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ACADEMIC PAPER

Numeracy and literacy in sports studies students: barriers to skills development

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Abstract

Griffiths and Randall (2004) expressed concern about the key skills of numeracy and literacy in sports studies students. Studies of communication development and mathematics education have identified barriers to the development of these skills. The levels of mathematics anxiety and communication apprehension of sports studies students were measured at the beginning of the students' first year, prior to teaching. Following this the results for sport students were compared to students of other disciplines. The study suggests that it may be necessary to take measures to solve the specific problem of apprehension before skills development can take place.

Keywords: Sports Studies, Numeracy, Literacy, Skills Development.

Introduction

There has been an increasing emphasis on the role of education as a specific preparation for the workplace. Employers and their representatives (Confederation of British Industry [CBI] 1991, Raggart and Williams, 1999) have stressed the need to develop a closer relationship between education and industry. European governments have expressed strong views on the reform of education and training. These views are in line with those of employers as evidenced by the Organisation for Economic Co-operation and Development (OECD, 1994, 1995, 1996a, 1996b) which stated, "there is a common consensus that all children must master a core of essential knowledge and skills, and acquire the values and attitudes that prepare them effectively for adult life and the worlds of work and continued learning" (OECD 1996b: 103).

The UK Government has overseen the identification of a set of key skills and has embedded them into the national qualifications system as part of its education and training policy (Department for Education and Employment [DfEE], 1999). Three of these key skills – application of number, communications and information technology – are seen as compulsory for most programmes of study. These key skills emanate from the demands of employers and are referred to as 'transferable', 'generic', 'personal' or 'core' and relate to an individual's ability to operate in the workplace either alone or with others. Whilst some, for example Fryer (1997), see these key skills as central to the future life prospects of people entering the workplace, others have been more critical. Both Hyland and Johnson (1998), and Barnett (1994), have raised fundamental objections, both in terms of the definition of what a skill actually is and the extent to which transferability really exists. Green (1997) argued that the core skills approaches taken in the UK and USA are deficit models that try to make amends for inadequate schooling systems and that this compares unfavourably with the general, technical and vocational approach to education and training taken by France, Germany and Japan.

To support this notion the national employers' skills survey (Learning and Skills Council, 2003) found that over 10% of the English workforce (2.4 million workers) lack the skills needed to do their job. One fifth of all job vacancies (135,000 posts) remain unfilled because of a lack of skilled applicants. Poor basic skills cost a typical business employing 50 people £165,000 per year (Learning and Skills Council, 2003). The concerns relating to vocational skills, and ultimately their impact on the employment prospects of students, have been mirrored in the occupational area of Sport and Leisure Studies. In order to place our study in context a brief review of the sport and leisure industry is given below.

Sport and leisure context

Anecdotally, the sport and leisure industry is not always given the recognition it deserves in relation to its economic, social and political significance. Perhaps because sport is seen to operate in a leisure, recreational and tourism context, it is viewed as being a less serious industry. However, research shows that in terms of employment, the leisure sector contributes more than industries such as engineering, financial and business services, and the chemical, mineral and metal industries to the UK economy (Wolsey and Abrams, 2001). Furthermore, research conducted by the DfEE (1999) indicated that leisure related employment, including employment in sport, is estimated at more than 1.6 million jobs. Trends since 1988 have illustrated that the industry has seen significant growth in

employment in the 10 years to 1998 and there is a projection of future growth (Wolsey and Abrams, 2001).

In the light of this growth there has been a flourishing of related educational courses. Sport and leisure subjects are the fastest expanding and popular disciplines in Higher Education (HE), particularly sport-related courses (Hansen et al, 1998). According to Wolsey and Abrams (2001), there are currently 160 degrees awarded in 80 institutions and 79 post-graduate courses in 79 institutions. These reflect the booming industry.

This growth in sports related educational courses is sometimes greeted by a certain amount of scepticism as to the academic rigour of these programmes. Usually, this is by the media who enjoy using the juxtaposition of people enjoying themselves and playing sport, with the idea of serious academic study. Yet sport, as already proposed, is a significant social and economic phenomenon, and as such needs to be managed using a variety of academic and business disciplines. It is also an industry which is increasingly marked by an enhancement of professionalism and where operations need to be more efficient and effective to ensure better return on investment (Smith, 2003).

