

Predicting degree performance with the Thinking Skills Assessment

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Background & Summary

This report looks at the 2003 TSA scores and the subsequent Tripos results of students of Computer Science, Economics, Engineering and Natural Science (Part 1A exams taken in 2005). Correlations, descriptive statistics and tau analyses are presented in support of the predictive validity of the TSA. Correlation coefficients between the TSA and subsequent exam performance are unexpectedly strong, given the problems of restricted score ranges with such highly selected candidates. Students attaining higher degree classes attained higher TSA scores across all subjects and the tau analyses suggest that selecting candidates on their TSA scores alone would have given at least the same success rates as the existing selection procedures. Descriptive statistics and tau analyses are also presented for the final Computer Science degree outcome (Part II exams taken in 2005) of the students who sat the TSA in 2001. These again support the predictive validity of the TSA even after a four-year test interval.

TSA Score Distributions of Accepted and Rejected Applicants

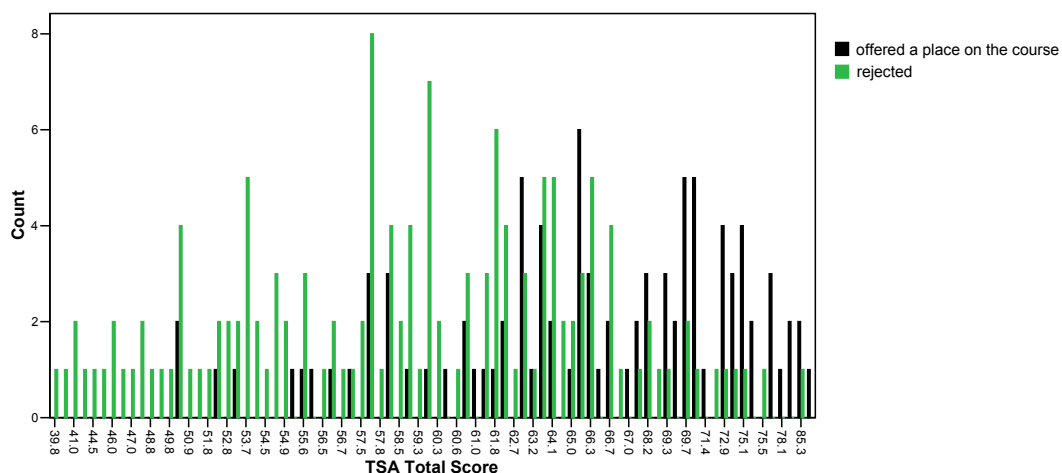
A total of 1551 candidates sat the TSA in 2003. These were applicants to 29 Colleges, predominantly for courses in Computer Science, Economics, Engineering and Natural Sciences (a very few had applied to study Mathematics or Land Economy.) Of these, 492 received an offer of a place.

TSA scores are reported as a total calibrated score and as separate Problem Solving and Critical Thinking sub-scores. The calibration process allows the results of candidates taking different versions of the test to be reported on a common interval scale.

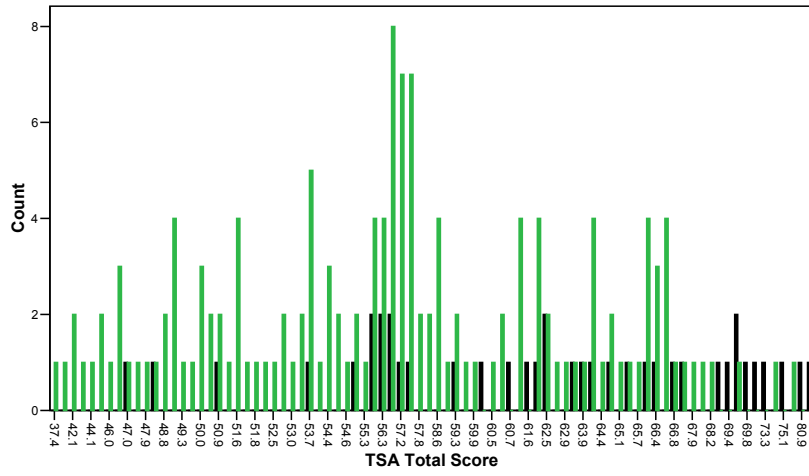
Bar charts showing the TSA score distributions of candidates who were offered a place (conditional or unconditional) and candidates who were rejected are given below for each course. These bar charts are particularly useful in evaluating whether a test is likely to be useful for deselecting some candidates. In the charts below, few if any of the accepted candidates had low scores. If the test were to be used for pre-selection, two questions need to be considered: why were these candidates accepted; and could they be spotted without an interviewer. Bar charts displaying distributions of the separate Problem Solving and Critical Thinking sub-scores are given in Appendix A.

Figure 1: Bar charts showing the TSA score distributions of candidates who were offered a place (conditional or unconditional) and candidates who were rejected, by course.

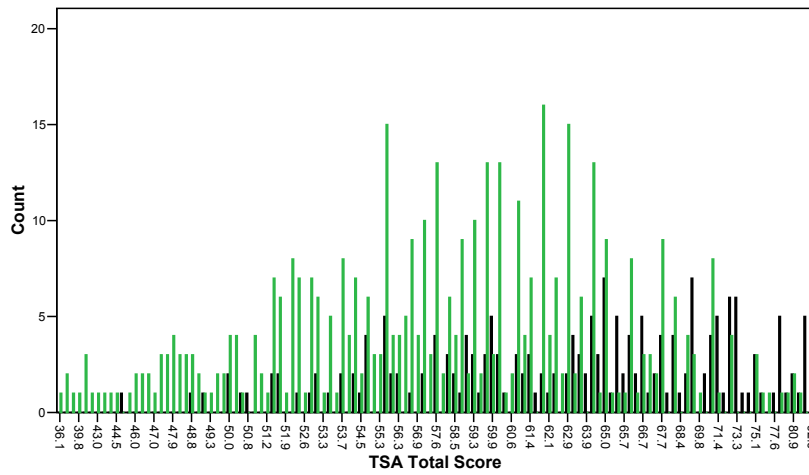
Computer Science (TSA 2003)



