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Item Reduction in 'Course Evaluation Survey' Questionnaire: Some Exploratory Analysis and Empirical Evidence

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ABSTRACT:
To develop and sustain quality in higher education, the integrated role of course evaluation survey (CES) among students in academic programs is fully understood. An original CES questionnaire (CESQ) involving 24 closed questions (items), prescribed by the National Commission for Academic Accreditation & Assessment (NCAAA), is being used presently at all colleges of our university. This article aims to deal with optimized reduction of items in this CESQ. To guide this through scientific research, methodological results under exploratory analysis of existing CES data available for College of Nursing are used. The observed collinearity among the items of the CESQ also justifies the demand of optimizing it by the university community. A critical comparative appraisal of the analytical results of the existing data sets (considering exploratory sub sets of items) provided an optimum set of 15 items that reflects relative merits in terms of required attributes: viz., reduced problem of collinearity among items; retained relationship among them; appropriateness regarding extracted factors as well as their independence; negligible change in overall reliability of questionnaire; and also in proportion of total variance being explained by the underlying factors. This 15 items CESQ also holds similar merits in comparison to the 24 items CESQ.
Keywords: academic program, course evaluation survey, questionnaire, item reduction, optimization, collinearity, exploratory analysis, reliability

BACKGROUND

To develop and maintain high quality in higher education, various types of evaluation surveys among students play an important role. Since the year 2009, Course Evaluation Surveys (CES) have been conducted in various undergraduate programs of our university. They are Colleges of Nursing, Medicine, Dentistry and Engineering. By the Deanship of Quality and Academic Accreditation, a CES schedule was prepared and executed in consultation with the concerned college authority (i.e. deans and course coordinators). As a priority, data were analyzed and reported accurately and appropriately. Furthermore, validation of the results required detailed discussion with college authorities. The findings were then widely disseminated among corresponding faculty and students. As part of their feedback, the colleges repeatedly expressed and emphasized two major concerns about the existing CES questionnaire (English version). First, it should be optimally reduced in terms of the number of closed questions (i.e. items). Secondly, English not being a mother tongue, further clarity of questions to students can enhance the quality, accuracy and reliability of data.

It was this constructive feedback, reflecting real needs of the institution, which triggered the conceptualization of this research study: viz. optimum reduction of items in a CES questionnaire. A range of literature is available on development of new evaluation questionnaires; including CES [1]. In order to incorporate real needs of or changes in institutions or programs, many authors have also emphasized the need to occasionally review existing questionnaires that involves possible inclusion as well as exclusion of the items. In particular, item reduction in existing questionnaire can be mandated by the observed needs of institutions [2,3].

On the one hand, the steps involved in reviewing an existing questionnaire are different from those involved in developing a new questionnaire. On the other hand, the steps involved in optimum reduction of items in existing questionnaire are different from those involved in its review. Therefore, it is necessary to emphasize that this study involves optimum reduction of items from an existing questionnaire. It is neither the developing of a new questionnaire, nor reviewing an existing one.

In summary, this article deals with an optimum reduction of items in an existing original CES questionnaire consisting of 24 items (Appendix 1). For this, as an attempt to retain the structure and psychometric evidence (such as reliability or factor analysis) of the original questionnaire in reduced questionnaire, results under an exploratory analysis of

existing CES data have been used as a supportive evidence.

MATERIALS AND METHODS

Properly worded items and their appropriate ordering may provide more valid information [1,4]. Therefore, prior to the process of optimized item reduction, each item of the existing (i.e. original) CES questionnaire was further clarified by means of changing words or sentences or both. Further, all closed items were re-arranged, listing them sequentially within five areas. This also helped in prioritization regarding selection of one of the highly correlated items under this task, especially to retain the structure of the questionnaire.

Keeping in view of the goal under this study, instead of relying on only logical and pragmatic approach, exploratory analysis of existing CES data was also considered. This was driven by the imperative to retain the theoretical structure as well as analytical power of the original questionnaire. In other words, while performing item reduction, care was taken to retain the structure and psychometric evidence (such as reliability or factor analysis) of the questionnaire. For completeness, the existing data used in exploratory analysis as well as analytical methods are briefly described in the following sections.

