

Swedish student perceptions of achievement practices: The role of intelligence

Gavin T L Brown

The University of Auckland & Umeå Universitet, Sweden

Presentation to COMPASS, University of Auckland. October 2019



EDUCATION AND
SOCIAL WORK



Umeå universitet



Umeå universitet



EDUCATION AND
SOCIAL WORK

Intelligence

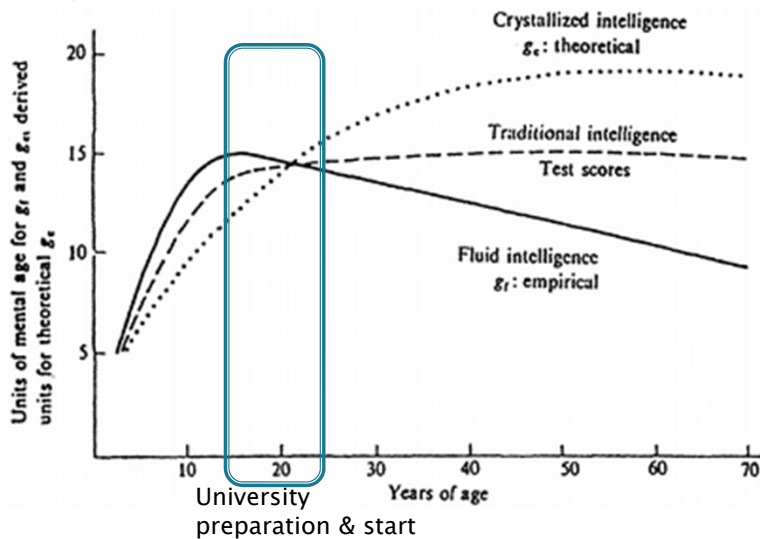
- ▶ The ability to flourish and succeed within the environment
 - Not fixed, not unitary, not just inherited
- ▶ Multi-componential & multiple models
- ▶ Spearman
 - Performance across subjects is correlated → 'g' general intelligence
- ▶ Cattell
 - Sub-components depending on structure of process
 - Crystallised and structured capabilities → 'G_c' crystallised intelligence ability to use learned knowledge and experience
 - Fluid or dynamic capabilities → 'G_f' fluid intelligence: ability to solve new problems, use logic in new situations, and identify patterns



Umeå universitet

EDUCATION AND
SOCIAL WORK

Raymond B. Cattell model

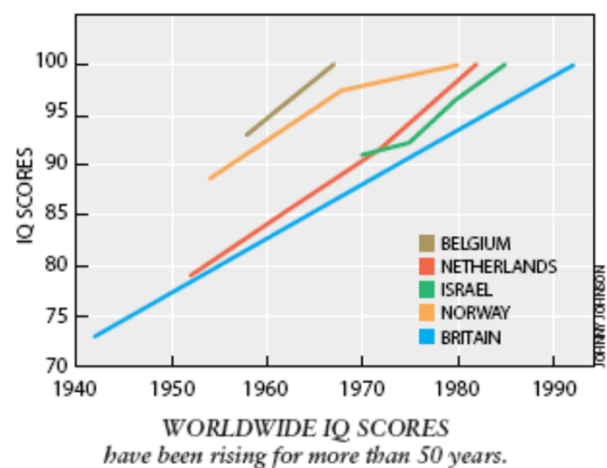


Umeå universitet

EDUCATION AND
SOCIAL WORK

Is intelligence teachable?

- ▶ Intelligence is a product of genetic and environmental factors
 - Not fixed!
- ▶ Intelligence appears to be growing (Flynn effect)





Umeå universitet

EDUCATION AND
SOCIAL WORK

Schooling contributes

- ▶ School attendance increases intelligence
- ▶ Curriculum processes contribute if students develop:
 - Effortless recall of important data
 - Ability to identify patterns, structure, relationships in data
 - Broad cognitive skills taught and assessed: Analysis, synthesis, evaluation, creation, problem-solving, etc.
- ▶ Large burden on curriculum, teaching, and assessment