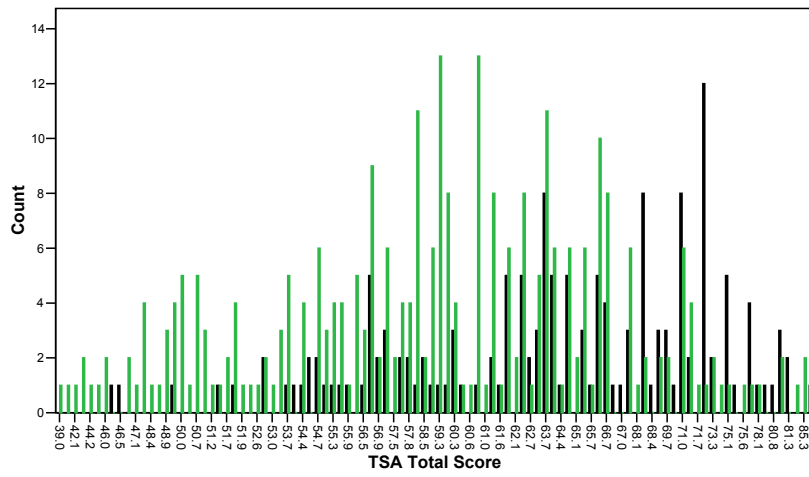
Economics (TSA 2003)



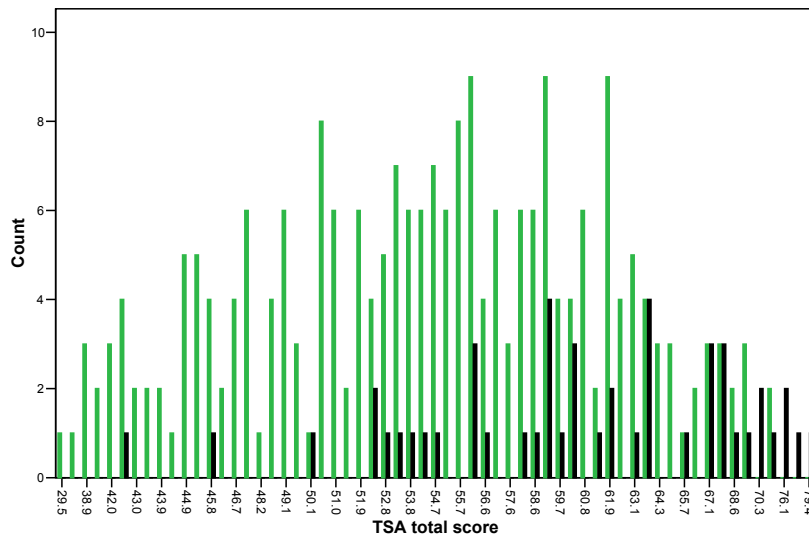
Engineering (TSA 2003)



Natural Sciences (TSA 2003)



Computer Science (TSA 2001)



Correlations

The following tables display the correlation coefficients between TSA scores (2003 sitting) and 1st year exam performance in 2005 (by subject). Pearson coefficients are given for all variables except 'rank' where a Spearman's rho is used due to the ordinal nature of the data. All hypotheses are one-tailed.

It should be noted that the correlation coefficients presented throughout the report are uncorrected for effects such as range restriction and attenuation. The magnitude of a correlation coefficient is affected by the range of scores achieved on the measures and the reliability of the tests used. It is therefore common practice in validity studies to adjust for the effects of having a narrower range of scores than that of the cohort as a whole (as is the case here in such a highly selected group of high-achieving candidates). The corrective formulae shown in Appendix B were not used here but would have increased the strength of the coefficients.

General Guidelines for Interpreting Validity Coefficients

Validity coefficient value	Interpretation
above .35	very beneficial
.21 - .35	likely to be useful
.11 - .20	depends on circumstances
below .11	unlikely to be useful

(US Department of Labor, Employment Training and Administration, 1999)

In the correlation matrices presented on the following pages the following key applies:

- ** The correlation is significant at the 0.01 level.
- * The correlation is significant at the 0.05 level.

Table 1: Correlations between TSA scores and Part 1A exam outcome – Computer Science

		TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
TSA Total Score	Correlation Coefficient		.791**	.839**
	Sig. (1-tailed)		.000	.000
	N		67	67
TSA Problem Solving Score	Correlation Coefficient			.365**
	Sig. (1-tailed)			.001
	N			67
Computer Science Part 1A Rank	Correlation Coefficient	-.453**	-.439**	-.292**
	Sig. (1-tailed)	.000	.000	.008
	N	67	67	67
Computer Science Part 1A Total	Correlation Coefficient	.445**	.419**	.315**
	Sig. (1-tailed)	.000	.000	.004
	N	67	67	67
Computer Science Paper 1 Mark	Correlation Coefficient	.488**	.477**	.327**
	Sig. (1-tailed)	.000	.000	.003
	N	67	67	67
Computer Science Paper 2 Mark	Correlation Coefficient	.566**	.505**	.425**
	Sig. (1-tailed)	.000	.000	.000
	N	64	64	64
Maths Mark	Correlation Coefficient	.105	.178	.007
	Sig. (1-tailed)	.193	.071	.476
	N	67	67	67
Materials and Mineral Sciences Mark	Correlation Coefficient	.894*	.943**	.755
	Sig. (1-tailed)	.020	.008	.070
	N	5	5	5
Geology Mark	Correlation Coefficient	.451	.584	.237
	Sig. (1-tailed)	.155	.084	.304
	N	7	7	7
Physics Mark	Correlation Coefficient	.270*	.208	.223*
	Sig. (1-tailed)	.020	.058	.046
	N	58	58	58

Both the Problem Solving and the Critical Thinking components of the TSA show highly significant positive correlations with part 1A exam outcome for Computer Science. The relationships are slightly stronger for the Problem Solving component in all parts of the exam other than the Physics paper, where Critical Thinking shows the stronger relationship. The Maths paper is the only component which does not appear to be well predicted by the TSA in Computer Science. However, differences in the strength of the coefficients between the various exam components may be due to the ranges of scores achieved by the candidates, with smaller ranges leading to poorer correlations. Care should also be taken in interpreting the coefficients where the number of candidates is very low (Materials and Mineral Sciences, Geology).