Data

For exploration, existing CES data from students in undergraduate program of the College of Nursing were used. Because of limited sample size of available CES data under academic programs of other colleges (Medicine, Engineering & Dentistry), its consideration remained inappropriate for valid exploration. In addition, in the College of Nursing, the CES questionnaires were complete in all respects where as those in some colleges (e.g. College of Medicine) were incomplete in relation to item number 14 "Gave fair grade to my Continuous Assessments [tests & assignments]". This College had coverage of a total of 15 courses related to students of semester 1 to 4 during the academic year 2008/09 (Table 1).

Keeping in view of the required appropriateness of sample size regarding factor analysis [5,6], the CES data related to courses covered at first instance by students of each semester were further pooled together. Likewise, it was adopted for successive coverage also. Thus, this consideration helped in maintaining good to very good adequacy of required sample size [6]. This adequacy further gets reflected by the observed higher magnitude of factor loadings as well as higher communalities under factor analysis [5,7] and Kaiser – Meyer – Olkin measure (KMO) of sampling adequacy [8,9]. In addition, the required assumption related to independence of records also remained intact. Finally, four independent study groups (Table1) were explored from the College of Nursing.

Table 1: The Courses of B.Sc. Nursing, College of Nursing, used under this exploration

Study Group	Semester	Course	No. of Students	
			Course specific	Group
1	1	Applied Medical Physics	112	410
	2	Human Biology	107	
	3	Anatomy & Physiology I	094	
	4	Fundamental of Nursing	097	
2	1	Chemistry	111	410
	2	Medical Terminology	113	
	3	Biochemistry	095	
	4	Nutrition	091	
3	1	General English I	112	411
	2	HR & Communication Skills	113	
	3	Microbiology & Parasitology	095	
	4	Pathology	091	
4	1	Introduction & Bioethics in Nursing	113	308
	2	IT for Nurse	107	
	4	Pharmacology	088	

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Table 2: Item Specific Descriptive Statistics