Whilst offering industry specific courses to under and post graduates is one thing, equipping them for the requirements of work is another. The 1987 White Paper (Higher Education: Meeting the Challenge, cited in Wolsey and Abrams, 2001), outlined the aspirations of the Thatcher Government for HE to provide courses which offered undergraduates with competencies and aptitudes relevant to the workplace, with particular attention to transferable skills. As a result, graduates would be more able to serve the economy and the companies they worked with. This evidence presents a clear case for the question regarding the current employability of graduates.

The need for key skills in the industry has been investigated by Hansen et al (1998) and it has been shown that the aptitudes needed by graduates in the sport and leisure industry were: interpersonal and communication skills; self-motivation; the ability to work independently; time management; flexibility; adaptability; and the ability to work in a team. However, Wolsey and Abrams (2001) also suggested that the main problem with graduate employment is the perceptions of students and graduates. They do not appreciate the importance/relevance of the skills that they develop during a degree programme. As a result, when they apply for jobs they cannot articulate their transferable skills to the employer.

The Institute of Leisure and Amenities Management (ILAM) have produced a 'skills barometer' (Griffiths and Randall, 2004) for a range of career pathways in the sport, leisure and tourism industry. It can be readily assumed that eight of these pathways are sport related: sport research; sport administration (voluntary/governing body); sport administration (public); sport facility management (public); sport facility management (private); and professional coaching and sport development. Through industry consultation, a variety of key skills were identified and ranked in relation to their relative importance for the specific career pathway. The skills identified were: literacy, numeracy, technical competence, management, social and interpersonal skills, and marketing.

The ILAM study raised a number of constructive issues in relation to the skills required by the sport industry. The 'skills barometer' focussed on the skills of literacy, numeracy, technical competence, management, social and interpersonal and marketing, together with any subject specific skills that the pathway may require. The skills required varied according to the pathway. However, what is of particular relevance to this study is that numeracy, literacy, and social and interpersonal (communication) skills are ranked highly in all job specifications.

The emphasis on numeracy reflects the nature of the business environment that sport operates in, although literacy and communication skills also form an integral part of any sport position. These findings match those of the DfEE (1999) and emphasise the need for such skills in the sport industry. Sport needs to be considered as a serious and important industry for the United Kingdom. Consequently the calls for a skilled and qualified workforce by the sport and leisure industry are as

significant as that from any other employer. The question is do our graduates possess the necessary transferable skills to answer these calls?

Barriers to skills development

There have been many attempts to improve the personal skills of students in Higher Education. Stanga and Ladd (1990) note that despite the importance of communication skills, relatively little is known about the obstacles that students face when attempting to develop their communication abilities.

Current thinking in communication has indicated a split between communication apprehension (CA) and communication development. There are indications, for example Allen and Bourhis (1996), and Spitzberg and Cupach (1984), that techniques aimed at the development of communication skills will not resolve communication apprehension. If an individual has a high level of apprehension then techniques will not result in improved communication performance. Therefore, in order for the effective development of communication skills to take place it is necessary to diminish the level of communication apprehension that an individual may feel.

McCroskey (1984: 78) defines CA as, "an individual's level of fear and anxiety associated with either real or anticipated communication with another person". However, this fear can be typified as being 'trait' or 'state' (Richmond and McCroskey, 1989): an individual's general unease in communication situations is seen as being a personal 'trait', whereas the fear of communicating in specific situations is referred to as 'state'. Individuals will exhibit both types of CA: they will have a general trait level of CA plus a state reaction to the specific context in which they are attempting to communicate. In the same way that CA interferes with the development of communication skills, the progress in numeric skills can be impeded by mathematics anxiety.

Mathematics anxiety (MA) is characterised as, "feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations" (Richardson and Suinn, 1972: 551). Several studies have documented the negative effects of mathematics anxiety on mathematics performance and achievement (Betz, 1978; Brush, 1978; Dreger and Aitken, 1957; Gaudry and Spielberger, 1971; Suinn *et al*. 1972; Wigfield and Meece, 1988).

