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QHEQ: A Validation Study on Students' Evaluation

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Abstract. QHEQ is a student evaluation questionnaire on quality in higher education developed by the author in a previous research. The key purpose of student evaluations on the extent of quality assurance implementation in higher education institutions is to provide feedback that might lead to better cost effectiveness and higher competitiveness in the higher education sector. The literature on quality in higher education showed that there had been some evaluations of perception of quality in higher education, yet few studies have conducted psychometric analyses in order to develop a *simple* questionnaire for students to assess the quality assurance implementation in the higher education as a whole. This paper addresses the validity of QHEQ using Confirmatory Factor Analysis (CFA) conducted on data from a sample of 768 undergraduates from two Malaysian universities. The results revealed that a five-factor model represents the best-fitting model for quality in higher education perceived by the undergraduate students. In addition, Bollen-Stine bootstrap was employed to correct for standard error and fit statistic bias that occurs in structural equation modeling applications due to non-normal data. The QHEQ has substantial evidence for reliability and construct validity. Hence, the instrument is recommended for the measurement student experiences on quality in higher education.

Keywords: Quality, Higher Education, Questionnaire Validation, Structural Equation Modelling, Bollen-Stine Bootstrap, Student Evaluation

1. Introduction

The importance of quality assurance in higher education and the roles of higher education institutions in developing the country's higher education is undeniable. The concept of quality is more complex in higher education as opposed to in the industry where the end products are clearly defined. According to Harvey and Green, higher education involves transformation process that frequently engage in cognitive transcendence in the students and not just providing service for them [9].

In terms of operationalisation of quality assurance mechanism, the extent of the implementation may vary among the higher education institutions and may reflect the interests of different stakeholders in higher education. Concern about quality in higher education has always exist and discernible in many ways. As stakeholders in the higher education, it is important that due consideration is given to students' perceptions on quality in higher education institutions because they are the receivers in the process of transcending cognitive skills as well as for quality process improvement. This is supported by Srikanthan and Dalrymple who elucidated students' criteria for quality in higher education as to provide them with an evidence of the comparatively high standards in order to guide their choices [20]. Furthermore, student feedback is gaining importance in higher education course provision review and development.

However, the exploration of literature on quality in higher education revealed that there had been some evaluations of perception of quality in higher education [10, 19, 21, 25] but yet few studies have conducted psychometric analyses in order to develop a *simple* questionnaire for students to assess the quality assurance implementation in the higher education as a whole. Most of the past researches involved lengthy questionnaire and/or specifically focused on the evaluation of individual teachers, teaching quality, service

quality, study program`, individual study units and student experienced respectively. Another reason leading to the development of the questionnaire was that the researcher desired a quick way to collect data for her PhD thesis in order to triangulate her qualitative data pertaining to quality assurance implementation in higher education institutions.

Subsequently, the researcher, in her recent study [24], has developed and pilot tested a simple measure of quality in higher education questionnaire which was intended for use by students to assess the quality in higher education. QHEQ was developed based on empirical translation of theoretical concepts, expert panel reviews and interviews with students. Originally it has 35 items but finally it was reduced to a 17-item instrument following some reliability tests and exploratory factor analysis after the pilot test. The pilot test was conducted using a sample of 107 undergraduate students from a Malaysian university. As a result of the study, five easily interpretable factors were extracted. The reliable indicators of the underlying construct of perceived quality in higher education by the students were Effective Teaching and Learning, Personal Development, Supportive Learning Environment, Improved Communication Skills, and Information Availability, Accuracy and Accessibility. The items (labeled with the original item number) in each of the components derived from the pilot study is shown in Table 1. This paper aims to validate the QHEQ using CFA and confirm if the five-factor model represents the best-fitting model for quality in higher education perceived by the undergraduate students.

