Bias against women in the professional examinations? Such is one of the disturbing possibilities revealed by the authors of this statistical survey of a recent optical examination and the factors which influenced the candidates' final results

Factors in professional examination performance

C. French, MA and A. Tomlinson, MSc, PhD, FBOA, DCLP

In September 1971, 59 undergraduate students who had successfully completed the second year of their degree courses in ophthalmic optics took, for the first time, the whole of the Joint Part I Professional Examination at the University of Aston in Birmingham. This series of practical and oral examinations is set jointly by the BOA and SMC and assesses the student's competence in ophthalmoscopy, visual fields, retinoscopy and subjective refraction, dispensing, and general oral. Of the 59 students taking the examinations 13 (10 male and 3 female) were from the University of Wales Institute of Science and Technology, 21 (14 male and 7 female) from the University of Aston, and 25 (12 male and 13 female) from the University of Manchester Institute of Science and Technology.

As a result of the recurring interest in the performance of degree students in professional examinations, it was decided to analyse the results of these examinations with respect to certain factors which were thought might be of influence. As it was not possible to get complete information on the Cardiff and Aston students, because of the confidential nature of the examination marks, an analysis in depth was only possible for the UMIST students.

The consideration of the factors is divided here into four sections:

(1) The candidate's previous record, as indicated by the results of the Advanced Level of the General Certificate of Education and the Part I, BSc examination, was compared with the performance attained in the professional examinations.

(2) As the Joint Part I examinations are all either practical or oral, requiring the examiner to make a subjective assessment of the candidate's ability, the possible influence of the "attractiveness" and "apparent intelligence" of the candidate on the results was investigated.

(3) The results obtained from the three different universities were compared to determine whether the student's performance had been influenced by the choice of training institution.

(4) The difference in performance of males and females in the same professional examinations was compared with the inter-sex differences in other examinations.

Method of measurement of these factors

The methods of grading students in the three sets of examinations considered in section 1 differed between the use of fairly wide-band lettered classifications in the "A" level and Joint I professional, and the percentage marking system employed by the university examiners. To overcome this disparity and to allow for overall evaluations of the performance in the several subjects taken at "A" level or in the professional examinations, a point system was substituted for the letter classifications: *ie* 5 to 1 for the "A" level grades and 6 to 1 for the Joint Part I results.

In section 2 "attractiveness" and "apparent intelligence" were assessed for the candidates from UMIST from photographs of these assessors (three male and two female) listed the students in descending order of "attractiveness" on two separate scales for males and females, and allocated them marks out of 100. The same five assessors then graded the UMIST candidates on one scale for "apparent intelligence", giving them again marks out of 100.

Results and discussion

Throughout the consideration of the results of this study it must be remembered that what is found to be true statistically of the results of the Joint Part I Professional examinations at Aston in September 1971 may or may not be true of other professional examinations held at other times.

The comparison of the performance of UMIST students in the "A" level examinations with their performance in the BSc Part I and the Joint Part I professional examinations (Table I) shows a significant relationship between these results (p<0-05 in each case).

This suggests that as an index of suitability for admission to a university course in ophthalmic optics and thus

TABLE I

This table shows the Spearman Rank correlations between the three sets of examination results at "A" level of the GCE, Part I of the BSc and Part I of the joint professional examinations; together with the correlations found for the relationship between Joint Part I results and "attractiveness" and "apparent intelligence".

Relationship for UMIST students between	Correlation	Significance level
"A" level and Part 1, BSc results	+ 0.41	*
"A" level and Joint Part I, Professional	+ 0.44	*
Part I, BSc and Joint Part I Professional	+ 0.56	**
"Attractiveness" and Joint Part I Professional	+0.09 female -0.28 male	n.s. n.s.
"Apparent intelligence" and Joint Part I Professional	+ 0.11	n.s.

n.s. The correlation coefficient is not statistically significant ***ie.*** p>0.05.
* $p < 0.05$
** $p < 0.01$

students. Five

TABLE II

This table shows the means and standard deviations of the results obtained by the students of the different universities in the various subjects presented in the Joint Part I professional examinations in September 1971. The results obtained by the different universities in each subject are compared by a standard analysis of variance test *F* ratio[1]. Bartlett's test for homogeneity of variance[2] was applied to the data to ensure that it was valid to use this parametric test. Individual differences were tested according to a Scheffé test".

