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Assessing the research experience of postgraduate students at a Hong Kong university

Lily M. Zeng

The University of Hong Kong, Hong Kong
Guangdong University of Foreign Studies, Guangzhou, China
zengll@hku.hk

Beverley J. Webster

The University of Hong Kong, Hong Kong
bwebster@hku.hk

The Student Research Experience Questionnaire (SREQ) has been used in an Australian university to measure postgraduates' research experiences for many years. Hong Kong is undergoing major education reform and for some universities instigating the systematic evaluation of student learning experiences at all levels. The aims of this study were to validate SREQ in a Hong Kong university and explore the effect of student research experiences on the perceived development of generic skills and overall satisfaction. Data were collected from 599 currently enrolled postgraduate students at a Hong Kong university. Exploratory and confirmatory factor analysis were used to determine the construct validity of the scales and the effects of student research experiences on the perceived development of generic skills. Overall satisfaction was explored using structural equation modelling. The results from exploratory and confirmatory factor analyses supported the scale structure of five SREQ scales in the Hong Kong context. The reliability estimates ranged from .88 to .93. The structural equation modelling indicated that supervision was a significant predictor of *students' perceived skill development and overall satisfaction*. Infrastructure and intellectual climate had only significant contribution to overall *satisfaction*. The results suggested that the SREQ is a reliable and valid instrument for the measurement of research students' research experience in the Hong Kong context. The data can provide important information about relationships between student research experiences and how to promote positive learning outcomes.

Keywords: Student Research Experience Questionnaire, validation, Hong Kong context

Introduction

Higher education institutions around the world are experiencing a series of quality evaluations nowadays as demanded by the national government for public accountability and quality assurance (Ertl, Hayward, Wright, Edwards, Lunt, Mills, & Yu, 2008; Webster, Chan, Prosser, & Watkins, 2009). In addition to the traditional standards of the quality of higher education such as reputation, resources, and publication, student experience is an indicator used more and more widely nowadays in practice (for example, University of Sydney, Institute of Teaching and Learning, 2005; The Higher Education Academy, 2009a; University of Hong Kong, Centre for the Enhancement of Teaching and Learning, 2009). The Course Experience Questionnaire (CEQ, University of Sydney, Institute of Teaching and Learning, 2005) is an instrument developed in Australia (and used in many other places in adapted forms) for the evaluation of undergraduate student learning experience. It was designed with the notion that students' perceptions of teaching, workload, clarity of standards, and

assessment would have effect on their learning approaches and the quality of their learning outcomes in the end (Marton & Säljö, 1976; Entwistle & Ramsden, 1983). The data obtained have supported universities in improving the quality of the student experience as well as benchmarking between universities and faculties within a university. Research has supported the appropriateness of using the CEQ outside Australia and in some specific disciplinary settings (for example, Byrne & Flood, 2003; Diseth, 2007; Kreber, 2003; Lyon & Hendry, 2002; Webster, Chan, Prosser, & Watkins, 2009).

Research experience questionnaires

Based on the similar theory context, in the late 1990s, the Postgraduate Research Experience Questionnaire (PREQ) (University of Sydney, Institute for Teaching and Learning, 2007a) was developed and piloted in Australian and New Zealand universities (Marsh, Rowe, & Martin, 2002). Its development incorporated extensive input from diverse sources, such as reviews of instruments used in a variety of universities, feedback from higher education staff with relevant experiences, and student feedback (Australian Council for Educational Research, 1999). Like CEQ, the PREQ provides a multidimensional measure of the research students' experience: supervision, intellectual climate, infrastructure, thesis examination, goals and expectations, and skills development in research degrees. From 2002, the Institute for Teaching and Learning (ITL) at the University of Sydney began to run the PREQ nationwide on graduated research students in Australia. As there are only limited numbers of research students graduating every year, Student Research Experience Questionnaire (SREQ) (University of Sydney, Institute for Teaching and Learning, 2007b) was designed with items similar to PREQ in order to collect data from current students within the University of Sydney. As the instruments measuring postgraduates' research experience, both questionnaires cover supervision, infrastructure, intellectual climate, and skill development. PREQ includes two additional scales that are more relevant to graduates: thesis examination, and goals and standards. Student Research Experience Questionnaire (SREQ) has 11 more items than PREQ: an overall satisfaction item in supervision and infrastructure, one item in infrastructure, four items in intellectual climate, and four items in skill development. Such work has prepared the ground for the development of a similar instrument in the UK, the Postgraduate Research Experience Survey (PRES, The Higher Education Academy, 2009b). The Postgraduate Research Experience Survey collects feedback from current students and covers similar areas as the PREQ and SREQ: supervision, skills development, infrastructure, intellectual climate (research environment), goals and standards, and thesis examination (The Higher Education Academy, 2008).