Umeå universitet

EDUCATION AND
SOCIAL WORK

Achievement demands of school

- ▶ Tests, Homework, Questions in class, failing-success,
 - Creates pressure on students from
 - Themselves
 - Teachers
 - Parents
- ▶ Coping with demands is important
 - Self-regulation, self-efficacy contribute to greater success
- ▶ Parental concerns rub off on students



Umeå universitet

EDUCATION AND
SOCIAL WORK

Student attitudes matter

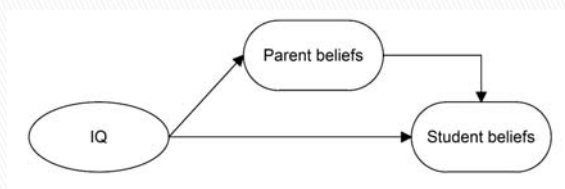
- ▶ Positive views about assessment are associated with > test scores; Negative views about assessment < test scores
- ▶ IQ contributes to > school achievement
- ▶ Twin / triplet studies show that
 - IQ contributes to > coping, self-efficacy
- ▶ Question
 - IQ lead to positive beliefs about achievement in normal populations of parents and students?



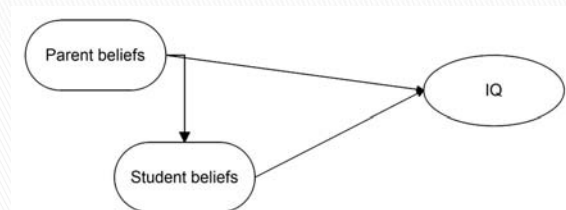
Umeå universitet

EDUCATION AND
SOCIAL WORK

Conceptual model



IQ as predictor of beliefs
(Model 1)



IQ as dependent on beliefs
(Model 2)



Umeå universitet



EDUCATION AND
SOCIAL WORK

Secondary Data: Swedish Evaluation Through Follow-up (ETF)

- ▶ large cohort-sequential longitudinal database,
 - 9 cohorts with individuals born between 1948 and 1998.
 - Each cohort about 9000 pupils, sampled to be nationally representative.
 - Cognitive tests and questionnaire with items about their experience of selected aspects of schooling.
 - parents of each student completed a questionnaire.
 - Students sampled through a multi-stage sampling design
 - Municipalities, schools, classes
 - http://ips.gu.se/english/research/research_projects/ETF



Umeå universitet



EDUCATION AND
SOCIAL WORK

1998 birth cohort

- ▶ Cohort 9 in Grade 6 survey = 2011 testing
- ▶ N=9671 children, who were nominally 13 years old in early 2011 during the 2nd semester of their 6th year of schooling.
 - 96.5% born in calendar year 1998,
 - born in 1997 ($n=84$) and 1999 ($n=81$).
- ▶ Cases with >10% missing questionnaire responses deleted, those without matching parent data deleted
- ▶ Effective sample $n=4749$
- ▶ Sex: 51.8% boys, 48.2% girls



Umeå universitet

EDUCATION AND
SOCIAL WORK

School clustering

- ▶ School was available only for $n=2918$ (61% of retained sample)
- ▶ Schools with ≥ 20 students $n=1056$; just 11%
- ▶ Thus multilevel problematically non-generalizable?
 - ICCs ranged from 0.02 to 0.175 ($M=0.05$, $SD=0.03$)
 - only 1 value > 0.10 (i.e., QS611–How often do you do tests?).
 - This item should show a significant school variance component since the frequency of testing is determined at the school level
 - The larger message is that the school contribution to variance in the model was relatively trivial
 - So a one-level model is defensible.