Item	Study Group																					
	1 (n=410)						2 (n=410)						3 (n=411)						4 (n=308)					
	Mean	SE	Median	Mode	Skewness	Kurtosis	Mean	SE	Median	Mode	Skewness	Kurtosis	Mean	SE	Median	Mode	Skewness	Kurtosis	Mean	SE	Median	Mode	Skewness	Kurtosis
At the start of the course, I was made clear about:																								
1	4.1	0.05	4	4	-1.1	1.1	3.5	0.07	4	5	-0.5	-1.1	3.9	0.05	4	4	-0.8	0.1	3.1	0.06	3	3	-0.1	-0.7
2	3.9	0.05	4	4	-0.6	0.0	3.2	0.06	3	4	-0.3	-0.9	4	0.05	4	4	-0.6	-0.2	2.8	0.06	3	3	0.1	-0.4
3	3.7	0.05	4	4	-0.5	-0.4	3.1	0.07	3	3	-0.1	-1.1	3.6	0.06	4	4	-0.3	-0.8	2.8	0.06	3	3	0.3	-0.5
During this course, my instructors:																								
4	3.8	0.05	4	4	-0.7	0.0	3.2	0.06	3	4	-0.3	-1.0	3.7	0.05	4	4	-0.6	-0.1	3.1	0.06	3	3	-0.1	-0.6
5	3.7	0.05	4	4	-0.5	-0.3	3.1	0.07	3	4	-0.2	-1.2	3.7	0.05	4	4	-0.5	-0.6	2.8	0.06	3	3	0.0	-0.6
6	3.8	0.05	4	4	-0.7	-0.2	3.4	0.07	4	5	-0.4	-1.1	3.7	0.06	4	4	-0.6	-0.5	2.8	0.07	3	3	0.1	-0.9
7	3.9	0.05	4	4	-0.8	0.3	3.5	0.07	4	4	-0.5	-0.9	3.8	0.05	4	4	-0.6	-0.2	3.1	0.06	3	3	-0.2	-0.6
8	3.7	0.05	4	4	-0.8	0.1	2.9	0.07	3	2	0.1	-1.2	3.6	0.06	4	4	-0.4	-0.7	2.8	0.07	3	3	0.0	-0.8
9	3.8	0.05	4	4	-0.7	0.0	3.2	0.07	3	4	-0.3	-1.1	3.8	0.05	4	4	-0.6	-0.3	3.1	0.06	3	3	-0.2	-0.7
10	3.7	0.05	4	4	-0.5	-0.3	3.3	0.07	3	4	-0.3	-1.1	3.6	0.06	4	4	-0.5	-0.5	3.0	0.06	3	3	0.0	-0.7
11	3.6	0.05	4	4	-0.6	-0.3	3.3	0.07	3	5	-0.3	-1.1	3.6	0.05	4	4	-0.5	-0.4	2.9	0.06	3	3	0.0	-0.7
12	3.7	0.05	4	4	-0.5	-0.4	3.2	0.07	3	4	-0.2	-1.2	3.5	0.06	4	3	-0.3	-0.7	2.8	0.06	3	3	0.1	-0.6
13	3.7	0.05	4	4	-0.6	-0.3	3.2	0.07	3	5	-0.2	-1.2	3.6	0.06	4	4	-0.4	-0.6	2.8	0.07	3	3	0.1	-0.9
14	3.7	0.05	4	4	-0.5	-0.3	3.1	0.07	3	4	-0.2	-1.3	3.5	0.06	4	4	-0.4	-0.7	2.7	0.06	3	3	0.2	-0.7
15	3.5	0.05	4	4	-0.4	-0.4	3.1	0.07	3	4	-0.1	-1.3	3.5	0.06	4	4	-0.4	-0.8	2.6	0.06	3	3	0.2	-0.9
During this course, my college/department:																								
16	3.7	0.06	4	4	-0.6	-0.3	3.2	0.06	3	4	-0.2	-1.1	3.6	0.06	4	4	-0.5	-0.6	3.0	0.07	3	3	0.0	-0.8
17	3.8	0.05	4	4	-0.7	-0.2	3.2	0.07	3	4	-0.2	-1.2	3.6	0.06	4	4	-0.4	-0.6	3.1	0.07	3	3	-0.1	-0.7
18	3.7	0.05	4	4	-0.6	-0.1	3.2	0.07	3	4	-0.3	-1.1	3	0.06	3	4	-0.3	-0.9	2.8	0.06	3	3	0.0	-0.7
19	3.7	0.05	4	4	-0.6	-0.1	3.3	0.07	3	4	-0.4	-1.0	4	0.05	4	4	-0.3	-0.7	2.9	0.06	3	3	0.0	-0.7
Evaluation of the course: this course helped me to:																								
20	3.8	0.06	4	4	-0.7	-0.2	3.4	0.07	4	5	-0.4	-1.3	4	0.06	4	5	-0.7	-0.3	3.1	0.07	3	3	-0.1	-0.6
21	3.7	0.05	4	4	-0.6	-0.4	3.0	0.07	3	4	-0.1	-1.2	3.5	0.06	4	4	-0.4	-0.6	2.9	0.06	3	3	-0.1	-0.7
22	3.7	0.05	4	4	-0.5	-0.4	3.0	0.07	3	3	0.0	-1.2	3	0.06	4	4	-0.3	-0.8	2.9	0.07	3	3	0.1	-0.7
23	3.6	0.05	4	4	-0.5	-0.4	2.8	0.06	3	3	0.1	-1.1	3	0.06	3	4	-0.3	-0.8	2.8	0.06	3	3	0.1	-0.6
Overall evaluation																								
24	3.7	0.05	4	4	-0.7	-0.1	3.2	0.07	3	4	-0.3	-1.3	3.6	0.06	4	4	-0.5	-0.6	2.7	0.07	3	3	0.2	-0.8