Subject	Means and s.d.s.			Overall comparison		Significance of differences		
	Aston	UMIST	UW1ST	F(2,56)	significance level	Aston — UMIST	UMIST— UW1ST	Aston — UWIST
ophthalmoscopy	4.1 ± 0.8	4.0 ± 0.6	3.8 ± 0.4	0.59	n.s.	n.s.	n.s.	n.s.
retinoscopy and subjective refraction	4. 1 ± 0.7	3.9 ± 0.7	4.1 ±0.5	0.98	n.s.	n.s.	n.s.	n.s.
visual fields	4.2 ± 0.7	4.0 ± 0.5	4.3 ± 0.5	1.60	n.s.	n.s.	n.s.	n.s.
dispensing	3.7 ± 0.6	3.3 ± 0.8	4.1 ± 0.5	6.24	**	n.s.	sig.	n.s.
general oral	4.1 ± 0.5	3.6 ± 0.8	4.0 ± 0.6	2.85	n.s.	n.s.	n.s.	n.s.
all subjects	20.4 ± 2.0	18.8 ± 2.5	20.4 ± 1.4	4.06	*	sig.	sig.	n.s.

n.s. The comparison in question did not reach statistical significance *ie.* p > 0.05.
sig. These individual comparisons are statistically significant *ie. p* < 0.05.
* p < 0.05
** p < 0.01

TABLE III

This table shows the means and standard deviations obtained by the male and female students of UMIST, together with the results of all the students taking the Part I professional examinations in September 1971. The inter-sex differences are compared by a standard analysis of variance test *F* ratio[1] for the students from UMIST and also for *all* the students taking the examination for the first time. Bartlett's test for homogeneity of variance[2] was applied to the data to ensure that it was valid to use this parametric test.

Subject	UMIST students				All students			
	means and s.d.s.		sex comparison		means and s.d.s.		sex comparison	
	males	females	F(l,23)	sig. level	males	females	F(l,57)	sig. level
ophthalmoscopy	4.2 ± 0.6	3.8 ± 0.6	3.88	n.s.	4.1 ± 0.6	3.9 ± 0.6	1.56	n.s.
retinoscopy and subjective refraction	4.1 ± 0.7	3.7 ± 0.7	1.88	n.s.	4.2 ± *0.6*	3.8 ±0.8	4.74	*
visual fields	4.0 ± 0.4	4.0 ± 0.7	0.00	n.s.	4.3 ± 0.6	4.1 ± 0.6	1.21	n.s.
dispensing	3.6 ± 0.8	3.1 ± 0.9	2.32	n.s.	3.9 ± 0.7	3.3 ± 0.7	11.27	***
general oral	4.0 ± 0.4	3.3 ± 0.9	5.29†	*	4.0 ± 0.4	3.6 ± 0.9	4.31†	*
all subjects	19.9 ± 1.9	17.8 ± 2.5	5.19	*	20.4 ± 1.8	18.7 ± 2.4	9.89	**

† In these cases Bartlett's test indicates a significant departure from Normality.
n.s. The comparison in question did not reach statistical significance *ie.* p > 0.05.
* p < 0.05
** p < 0.01
*** p < 0.001

ultimately for admission to professional examinations the "A" level performance is of some value. It will also be noted that there is a very significant (p<0-01) correlation between performance in the Part I sections of the BSc and professional examinations. Although the former is essentially a written examination and the latter practical, students who do well internally also do well externally. The appearance of candidates in terms of physical attractiveness or of apparent intelligence would not appear to influence the examiners' assessment of their professional competence (see Table I); this finding will perhaps dispel the popular conception that attractive women have an unfair advantage in face to face examinations.

Superficially, at least, the choice of training institution would appear to affect the candidate's ability to cope with the professional examination (Table II).

The overall performance of students from UMIST in all the subjects taken in the Joint Part I is significantly worse than that of either UWIST or Aston students (p<0-05). One possible explanation for this disparity is that the quality of students going to UMIST is lower than the others. This, however, would appear unlikely as the academic potential of the UMIST students as judged by their "A" level results was at least as high as those of the UWIST students. It is true that at Manchester the degree course in ophthalmic optics is probably more academically biased than at other universities, but the clinical side is not neglected and it is suggested here that the poorer performance in these professional examinations is due to an alternative factor not so far considered: that is the difference *in* the performance of male and female students in professional examinations.

An inter-sex comparison of the Joint Part I results of the males and females reveals some interesting differences (Table HI).