These surveys have served as a basis for strategic academic development and curriculum review for Australia universities and helped their faculties to further enhance the quality of their research postgraduate education. Researchers have suggested that although these instruments might not support the usefulness of PhD students' evaluations for benchmarking universities or faculties and departments, they are still good instruments according to many traditional criteria on the basis of individual responses (Marsh *et al.*, 2002; Ginns, Marsh, Behnia, Cheng & Scalas, 2009).

The Hong Kong context

In recent years, universities in Hong Kong, like universities in many other countries, are seeking ways to improve the quality and enhance the accountability of its higher education sector (University Grants Committee, 2005). Hong Kong is also undergoing a reform of

undergraduate education under the “3+3+4” academic structure, to take effect in 2012. The University of Hong Kong is currently using this opportunity to evaluate student learning experience systematically at all levels to facilitate the reform and quality enhancement. The Course Experience Questionnaire has served as an initial tool to commence this evaluation process and a modified version of CEQ evaluating course experience of undergraduate students studying at the University of Hong Kong has been validated (Webster *et al.*, 2009). The evaluation of students’ experiences using this modified tool has helped revisit undergraduate curriculum and improve student learning experiences at the University of Hong Kong.

The University of Hong Kong is preparing to commence a systematic evaluation of postgraduate learning experiences. The SREQ developed by Australian universities has potential as an instrument for use in Hong Kong. In an earlier study on Mainland Chinese students’ learning experience at the University of Hong Kong, factors that contributed to their research progress and overall satisfaction were identified (Zeng, 2009), factors that were in line with the major factors in the theoretical framework of such a tool. However, to date there is little evidence on the reliability and validity of SREQ in a non-western context such as Hong Kong. The purpose of the study is to provide such evidence.

This study

The overarching focus of the present study was to validate SREQ in the context of the University of Hong Kong. More specifically, the appropriateness of using SREQ with Hong Kong research students was examined with the objectives of exploring: 1) the goodness of fit and reliability of the data to the hypothesised scale structures; and 2) the construct validity in terms of relationships between perceptions of research experience. An additional aim of this study to explore the predictability of research experiences on students’ perceived skill development, as in accordance with the designer of SREQ, it is also reasonable to assume that research may have direct effect on student skill development and overall satisfaction.

Method

Sample

A total of 599 research postgraduate students who were concurrently enrolled at the University of Hong Kong from May 2009 to October 2009 elected to participate in this study, representing approximately 25.3% of the population. They were from 10 faculties (Humanities, n=302; Sciences, n=297). Two hundred and thirty students (38.4%) were local Hong Kong students, 51.3% (n=370) were Mainland Chinese students, and 10.4% (n=62) were from 26 other countries and districts. There were 171 (28.5%) M. Philosophy students and 426 (71.1%) PhD students. The majority of participants were full-time students (90.8%, n=544). Three hundred and eleven students (51.9%) were female and 287 (47.9%) were male.

Instruments and procedure

Before adapting the SREQ, the original 33 items were sent to experts in related fields, research students and staff members with relevant experience for comment. Eventually, 29 SREQ items were adapted from the SREQ (University of Sydney, Institute for Teaching and Learning, 2007). The items measured research supervision, intellectual climate, infrastructure, skill development, and overall satisfaction (see Appendix 1). The wording of some items was modified slightly according to reviewer suggestions. For example, apart from departments, there are some research units at HKU referred to as “centres”, “schools” or “institutes”, which

also recruit research students. Therefore, question items such as “the department/school provides opportunities for social contact with other postgraduate students” were changed to “I am provided with opportunities for social contact with other research students” to avoid naming the department/school/centre/institute. The students were asked to respond to each item by nominating the extent to which they agreed with a particular statement along a 5-point Likert scale (1=strongly disagree to 5= strongly agree). Additional participant background information was gathered, such as gender, program, faculty, mode of study, and origin of student. Before the formal data collection, the questionnaire was piloted among research students from different faculties as well as staff with the relevant experience and expertise. The survey was then prepared as an online survey system. Email invitations were sent to the currently enrolled research students for voluntary participation via their University email accounts. Ethical approval was obtained before the commencement of the survey.

