Postgraduate Research Students' Knowledge and Attitudes towards Good Supervisory Practice at the University of Exeter

Submitted by

Ahmad M. M. Abdelhafez

An assistant lecturer at the dept. of Curricula & English teaching methods, Faculty of Education, Minia University, Egypt, A PhD candidate at the School of Education, University of Exeter, UK

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Abstract

Background. Research reveals that the relationship between a student and a supervisor is so crucial that students cannot afford to leave it to chance. It must be managed. Phillips and Pugh (2000, p. 193) maintains that if students are to do this well, they must understand what their supervisors expect of them. Once they have this 'inside information' they will be in a better position to develop the skills necessary to reduce any communication barriers and sustain the relationship for mutual benefit.

Aims. The study aims to investigate the relationship between postgraduate research students' knowledge of code of supervisory practice at the University of Exeter and how this knowledge could affect their attitudes towards their supervisors. It also aims to find out if there are any significant differences in students' knowledge and attitudes in relation to students' gender and year of study.

Sample. Thirty full-time postgraduate research students at the University of Exeter participated in the study by completing the survey questionnaire either through email or hand-given.

Method. A questionnaire was designed to collect the data about the study. The questionnaire consisted of two sections. Section 1 measured students' knowledge of code of good practice at the University of Exeter whereas section 2 measured their attitudes towards their supervisors.

Results. This study revealed that there is a significant positive correlation between Exeter University students' knowledge of code of supervisory practice and their attitudes towards their supervisor. No differences were found in students' knowledge or attitudes in relation to gender and year of study .

Conclusions. As suggested by the results of this study, if students have more knowledge about code of supervisory practice, this will develop a positive relationship between students and supervisors for mutual benefit.

Background

Postgraduate prospectuses imply that research students will be supervised by leading scholars who provide direction and monitoring of students' work. Phillips and Pugh (2000, p. 193) maintains that the supervisor is responsible for providing all the assistance that the student needs in discipline content, research methodology and topic development, as well as inculcating professional standards and providing personal support. However, Wakeford (2004, 2006) reveals that this is not always the case. The reality is often different. Many students find their original supervisors too busy, or unavailable because of study leave, promotion, illness, personal problems or retirement.

The relationship between a student and a supervisor is so crucial that students cannot afford to leave it to chance. It must be managed. Phillips and Pugh (2000, p. 193) adds that if students are to do this well, they must understand what their supervisors expect of them. Once they have this 'inside information' they will be in a better position to develop the skills necessary to reduce any communication barriers and sustain the relationship for mutual benefit. It could be argued that knowledge of the regulations governing this relationship may affect students' attitudes toward their supervisors. The purpose of this enquiry is to uncover the relationship between postgraduate research students' knowledge of code of supervisory practice and their attitudes towards their supervisors. It also aims to find out if there are any significant differences in relation to students' gender and year of study.

Hypotheses

Coolidge (2000) indicates that experiments are carried out with the researcher having a research idea or hunch in mind. This research idea or hunch is called a research hypothesis. He further adds that, in theory, all experiments are begun with a statement called the null hypothesis which states that there is no relationship between the independent variable and the dependent variable or response variable. Thus, frequently the null hypothesis will be the opposite of what the scientist believes or hopes to be true. The prior research hunch or belief is called the alternative hypothesis. Below both null and alternative hypotheses are listed for the present study.

1- *Null Hypothesis*. There will be no statistically significant correlation at (0.05) level between Postgraduate research students' knowledge about the code of good

supervisory practice and their attitudes towards supervisors. *Alternative Hypothesis*. There will be a statistically significant correlation at (0.05) level between Postgraduate research students' knowledge of the code of good supervisory practice and attitudes towards supervisors

2- *Null Hypothesis*. There will be no statistically significant difference at (0.05) level between female and male Postgraduate research students in their knowledge of the code of good supervisory practice at the University of Exeter. *Alternative Hypothesis*. There will be a statistically significant difference at (0.05) level between female and male Postgraduate research students in their knowledge of the code of good supervisory practice at the University of Exeter.

3- *Null Hypothesis.* There will be no statistically significant difference at (0.05) level between female and male Postgraduate research students in their attitudes towards their supervisors. *Alternative Hypothesis*. There will be a statistically significant difference at (0.05) level between female and male Postgraduate research students in their attitudes towards their supervisors.

