ITEE's.

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