Table 2: Correlations between TSA scores and Part 1A exam outcome – Economics

		TSA Score	TSA Problem Solving Score	TSA Critical Thinking Score
TSA Total Score	Correlation Coefficient		.909**	.823**
	Sig. (1-tailed)		.000	.000
	N		25	25
TSA Problem Solving Score	Correlation Coefficient			.519**
	Sig. (1-tailed)			.004
	N			25
Economics Part 1A Rank	Correlation Coefficient	-.361*	-.429*	-.384*
	Sig. (1-tailed)	.038	.016	.029
	N	25	25	25
Economics Part 1A Total	Correlation Coefficient	.323	.311	.272
	Sig. (1-tailed)	.058	.065	.094
	N	25	25	25
Paper 1	Correlation Coefficient	.255	.247	.226
	Sig. (1-tailed)	.109	.117	.138
	N	25	25	25
Paper 2	Correlation Coefficient	.258	.327	.086
	Sig. (1-tailed)	.106	.056	.341
	N	25	25	25
Paper 3	Correlation Coefficient	.363*	.350*	.329
	Sig. (1-tailed)	.037	.043	.054
	N	25	25	25
Paper 4	Correlation Coefficient	.330	.315	.270
	Sig. (1-tailed)	.054	.062	.096
	N	25	25	25
Paper 5	Correlation Coefficient	.166	.116	.203
	Sig. (1-tailed)	.213	.290	.165
	N	25	25	25

In the case of Economics, there is again a significant positive relationship between TSA and exam outcome, with higher TSA scores being associated with higher exam scores and a higher rank. The lower significance levels in Economics are partly due to the smaller number of candidates with both TSA and exam data (n=25). As with Computer Science, the Problem Solving component shows the slightly stronger relationship with exam outcome. Rank in the Part 1A exams is significantly related to both components of the TSA at the 0.05 level despite small numbers of candidates and a very highly selected sample (proportionally, the fewest offers of a place were made to the Economics candidates).

Table 3: Correlations between TSA scores and Part 1A exam outcome – Engineering

		TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
TSA Total Score	Correlation Coefficient		.830**	.852**
	Sig. (1-tailed)		.000	.000
	N		106	106
TSA Problem Solving Score	Correlation Coefficient			.447**
	Sig. (1-tailed)			.000
	N			106
Engineering Part 1A Rank	Correlation Coefficient	-.180*	-.221*	-.136
	Sig. (1-tailed)	.032	.011	.083
	N	106	106	106
Engineering Part 1A Total Marks	Correlation Coefficient	.203*	.229**	.116
	Sig. (1-tailed)	.019	.009	.118
	N	106	106	106
Mechanical Engineering	Correlation Coefficient	.245**	.245**	.164*
	Sig. (1-tailed)	.006	.006	.047
	N	106	106	106
Structures and Materials	Correlation Coefficient	.160	.193*	.098
	Sig. (1-tailed)	.051	.024	.159
	N	106	106	106
Electrical and Information Engineering	Correlation Coefficient	.205*	.236**	.121
	Sig. (1-tailed)	.018	.007	.108
	N	106	106	106
Mathematical Methods	Correlation Coefficient	.130	.163*	.043
	Sig. (1-tailed)	.092	.048	.333
	N	106	106	106
Coursework	Correlation Coefficient	.087	.074	.084
	Sig. (1-tailed)	.187	.226	.195
	N	106	106	106

Exam outcome in Engineering is significantly related to the Problem Solving component of the TSA for all sections except coursework. The coursework marks here have a mean score of 99.19 (out of a possible 100) and this illustrates the point about range restriction which was made earlier, suggesting that the correlation coefficient may not be a useful predictive validity statistic in such cases. The Critical Thinking component again appears to have a slightly weaker relationship with the individual exam components but the total TSA score is significantly related to both rank and total marks achieved.

Table 4: Correlations between TSA scores and Part 1A exam outcome – Natural Sciences

		TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
TSA Total Score	Correlation Coefficient		.833**	.839**
	Sig. (1-tailed)		.000	.000
	N		106	106
TSA Problem Solving Score	Correlation Coefficient			.428**
	Sig. (1-tailed)			.000
	N			106
Natural Science Part 1A Rank	Correlation Coefficient	-.248**	-.244**	-.201*
	Sig. (1-tailed)	.005	.006	.019
	N	106	106	106
Natural Science Part 1A Total	Correlation Coefficient	.233**	.192*	.213*
	Sig. (1-tailed)	.008	.024	.014
	N	106	106	106
Biology of Cells	Correlation Coefficient	.280*	.172	.326*
	Sig. (1-tailed)	.028	.125	.013
	N	47	47	47
Evolution and Behaviour	Correlation Coefficient	-.321	-.285	-.246
	Sig. (1-tailed)	.059	.083	.118
	N	25	25	25
Chemistry	Correlation Coefficient	.294**	.209*	.280**
	Sig. (1-tailed)	.003	.028	.005
	N	84	84	84
Materials and Mineral Sciences	Correlation Coefficient	.337*	.288*	.324*
	Sig. (1-tailed)	.024	.046	.029
	N	35	35	35
Geology	Correlation Coefficient	.070	.054	-.024
	Sig. (1-tailed)	.352	.384	.447
	N	32	32	32
Physics	Correlation Coefficient	.168	.185	.103
	Sig. (1-tailed)	.083	.062	.197
	N	70	70	70
Physiology of Organisms	Correlation Coefficient	.072	-.141	.220
	Sig. (1-tailed)	.367	.250	.145
	N	25	25	25
Mathematics	Correlation Coefficient	.170	.210*	.108
	Sig. (1-tailed)	.066	.031	.171
	N	80	80	80
Elementary Mathematics for Biologists	Correlation Coefficient	.611	.334	.766*
	Sig. (1-tailed)	.099	.259	.038
	N	6	6	6
Quantitative Biology	Correlation Coefficient	.138	-.008	.236
	Sig. (1-tailed)	.281	.487	.158
	N	20	20	20

For the Natural Sciences courses, there is a highly statistically significant relationship between the total TSA score and the overall exam rank and totals. Correlations with the two individual TSA components are also significant. The total exam score coefficients mask a range of coefficients achieved for the various exam papers: those for the Biology of Cells, Chemistry and Materials & Mineral Sciences exams are comparatively strong. Unlike Computer Science, Economics and Engineering, the TSA Critical Thinking component here appears to have as strong a relationship with exam performance as does the Problem Solving component.