4- *Null Hypothesis*. There will be no statistically significant difference at (0.05) level between older postgraduate research students (second year or beyond) and younger students (first year) in their knowledge of the code of good supervisory practice at the University of Exeter. *Alternative Hypothesis*. There will be a statistically significant difference at (0.05) level between older postgraduate research students (second year or beyond) and younger students (first year) in their knowledge of the code of good supervisory practice at the University of Exeter.

5- *Null Hypothesis*. There will be no statistically significant difference at (0.05) level between older postgraduate research students (second year or beyond) and younger students (first year) in their attitudes towards their supervisors. *Alternative Hypothesis*. There will be a statistically significant difference at (0.05) level between older postgraduate research students (second year or beyond) and younger students (first year) in their attitudes towards their supervisors.

Variables and tests used to measure them

An independent variable is presumed to have an effect on, to influence somehow, another variable. The variable that the independent variable is presumed to effect is called the dependent variable (Wallen & Fraenkel, 2001, p. 37). For this enquiry, independent and dependent variables and the tests to measure them are shown in table (1) below.

Table (1) Variables and tests used to measure them

Hypothesis	Independent variable	Dependent variable	Test used
First	Knowledge	Attitude	Pearson Correlation coefficient
Second	Gender	Knowledge	T-test to measure the differences
Third	Gender	Attitudes	T-test to measure the differences
Fourth	Year of study	Attitudes	T-test to measure the differences

Overview of methods

The methodology employed in this enquiry is the survey. Verma & Mallick (1999) state that, "The survey has come to be one of the most widely employed tools in educational research". The research tool used to measure the constructs of this study is the questionnaire which is often a vital tool in the collection of data. The questionnaire consisted of two sections in addition to the part asking the participants to fill in demographic data about gender and year of study. The first section consisted of ten items to measure research students' knowledge of the code of good supervisory practice at the University of Exeter. Students' knowledge of good supervisory practice was operationalised as the postgraduate research students' ability to answer correctly factual questions about the code of good supervisory practice at the University of Exeter. The items were designed with the help of the Teaching Quality Assurance (TQA) manual which is published on the university web site at: www.admin.ex.ac.uk/academic/tls/tqa/pgsuper.htm. For each one of the ten items, students had the choice to select one of three alternatives: 'true', 'false', or 'I don't know'. The

student who answered an item correctly got one score to accumulate his/her score out of ten. The student who answered an item incorrectly or selected the 'I don't know' option did not get any score. The rationale behind including the 'I don't know' option which is a perfectly legitimate response that could be of value to a study with one set of objectives as indicated by Verma and Mallick (1999) is for two reasons. First, I wanted to provide some flexibility of response so that the respondents were not forced to choose one alternative or the other. Second, I intended to conduct further item analysis to differentiate between the areas of misunderstanding and the areas of lack of knowledge. This is shown in the discussion section.

For some questions, the proportion of students who did not answer the question right needs to be differentiated from the proportion of students who said that they did not know the answer. For students who said that they did not know the answer, they denied having access to this information before. The case is different for students who answered it wrong because they have misunderstanding about their knowledge of supervisory practice. Therefore, the treatment needs to be different because for students who do not know the answer, they need first to have access to knowledge. However, for students who have misunderstandings, their information need to be corrected because they had access before to the information but they got it wrong.

The second section of the questionnaire is the attitude scale. Attitude towards supervisors was operationalised as the self-report of attitudes shown on a 5-point Likert scale (strongly agree, agree, not sure, disagree, and strongly disagree). It is indicated by Verma & Mallick that, 'The five-point scale is the most practical for most common purposes' (Verma & Mallick, 1999, p.119).

Apart from ensuring the face validity of the items of the questionnaire and revising it based on the feedback I got from the module tutor and other 8 jury members, two important considerations were taken into account when designing the questionnaire. The first is to design the questionnaire attractively because as stated by Verma and Mallick (1999) "potential respondents are more likely to take seriously a document that has been carefully and attractively produced than one that looks as if it has been casually thrown together" (p. 120). The second is the ethical consideration with regard to protecting the respondents' anonymity and vulnerability given that the research topic is a sensitive one. I did not forget to

express my thanks to the respondents for cooperating in the study by completing the questionnaire.