Table 1 QHEQ components with their respective items after the pilot test

Components derived from pilot study	Quality of Higher Education Items Level of agreement	
Effective Teaching and Learning	10.	My lecturers understand the difficulties faced by students in their studies
	26.	I would recommend others to study the same program at this institution
	9.	Students were given enough time to understand the things that we had to learn
	11.	My lecturers normally gave helpful feedback on how I was doing in my studies
	27.	What I learned in my program is relevant to the real work situation
	15.	There were sufficient equipments, computers, etc for practical lessons
Personal Development	18.	This program improves my analytical skills
	17.	This program helps me to gain problem solving skills
	19.	My reasoning abilities improved after joining this program
	20.	I am more technology-savvy after joining this program
Supportive Learning Environment	7.	My lecturers motivate me in class
	12.	My lecturers are knowledgeable and able to explain things clearly
	16.	I find the teaching and learning activities effective.
Improved Communication Skill	23.	This program helps me to improve my written communication skills
	24.	This program helps me to improve my oral communication skills
Information Availability, Accuracy and Accessibility	34.	When I first joined the university, the admission criteria (e.g. entry requirement) and procedures were clear
	32.	Assessment rules, regulations and criteria are published in a full and accessible form and are made available to students

Source:[24]

2. Method

2.1. Research Participants and Data Collection

768 undergraduate students comprising 56.4% females, from a wide range of faculties in two Malaysian private universities (44.8% and 55. 5% respectively from each university) participated voluntarily in this study. The two universities were selected based on convenience sampling. The participants are local (87%) and international (13%) students whose age mostly ranged from 18 to 25 years old. While most of the questionnaires were administered during lectures and tutorials, some were administered in students' common area such as the cafeteria and library in order to obtain a diverse participant group. The participants were

briefed on the purpose of the study and told of their rights to withhold their participation during and after they had completed the questionnaire.

2.2. Measures

The QHEQ was used in this study and it was developed by the researcher in her recent study [24]. The 17-item survey questionnaire comprising five subscales of the QHEQ, which has several items, measuring the Effective Teaching and Learning, Personal Development, Supportive Learning Environment, Improved Communication Skills, and Information Availability, Accuracy and Accessibility. Each item was measured on a five-point Likert scale with 1 = *strongly disagree* to 5 = *strongly agree*. In an earlier pilot study conducted by the researcher, it was found that the reliability of each subscale ranges from 0.6 – 0.8. Hence the aim of the validation procedure in this study is to determine if that it is the true trend of results.

The participants were also asked to identify their gender, nationality, university, study field and study level (diploma, undergraduate, etc). They were assured of the confidentiality of their responses which would be used for research and improvement purposes only and would not be used in any way to refer to them as an individual.

3. Results

The hypothesized model tested in CFA using Structural Equation Modeling (SEM) with AMOS version 18.0 program, postulates a priori that quality in higher education perceived by students is a five-factor structure composed of Effective Teaching and Learning (ETL), Personal Development (PD), Supportive Learning Environment (SLE), Improved Communication Skills (ICS), and Information Availability, Accuracy and Accessibility (IAAA) which is presented schematically in Fig. 1.

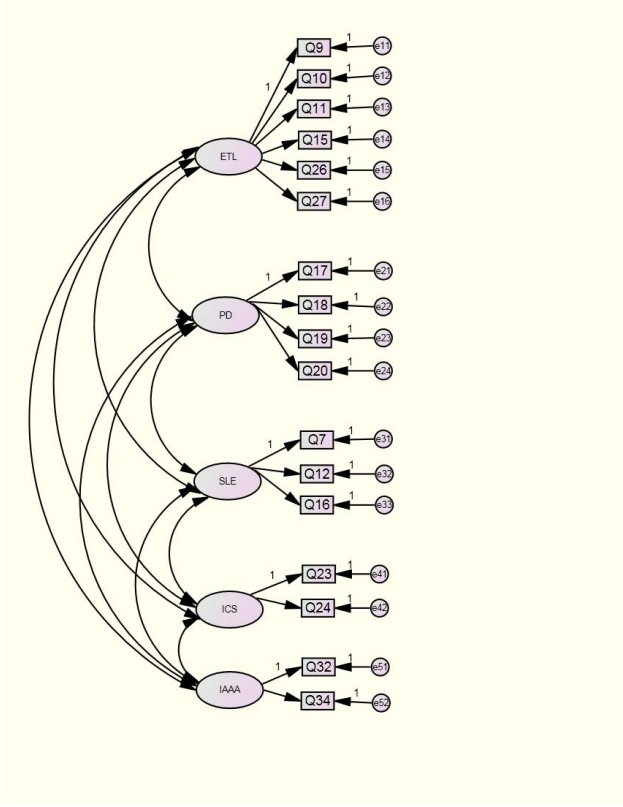

Fig. 1: Hypothesized five-factor CFA model (under H0) of quality in higher education