In all, the correlation coefficients between total exam performance and the TSA fall within the 'useful' to 'very beneficial' ranges. They are particularly strong for the Computer Science Tripos. However, these figures are all unadjusted for range restriction and may therefore be underestimates of the true predictive value of the TSA.

Descriptive Statistics

Tables 5 to 8 display the means and standard deviations of the TSA scores of candidates achieving various Part 1A exam classes in 2005. Table 9 displays the TSA scores (taken in 2001) of the candidates who took their final (Part II) exams in Computer Science in 2005.

For all subject groups, students obtaining 1st class Part 1A results tend, on average, to have gained higher total scores on the TSA than those who went on to obtain a 2:1, who in turn tend to have achieved higher scores on the TSA than those obtaining a 2:2. This is also true for the Problem Solving and Critical Thinking sub-scores, with the single exception of Engineering, where those obtaining a 2:1 had a slightly higher average Critical Thinking score than those gaining a 1st.

It is notable that the average TSA scores of students gaining a 3rd are often higher than those of candidates gaining a 2:2 or above. It could be that candidates who struggle on their course do so for reasons that are not necessarily related to their academic abilities.

If the purpose of selection is to identify those who will excel in their studies, it would seem wise, all other things being equal, to choose those with higher TSA scores.

Table 5: Computer Science

Part 1A Class		N	Mean	Std. Deviation
TSA Total Score	1st class	16	71.5	7.99
	2nd class division 1	18	68.5	6.96
	2nd class division 2	23	63.4	7.36
	3rd class	7	63.9	6.14
	Total	64	66.9	7.89
TSA Problem Solving Score	1st class	16	75.2	12.09
	2nd class division 1	18	74.6	11.46
	2nd class division 2	23	66.2	8.60
	3rd class	7	62.7	7.18
	Total	64	70.4	11.16
TSA Critical Thinking Score	1st class	16	70.2	8.70
	2nd class division 1	18	65.8	9.43
	2nd class division 2	23	61.4	8.32
	3rd class	7	65.7	6.63
	Total	64	65.3	9.07

Table 6: Economics

	Part 1A Class	N	Mean	Std. Deviation
TSA Total Score	1st class	8	70.0	9.19
	2nd class division 1	10	62.6	5.94
	2nd class division 2	6	59.0	7.99
	3rd class	1	60.7	.
	Total	25	64.0	8.39
TSA Problem Solving Score	1st class	8	71.3	13.43
	2nd class division 1	10	64.3	9.13
	2nd class division 2	6	57.2	8.81
	3rd class	1	62.0	.
	Total	25	64.7	11.37
TSA Critical Thinking Score	1st class	8	69.7	6.69
	2nd class division 1	10	62.4	8.03
	2nd class division 2	6	61.6	8.87
	3rd class	1	59.2	.
	Total	25	64.4	8.24

Table 7: Engineering

	Part 1A Class	N	Mean	Std. Deviation
TSA Total Score	1st class	31	65.7	8.78
	2nd class division 1	42	64.5	9.76
	2nd class division 2	21	62.0	6.26
	3rd class	6	60.1	6.51
	Total	100	64.1	8.69
TSA Problem Solving Score	1st class	31	69.7	10.73
	2nd class division 1	42	66.8	10.49
	2nd class division 2	21	64.5	9.25
	3rd class	6	63.8	10.64
	Total	100	67.0	10.37
TSA Critical Thinking Score	1st class	31	63.0	11.23
	2nd class division 1	42	63.6	12.32
	2nd class division 2	21	60.7	8.21
	3rd class	6	57.7	7.28
	Total	100	62.4	10.96

Table 8: Natural Sciences

Part 1A Class		N	Mean	Std. Deviation
TSA Total Score	1st class	24	67.9	7.66
	2nd class	71	65.1	7.59
	3rd class	9	61.7	8.28
	Total	104	65.5	7.76
TSA Problem Solving Score	1st class	24	71.3	11.02
	2nd class	71	66.9	10.75
	3rd class	9	63.4	10.50
	Total	104	67.6	10.92
TSA Critical Thinking Score	1st class	24	66.2	8.68
	2nd class	71	64.8	8.98
	3rd class	9	60.8	8.12
	Total	104	64.7	8.87

Table 9: Computer Science Part II Exams (TSA taken in 2001)

Part II Class		N	Mean	Std. Deviation
TSA Total Score	1st class	15	64.4	7.61
	2nd class division 1	12	59.3	8.03
	2nd class division 2	9	58.9	6.86
	3rd class	3	54.3	7.78
	Total	39	60.8	7.94
TSA Problem Solving Score	1st class	15	64.6	11.26
	2nd class division 1	12	60.8	10.50
	2nd class division 2	9	61.3	10.65
	3rd class	3	57.8	3.16
	Total	39	62.2	10.38
TSA Critical Thinking Score	1st class	15	65.3	7.33
	2nd class division 1	12	58.5	8.91
	2nd class division 2	9	58.6	11.05
	3rd class	3	50.4	14.62
	Total	39	60.5	9.95

Students gaining 1st class Part II results tend, on average, to have obtained higher scores on the TSA. This is true for total TSA scores and for the Problem Solving and Critical Thinking sub-scores.