Analytical methods

For the exploratory analysis, although each item was observed on a Likert scale (5 = "strongly agree"; 4 = "agree" ; 3 = "true sometimes"; 2 = "disagree"; 1 = "strongly disagree"), it was considered to be measured as on interval scale [10]. Further, normality of the responses to an item was examined through descriptive statistics (Table 2). They include mean, standard error of mean, median, mode, skewness & kurtosis. The presence of normality deviation, as evident through observed skewness and kurtosis, may be mainly attributed to the considered large sets of student scores. It may be pointed out here that these numerical ways of determining non- normality are very sensitive to the considered numbers of scores [11]. Since correlation, factor analysis, and related linear techniques are

known to be relatively robust against non-extreme deviations from normality [12,13], confinement of normality presumption based on only skewness and kurtosis may be deceptive in the present case. Hence, as a pragmatic approach, an eyeball test of first four descriptive statistics of evaluation scores on each item was used to establish justification in presuming its required normality assumption. None of the items in this study had extreme deviations from normality, hence was not deleted on this basis.

To begin with, the correlation matrix dealing with simple correlation of each item with all other items included in CES questionnaire was examined for each study group. To further emphasize, as evident from these results, one can also visualize the extent of relationship of each item with the respective overall satisfaction item. The presence of a positive and high to very high correlation, for numerous pairs of items (especially second study group), indicates possible presence of multicollinearity (Appendix 2). As a matter of fact, the items have to be intercorrelated, but the presence of too high correlation between items may cause difficulties in determining the unique contribution of an item to a factor [7]. Hence, instead of deleting one of them abruptly, it was decided to delete one of the highly correlated items more objectively based on relative merits observed under exploratory factor analysis.

The inetercorrelations between the items were observed in two steps. First, a significant Bartlett's test of sphericity just reveals that there is intercorrelation between the items. Second, the determinant of correlation matrix less than 0.00001 further reveals that there is multicollinearity [7]. The intercorrelation between the items is a requirement. However, to overcome the problem of collinearity, items involving a correlation of 0.70 and more (Appendix 2) were considered collinear [14]. For exploration, at a time, only one of the two collinear items in such pairs was needed to be considered. Keeping in view of the presence of more number of such pairs, a series of exploratory subsets of items were generated to carry out further exploratory analysis.

Under second study group, separately for original set of items as well as each of the various generated subsets of items, exploratory factor analysis was carried out. This involved principal component analysis as extraction method and orthogonal varimax (with Kaiser Normalization) as rotation method [14]. This exploratory analysis was used to guide the strategy regarding item reduction. Every time, Cronbach's alpha as reliability coefficient for questionnaire was worked out. Further, Cronbach's alpha in case an item is deleted was also examined (results not listed). Under this analysis, different underlying factors (i.e., constructs or components) and items associated with them were also identified (Appendix 3). In case of more than one construct, one of the possible interpretations may be that CES questionnaire failed to completely measure quality of course, but did measure some related constructs [15]. In this case, for more appropriateness, the number of such constructs is expected to equate the number of sections/ visible broad features in the questionnaire. Also, logically and intuitively each of the identified constructs need to involve a different set of related items in order to consider them as sub – components of quality of course [15].

A critical comparative appraisal of results under exploratory analysis of various data sets, resulted from generated sub sets of items under second study group, could provide an optimized reduced set of 15 items (i.e. reduced questionnaire). This questionnaire (Appendix 4) reflects relative desired merits in terms of reducing problem of collinearity among items; retaining relationship among them; involving genuine number of extracted factors (i.e., constructs or components), and also increased independence of extracted factors; and showing negligible change in overall reliability of questionnaire, as well as the proportion of total variance being explained by the underlying factors [3, 7, 8, 9, 14].

To add further strength to this exercise, as a measure to assess the consistency in pattern of observed results, this exploration was again repeated for remaining study groups (first, third & fourth).

RESULTS

As indicated by the observed determinant of matrix (Table 3), for each of the four study groups in college of nursing, there was genuine evidence regarding serious involvement of multicollinearity among the items of the original questionnaire. This further supports expressed views, by the college administrators as well as faculty, regarding the need of possible reduction of items in this questionnaire. For this, as mentioned earlier, only one of the two highly correlated (0.70 or higher correlation) items needs to be retained in the questionnaire. For each of the considered study groups in College of Nursing, the correlation matrix was explored (e.g. Appendix 2). The initial exploration involved second study group with largest pairs of highly correlated items (0.70 or higher correlation). Accordingly, as an added strength to exploratory analysis, this exploration relied on a large number of probable subsets of items. As a matter of fact, the subset of items without item 14 comparatively involved more desired merits of CESQ than that with item 14 (results not listed). Finally, an optimized reduced set of 15 items could be identified that reflects relative desired merits in terms of reducing