Analysis

As previous studies have shown that SREQ is appropriate for analysis on the basis of the individual responses but not very robust on faculty and university levels (Ginns *et al.*, 2009), this study examined mainly the psychometric properties on the level of individual students. The whole sample was split into two random samples ($n_1=257$, $n_2=298$). After the missing values were removed, the final samples consisted of 248 cases for random sample 1 and 287 for random sample 2. Exploratory factor analysis was first conducted on sample 1 with SPSS 15.0 to test the factorial structure of 29 SREQ items. The internal consistency of the scales was then assessed using Cronbach’s alpha (Cronbach, 1951).

Subsequently, confirmatory factor analyses on each one-factor model and the hypothesised measurement model were conducted with sample 2 using LISREL 8.80 (Jöreskog & Sörbom, 2005–2010). Robust Maximum Likelihood (RML) was used to estimate the goodness-of-fit indices based on an asymptotic covariance matrix as the sample size of this study was comparatively small (Boomsma & Hoogland, 2001). The selection of criteria for the assessment of model fit flowed from the literature for the original scale (Ginns *et al.*, 2009), this included chi-square, non-normed fit index (NNFI), comparative fit index (CFI) and the root mean square error of approximation (RMSEA). The chi-square statistic tests the null hypothesis of perfect fit to the data. A non-significant chi-square indicates a good fit. However, as chi-square is often sensitive to sample size and the normality of the data, the χ^2/df ratio was considered as well for the assessment of model fit rather than using chi-square only (Marsh & Hau, 1996; Byrne, 2001). An χ^2/df ratio less than 5 suggests a reasonable model fit and a value lower than 2 suggests a good fit. The “comparative fit index” (CFI) (Bentler, 1990) assesses the extent to which the specified model provides a better fit to the data than a null model. The “non-normed fit index” (NNFI) (Bollen, 1989) compares the fit of the two models. Their values of .90 or higher indicate good fit. The “root mean square error of approximation” (RMSEA) is an index of badness of fit (Steiger, 1989). Values of .05 or lower suggest good fit and values between .05 and .08 suggest moderate fit (Tomarken & Waller, 2003).

After the confirmatory factor analysis on each scale and the measurement model, correlation and structural equation modeling (SEM) was completed to explore the relationships between student perception of research experience and perceived skill development with the whole sample. This structural model fit was carried out in two steps as advocated by Anderson and Gerbing (1988): the measurement model was tested before the structural relationships between the variables were estimated.

Results

Exploratory factor analysis and reliability

An initial principal components analysis with Oblimin rotation method identified a 5-factor solution based on the eigenvalue > 1 criterion, explaining 67.32% of the total variance (see Table 1). There was no cross loading on other scales greater than .30 among 29 SREQ items. Analysis indicated that the scales had good internal consistency at the level of individual students. The estimates of reliability ranged from 0.88 to 0.93.

Table 1: Factor loadings of 29 SREQ items (random sample 1: n=248)

Scales	Items	Factor loading				
		1	2	3	4	5
Intellectual climate	ic3	.837	-.002	-.053	.050	-.024
	ic2	.835	.053	.044	-.036	-.006
	ic1	.811	-.069	-.088	.087	-.082
	ic5	.800	.108	.002	-.032	-.050
	ic7	.746	.020	.079	.026	.108
	ic6	.725	-.002	.056	.179	.129
	ic4	.613	.047	.143	.056	-.059
Supervision	s2	-.041	.892	.035	-.037	.081
	s7	.013	.883	-.015	-.043	-.038
	s4	-.064	.876	.026	.042	.022
	s3	-.096	.846	-.001	.056	-.061
	s6	.157	.781	-.004	-.034	.007
	s5	.246	.753	-.005	-.068	.047
	s1	-.014	.751	.015	.143	-.052
Skill development	sd2	-.015	-.073	.818	-.002	-.088
	sd3	-.051	.112	.811	-.045	.053
	sd1	-.026	-.008	.782	.150	.049
	sd4	-.089	.106	.773	.070	-.096
	sd7	.043	-.064	.765	-.017	.063
	sd5	.092	-.009	.664	-.044	-.165
	sd6	.120	.053	.622	-.003	.153
Infrastructure	i7	.064	.027	-.056	.883	.015
	i4	-.065	-.010	.022	.849	-.074
	i1	-.078	-.020	.043	.843	.041
	i2	.060	.041	.029	.772	-.015
	i3	.044	.109	.004	.771	.010
	i6	.049	-.023	.061	.693	.046
	i5	.238	-.023	-.082	.580	.012
Overall satisfaction		-.042	-.014	-.034	.016	.957
Eigenvalues		9.97	3.84	2.93	1.75	1.02
% of variance		34.39	13.25	10.12	6.03	3.53
Reliability		.91	.93	.88	.91	-