Tau Analysis: Probability of Gaining a 1st Class Degree

The following tables display the results of tau analyses comparing the probable number of 1st class degrees that would be achieved by employing the existing selection process, a random selection of candidates and a TSA-only selection method.

Tau analysis has been developed in response to the potential problems of using correlation coefficients to assess predictive validity (Bell, 2005). The method uses logistic regression equations to calculate the probability that any given TSA score will result in the student who achieved it gaining a 1st class degree. The students who were actually selected for course entry using the existing methods (predicted grades, interview performance) are compared to the students who *would* have been selected if TSA scores alone had been used, in terms of how many 1st class degrees they achieved (or *would* have achieved). The probable number of 1sts achieved with the TSA-only method is calculated by taking the top *n* highest scoring TSA candidates (the same number as were actually selected) and simply summing together their calculated probabilities of gaining a 1st class degree.

The analysis also considers the degree of confidence in the existing selection system. It is assumed that, for any given mark on the TSA, any candidate that was rejected by the existing method had a lower probability of success than one who has been accepted. The tau method quantifies this difference. This is achieved by multiplying the probabilities of gaining a 1st for the rejected candidates by a confidence factor (1 minus 'K'). The possible values of K can range from 0 (no confidence) to 1 (absolute confidence). The tau tables presented below show, for each subject in turn, the case where K=0.75 (thus assuming high confidence in the existing system) and the case where K=0.5. The 'accepted' candidates are those who were actually selected by the colleges and for whom the number of 1sts is known. The 'selected' group are those who would have been chosen on the basis of the TSA alone. The success rates and ratios presented below compare the proportion or likely proportion of students gaining a 1st class degree using the old, new and random selection methods.

The results suggest that, even where confidence in the existing system is very high, using the TSA alone would have resulted in at least the same success rate as was obtained using the existing selection method. The success rates for both methods are vastly superior to a random selection of candidates from the applicant pool, varying from 1.7 times (in Engineering) to 4.3 times (in Economics) the number of probable 1sts gained by the candidates. The predictive value of the Problem Solving and Critical Thinking components appears similar for all the subjects here.

Tau analysis was developed to evaluate the usefulness of a newly piloted test (i.e. one that has not already been used to influence admissions decisions). However, a questionnaire survey of colleges, conducted shortly after the 2003/04 admissions round, found that the majority of respondents were using TSA scores in the admissions process (Shannon, 2004). This can also be seen from the differences in TSA score distributions between the accepted and rejected candidates in Figure 1. The candidates who would have been selected using the TSA-only method were therefore often the same candidates who were actually selected, accounting for the similarity in success rates between the two methods. The analysis appears to suggest that, if Colleges were to find themselves in a position where it was not possible to interview all candidates, they might reasonably use the TSA as a screening tool.

The TSA might also be used as a check of the existing selection procedure. Colleges might review their selection decisions in the light of applicant's TSA results. Below a certain low score, colleges might choose to reject candidates unless there is good reason to believe that the TSA score is not a true indication of the candidate's ability. Similarly, above a certain high score, colleges might choose to accept candidates unless there is good reason to believe that the TSA score is not a true indication of the candidate's ability. Between these two scores, the normal selection criteria would apply.

Table 10: Tau analyses, by subject, comparing the probable success rates achieved using TSA-only versus existing selection methods

Computer Science Part 1A 2005

confidence in existing system: $k=0.75$

	New Predictor Measure (TSA subscore)		
	TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
applicants	210	210	210
accepted	67	67	67
selected with new method	67	70	67
actual number of 1sts	16	16	16
predicted 1sts for new method	16.2	16.3	16.4
observed success rate	0.24	0.24	0.24
predicted success rate of new method	0.24	0.23	0.24
new/existing	1.0	1.0	1.0
new/random	2.5	2.3	2.4
existing/random	2.4	2.3	2.3

confidence in existing system: $k=0.5$

	New Predictor Measure (TSA subscore)		
	TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
applicants	210	210	210
accepted	67	67	67
selected with new method	68	67	67
actual number of 1sts	16	16	16
predicted 1sts for new method	17.2	16.4	17.7
observed success rate	0.24	0.24	0.24
predicted success rate of new method	0.25	0.24	0.26
new/existing	1.1	1.0	1.1
new/random	2.1	1.9	2.1
existing/random	2.0	1.8	1.9

Economics Part 1A 2005

confidence in existing system: $k=0.75$

	New Predictor Measure (TSA subscore)		
	TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
applicants	173	173	173
accepted	25	25	25
selected with new method	24	25	25
actual number of 1sts	8	8	8
predicted 1sts for new method	8.1	8.2	8.3
observed success rate	0.32	0.32	0.32
predicted success rate of new method	0.34	0.33	0.33
new/existing	1.1	1.0	1.0
new/random	4.3	3.6	4.0
existing/random	4.0	3.6	3.9

confidence in existing system: $k=0.5$

	New Predictor Measure (TSA subscore)		
	TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
applicants	173	173	173
accepted	25	25	25
selected with new method	27	25	27
actual number of 1sts	8	8	8
predicted 1sts for new method	9.6	9.06	9.64
observed success rate	0.32	0.32	0.32
predicted success rate of new method	0.36	0.36	0.36
new/existing	1.1	1.1	1.1
new/random	3.1	2.7	3.0
existing/random	2.8	2.4	2.7

Engineering Part 1A 2005

confidence in existing system: $k=0.75$

	New Predictor Measure (TSA subscore)		
	TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
applicants	549	549	549
accepted	106	106	106
selected with new method	106	106	106
actual number of 1sts	31	31	31
predicted 1sts for new method	31.0	31.0	31.0
observed success rate	0.29	0.29	0.29
predicted success rate of new method	0.29	0.29	0.29
new/existing	1.0	1.0	1.0
new/random	2.7	2.8	2.6
existing/random	2.7	2.8	2.6

confidence in existing system: $k=0.5$

	New Predictor Measure (TSA subscore)		
	TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
applicants	549	549	549
accepted	106	106	106
selected with new method	106	106	106
actual number of 1sts	31	31	31
predicted 1sts for new method	31.1	31.7	31.0
observed success rate	0.29	0.29	0.29
predicted success rate of new method	0.29	0.30	0.29
new/existing	1.0	1.0	1.0
new/random	1.8	1.9	1.7
existing/random	1.8	1.9	1.7