Sample of the study

A convenience sample of 30 participants was used. The participants were MSc or PhD full-time research students at the University of Exeter. This group was chosen with the aim of recruiting equal numbers of participants according to the two independent variables: gender (15 female and 15 male students), year of study (15 first year and 15 second year or beyond).

Procedures of Administration

The survey was given to students either by hand or via email. Because the survey should only take a few minutes to complete, I collected back hand-given surveys at the same time they were given. This should ensure a high rate of return. The surveys given via email enabled inexpensive and easy return, and also the quick and easy facility to remind participants of the need to return their response, if necessary.

Instructions to participants were included at the start of the survey with ethical information provided such as the purpose of the study, the anonymous and confidential nature of their response, and their right to refuse to complete the survey.

After the collection of the questionnaire forms, the coding sheet was made, then the SPSS, which, as indicated by Bryman and Cramer (1999) enables a researcher to score and analyse quatitative data very quickly and in many different ways, was used to analyse the data using Pearson's correlation analysis and T-test.

Regarding the item difficulty of the knowledge test, the overall *p* value of the whole test is (.5). This is calculated by adding up the p values for all the items and dividing the sum by the number of items. This overall (.5) facility index refers that the difficulty level of the test is ideal because it neither too difficult not too easy to answer.

Validation procedures of the instruments

Reliability

Reliability refers to the purity and consistency of a measure, to repeatability, to the probability of obtaining the same results again if the measure were to be duplicated (Oppenheim, 1992, p.144). To check the reliability of the questionnaire, internal consistency reliability was employed. The method that was used to check the reliability of the questionnaire was split half analysis of the target participant group. This involves scoring two halves (usually odd items vs. even items) of a test separately for each person. This kind of reliability indicates the degree to which the two halves of the test provide the same results, and hence describes the internal consistency of the test (Wallen & Fraenkel, 2001, p. 100). Oppenheim refers to an advantage of this method. 'To avoid annoying the respondent we will probably refrain from asking the same question repeatedly in the same way, but in spite of variations in technique we expect co-operative respondent to be consistent in factual matters; an inconsistency would point to faults in question wording, serial or contextual effects, or other sources of error' (1992, p.145).

Postlethwaite (2007) indicate that a more general measure of the internal consistency reliability of a test would be provided by averaging the corrected split-half coefficients for all possible divisions of the test which is called Cronbach's Alpha Formula which is available through the SPSS programme. Cronbach's Alpha Formula was used for the easy calculation of such an internal consistency reliability for the attitude scale which contains non-dichotomously marked questions. The Alpha reliability coefficient for the attitude scale consisting of ten items administered on 30 participants is (.699). A decent Alpha value is at least (.7). One thing that can be done to raise the overall alpha reliability coefficient of the attitude scale is to delete one or more items of the scale. In the case of the current scale and as shown in the table (2), the deletion of the fifth item will raise the Alpha value to (.746) which means that the scale is no more unreliable.

Table (2) Cronbach's Alpha Statistics if Item Deleted

Items	Cronbach's Alpha if Item Deleted
Attitude 1	.672
Attitude 2	.661
Attitude 3	.668
Attitude 4	.701
Attitude 5	.746
Attitude 6	.642
Attitude 7	.737
Attitude 8	.609
Attitude 9	.643
Attitude 10	.659

The KR-20 formula (Kuder-Richardson formula 20) was used to check the reliability of the knowledge questionnaire because this kind of formula is used to measure the reliability of a test containing dichotomous items (Postlethwaite, 2007). The reliability coefficient resulted is (.79). (Please see appendix 3 for the calculation of this reliability coefficient.)

$$PKR20 = \frac{K}{K-1}\left(1 - \frac{\Sigma pq}{\sigma^2}\right)$$

$$= \frac{10}{9}\left(1 - \frac{2.06}{9.25}\right) = .79$$

Whereas ***p*** is the proportion of students passing a given item, ***q*** is the proportion of students that did not pass a given item, $\boldsymbol{\sigma^2}$ is the variance of the total score on this assessment, and ***k*** is the number of items on the test.