More recent studies have built on these earlier works to suggest that mathematics anxiety can result from a wide range of factors. Factors such as: myths, teachers and parents have been listed by Steele and Arth (1998), and Trujillo and Hadfield (1999) include intellectual factors such as learning styles, persistence, self-doubt and dyslexia. Personality factors including low self-esteem, shyness and intimidation have also been shown to have an impact on mathematics anxiety (Fotoples, 2000; Levine, 1995). The importance of recognising and then dealing with mathematics anxiety is of great concern. Ashcraft (2002: 181) commented, "math (sic) anxiety disrupts cognitive processing by compromising ongoing activity in working memory. Although the causes of math anxiety are undetermined, some teaching styles are implicated as risk factors". This implies that contextual factors (i.e. 'state') can add to the inherent 'trait' levels possessed by specific individuals.

Other lines of research have concentrated on suggesting ways in which teachers can reduce mathematics anxiety. Methods that have been suggested include: designing appropriate teaching practices (Cornell, 1999; Steele and Arth, 1998) and using alternative assessment (NCTM, 1995; Steele and Arth, 1998).

Given the importance of MA and CA levels in the development of relevant abilities, the purpose of this study is to measure the levels of communication apprehension and mathematics anxiety in sports studies students immediately before they undertake their chosen courses at university.

Simons *et al.* (1995) and Hassall *et al.* (2000) found evidence of gender differences in the levels of communication apprehension. This confirms the observation of Daly and Miller (1975) that women have significantly higher oral communication apprehension (OCA), but lower writing apprehension

(WA), than male counterparts. Simons *et al.*'s results indicate that while females written communication apprehension was lower, it was not significantly so. Female students did, however, have significantly higher overall oral CA scores and higher scores associated with formal speaking contexts; namely, the meeting and public speaking subscale scores. These results are replicated in Hassall *et al*.'s study, and indicate commonalities between UK and US students. Similar gender differences were found in the levels of MA reported by students (Dew *et al*., 1983; Fox, 1977; Alexander and Matray, 1989), and differences on CA and MA levels and profiles, related to demographic characteristics, were tested.

Research method

In order to assess the levels of communication apprehension for this study, an instrument was developed that used as its basis:

(i) the Personal Report of Communication Apprehension (PRCA-24) developed by McCroskey (1984) to measure oral communication apprehension (OCA), and;

(ii) the written communication apprehension (WCA) instrument developed by Daly and Miller (1975) (both instruments can be found in Simons et al., 1995).

The internal reliability and validity of these instruments are documented (McCroskey, 1984 and Bennett and Rhodes, 1988)

The oral communication items consisted of four equal subsections - "group discussions", "interviews", "conversations" and "presentations" - and six questions were assigned to each. A pictorial representation of the areas is shown in Figure 1 below.

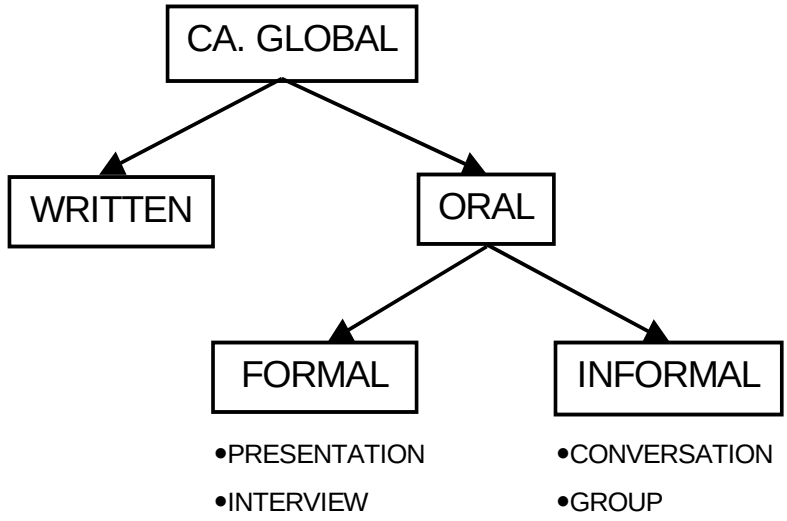

Figure 1: Areas of communication

In order to avoid any confusion or misunderstanding of these concepts, a definition of each relevant term was given in the questionnaire. (Where appropriate, the internal reliability statistics for this study are shown in Table 3.)