Natural Sciences Part 1A 2005

confidence in existing system: $k=0.75$

	New Predictor Measure (TSA subscore)		
	TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
applicants	403	403	403
accepted	106	106	106
selected with new method	107	106	106
actual number of 1sts	24	24	24
predicted 1sts for new method	24.1	24.0	24.0
observed success rate	0.23	0.23	0.23
predicted success rate of new method	0.23	0.23	0.23
new/existing	1.0	1.0	1.0
new/random	2.4	2.4	2.3
existing/random	2.5	2.4	2.3

confidence in existing system: $k=0.5$

	New Predictor Measure (TSA subscore)		
	TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
applicants	403	403	403
accepted	106	106	106
selected with new method	106	107	106
actual number of 1sts	24	24	24
predicted 1sts for new method	24.7	24.6	24.1
observed success rate	0.23	0.23	0.23
predicted success rate of new method	0.23	0.23	0.23
new/existing	1.0	1.0	1.0
new/random	1.9	1.8	1.7
existing/random	1.8	1.8	1.7

Computer Science Part II 2005

confidence in existing system: $k=0.75$

	New Predictor Measure (TSA subscore)		
	TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
applicants	284	284	284
accepted	48	48	48
selected with new method	49	48	49
actual number of 1sts	15	15	15
predicted 1sts for new method	15.1	15.0	15.2
observed success rate	0.31	0.31	0.31
predicted success rate of new method	0.31	0.31	0.31
new/existing	1.0	1.0	1.0
new/random	3.1	2.9	3.1
existing/random	3.1	2.9	3.1

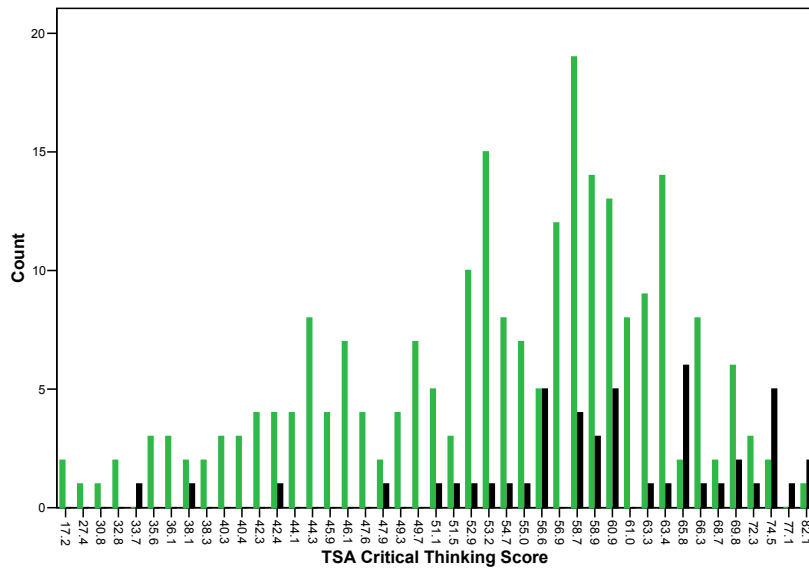
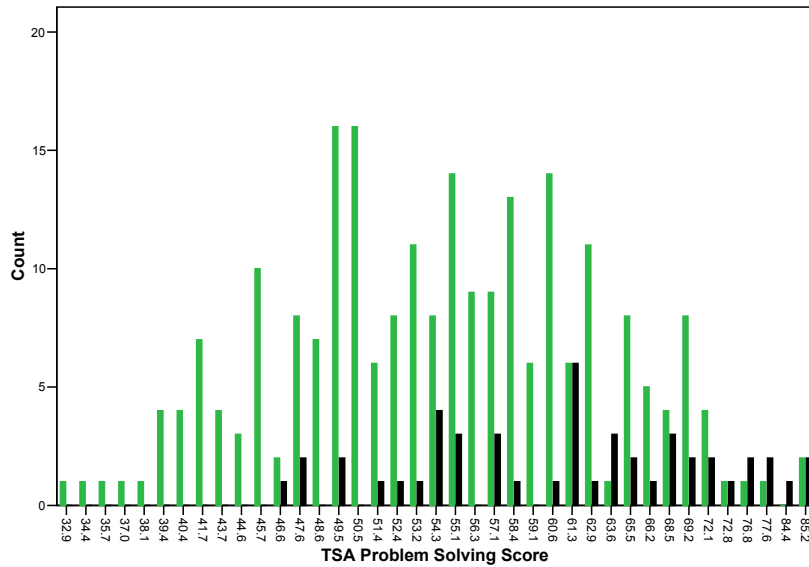
confidence in existing system: $k=0.5$

	New Predictor Measure (TSA subscore)		
	TSA Total Score	TSA Problem Solving Score	TSA Critical Thinking Score
applicants	284	284	284
accepted	48	48	48
selected with new method	48	50	48
actual number of 1sts	15	15	15
predicted 1sts for new method	15.3	15.4	15.6
observed success rate	0.31	0.31	0.31
predicted success rate of new method	0.32	0.31	0.32
new/existing	1.0	1.0	1.0
new/random	2.2	1.9	2.2
existing/random	2.1	1.9	2.1