Validity

Oppenheim maintains that validity tells us whether the question, item or score measures what it is supposed to measure (1992, p.144-145). Content validity of the survey was employed. One widely used method of measuring content validity was developed by C. H. Lawshe. It is essentially a method for gauging agreement among raters or judges regarding how essential a particular item is. Lawshe (1975) proposed that each rater on the judging panel respond to the following question for each item: "Is the knowledge measured by this item essential/useful?" According to Lawshe, if more than half the panelists indicate that an item is essential, that

item has at least some content validity. The questionnaire in it preliminary version was shown to nine professors at the School of Education and Lifelong Learning at the University of Exeter. More than half the panelists indicated that 7 items of the knowledge section of the questionnaire are essential whereas the three remaining items were not found essential measuring perceptions rather than knowledge per se. These were replaced by other three items recommended by the jury of panels with the help of the TQA manual. As for the items of the attitude scale, these were found essential according to more than 50% of the panelists.

Findings of each hypothesis

Based on the data analysis of the questionnaire, it was found that:

1- There was a positive correlation of (.59) statistically significant at (0.05) level between postgraduate research students' knowledge of the code of good supervisory practice and their attitudes towards their supervisors. It is worth noting that this test statistic is also significant at (0.01) which means that the differences are highly significant. Therefore the alternative hypothesis is accepted and the null hypothesis is rejected. The test used to measure the relationship between students' knowledge and attitudes is Pearson product-moment correlation. Pallant (2005) states that "Correlation analysis is used to describe the strength of the linear relationship between two variables" (p. 121). As is shown in table (3) the direction of the relationship between the two variables measured is positive.

Table (3) Correlation between knowledge and attitudes

variables	Correlation	Knowledge	Attitude
Knowledge	Pearson Correlation	1	.586**
	Sig. (2-tailed)	.	.001
	N	30	30
Attitude	Pearson Correlation	.586**	1
	Sig. (2-tailed)	.001	.
	N	30	30

** Correlation is significant at the 0.01 level (2-tailed).

Figure (1) indicates a rinsing pattern of attitude scores with the rise in knowledge

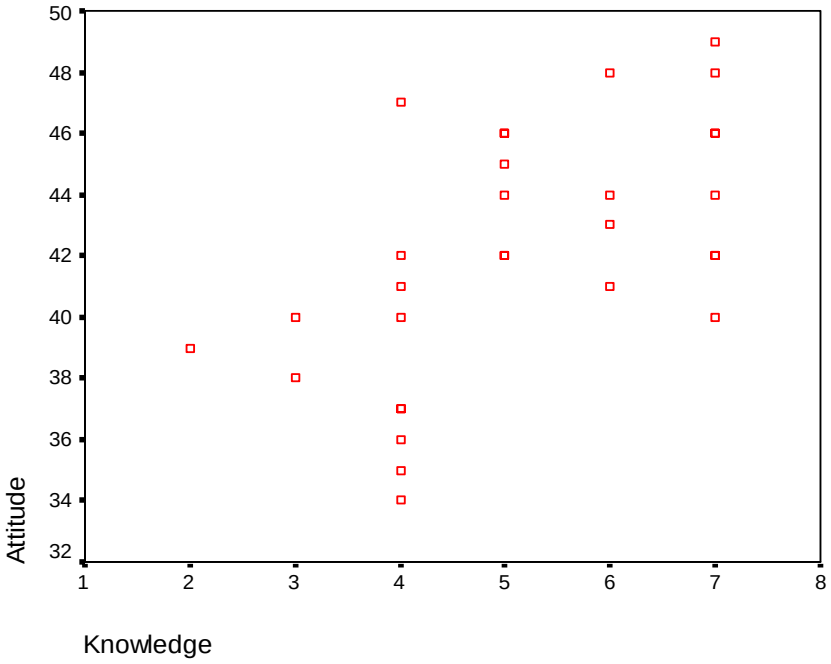

Figure (1) a scatter plot of the correlation between the knowledge and attitude scores

2- There was no statistically significant difference at (0.05) level between female and male postgraduate research students in their knowledge of the code of good supervisory practice at the University of Exeter. The t-test results revealed that the test statistic is (.807) which is bigger than (.05). If the test statistic is bigger that (.05), this means that the differences are not statistically significant. Therefore, the null hypothesis is accepted and the alternative hypothesis is rejected.

3- There was no statistically significant difference at (0.05) level between female and male postgraduate research students in their attitudes towards their supervisors. The t-test results revealed that the test statistic is (.930) which is bigger than (.05). Therefore, the null hypothesis is accepted and the alternative hypothesis is rejected.