The test of H_0 yielded a χ^2 value of 302.163, with 109 degrees of freedom and a probability .000 ($p < 0.001$), thereby suggesting that the fit of the data to the hypothesized model is not entirely adequate. In other words, given the present data, the hypothesis bearing the quality values to the students in higher education as summarized in the model, represents an unlikely event and should be rejected. However, the χ^2 test statistic is known to be very sensitive to large sample sizes and the χ^2 limitations have been addressed by many researchers [8, 12, 18, 23]. In turn, some of them have developed other goodness-of-fit indices that take a

more sensible approach to the evaluation process and are usually used as appendage to the χ^2 statistic. In this study, several statistics were used to evaluate the fit of the proposed measurement model. Two incremental or comparative indices of fit, namely the normed fit index (NFI; [2]) and the comparative fit index (CFI: [3]) were examined. Bentler suggested that CFI should be the index of choice because NFI tends to underestimate fit in small sample [3]. Since the sample size (N=768) for this study is relatively large, it is unlikely that we will face this problem. Both the NFI (0.931) and CFI (0.954) are greater than the cut-off values of 0.90 and 0.95 respectively [13] suggesting that the hypothesized model represented an adequate fit to the data.

According to Hu and Bentler [13], if the relative fit index (RFI) is close to 0.95, then it indicates a superior fit. RFI is a derivative of the NFI [4] and from the finding of RFI = 0.914, it is consistent with that of the NFI and CFI. The incremental index of fit (IFI: [5] which addresses the issue of parsimony and sample size, and the Tucker-Lewis index (TLI; [26]) yield values of 0.955 and 0.943 respectively, being indicative of good fit too. The root mean square error of approximation (RMSEA; [22]) which takes into account the error of approximation is another good indicator of model fit adequacy. In this study, the RMSEA = 0.048 which is far lesser than 0.05 indicating a good fit. According to Browne and Cudeck [7], reasonable errors of approximation in the population can tolerate RMSEA values up to 0.08. MacCallum et al. [17] in a later study suggested that values ranging from 0.08 and 0.10 indicate mediocre fit and any value greater than 0.10 indicates inadequate fit. The RMSEA has a 90% confidence interval ranging from value 0.042-0.055 and the p value for the test of closeness of fit equals to 0.679, consistent with the conclusion that the hypothesized model fits the data well.

The output from AMOS also provides the Hoelter's indices (labeled as Hoelter's 0.05 and 0.01 indices). Values greater than 200 are indicative of a model that adequately represents the sample data [11]. In this study, the 0.05 and 0.01 Hoelter's indices for the hypothesized model were 342 and 372 respectively (both exceeding 200) leading us to conclude that the size of our sample (N=768) is satisfactory.

Table 2 Modification indices for covariances and regression weights

Covariances			M.I.	Par Change
e24	<-->	ICS	35.376	.093
e24	<-->	e42	12.410	.058
e21	<-->	e23	11.739	-.037
e21	<-->	e22	15.102	.037
e15	<-->	e16	14.162	.081
e14	<-->	e51	10.017	.092
e14	<-->	e33	23.891	-.111
e14	<-->	e31	11.472	-.089
e12	<-->	e16	12.040	-.066
e12	<-->	e15	10.823	-.064
e12	<-->	e13	35.063	.104

Regression Weights			M.I.	Par Change
Q16	<---	Q15	20.984	-.086
Q7	<---	Q15	10.204	-.069
Q20	<---	ICS	18.976	.196
Q20	<---	Q24	22.329	.139
Q20	<---	Q23	17.471	.131
Q15	<---	Q16	10.817	-.169
Q11	<---	Q10	15.527	.113
Q10	<---	Q11	18.685	.125

Joreskog [14] suggested that while a model appears to be a good fit to the data, it may still be possible to enhance the fit further by indentifying any area of misfit in the model. To improve the overall fit, the model misspecification can be detected using the modification indices suggested by AMOS are shown in Table 2. The modification index (MI) is the expected drop in overall χ^2 value if the parameter were to be freely estimated (MI = 0) in a subsequent run. However, there is no absolute rule on changing a particular parameter but the decision made on the basis of the modification indices must be theoretically meaningful. Having that in mind, the researcher decided to remove items Q10, Q15 and Q20.

A second model was thus estimated after removing the three items. Again, the χ^2 statistic for model fit is still significant (p = .000) with χ^2 value of 121.101 and 67 degrees of freedom. Table 3 gives the other goodness of fit indices. All the values of NFI, CFI, RFI, IFI, TLI, RMSEA and the 90% confidence interval of RMSEA indicate a rather good fit. Subsequently, AMOS only suggests adding covariance between the error terms e12 and e13 but the researcher feels that it is plausible to omit item Q19.