problem of collinearity among items; retaining relationship among them; involving increased appropriateness of extracted factors (i.e., constructs or components), and also increased independence of extracted factors; and showing negligible change in overall reliability of questionnaire, as well as the proportion of total variance being explained by the underlying factors. In conclusion, the optimised reduced CES questionnaire is finalised to consist of only 15 items (Appendix 4) instead of 24 items in the original CES questionnaire (Appendix 1).

For each study group, the results of factor analysis for original and reduced CES questionnaires are compared (Table 3). This table embodies the respective results 3, 7, 8, 9, 14] related to characteristics desired to assess adequacy of exploratory analysis and also the merits of a questionnaire. They are as: Kaiser-meyer-olkin (KMO) measure of sampling adequacy, determinant of correlation matrix (status of collinearity), significance level for Bartlet's test of sphericity (interrelationship of items), number of extracted components (eigen value >1) as indicative evidence towards unidimensionality of the questionnaire, % of total variance accounted by the extracted factors, and Cronbach's alpha (overall reliability of questionnaire). Again, under each study group, these results for each section (involving more than one item) of the questionnaires are compared (Table 4).

Table 3: Comparative results of factor analysis for original and reduced CES questionnaire

Group	Questionnaire	1*	2*	3*	4*	5*	6*
1	Original	0.969	1.44E-008	0.000	2	61.404	0.966
	Reduced	0.962	8.32E-005	0.000	1	56.886	0.946
2	Original	0.979	2.46E-012	0.000	2	72.966	0.979
	Reduced	0.970	5.93E-007	0.000	1	67.787	0.965
3	Original	0.976	3.28E-009	0.000	2	63.887	0.970
	Reduced	0.967	2.24E-005	0.000	1	60.587	0.953
4	Original	0.959	1.77E-007	0.000	2	55.935	0.958
	Reduced	0.945	0.000	0.000	1	50.706	0.930

* *1: Kaiser-meyer-olkin measure of sampling adequacy*
2: Determinant of correlation matrix
3: p-value, bartlett's test of sphericity
4: Number of factors extracted (eigen value >1)
5: % of total variance explained by these factors
6: Cronbach's alpha

Table 4: Groupwise Cronbach's Alpha by Section of the Questionnaire

#	Section	Group 1		Group 2		Group 3		Group 4	
		OQ	RQ	OQ	RQ	OQ	RQ	OQ	RQ
1	*At the start of the course, I was made clear about*	0.834	0.743	0.896	0.825	0.860	0.770	0.821	0.710
2	*During this course, my instructors*	0.938	0.918	0.961	0.944	0.946	0.929	0.916	0.887
3	*During this course, my college/dept.*	0.802	0.619	0.866	0.720	0.818	0.737	0.775	0.616
4	*Evaluation of the course: this course helped me to*	0.869		0.902		0.893		0.866	
	Combined	0.966	0.946	0.979	0.965	0.970	0.953	0.958	0.930
OQ - Original Questionnaire, RQ - Reduced Questionnaire									

Under analysis of original questionnaire in each study group, there were two extracted factors (Table 3, Appendix 3). It reflects neither unidimensionality of this questionnaire nor expected number of factors (five in the present case because of five sections in the questionnaire). But, consistently a higher magnitude of factor loading (≥0.40) was observed for each item under each factor. However, these factors did not involve distinct set of items. Also, the related extracted communalities reflecting the amount of total variance in each item that can be explained by the retained factors [15] was consistently higher. On the other hand, under analysis of items in reduced questionnaire, there was only one extracted factor that reflects unidimensionality of the questionnaire. Also, comparatively a higher magnitude of factor loading (≥0.60) was observed for each item. Interestingly, it remained true under each study group. Each of the four study groups revealed almost similar observations through analysis of original and reduced questionnaires. As an added observation, consistently a higher magnitude of factor loadings as well as communalities supports the validity of this exploratory analysis [3,7]. Further, Kaiser-meyer-olkin (KMO) measure of sampling adequacy (Table 3) also supports this view.

