Free admission to medical school: Does a knowledge-based end-of-first-year exam impact the profile of future doctors?

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BACKGROUND

Reliable and valid methods are essential to select students with the greatest potential to become efficient, professional and caring future doctors.

In Geneva, Switzerland, admission to medical school is free. Students are selected on the basis of their scores on an end-of-first-year knowledge-based MCQ exam, in a competitive context.

The question arises of whether this cognitive-only selection process could disadvantage students with suitable non-cognitive qualities such as empathy, openness, extraversion

Research question

- **Does a knowledge-based selection exam disadvantage students with suitable non-cognitive qualities?**

Aims

- **To compare the profile of selected and non-selected medical students using a set of cognitive and non-cognitive features**
- **To investigate the contribution of these features to first-year exams scores**

METHODS

Setting: Self-reported questionnaire completed during classroom on a voluntary basis. Confidentiality ensured by a self-generated non-identifying code for each student. Student's academic performances monitored during the 2 years allowed to take exams. Medical school aptitude test scores, compulsory but not selective.

Participants: All students officially enrolled in year 1 of Geneva Medical School during academic years 2013 were eligible. Out of 420 students in the classroom on the survey day, 83% (N=349) agreed to participate and signed a written consent form as appropriate.

For this study, only students who took exams (N=321) were included – (109 males, 212 females, mean age = 19 yrs, range,16-22) -.

Within students taking exams for the first time (freshmen) 28% pass after 1 year (41 % of the males, 21% of the females). Within students retaking exams for the second time (repeaters), 50% pass the year (same rate for males and females). Globally, after 2 years, about 60% of the freshmen succeed (about 65% of the males and 55% of the females)

Data Analysis: Mean±SD of features (Table 1) calculated and stratified by gender. MANOVA to investigate differences between selected and non-selected students by gender. Linear regression to analyze the predictive contribution of cognitive and non-cognitive features and gender on biannual exams' scores.

Table 1: Measures

		Variables	Measured by	Features	Min/Max
PREDICTORS	COGNITIVE	**School grades**	Final high school Grade Points Average, Self-reported	- HS GPA	0 to 100
		Medical School Aptitude Test (EMS)	EMS, Eignungtest für Medinizinstudium (Haensgen, 2000)	- Global score EMS	0 to 100
	NON COGNITIVE	**Motivations**	Home-made scales, Self-reported	- Intrinsic (mission, vocation, altruism), MI - Extrinsic (income, status, executive job), ME - Care (patients, illness, life), MC	1 to 6
		Learning Approach	SPQ, Study Process Questionnaire2R (Biggs, 2011)	- Deep Approach DA, - Surface Approach SA	1 to 40
		Coping	CISS, Coping Inventory for stressful situations (Endler & Parker, 1998)	- Task, CISS T - Emotional, CISS E - Avoidant, NEO O	1 to 80
		Personality	NEO FFI-R (Costa, 1994)	- Neuroticism, NEO N - Extraversion, NEO E - Openness, NEO O - Agreeableness, NEO A - Conscientiousness, NEO C	0 to 48
		Empathy	JSE (Jefferson, 2010)	- Valuing of empathy	0 to 140
OUTCOMES		**Selection**	First-year biannual exams grades: min of 4 of a max of 6 in both biannual exams to be selected.	- Selected/Non-selected for Year 2	Pass/Fail
		Exams' scores	First-year biannual exams scores	- Score' exam 1, S1 - Score' exam 2, S2	0 to 100