4- There was no statistically significant difference at (0.05) level between older postgraduate research students (second year or beyond) and younger students (first year) in their knowledge of the code of good supervisory practice at the University of Exeter. The t-test results revealed that the test statistic is (.642) which is bigger than

(.05). This results in the acceptance of the null hypothesis and the rejection of the alternative hypothesis.

5- There was no statistically significant difference at (0.05) level between older postgraduate research students (second year or beyond) and younger students (first year) in their attitudes towards their supervisors. The t-test results revealed that the test statistic is (.209) which is bigger than (.05). Therefore the null hypothesis is accepted and the alternative hypothesis is rejected.

Discussion of the results

It is clear from the previous results that there is a relationship between students' knowledge about supervisory practice and their attitudes towards their supervisors. Earlier studies conducted in this field emphasise the same correlation. For example, Hockey's study (1996) concludes that the quality of supervision is influenced by a range of factors. One of these factors is the attitudes of research students towards their supervisors. The study of Kilminster & Jolly (2000) concludes that the supervision relationship is probably the single most important factor for the effectiveness of supervision, more important than the supervisory methods used. They stress that attitudes towards supervision of those who are supervised require more investigation.

The study also found that there were no statistically significant differences between students' gender or year of study and knowledge of the code of good supervisory practice at the University of Exeter. The lack of gender differences which means that both male and female students in the study have a similar level of knowledge may be attributed to the fact that the code of practice is published on the university website and is accessible to both sexes. This similar level means that both male and female students appreciate the importance of knowledge about supervisory practice. It is important for every body regardless of gender to have this kind of knowledge. However, it goes against the grain that older students have the same level of knowledge as first year students. This could be attributed to a variety of reasons. One possible explanation is that the lack of statistically significant differences does not mean that there are no differences at all. There might be differences but these differences are not big enough to reach statistical significance given the small size of the sample. Pallant (2005) points out that the significance of differences is strongly influenced by the size of the sample.

In a small sample (e.g N=30), there may be moderate differences that do not reach statistical significance at the traditional p <.05 level. In large samples (N=100+), however, very small differences may be statistically significant. Another possible explanation is the both older and younger students have the same access to code of practice through the university website. Supervisory knowledge is necessary not only to older students but also to new students who may be keener to know the regulations governing their relationship with their supervisors.

Frequency analysis of students' responses to the items of the knowledge questionnaire reveals interesting results about students' knowledge about supervision. All students knew their right to complain to the school if they were not satisfied with their supervisors. Most students (76.6%) identify their role in a supervisory tutorial as both taking and giving feedback. Half students had incorrect knowledge their supervisors' were not responsible to conduct a training needs analysis for them and to ensure that training needs were being met. The opposite is true according to the code of practice manual. Interestingly, 56.6 % of students had lack of knowledge that unsatisfactory supervision was not adequate grounds for an appeal against the decision of the examiners of their theses. Their intuitive heuristics could have led them to this piece of knowledge as long as they were given the chance before they submitted their work to complain to the school if they were not satisfied with their supervisors.

The study also found no differences between either male and female students or older and younger students in their attitudes towards their supervisors. All students were found to have positive attitudes towards their supervisors at the University of Exeter. This may be because the University represented in all it academic departments implement the code of good supervisory practice. Guidance on the supervision of students are circulated to all students on a termly basis as part of quality assurance procedures to make sure that students receive adequate supervision and that supervision runs smoothly. All students are given the chance to raise any concerns or to report any problems they have experienced during the term. All students expressed their positive attitudes regardless of gender or year of study.

Frequency analysis of students' responses to the items of the attitude scale reveal that 93.4% of students get along easily in their supervisory tutorials, 93.4% think that supervisory tutorials are important and useful, 93.3% mentioned that their supervisors provide them with

useful advice on how to improve their work, 93.3% feel that their supervisors give them helpful feedback, 90% feel that their supervisors are encouraging, 86.7% feel that their supervisors read their work carefully, 73.3% get immediate feedback from their supervisors, and 63% feel their supervisors are available whenever they need them. It is clear from the above results that students worry too much about the issue of time. The two items about getting immediate feedback and the availability of the supervisor are the least positive.