The results across the considered study groups (Table 3) reveal that the reduced questionnaire fulfils almost all the required attributes. For example, it retains the required interrelationship among the items. Further, in case of almost each study group, it reduces level of collinearity problem present in the original questionnaire. Also, in each study group, it provides only one extracted component as indicative evidence towards unidimensionality of the questionnaire (Table 3, Appendix 3). Further, for each study group, the original questionnaire results to two components that do not involve distinct set of items (Appendix 3). The proportion of total variance being explained by the underlying factors under reduced questionnaire remains at acceptable range (Table 3). Also, deletion of any individual item from the questionnaire does not make any change in reliability of the questionnaire (results not listed). Finally, the overall reliability of the reduced questionnaire almost remains almost same as that of the original questionnaire (Table 3). A comparison of section wise reliability also flows on same line (Table 4). It may be worthwhile to emphasize here that these explorations with existing CES data in college of nursing provided consistent results across the study groups. Hence, the number of items in reduced questionnaire remains as optimum.

Thus, especially in an early phase of preparing for academic accreditation, the original CES questionnaire involving 24 items (Appendix 1) can be very well replaced by this reduced CES questionnaire involving only 15 items (Appendix 4).

SUMMARY AND CONCLUSIONS

In summary, based on exploratory analysis of existing CES data, the reduction of items in the CES questionnaire from 24 to 15 does not distort its desired attributes. Incidentally it seems to involve better required scientific merits of a questionnaire. It retains the required interrelationship among the items; and also it reduces level of collinearity problem present in the original questionnaire. Also, interestingly it has indicative evidence towards unidimensionality of the questionnaire consistently. These observations suggest that reduced CES questionnaire is likely to measure quality of course at par with original questionnaire, if not more meaningfully. The proportion of total variance being explained by the underlying factors under reduced questionnaire also remains at acceptable range.

As a matter of fact, deletion of any individual item from the original CES questionnaire did not make any noticeable change in overall reliability of the questionnaire (results not listed). Also, the overall reliability of the reduced questionnaire almost remained same as that of the original. It may be worthwhile to emphasize here that these explorations with existing CES data provided almost consistent results across four study groups. Hence, in our opinion, the number of items in reduced questionnaire remains as optimum.

The excluded items from the 24-item original questionnaire incidentally do not capture all the items of any of the five areas of the questionnaire. In other words, each of the five aspects of the original questionnaire also remains intact in the reduced questionnaire. As a matter of fact, comparatively (Appendix 1 & 4), most of the excluded items also lack clarity at the level of students. Further, as required at this institution, reduced questionnaire will also reduce burden on the students. Hence, the use of optimized 15- item questionnaire is likely to have better involvement of students that can provide more accurate and reliable data. It may thus be concluded that the optimized 15-item CES questionnaire (Appendix – 4) may be used without compromising much with structure and analytical power of the original CES questionnaire (Appendix 1).

In the field of higher education, for the sake of its quality, consideration of the voices of students on issues related to enhancement and advancement of learning are equally important [16, 17, 18, 19, 20]. For this, one has to make all efforts to produce accurate results through a good evaluation process. Furthermore, an institution has to evolve a system of

regular evaluation of the evaluation system [21, 22, 23, 24]. In this regard, we strongly believe that there is no better options than to listen every section of the university community (college administrators, faculty, students). As opined by them, possible reduction of items in existing course evaluation questionnaire is expected to be more appropriate for accurate and reliable evidence towards academic accreditation. In view of this, using exploratory analytical results of existing data, we could finalise optimised reduced CES questionnaire that is supported with exploratory scientific evidence. Like item reduction, institutions in higher education can very well make use of existing data in exploratory research to scientifically achieve other required objectives towards educational developments.