The measurement of the levels of mathematics anxiety was done using the 25-item Math Anxiety Rating Scale (MARS), developed by Alexander and Matray (1989) from the 98-item MARS of Suinn (1972). The internal reliability and validity of this instrument is documented (Richardson and Suinn, 1972; Suinn and Edwards, 1982). The questionnaires were administered to first year students entering the sports studies area at Sheffield Hallam University. The students completed the questionnaire on their first or second day at the University in an introductory session prior to registration i.e. before any formal teaching had commenced or any information had been given to the students concerning the academic content of their chosen courses. The purpose of the study and the anonymity of students participating were explained in line with the University's guidelines on ethics in research.

Results

The courses involved and the number of students from each course who completed the questionnaire are shown in Table 1. The questionnaire was directly administered to students and the response rate was 100% for every element of the selected sample.

Course studying	Number	% age
Law	175	18.8
Financial Services	33	3.5
International Business	97	10.4
Business &Technology	50	5.4
Nursing	76	8.2
Accounting	111	11.9
Sports Studies	147	15.8
Engineering	65	7.0
Business Studies	178	19.1
Total	932	100.0

Table 1: Composition of the overall sample

Table 2 shows the composition of the whole sample, in relation to gender and educational background, for the sports studies sub-sample and other course sub samples.

	Gender			Education background		
	Male	*Female*	*Total*	*Numeracy/ Science*	*Literate/ Arts*	*Total*
Sports Studies	62.6	37.4	100	61.11	38.89	100
Others	46.8	53.2	100	45.87	54.13	100
Total	49.3	50.7	100	48.32	51.68	100

Significant at 1% level (Pearson's Chi square two tail)

Table 2: Gender and educational background by area

As the data in Table 2 illustrate, the proportion of male students in the sports studies sub-sample was higher than in the other courses. Also, the percentage of students with a numerical/scientific educational background was significantly higher for sports studies programmes, as shown by a chi square test.

	Scale[(1)] Reliability	Shapiro-Wilk sig.	Mean	Median	St. Dev.	Min	Max	Skewness	Kurtosis
Total Score CA	-	0.928	129.38	130	21.82	63	193	-0.02	-0.08
Writing App. Score	.917	0.002	62.95	62	13.20	25	112	0.29	0.08
CA Oral Score	-	0.623	66.43	66	13.56	24	112	0.04	-0.07
Formal	-	0.014	37.60	38	8.34	12	60	-0.05	-0.38
Interview Score	.874	0.000	17.93	18	4.46	6	30	-0.13	-0.43
Presentation Score	.894	0.000	19.67	20	5.06	6	30	-0.04	-0.52
Informal	-	0.000	28.82	28	7.07	12	56	0.44	0.31
Group Score	.860	0.000	14.75	14	4.32	6	30	0.48	0.30
Conversation Score	.853	0.000	14.07	13	3.66	6	29	0.49	0.44
Mathematics Anxiety	.918	0.000	59.59	58	16.46	26	116	0.52	0.07

(1) Cronbach's alpha

Table 3: Descriptives and statistics for scales (overall sample)

Descriptive statistics of the scores (overall sample) are shown in Table 3. In this Table, normality tests results (Shapiro-Wilk) and internal reliability analysis of basic scales (Cronbach's alpha) are provided. All basic scales appear to be highly reliable, with alpha values ranging from 0.85 to 0.93.

The scales containing a reduced number of items (interview, presentation, group and conversation; 6 items each) have lower alpha values because there are fewer items in each section. However, all of them indicate very strong internal reliability, meaning that the results can be confidently used for comparative analysis. Although both the total CA and oral CA scores seem to follow a normal distribution, the normality test, skewness and kurtosis statistics indicate that the distributions of the basic scores depart from normality.

As the composition of each sub sample is significantly different in relation to gender and educational background, a univariate comparison could be biased by the differences associated with the other variables. Therefore, multiple analysis of variance tests were performed. Although MANOVA is a parametric test, and requires the distribution of the variables to be normal, the F statistic on which the test is based is fairly robust against violations of the assumption of normality (Ferran Aranaz, 1999). The results of MANOVA are shown in Table 4.

The results show that sport studies students have significantly higher levels (p=.022) of mathematics anxiety than the other students in the study. Both gender and educational background are shown to be related to mathematics anxiety. The study shows that female students and those students from a literate/art background have higher levels of mathematics anxiety (p<.01). In respect of communication apprehension scores, the results show significant differences (p = .002) in total communication score for students from differing academic backgrounds. This arises because of the significant difference in the writing apprehension scores (oral communication apprehension scores show no differences for educational background). There are significant differences in the total sample in terms of gender for formal communication apprehension. This applies to both the interview and presentation components. There are also significant differences in the presentation score between sports studies and other students (p= .005).