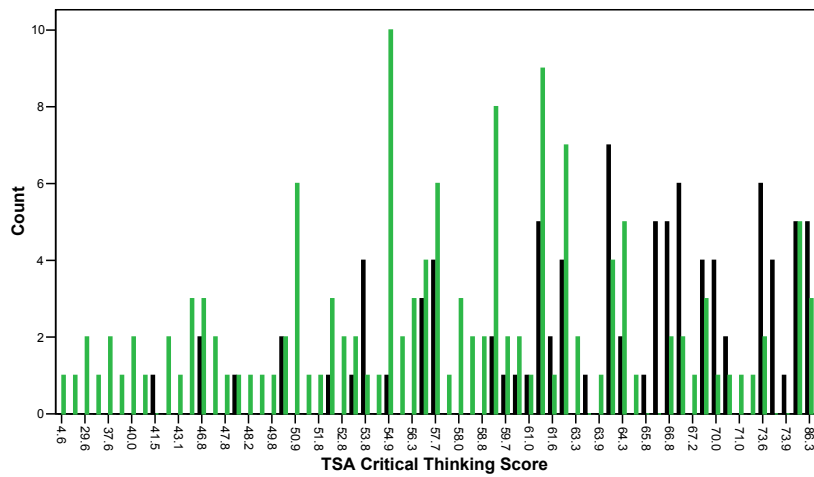
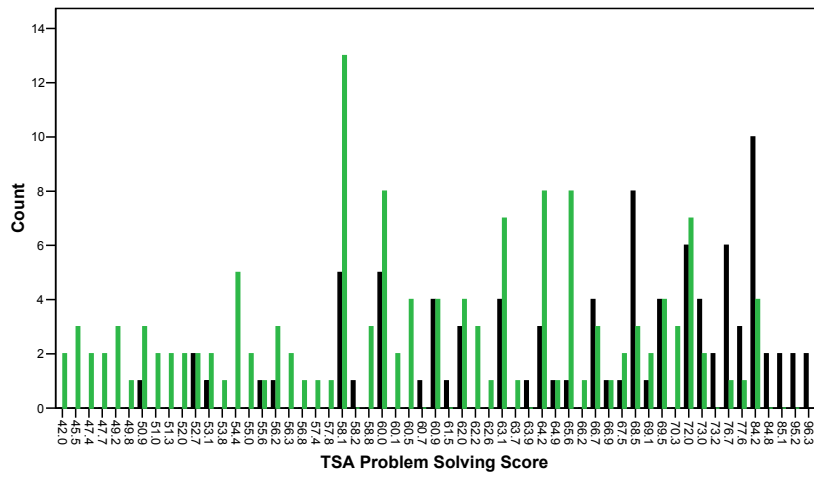
Appendix A

The following bar charts show the TSA Problem Solving and Critical Thinking score distributions of candidates who were offered a place (conditional or unconditional) and candidates who were rejected, by course.

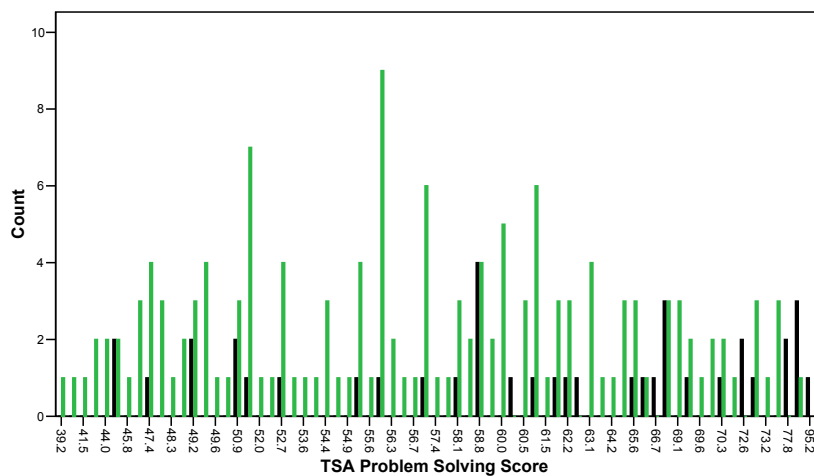
Computer Science (TSA 2001)

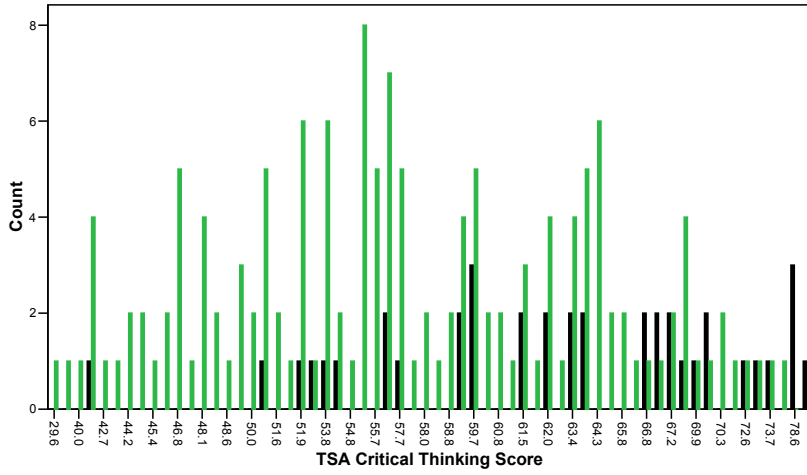


Computer Science (TSA 2003)