Umeå universitet

EDUCATION AND
SOCIAL WORK

Modeling

- ▶ CFA for student, parent, and IQ item sets
- ▶ SEM for relationship of student–parent–IQ factors
 - Missing data with EM imputation
 - MLR estimation
 - Fit imputed not reject if: $RMSEA < 0.08$; $SRMR \approx 0.06$; CFI & $\hat{\gamma} > 0.90$; χ^2/df ratio has $p > .05$
 - MPlus used
- ▶ Models compared for selection
 - $\Delta AIC > 10 \rightarrow$ smaller value preferred



Umeå universitet

EDUCATION AND
SOCIAL WORK

A comment on missing values

- ▶ Rubin & Little 2002
 - Imputation valid if missing is small (<5%)
- ▶ Imputation techniques work if missing is large (<50%)
- ▶ EM and MI maximise the input values of M, SD, matrices (covariance/correlation)
- ▶ But meaningful in terms of the truth?
- ▶ We deleted 4251 because >10% missing but FIML with 8650 found results almost identical, so proof that imputation maximises start values... *which should you use if they are the same?*



Umeå universitet

Student result

- ▶ Fit
 - $\chi^2=312.24$; $df=48$; $\chi^2/df=6.05$, $p=.01$; $CFI=0.97$; $\gamma_{hat}=0.99$; $RMSEA=0.03$; $SRMR=0.03$
- ▶ Students
 - strongly endorsed I cope with demands
 - moderately agreed that parents enquired about performance
 - reasonably high frequency of testing and homework
- ▶ Overall, rejected being worried about tests, exams, and school happenings

Scale & items	Loading	Scale inter-correlations			
		I	II	III	IV
I. I Worry ($M = 2.47, SD = 0.88$)		(0.73)			
I worry about tests on homework	0.75				
I worry about how I am going to pass exams	0.74				
I worry about things that happen in school	0.58				
II. I Cope ($M = 4.08, SD = 0.50$)		-0.39	(0.64)		
It is easy for me to meet the teachers demands	0.71				
I normally manage to do the tasks that I am given	0.70				
I can normally answer correctly when I get a question	0.62				
I try to avoid failing/making mistakes in school	0.31				
III. Parents Ask ($M = 3.77, SD = 0.85$)		-0.01	0.21	(0.72)	
How well I do in different subjects	0.89				
How I work during lessons	0.66				
How I did on a test or test of homework	0.55				
IV. Test Frequency ($M = 3.79, SD = 0.69$)		0.07	0.18	0.29	(0.45)
Doing test	0.67				
Having written homework tests	0.43				



Umeå universitet

EDUCATION AND
SOCIAL WORK

Parent result

Scale & items	Loading	Scale Inter-correlations		
		I	II	III
I. Demands ($M = 2.99, SD = 0.53$)		(0.80)		
The demands that the school puts on your child: Performance	0.83			
The demands that the school puts on your child: Pace of study	0.82			
The demands that the school puts on your child: Homework	0.74			
The demands that the school puts on your child: Taking personal responsibility	0.46			
II. Pressure ($M = 1.79, SD = 0.65$)		0.35	(0.74)	
During the last year has your child: Felt pressurised by school work	0.94			
During the last year has your child: Felt pressurised by exams	0.80			
During the last year has your child: Experienced anxiety/unease about going to school	0.39			
III. Grading ($M = 2.32, SD = 0.42$)		-0.14	-0.06	(0.56)
What do you think about the number of scale points in the current grading system (G, VG & MVG)?	0.92			
What do you think about the next grade levels (F, E, D, C, B, A)?	0.64			
Do you think that pupils should get grades in secondary school?	0.27			

- ▶ Fit: $\chi^2=197.53$; $df=32$; $\chi^2/df=6.17$, $p=.01$; CFI=0.98; gamma hat=0.99; RMSEA=0.03; SRMR=0.03
- ▶ Parents want grades, but with more grade points than the then current 3-point scale.
- ▶ Moderate level of demand from homework, pace of study, and responsibility.
- ▶ Generally rejected the idea that school work and testing was too much pressure on their child.



Umeå universitet

EDUCATION AND
SOCIAL WORK

IQ Result

Scale & items	Loading	Reliability estimate
I. Intelligence		(0.70)
Synonymous ability ($M = 15.17, SD = 4.35$)	0.59	
Verbal antonyms ($M = 20.24, SD = 5.23$)	0.60	
Inductive ability ($M = 23.55, SD = 8.24$)	0.69	
Spatial ability ($M = 22.06, SD = 8.14$)	0.59	