	Significance of F for sources of variation							Model sig.
	(1) area	(2) gender	(3) ed. background	(1) by (2)	(1) by (3)	(2) by (3)	(1) by (2) by (3)	
Total Score CA	n.s.	n.s.	*0.002*	n.s.	n.s.	n.s.	n.s.	*0.000*
Writing App. Score	n.s.	n.s.	*0.000*	n.s.	n.s.	n.s.	n.s.	*0.000*
CA Oral Score	n.s.	0.078	n.s.	n.s.	n.s.	n.s.	n.s.	*0.007*
Formal	0.059	*0.001*	n.s.	n.s.	n.s.	n.s.	n.s.	*0.000*
Interview Score	n.s.	*0.001*	n.s.	n.s.	n.s.	n.s.	n.s.	*0.000*
Presentation Score	*0.005*	*0.012*	n.s.	n.s.	n.s.	n.s.	n.s.	*0.000*
Informal	n.s.	n.s.	n.s.	0.091	n.s.	n.s.	n.s.	n.s.
Group Score	n.s.	n.s.	n.s.	*0.041*	n.s.	n.s.	n.s.	n.s.
Conversation Score	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Mathematics Anxiety	*0.022*	*0.002*	*0.003*	n.s.	n.s.	n.s.	0.072	*0.000*

Table 4: Multivariate analysis of variance results

Table 5 shows the means for sports studies and others and the total population for each of the constructs measured.

Study Area	Gender	Educational background	Maths anxiety	Writing app. score	Group score	Interview score	Conversation score	Presentation score
Sports Studies	Male	num. / sci.	54.24	67.43	14.72	17.02	13.75	17.62
		lit. / arts	63.72	61.30	15.41	17.35	15.16	18.78
		Total	58.16	64.91	15.00	17.16	14.33	18.10
	Female	num. / sci.	67.42	66.91	14.51	18.46	13.74	19.03
		lit. / arts	65.72	63.05	13.74	18.63	13.95	19.00
		Total	*66.82*	*65.56*	*14.24*	*18.52*	*13.81*	*19.02*
Others	Male	num. / sci.	54.91	69.03	14.69	17.27	14.35	19.35
		lit. / arts	60.48	60.74	14.19	17.16	14.05	18.95
		Total	56.97	65.97	14.50	17.23	14.24	19.20
	Female	num. / sci.	57.33	65.45	15.39	18.87	14.24	21.17
		lit. / arts	63.42	57.76	15.10	18.79	14.13	20.29
		Total	*61.46*	*60.12*	*15.19*	*18.82*	*14.16*	*20.56*
Total Studies	Male	num. / sci.	54.78	68.72	14.69	17.22	14.24	19.01
		lit. / arts	61.23	60.87	14.46	17.20	14.30	18.91
		Total	57.22	65.75	14.60	17.21	14.26	18.97
	Female	num. / sci.	59.54	65.77	15.20	18.78	14.13	20.70
		lit. / arts	63.57	58.10	15.01	18.78	14.11	20.21
		Total	*62.12*	*60.77*	*15.07*	*18.78*	*14.12*	*20.38*

Table 5: Mean of scores for sub samples (basic scales)

Discussion

This study was based on data obtained from first year students at the commencement of the academic year. The students at this point in time had not had any formal contact with the academic staff from their respective disciplines. Therefore what was being measured was the scores that they effectively brought with them i.e. the scores are not the result of the development from the academic course they had chosen. The initial comparison is therefore undertaken on prospective students preparing to undertake an academic course in sports studies and a large sample of prospective students from a range of other disciplines.

The results highlight a number of areas that give some cause for concern, or challenge some preconceived assumptions. The first indication is that sports studies students, in comparison with students on other programmes, possess a high degree of mathematics anxiety on commencement of their university studies. This would indicate that these students may feel apprehensive about using numbers in a variety of contexts, for example compiling budgets (an essential skill required in sport studies degree programmes). The concern is raised because when comparing this observation with, for example, the ILAM skills barometer, numeracy was a very important skill for most career pathways. According to the ILAM study, in all of the sport and leisure related pathways except two, numeracy was regarded as a significant skill, achieving between 60% and 90% in the 'relative importance' rating as a skill needed to do the job effectively. The pathways where it was less were the areas of sport development (52%) and professional coaching (48%) (ILAM, 2004). There must also be concerns about the progression of sport studies students through their chosen degrees. Richardson and Suinn (1972) and Suinn, Edie *et al.* (1972) have documented the negative effect of mathematics anxiety on mathematics performance and achievement.