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Appendix 1. Original CES questionnaire

Items

At the start of the course, I was made clear about:

1. The course outline including the knowledge and skills
2. The things I had to do to succeed, including assessment tasks and criteria for assessment
3. Sources of help for me, including faculty office hours and reference material

During this course, my instructors:

4. Conducted the course consistent with the course outline
5. Were available during office hours to help me
6. Were enthusiastic about what they were teaching
7. Cared about my academic progress, and, were helpful to me
8. Were fully committed to the delivery. (E.g. On time start, regular presence, well prepared material etc)
9. Had thorough knowledge of the content of the course
10. Used up-to-date and useful course materials. (Texts, handouts, references etc.)
11. Encouraged me to ask questions, and, develop my own ideas
12. Inspired me to do my best work
13. Made clear to me the links between this and other courses in my total program
14. Gave fair grade to my Continuous Assessment [tests &assignments]
15. Gave the marks for the Continuous Assessment to me in time

During this course, my college/department:

16. Provided the resources I needed (textbooks, library, computers etc.) & made them available for me when I needed
17. Provided effective technology to support my learning
18. Made sure that the things to be done by me (class activities, assignments, laboratories etc), were appropriate for the knowledge & skills the course was intended to develop
19. Required a fair amount of work for the credit hours allocated

Evaluation of the course: this course helped me to:

20. Learn what is important, &, will be useful to me
21. Improve my ability to think & solve problems rather than memorize information
22. Develop my ability to work as a member of a team
23. Improve my ability to communicate effectively

Overall evaluation

24. Overall, I was satisfied with the quality of this course

Appendix - 2: Correlation Matrix – Study Group 2

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24
Q1	1.00																							
Q2	0.81	1.00																						
Q3	0.71	0.74	1.00																					
Q4	0.77	0.74	0.71	1.00																				
Q5	0.68	0.73	0.70	0.68	1.00																			
Q6	0.74	0.72	0.59	0.68	0.70	1.00																		
Q7	0.80	0.76	0.68	0.76	0.75	0.76	1.00																	
Q8	0.43	0.52	0.63	0.58	0.56	0.42	0.47	1.00																
Q9	0.72	0.72	0.70	0.73	0.73	0.74	0.74	0.59	1.00															
Q10	0.75	0.74	0.66	0.71	0.68	0.69	0.81	0.46	0.70	1.00														
Q11	0.81	0.75	0.68	0.73	0.71	0.74	0.79	0.43	0.71	0.77	1.00													
Q12	0.74	0.73	0.67	0.71	0.70	0.67	0.73	0.46	0.69	0.74	0.78	1.00												
Q13	0.78	0.72	0.62	0.72	0.67	0.67	0.77	0.43	0.68	0.74	0.79	0.74	1.00											
Q14	0.74	0.69	0.63	0.63	0.65	0.66	0.74	0.39	0.67	0.73	0.74	0.73	0.74	1.00										
Q15	0.75	0.68	0.62	0.65	0.65	0.66	0.72	0.43	0.67	0.72	0.75	0.72	0.72	0.79	1.00									
Q16	0.61	0.62	0.58	0.63	0.61	0.59	0.65	0.49	0.61	0.68	0.66	0.64	0.62	0.54	0.55	1.00								
Q17	0.60	0.59	0.58	0.59	0.57	0.56	0.64	0.45	0.57	0.61	0.66	0.62	0.63	0.55	0.59	0.58	1.00							
Q18	0.74	0.69	0.60	0.66	0.68	0.64	0.73	0.43	0.64	0.72	0.74	0.75	0.73	0.72	0.73	0.62	0.65	1.00						
Q19	0.75	0.72	0.63	0.68	0.61	0.70	0.72	0.41	0.64	0.68	0.76	0.71	0.73	0.70	0.74	0.59	0.61	0.72	1.00					
Q20	0.80	0.70	0.62	0.72	0.64	0.66	0.75	0.40	0.66	0.73	0.80	0.75	0.83	0.71	0.71	0.58	0.60	0.75	0.75	1.00				
Q21	0.73	0.64	0.59	0.66	0.67	0.63	0.68	0.42	0.63	0.62	0.71	0.75	0.74	0.67	0.68	0.54	0.58	0.72	0.66	0.78	1.00			
Q22	0.62	0.60	0.59	0.60	0.64	0.55	0.61	0.53	0.60	0.58	0.63	0.66	0.64	0.56	0.53	0.56	0.62	0.65	0.54	0.63	0.70	1.00		
Q23	0.63	0.63	0.63	0.63	0.68	0.57	0.65	0.61	0.66	0.63	0.66	0.70	0.68	0.59	0.59	0.65	0.64	0.67	0.55	0.62	0.69	0.79	1.00	
Q24	0.81	0.74	0.67	0.75	0.69	0.70	0.76	0.45	0.71	0.73	0.79	0.78	0.81	0.77	0.75	0.59	0.60	0.73	0.75	0.85	0.74	0.62	0.66	1.00