- ▶ IQ model
 - Crystallised: antonyms & synonyms
 - Fluid: metal folding & number series
- ▶ Fit:
 - $\chi^2=7.23$; $df=1$; $\chi^2/df=7.23$, $p < .01$; CFI=0.99; gamma hat=0.99; RMSEA=0.04; SRMR=0.01
 - NB: synonyms & antonyms correlated $r=.48$



Umeå universitet

EDUCATION AND
SOCIAL WORK

SEM results

- ▶ Fit:
 - $\chi^2=1815.43$; $df=278$;
 - $\chi^2/df=6.53$, $p=.01$; CFI=0.95;
 - gamma hat=0.97;
 - RMSEA=0.034; SRMR=0.041;
 - AIC=334,565.416
- ▶ $\Delta AIC=317.516$, this model smaller so preferred

- ▶ Fit:
 - $\chi^2=2113.77$; $df=284$;
 - $\chi^2/df=7.44$, $p<.01$;
 - CFI=0.94; gamma hat=0.97;
 - RMSEA=0.037; SRMR=0.047;
 - AIC=334,882.932

Model 1: IQ predictor

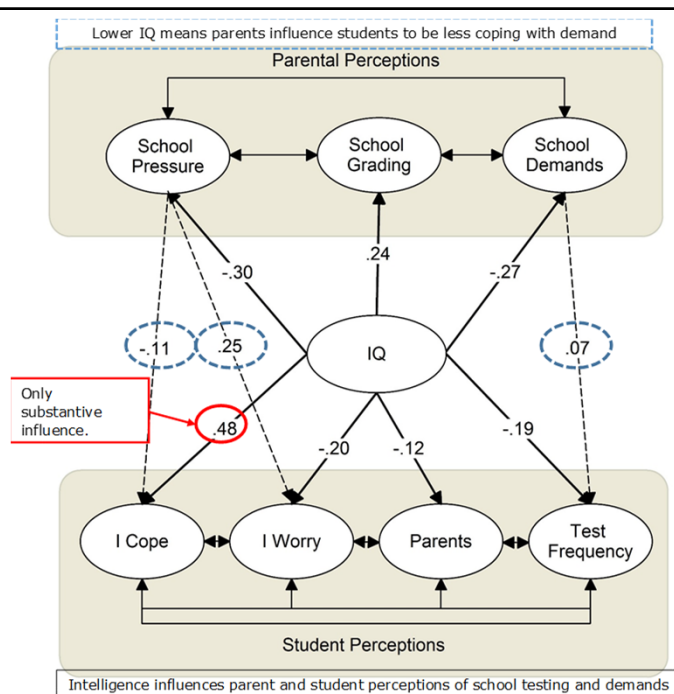
Model 2: IQ dependent



Umeå universitet

SEM result

- ▶ Greater coping with school and reduced parental concern present among intellectually more able children
- ▶ Parents beliefs do influence student coping
- ▶ Cognitive tests are moderately strong predictors of student beliefs about achievement





Umeå universitet

EDUCATION AND
SOCIAL WORK

Significance

- ▶ Large, representative sample of the population with little (if any) shared genetic environments.
- ▶ Thus is generalizable to the full population in schooling.
 - Unlike twin/triplet studies
- ▶ Increasing IQ will help students cope better
 - Can we stimulate children during the neuro-plastic phases of schooling to greater intelligence? Surely yes!



Umeå universitet

EDUCATION AND
SOCIAL WORK

Further research

- ▶ Need to prove that changing IQ has the impact we want on self-regulation
 - IQ → Self-regulating Beliefs → Academic Achievement
 - Longitudinal or experimental studies
 - Follow cohort to university entrance for NCEA/IB/A Levels final year grades and then 1st year performance
- ▶ ETF
 - Add more tests for G_f and G_c , so correlated residuals not required
 - Add school achievement measures
 - Add attitudes about the IQ tests themselves



Umeå universitet



EDUCATION AND
SOCIAL WORK

Further reading

- ▶ Brown, G. T. L., & Eklöf, H. (2018). Swedish student perceptions of achievement practices: The role of intelligence. *Intelligence*, 69, 94–103. doi:10.1016/j.intell.2018.05.006

- ▶ Contact
 - Gavin Brown: gt.brown@auckland.ac.nz