Conclusion

The study corroborated the assumption that adequate knowledge of the code of good supervisory practice at the University of Exeter is required if students are to manage their relationship with their supervisors successfully. It is worth noting that due to the use of a convenience sample which is not representative of the whole population of the postgraduate research students at the University of Exeter, the results is not generalizable beyond the sample of the enquiry. I am aware that the aim of the assignment is to develop good understanding of how to plan, administer, analyse and report survey results rather than generalizing from this small scale enquiry. However, this attempt constitutes a pilot study for a larger scale enquiry that can be carried out about the need for postgraduate research students at the University of Exeter to have adequate information about their rights and responsibilities towards their supervisors and the responsibilities and the rights of their supervisors towards them. Wisker (2005) emphasises that the supervisory relationship varies which highlights the need for further research to study it with regard to subjects, cultural expectations, learning differences, gender, distance and whether the student is part-time or full-time, variables that were not covered by this study. These studies are expected to contribute in expanding the knowledge about supervision, and consequently, develop a positive relationship between knowledge and attitudes for mutual benefit.

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Appendix 1: The Questionnaire

Postgraduate research students' knowledge and attitudes towards Good Supervisory Practice at Exeter University

Dear colleague
This is a questionnaire to assess your knowledge of the code of good supervisory practice related to postgraduate research students at Exeter University and how this knowledge may affect your attitude towards your supervisor. I would like to assure you that all your details and responses will be kept confidential and all information will be anonymized in any report arising from this study. This survey will take no more than five minutes and your cooperation will help a lot in carrying out the enquiry.

Demographic data

1. **Name** (Optional): ……..
2. **School**: ……..

Please tick (√) the appropriate box that best describes you:

3. **Gender**: ☐ Female ☐ Male

4. **Year of study**: ☐ First ☐ Second ☐Third ☐Fourth ☐Fifth or beyond

5. Do you consider English your first language? ☐Yes ☐No

The Questionnaire

Section 1: Knowledge

The following table contains ten statements. Please read the statement and tick (√) the appropriate answer.

No	*Statements*	*True*	*False*	*Don't Know*
1	Your supervisor initiates procedures for the appointment of examiners well in advance of the thesis being submitted			
2	Your supervisor has the right to attend your oral examination of your thesis			
3	It is yours not your supervisor's decision to submit your thesis when it is ready			
4	Unsatisfactory supervision is adequate grounds for an appeal against the decision of the examiners			
5	It is part of your supervisor's responsibility to make sure that you don't need further language training			
6	Your supervisor is required to conduct a training needs analysis and ensure that training needs are being met.			

7	As a postgraduate research student, you are required to meet your supervisor at least once a month			
8	During the writing-up period, your supervisor has to undertake substantial editing and revision of a draft thesis			
9	You can complain to the school if you are not satisfied with your supervisor			
10	Your role in a supervisory tutorial is to take feedback not to give it			

Section 2: Attitudes

The following table contains ten statements. Please circle what you feel. There are no 'right' or 'wrong' answers. The only correct responses are those that are true for you. Whenever possible, let the things that have happened to you help you make choice.

No	Statements	strongly agree	agree	not sure	disagree	strongly disagree
1	I get along easily in my supervisor's tutorials					
2	It takes my supervisor too much time to give me feedback					
3	I look forward to attending my supervision tutorials					
4	My supervisor does not praise my good work					
5	My supervisor is available whenever I need to meet him/her					
6	My supervisor does not provide me with useful advice on how to improve my work					
7	Supervisory meetings are not important for me					
8	My supervisor is encouraging and supportive					
9	My supervisor gives me helpful feedback					
10	My supervisor does not read my work carefully					

Thank you for your cooperation in completing the questionnaire

Ahmed M.M. Abdelhafez
School of Education and Lifelong learning
University of Exeter

Appendix 2: Jury members of the Face validity of the questionnaire

Names of the jury members ***(listed alphabetically)***	**Position**
Brahm Norwich	Professor of Educational Psychology and Special Educational Needs, School of Education and Lifelong Learning, University of Exeter
Deborah Morgan	Research Fellow, School of Education and Lifelong Learning, University of Exeter
Elizabeth Wood	Reader in Early Childhood Education, School of Education and Lifelong Learning, University of Exeter
Flora Macleod	Senior Lecturer, School of Education and Lifelong Learning, University of Exeter
Keith Postlethwaite	Associate Professor of science education, School of Education and Lifelong Learning, University of Exeter
Malcolm MacDonald	Director of EdD TESOL programme, School of Education and Lifelong Learning, University of Exeter
Nigel Skinner	MPhil / PhD Programme Director, School of Education and Lifelong Learning, University of Exeter
Patrick Dillon	Emeritus Professor, School of Education and Lifelong Learning, University of Exeter
Rupert Wegerif	Director of Education Studies, School of Education and Lifelong Learning, University of Exeter