Table 3 Goodness of fit indices for the second model with 14 items

NFI	CFI	RFI	IFI	TLI	RMSEA	90% CI of RMSEA
0.966	0.984	0.953	0.984	0.979	0.032	0.023-0.042

With the removal of item Q19, the revised model with 13 items was re-evaluated on the model fit. All the items have moderate to high standardized loadings on the factors suggesting that they are reliable indicators of the respective factors. The χ^2 statistic for model fit is still significant (p = .007) with χ^2 value of 83.855 and 55 degrees of freedom. Table 4 gives the other goodness of fit indices which all indicate a better fit from the previous model. The Hoelter's indices; Hoelter's 0.05 index = 671 and Hoelter's 0.01 index = 753 indicate that the hypothesized model adequately represents the sample data. Furthermore, the modification indices for all the parameters are below 10 (relatively small) leading us to conclude once again that the model fits the data extremely well.

Table 4 Goodness of fit indices for the revised (third) model with 13 items

NFI	CFI	RFI	IFI	TLI	RMSEA	90% CI of RMSEA
0.973	0.990	0.961	0.990	0.986	0.026	0.014-0.037

Univariate skewness and univariate kurtosis values ranges from -0.505 to 0.064 and -0.405 to 0.525 respectively. The relatively large value of Mardia's normalized multivariate estimate of multivariate kurtosis (31.653) shows evidence that the data are not multivariate normal. In order to address the issue of multivariate non-normality, bootstrapping is conducted to assess the stability of parameter estimates and report them more accurately. Within the context of SEM, bootstrapping provides a mechanism for addressing situations where the ponderous statistical assumptions of large sample size and multivariate normality may not hold [28]. In this study the Bollen-Stein bootstrap procedure [6] was employed. It is a modified bootstrap method for the χ^2 goodness of fit statistic which provides a means to testing the null hypothesis that the specified model is correct. In particular, it can be used to correct for standard error and fit statistic bias that occurs due to non-normal data. It tests the adequacy of the hypothesized model based on the transformation of the sample data such that the model is made to fit the data perfectly. In this study, 1000 bootstrap samples were drawn with replacement from this transformed sample. The Bollen-Stein bootstrap *p* value is 0.135 (> 0.05) indicates that there is insufficient evidence to reject the hypothesized model.

Considering the feasibility and statistical significance of all parameter estimates, the substantially good fit of the model and the lack of any substantial evidence of model misfit, the author conclude that the final five-factor model represents an adequate description of quality in higher education structure for the undergraduate students.

4. Discussion

The QHEQ is a short self-completed questionnaire with good evidence for high reliability and validity. The rigorous and systematic way of development and validation processes strengthen the arguments of those who are concerned about the reliability and validity of students' evaluation on quality in higher education, thus supporting the use of the instrument. The instrument was recently developed and pilot-tested by the author. The findings from that study provided evidence that from the undergraduates' perspectives, effective teaching and learning, personal development, supportive learning environment, improved communication skills, and information availability, accuracy and accessibility contributes significantly to quality in higher education [24].

Alemu [1] stressed that in principal, quality in higher education relies on the quality of educational inputs and throughputs. While he classified educational inputs to include physical, human and financial resources, curricular, material and equipment, the educational throughputs include institutional governance which necessitates accountability, setting and implementing clear standards, and effectiveness.

The effective teaching and learning scale ponders upon good teaching, student active engagement in learning and the relevancy of educational outcomes. Ramsden [19] defines good teaching involves giving clear explanation through interesting lessons and providing useful and timely feedback. Being supportive of students' problems is also essential. Kettunen and Kantola [16] describe the teachers as a key position for quality assurance in higher education and their sense of ownership is important in ensuring quality in teaching and learning. Kehm [15] agrees that the teacher plays a cast role in facilitating the learning experience by creating opportunities for acquiring such skills in the classroom. Srikanthan and Dalrymple [21], in developing a holistic model for quality in higher education, emphasized that learning is based on dynamic engagement between students and teachers, especially about the nature, scope and style of their learning. They recommended transformation by shifting attention from 'teaching' to 'learning'. In particular, students should be involved as partners in internal quality assurance activities in particular the teaching and learning initiatives. The sense of responsibility and high level of engagement between the teachers and students makes quality assurance effective [16].