Moreover, the sports studies students in this sample had low levels of oral communication apprehension in formal situations, particularly presentations. This is encouraging when it is considered that presentations are a key ingredient in the educational programmes offered at University

and generally essential at interview. Comparing the formal oral communication apprehension with the ILAM skills barometer causes some problems, as they do not necessarily include such a specific category, opting for a more general one of social and interpersonal skills. Yet even accepting these problems of comparative analysis, this is another significant skill required in many of the pathways, achieving high rating of nearly 70% or over.

Previous research (Simons *et al.*, 1995; and Hassall *et al.*, 2000) had indicated that there may be gender differences in respect of communication apprehension and mathematics anxiety. Such evidence is confirmed in this study where it was found that female students indicate significantly higher levels of both communication apprehension and mathematics anxiety than their male colleagues. In particular, the level of mathematics anxiety of female sport studies students was very high compared to both the overall population and male sport studies students (as shown in Table 5). Walkerdine (1998) suggests that females avoid mathematics to concentrate on areas of learning that fit with important personal constructs and capitalise on perceived strengths in verbal discourse. This is confirmed by their relatively lower scores for formal communication apprehension particularly in the areas of interview and presentations.

Educational background appears to influence, both in general and in the specific case of sports studies students, higher levels of writing apprehension and mathematics anxiety: students from a numerate/scientific background have a higher level of writing apprehension than those from a literate/arts background, but a lower level of mathematics anxiety. An interesting finding is that, for writing apprehension, all sports studies students have higher levels of anxiety than other students except for males from a numeric/scientific background. This is also the case for mathematics anxiety.

Conclusion

In light of the calls from industry, and the UK and European Governments (CBI, 1991; Raggart and Williams, 1999), it is important that educational programmes equip students with the key skills that will enable them to operate in their chosen work place. There appears to be a mismatch between the skills needed by the sport and leisure industries and those reported by students about to embark on degree programmes related to that area.

The results of this study indicate that prospective undergraduate students may already have high levels of mathematics anxiety but lower levels of formal communication apprehension prior to undertaking their courses. Their previous educational background may in part explain this. If, as indicated by the research, this apprehension may be a barrier to skill development, then an important future direction for this line of research is to measure the levels of apprehension of students in a longitudinal study. Another area for future research would be to investigate the process by which students make their vocational choice: are we attracting students with the appropriate skills to the courses? If not, why not: is there a need for the sports and leisure industry to change its image in terms of educational profile in addition to its contribution to the UK economy?

The ILAM skills barometer indicates the importance of literacy and numeracy for sports studies students. These skills are further analysed in terms of the various pathways within the vocational area. These are to an extent mirrored by the various sports related degrees offered at undergraduate and post graduate levels. It may therefore be important to measure and contrast the levels between these named undergraduate degrees. In conjunction with this approach it would also be interesting to contrast the respective areas of sports studies with their nearest counterparts, such as sports and leisure management, and business studies or accounting.

Previous studies indicate that there are two approaches to reducing anxiety and apprehension: behavioural and pedagogic. Behavioural approaches include techniques such as systematic desensitisation (Friedrich and Goss, 1984), cognitive restructuring (Fremouw, 1984), assertiveness training (Adler, 1977; Zuker, 1983), and visualisation techniques. There is evidence (Berger *et al.*, 1982; Berger and McCroskey, 1982), that these techniques can reduce CA Pedagogic approaches focus on the use of pedagogical strategies, such as restructuring programmes to reduce apprehension

(Daly and Miller, 1975). These techniques are complex, contextual and potentially resource intensive and more research is necessary in order to identify specific techniques that are effective in practical situations. The implications of this may be that, for example, educational institutions need to work at removing the fear of communication rather than providing opportunities for communication practice. However, the practicalities of this may not align with resource constraints: it is far more expensive to counsel apprehensions and anxieties (potentially on an individual basis) than it is to build 'presentations' into the curriculum.

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