Appendix 3: calculating the reliability coefficient of the knowledge section of the questionnaire using KR20 (Kuder-Richardson Formula 20)

Sample	Q. 1	Q. 2	Q. 3	Q. 4	Q.5	Q.6	Q.7	Q.8	Q.9	Q.10	*sum*	x	x^2
No. 1	1	1	1	0	0	1	0	0	1	1	6	0.9	0.81
No. 2	0	0	0	0	1	1	0	0	1	1	4	-1.1	1.21
No. 3	1	0	0	0	1	1	1	1	1	1	10	4.9	24.01
No. 4	0	0	0	1	0	1	0	0	1	0	3	-2.1	4.41
No. 5	0	0	1	0	1	0	0	0	1	1	4	-1.1	1.21
No. 6	1	0	1	1	1	1	1	0	1	0	7	1.9	3.61
No. 7	0	0	0	0	1	1	0	0	1	1	4	-1.1	1.21
No. 8	0	0	1	0	0	0	1	1	1	1	5	-0.1	0.01
No. 9	0	0	0	0	0	1	1	0	1	1	9	3.9	15.21
No.10	0	1	0	1	0	1	0	1	1	1	6	0.9	0.81
No.11	1	0	1	0	0	0	0	1	1	1	5	-0.1	0.01
No.12	1	1	1	1	0	0	1	0	1	1	11	5.9	34.81
No.13	1	0	1	0	1	0	0	0	1	0	4	-1.1	1.21
No.14	0	0	0	0	1	0	1	1	1	1	5	-0.9	0.81
No.15	0	0	0	0	0	1	0	0	1	1	9	3.9	15.21
No.16	1	0	0	0	0	1	1	1	1	1	6	0.9	0.81
No.17	0	1	1	1	1	0	0	1	1	1	7	1.9	3.61
No.18	1	1	0	0	1	1	0	0	1	1	13	7.9	62.41
No.19	1	1	0	1	0	1	0	0	1	1	6	0.9	0.81
No.20	1	1	0	0	0	0	0	1	1	1	5	-0.1	0.01
No.21	1	0	1	0	1	0	1	1	1	1	11	5.9	34.81
No.22	1	1	1	0	0	0	0	0	1	1	5	-0.1	0.01
No.23	0	1	0	0	0	0	1	1	1	0	4	-1.1	1.21
No.24	0	1	1	1	0	0	1	1	1	1	9	3.9	15.21
No.25	0	1	1	0	1	0	0	0	1	0	4	-1.1	1.21
No.26	0	0	1	0	1	0	1	1	1	0	5	-0.1	0.01
No.27	0	0	0	0	1	0	0	1	1	1	9	3.9	15.21
No.28	1	0	0	0	0	0	0	0	1	0	2	-3.1	9.61
No.29	1	1	1	0	1	0	0	1	1	1	7	1.9	3.61
No.30	0	0	1	0	1	0	0	0	1	1	9	3.9	15.21
Total	14	12	15	7	15	12	11	14	30	23	153		
p	0.46	0.4	0.5	0.23	0.5	0.4	0.36	0.46	1	0.76			$\Sigma\ x^2$ = 268.3
q	0.54	0.6	0.5	0.77	0.5	0.6	0.64	0.54	0	0.24			
pq	0.25	0.24	0.25	0.17	0.25	0.24	0.23	0.25	0	0.18	$\Sigma\ pq$ = 2.06		

p is the proportion of students passing a given item
q is the proportion of students that did not pass a given item
σ^2 is the variance of the total score on this assessment. $\sigma^2 = \frac{\Sigma\ x^2}{N-1}$
x is the student score minus the mean score;
x is squared and the squares are summed ($\Sigma\ x^2$);
the summed squares are divided by the number of students minus 1 (N-l)
k is the number of items on the test.