Confirmatory factor analysis

The goodness-of-fit of 4 measurement models (intellectual climate, infrastructure, skill development, and research supervision) was tested. The significant error covariances between observed variables were specified (Byrne, 1998; Jöreskog & Sörbom, 1996). The chi-square for all factor models were small and non-significant ($p > .20$) (see Table 2). The χ^2/df values were all below 2. The RMSEA values of all scales were smaller than .04, indicating good fits. The NNFI and CFI of all models were all equal to 1.00. Together, these fit estimates suggested good fit to the models for all one-factor models. The measurement model with supervision, infrastructure, intellectual climate, and the single-item factor, overall satisfaction, fit the data well with the second random sample ($\chi^2=326.16$, $df=330$, $p=.55$, $\chi^2/df=0.99$, RMSEA=.021, NNFI=1.00, CFI=1.00).

Table 2: Fitted measurement model and one-factor models for SREQ: goodness-of-fit indexes (random sample 2: n=287)

Composite variable	χ^2	df	p	χ^2/df	RMSEA	NNFI	CFI
Supervision	7.53	12	.82	.63	.037	1.00	1.00
Intellectual climate	10.16	10	.43	1.02	.0076	1.00	1.00
Infrastructure	12.15	12	.43	1.01	.0067	1.00	1.00
Skill development	11.90	10	.29	1.19	.026	1.00	1.00
Measurement model	326.16	330	.55	.99	.021	1.00	1.00

Correlations

All variables significantly correlated with each other ($p < .01$), particularly, students with higher satisfaction with intellectual climate had higher satisfaction with infrastructure ($r=.69$) (see Table 3). Those who rated supervision higher were more satisfied with their overall research experiences as well ($r=.66$). The correlation between two outcome factors (overall satisfaction and skill development) was moderate ($r=.47$, $p < .01$).

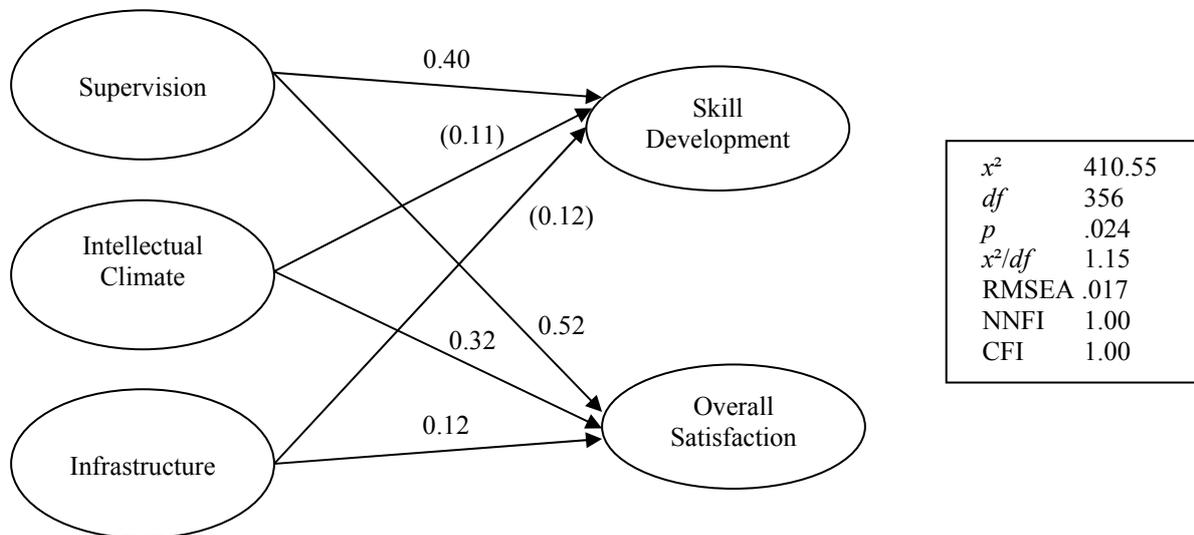
Table 3: Correlations between SREQ scales

	Supervision	Infrastructure	Intellectual climate	Skill development	Overall satisfaction
Supervision	1				
Infrastructure	.46	1			
Intellectual climate	.55	.69	1		
Skill development	.49	.39	.43	1	
Overall satisfaction	.66	.52	.59	.47	1

Note: All correlations are significant at the 0.01 level.