The personal development scale reflects the extent to which students perceive their studies in university would foster the development of a set of generic skills recognized by the university as a valuable outcome of university education, in addition to discipline specific skills and knowledge. It is worth noting that "improved communication skills" emerged as a separate factor on its own rather than subsumed in the personal development scale. This may be explained by its increasing importance as one of the most appealing skills to the employers. Both personal development and improved communication skills are perceived as important quality values to the students. Known as graduate capabilities to many universities, these skills represents the traits that are commonly sought by employers, thus preparing the students to be work ready, as expected by the employers. Examples include critical analyzing, problem solving, thinking inventively, logical reasoning, confidence and ability to see things from different perspectives. Supporting this, Kehm [15] posits that these skills together with the subject-specific learning outcomes must be clearly defined and the curricular be revised to teach and assess them. While most of the time the teachers are unsure when left with these assignments, it is recommended that training to be given to the teachers in terms of appropriate assessment strategies for such skills and ways to generate opportunities for students to acquire these skills. These skills are not just helpful in finding work in career of their choice but may lead them to a more contented personal life.

While there is a basic assumption that these skills are innate traits, close scrutiny on these skills would suggest that they can be acquired and cultivated over time. Higher education institutions can nurture these skills using several ways. Modeling helps to inspire students to follow what they see others, especially the teachers in demonstrating them. For example, when a teacher works through a problem together with the students during their lesson by illustrating the critical arguments in solving the problem, students not only realize the value and feel inspired to use them but they see how and when to apply them. Introducing puzzle questions encourages students to think critically and allow logical reasoning that would put students in a more competitive learning environment. This method facilitates students to contemplate others' viewpoint and reframe their thinking.

Students also see quality higher education as having a supportive learning environment especially getting support from their teachers. A study on students' perception of quality in higher education by Hill *et al*. [10] also suggested that social or emotional support systems are the important factors. Srikanthan and Dalrymple [21] postulate that one of the important aspects of quality in higher education is the significant commitment by the institution and individuals and providing students a supportive environment. As mentioned earlier, the teacher's role is regarded as vital in cognitive transcendence in the students and they look up at their teachers as role model in their demeanor and interest for the subject. Satisfaction in any learning experience must at least be achieved in the classroom, even though many feels that it should goes beyond the classroom. The teacher's response towards promoting an atmosphere that motivates self-directed and cooperative learning is crucial. This requires the mental change in the teachers that would need tactical influence of leadership and clear direction from top management regarding a shared vision about service quality improves overall institutional performance [27]. In addition, teachers who exhibit professionalism by showing respect for students and demonstrate commitment in ensuring learning are definitely supportive in creating a supportive

learning environment for the students. This is supported by Telford and Masson [25] who agreed that lecturer commitment is one of the quality values in congruence among the higher education stakeholders.

One surprising outcome of this study was the emergence of the Information Availability, Accuracy and Accessibility factor. This implies that students view information in terms of its availability, accuracy and accessibility as important quality value. Majority of the current student population is the generation Y who grew up with the internet. They are familiar with the online universe that they may even have the more updated facts than their teachers. They use technology extensively for variety, stimulation and access to information. It definitely changed the way they communicate and relate to learning. Hence, information is expected to be easily available especially in the electronic mode which warrants for quick availability and accessibility.

With thirteen items, the instrument is simple and quick to complete but covers important aspects of the student evaluation of quality in higher education. These items is measuring what is intended precisely namely the characteristics that are important determinants of quality in higher education. It is designed to be relevant to all undergraduate students. However it can be supplemented with other questions that assess different aspect of quality that may be specific to sub-groups of students, for example, those who are undertaking e-learning or vocational programs. For future research, it is recommended to explore the factorial invariance for various demographic attributes such as gender, nationality, age, study level (diploma, bachelor degree, master, PhD) and type of institution (university, university college and college) on quality in higher education.

The low level of missing data and the high response rate suggest that the instrument is mostly acceptable to undergraduate respondents in various settings in higher education. It is acknowledged that quality in higher education may vary depending on the availability of resources, students' accessibility of education, the diversity of the education programs and the diverse roles of the education provider. Hence, the QHEQ is recommended for use by students to evaluate quality in higher education institutions in order to provide feedback that might lead to better cost effectiveness and higher competitiveness in the higher education sector.

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