For the 59 students as a whole males did significantly better overall (p< 0-01). They also did significantly better in three out of the five individual examinations. For the UMIST sample alone, males again out-performed females overall (p<0-05). It is interesting that for UMIST and total samples in both individual examinations and the examinations as a whole, in no instance did female candidates perform better than male candidates. The reason for "this male supremacy is difficult to see.

If the previous academic records of male and female UMIST students are compared (Table IV) no significant differences between, the sexes is shown *prior* to the professional examinations. It may be suggested that males perform better than females under the stress condition of supervised practical examinations, but no such differential ability is indicated by the results of the internal practical examinations (subjective refraction, dispensing and general oral) taken at the end of the first year of the university course (Table IV).

TABLE IV

This table shows the means and standard deviations of the results obtained by the male and female students from UMIST in examinations taken by them prior to taking the Joint Part I professional examinations in September 1971. The inter-sex comparisons of these results are made with a standard analysis of variance test *F* ratio[1]. Bartlett's test for homogeneity of variance[2] was applied to the data to ensure that it was valid to apply this parametric test.

Examination	UM1ST students			
	means and s.d.s.		sex comparison	
	males	females	F(1, 23)	significance level
"A" level of GCE	7.0 ± 2.4	7.1 ± 3.7	0.00	n.s.
first year sessionals	52 ± 11	51 ± 9	0.03	n.s.
first year practicals	72 ± 13	67 ± 10	1.06	n.s.
Part 1, BSc	58 ± 9	56 ± 11	0.35	n.s.

n.s. The difference is not statistically significant *ie.* p>0.05.

TABLE V

This table shows separately the means and standard deviations of the results obtained by the male and female students from Aston, UMIST and UWIST in the Joint Part I professional examinations at Aston in September 1971. The inter-university comparison of the results for the same sex is made with a standard analysis of variance *F* ratio[1]. Bartlett's test for homo-geniety[2] was applied to the data to ensure that it was valid to use this parametric test.

Group	Overall performance means and s.d.s			Inter-university overall comparison	
	Aston	UMIST	UWIST	F(2,33)	sig. level
male	20.9 ± 2.0	19.9 ± 1.9	20.4 ± 1.4	0.86	n.s.
female	19.6 ± 1.8	17.8 ± 2.5	20.3 ± 1.5	0.22	n.s.

n.s. The data do not differ at a statistically significant level *ie.* p>0.05.

Bias against women students

A disturbing conclusion that could be reached from the evidence presented here is that there was some unconscious or even conscious examiner bias against women students taking the professional examinations. Recently some concern has been expressed in the profession about the increase in the proportion of women who have graduated in recent years and with the possible implications of this trend if, as seems likely, it continues in the future[4,6]. We think that it would be unfortunate if the relatively poor performance of female students in professional examinations reflected this antagonism.

Any need to discriminate against women for the sake of the "preservation" of the profession should be manifest before they are admitted to university courses and not at this comparatively late stage in their academic careers. Discrimination on this basis, however, is odious and ought not to be encouraged in a profession which, unlike others[6], has not practised it in the past.

The sex difference in performance may well account for the apparently poor overall performance of the students from UMIST in comparison to students from the other two universities (Table II). If the overall performance of the male students are compared (Table V), no significant differences are found between the universities.

A similar finding is obtained from an inter-university comparison of the results of female students (Table V). Therefore the reason that UMIST compares unfavourably with the other universities when considering the results from the mixed samples (Table II) simply appears to be because of the relatively high proportion of female students in the UMIST sample (52 per cent compared to 33 per cent at Aston and 23 per cent at UWIST).

Detailed analysis, similar to that carried out here, of the results of both the Joint Part I and Part II professional examinations over several years would-be necessary before any firm conclusions could be reached about the factors influencing examination performance. Nevertheless, it is felt that the analysis of the results of last September's Part I examinations alone has revealed some interesting trends which should be investigated further.

References

1 Winer B. J. *"Statistical Principles in Experimental Design",* New York: McGraw-Hill, 1962, p.96
2 Winer B. J. *Ibid.* p.95.
3 Winer B. J. *Ibid.* p.88.
4 THE OPTICIAN, 1971, 15-10-71, p.26
5 *Ophthalmic Optician,* 1971, 11:1054
6 "Medical Schools favour men," *The Times Higher Education Supplement,* 1971, 1:8, p.l.