Appendix 3: Factor loading on each item

Item	Group 1			Group 2			Group 3			Group 4		
	OQ		RQ	OQ		RQ	OQ		RQ	OQ		RQ
	Factor 1	Factor 2	Factor 1	Factor 1	Factor 2	Factor 1	Factor 1	Factor 2	Factor 1	Factor 1	Factor 2	Factor 1
1	0.72		0.72	0.81		0.89	0.68	0.41	0.78	0.44	0.66	0.75
2	0.73			0.69	0.52		0.75				0.71	
3	0.73		0.78	0.50	0.66	0.80	0.71		0.76		0.73	0.71
4	0.68	0.41	0.79	0.64	0.56	0.85	0.74		0.78		0.67	0.72
5	0.76		0.81	0.56	0.63	0.83	0.71	0.40	0.81		0.72	0.73
6	0.77		0.76	0.71		0.81	0.75		0.76		0.62	0.70
7	0.74			0.76	0.45		0.74			0.50	0.58	
8	0.67		0.74		0.87	0.60	0.69	0.42	0.79		0.73	0.66
9	0.70			0.59	0.61		0.74				0.65	
10	0.60	0.46	0.76	0.74	0.44	0.86	0.68	0.44	0.81	0.59	0.47	0.76
11	0.48	0.63	0.78	0.80	0.41	0.89	0.52	0.62	0.80	0.66		0.74
12	0.56	0.54	0.78	0.73	0.47	0.87	0.59	0.54	0.80	0.66		0.72
13	0.45	0.63	0.74	0.80		0.87	0.48	0.65	0.79	0.68		0.72
14	0.56	0.49	0.74	0.81		0.83	0.50	0.54	0.74	0.60		0.66
15	0.51	0.54		0.80			0.57	0.46		0.54		
16	0.56	0.44	0.73	0.50	0.58	0.75	0.46	0.57	0.73	0.52	0.46	0.69
17		0.68	0.73	0.53	0.53	0.74	0.47	0.54	0.72	0.58		0.66
18	0.59	0.53		0.75	0.41			0.66		0.64		
19	0.54	0.50		0.80			0.49	0.51		0.67		
20		0.68		0.84			0.43	0.71		0.72		
21		0.78	0.72	0.70	0.43	0.82		0.76	0.78	0.72		0.70
22		0.79		0.44	0.69			0.81		0.70		
23		0.81		0.44	0.75			0.81		0.68		
24	0.46	0.60	0.74	0.82		0.89	0.51	0.69	0.84	0.68		0.75

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

OQ - Original Questionnaire, RQ - Reduced Questionnaire

Appendix 4. Reduced CES questionnaire

Items

At the start of the course, I was made clear about:

1. The course outline including the knowledge and skills
2. Sources of help for me, including faculty office hours and reference material

During this course, my instructors:

3. Conducted the course consistent with the course outline
4. Were available during office hours to help me
5. Showed interest what they were teaching
6. Were fully committed to the delivery. (E.g. On time start, regular presence, well prepared material, etc)
7. Used up-to-date and useful course materials. (Texts, handouts, references etc.)
8. Encouraged me to ask questions, and, develop my own ideas
9. Inspired me to do my best work
10. Made clear to me the links between this and other courses in my total program
11. Gave the marks for the Continuous Assessment to me in time

During this course, my college/department:

12. Provided the resources I needed (textbooks, library, computers etc.) & made them available for me when I needed.
13. Provided effective technology to support my learning

Evaluation of the course: this course helped me to:

14. Improve my ability to think & solve problems rather than memorize information

Overall evaluation

15. Overall, I was satisfied with the quality of this course