RESULTS

Table 2: Profiles of selected and non-selected students stratified by gender

		All	Males	Females	Pass (after 2 years)	Fail (after 2 years)	Gender	Pass/ Fail
Measures	**Means ± SD**	***N=321***	***N=109***	***N=212***	***N=207***	***N=114****	***0.001***	***0.01***
Cognitive abilities	**GPA**	80.5 ± 0.9	79.4 ± 10.6	81.0 ± 9.5	82.0 ± 9.1	77.7 ± 10.7	0.150	**0.001**
	EMS	51.9 ± 10.7	54.3 ± 11.5	50.7 ± 10.1	54.0 ± 11.0	48.2 ± 9.3	**0.007**	**0.001**
Motivations	**Extrinsic**	3.9 ± 0.8	3.9 ± 0.8	3.8 ± 0.9	3.9 ± 0.8	3.8 ± 0.8	0.396	0.636
	Intrinsic	4.6 ± 1.0	4.4 ± 0.9	4.7 ± 1.1	4.5 ± 1.0	4.7 ± 1.1	**0.020**	0.283
	Care	5.5 ± 0.9	5.3 ± 0.9	5.6 ± 0.9	5.4 ± 0.8	5.6 ± 0.9	**0.001**	0.196
Learning Approaches	**Deep**	33.1 ± 5.9	34.1 ± 5.9	32.7 ± 5.8	33.0 ± 5.5	33.3 ± 6.4	***0.057***	0.640
	Surface	22.7 ± 5.6	22.5 ± 6.0	22.7 ± 5.3	22.2 ± 5.3	23.4 ± 5.9	0.697	***0.067***
Coping	**Task**	62.0 ± 8.9	63.0 ± 8.9	61.4 ± 8.8	62.4 ± 8.7	61.1 ± 9.0	0.186	0.244
	Emotional	44.0 ± 10.7	40.2 ± 8.6	46.1 ± 11.2	43.3 ± 10.3	45.4 ± 11.6	**0.001**	0.158
	Avoidant	44.5 ± 9.2	41.7 ± 9.4	46.1 ± 8.7	43.6 ± 8.8	46.4 ± 10.0	**0.001**	**0.022**
Personality	**Neuroticism**	22.0 ± 8.2	18.7 ± 7.2	23.8 ± 8.1	21.6 ± 8.1	22.8 ± 8.2	**0.001**	0.254
	Extraversion	29.1 ± 5.4	28.5± 4.9	29.4 ± 5.6	29.2 ± 5.4	28.9 ± 5.4	0.206	0.673
	Openness	30.0 ± 6.2	30.9 ± 5.8	29.4 ± 6.3	30.8 ± 6.3	28.5 ± 5.7	***0.070***	**0.006**
	Agreeableness	29.0 ± 5.0	27.9 ± 5.8	29.7 ± 4.4	28.8 ± 5.1	29.5 ± 4.8	**0.007**	0.258
	Conscientiousness	33.7 ± 6.7	33.2 ± 7.1	34.0 ± 6.5	34.4 ± 6.7	32.5 ± 6.7	0.399	**0.034**
Empathy	**Empathy**	111.4 ± 9.4	107.9± 9.7	113.3 ± 8.7	111.5 ± 9.2	111.3± 9.9	**0.001**	0.879

***Females failing more than males (Males=30/109, Females=84/212, p<.001) but no MANOVA significant gender x selections' interaction**

Table 3: Features contributing to first-year exam 1 scores

R square: 0.427, p<.0001.			
	Beta	**t**	**Sig.**
Constant		.768	ns
Medical School Aptitude Test	.451	6.122	**.001**
Conscientiousness	.321	3.956	**.001**
Gender (Males=1, Females=2)	-.213	-2.845	**.005**

Table 4: Features contributing to first -year exam 2 scores

R square: 0.357, p<.0001.			
	Beta	**t**	**Sig.**
Constant		2.502	**.01**
Medical School Aptitude Test	.334	4.109	**.001**
Conscientiousness	.283	2.961	**.001**
Surface Learning	-.264	-2.713	**.007**
Gender (Males=1, Females=2)	-.258	3.170	**.002**

DISCUSSION

➢ **Profiles of selected and non-selected first-year Geneva medical students (Table 2):**

- Both cognitive measures - GPA and Medical School Aptitude Test – featured selected students. In contrast, only three of 14 non-cognitive measures featured selected students namely openness, conscientiousness and rare avoidant coping.

  This confirms main metanalyses in the field (Ferguson, 2002; Doherty & Nugent, 2011). Our findings underline the strong cognitive facet of openness as shown in psychological studies where NEO O often highly correlate with cognitive measures (Caspi, 2005).
- There is no significant interaction between gender and selection. However, proportionally, females are significantly less selected than males. Differences were also found in personality, coping and empathy measures as expected from their instrument's guides. This suggests that gender stratification is mandatory when using these instruments.

➢ **Features contributing to first-year exam 1 (Table 3) and exam 2 (Table 4) :**

- Only Medical School Aptitude Test and conscientiousness trait contributed to academic performance. This is in line with the pure cognitive and competitive nature of our first-year exams.
- In exam 2, using less surface learning also contributed to a better score. This could be linked to the nature of exam 2, that implies less rote learning that exam 1 (testing more fundamental disciplines such as physics and chemistry).
- Above our measures, males performed better than females. Further studies are needed to better understand why and how
- Well-known GPA impact seem to be covered by Medical School Aptitude Test score, probably due to their high correlations.

CONCLUSION

- **A knowledge-based selection exam did not disadvantage students showing qualities presumably important for caring doctors such as agreeableness and empathy**
- **However it advantaged male, conscientious students with high cognitive abilities.**
- **The challenge remains to enhance selection of students with desirable non-cognitive qualities.**

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