Structural equation modelling

Before the structural equation modelling, the measurement model was tested with five constructs (supervision, intellectual climate, infrastructure, skill development, and overall satisfaction) using the whole sample. The error covariance of the only item for overall satisfaction was set to zero as was done in the Ginns *et al.* (2009) study. The test produced satisfactory fit indexes ($\chi^2 = 397.16$, $df = 353$, $p = .052$, $\chi^2/df = 1.13$, RMSEA = .015, NNFI = 1.00, CFI = 1.00). The structural equation model produced a significant chi-square value ($\chi^2 = 410.55$, $df = 356$, $p = .024$) (see Figure 1). However, the χ^2/df ratio was 1.15, lower than 2, indicating the data fit the five-factor CFA model considerably well (Marsh & Hau, 1996). This was also consistent with the other overall goodness of fit statistics (RMSEA = .017, NNFI = 1.00, CFI = 1.00). It showed that only supervision predicted skill development significantly whereas supervision, intellectual climate and infrastructure all contributed significantly to overall satisfaction. The whole model accounted for 30% of the variance in skill development and 67% of the variance in overall satisfaction.



Note: Figures in brackets indicate non-significant parameter estimates ($t < 1.96$).

Figure 1: Structural models of the effects of research experiences on skill development and overall satisfaction

Discussion

A previous study by the first author had found that supervision, infrastructure, and intellectual climate were important elements that could contribute to Mainland Chinese students’ progress in their research studies and the overall satisfaction with their experiences at the University of Hong Kong. The aspects of research experiences covered in the SREQ scales had been in line with such findings. This has provided the content validity of using SREQ in Hong Kong context. In the assessment of the psychometric properties of this questionnaire in the Hong Kong context, good internal consistency was found for SREQ scales. The initial exploratory factor analysis showed that 29 SREQ items formed a 5-factor structure. There was no cross loading larger than .30 among the items. The subsequent confirmatory factor analyses and tests on the measurement model indicated good fit of the models to the data. Between the latent factors, the correlations were lower than .70, which indicated that the factors were distinct. These together confirmed the factorial structure of SREQ reported in Ginns *et al.* (2009) and supported the validity of using the SREQ at the individual student level in the

Hong Kong context. The utility of such a tool, in a modified version, in the United Kingdom (The Higher Education Academy, 2009b) also provided satisfying psychometric properties, indicating its validity in another cultural context (The Higher Education Academy, 2008). These together may suggest that: 1) the learning experience of research students across these three places may share reasonable similarities; 2) the SREQ is likely to be a tool to be used in cross-cultural contexts. Nonetheless, it is noted that the University of Hong Kong and Australian universities have developed from British education tradition. It remains questionable whether SREQ could be used out of British educational tradition.

In their earlier study, Ginns *et al.* (2009) pointed out that the SREQ could not differentiate the student experience between universities or disciplines. Therefore, its utility for benchmarking across faculties and universities was quite limited. Besides, it was also regarded as inappropriate to use SREQ data for the rating of individual supervisors because there were only very small numbers of research students supervised by a supervisor every year. However, its psychometric properties were well supported (Ginns *et al.*, 2009). Therefore, despite this limitation, SREQ may still be a reliable and valid tool to be included as part of an instrument to explore the relationship between student research experience and their learning outcomes for quality enhancement purposes. For example, the effect of supervision, infrastructure and intellectual climate on completion of the degree on time, persistence, development of academic excellence, and so on could be investigated.

It is proposed that in future theoretical framework on quality assurance that SREQ is embedded as supervision, infrastructure, and intellectual climate are critical to student development in generic skills and overall satisfaction. The findings of this study largely supported such hypotheses. However, in contrast to the significant impact of supervision on students' skill development and overall satisfaction, intellectual climate and infrastructure contributed to overall satisfaction but not necessarily student development in generic skills. The implication from these findings is that, in general, the university needs to consider strategies to improve supervision, infrastructure, and intellectual climate in order to promote better student learning outcomes. If enhancing student academic excellence is the main interest of a university, greater emphasis could be placed on enhancing supervision. On the other hand, if the main aim is to improve students' general perceived quality of educational experience, the university could consider aspects of infrastructure and intellectual climate. However, the finding that skill development and overall satisfaction were correlated only moderately suggests that the enhancement of one of these might not necessarily affect the other. Namely, when the overall satisfaction of students with their research experience is improved, their perceived skill development may not be improved at the same time, and vice versa.

The current study demonstrates that the SREQ is a valid tool for measuring postgraduate student learning experience in the Hong Kong context. It may be useful to use this tool for further studies in order to relate student research experiences to other important aspects of postgraduate education in the Hong Kong context, and to seek more practical and operational implications for broader audiences such as supervisors of research students, research students, university administrators, and the public. As the existing studies using SREQ items were mainly found in the institutions from the British tradition, it may be worth conducting further studies to determine the extent to which SREQ could be applied in a non-British tradition in order to explore the validity of SREQ cross-culturally.

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