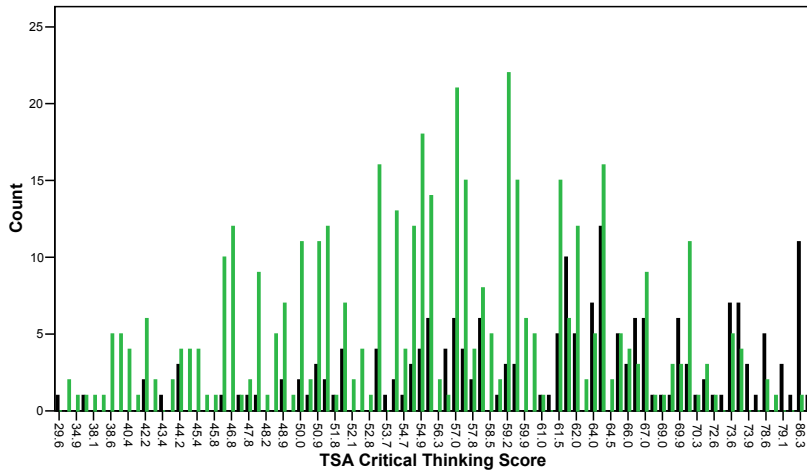
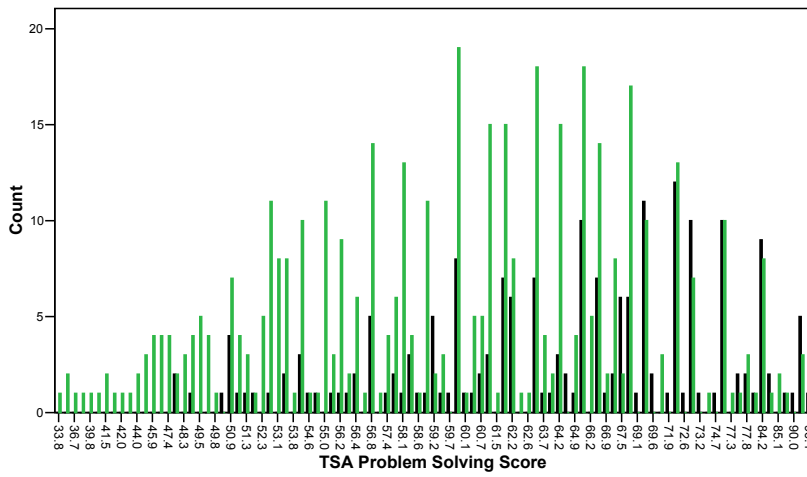


Economics (TSA 2003)

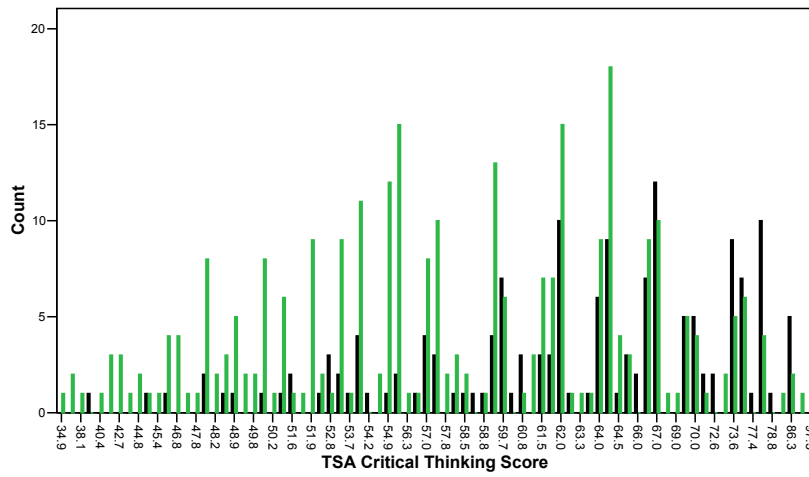
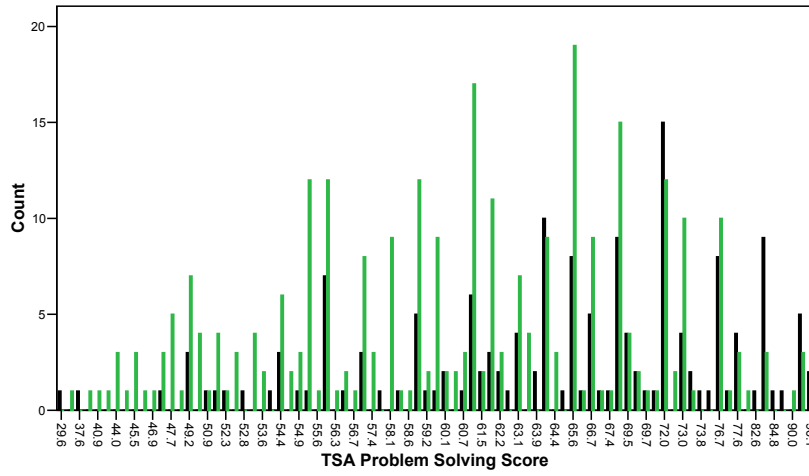




Engineering (TSA 2003)



Natural Sciences (TSA 2003)



Appendix B

Factors limiting validity coefficients

Attenuation

Attenuation is the reduction in the observed validity coefficient that results from error of measurement in the assessments being used. The equation below illustrates the quantitative relationship between the true correlation, $r_{\infty\omega}$, the observed validity coefficient, r_{xy} , and the reliabilities r_{xx} and r_{yy} of two tests, X and Y

$$r_{\infty\omega} = \frac{r_{xy}}{\sqrt{r_{xx}r_{yy}}}$$

Where:

x and y are the measured scores in two tests, X and Y;

r_{xx} and r_{yy} are the reliability coefficients of the two tests;

r_{xy} is the validity coefficient for predicting criterion Y from test X;

∞ and ω indicate the true scores in X and Y;

$r_{\infty\omega}$ is what the correlation would have been, had the two measures been perfectly reliable.

(Guilford & Fruchter, 1978, p450)

Restriction of Range

Groups selected using a test will typically represent a narrow (high scoring) section of the cohort. The coefficient of validity measured for accepted candidates is typically lower than it would be if it were measured for an unrestricted group, whose range of scores was more representative of all applicants.

The equation below can be used to estimate the correlation, r_u , for the unrestricted group.

$$r_u = \frac{r_c (S_u / S_c)}{\sqrt{1 - r_c^2 + r_c^2 (S_u^2 / S_c^2)}}$$

Where:

r_u is the correlation for the unrestricted group;

r_c is the correlation within the restricted group;

S_c is the standard deviation of the variable on which restriction occurs (e.g. test scores);

S_u is the standard deviation of the same variable in the unrestricted group.

(Guilford & Fruchter, 1978, p325)

These formulae are strictly only appropriate for particular sets of circumstances. Depending on how the selections were made, and the available information, other corrections may be more appropriate (Sackett & Yang, 2000).

It should be noted that the correlations in this report are simple, uncorrected, correlations.

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