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Between and Within Country Measurement Invariance Testing in a EU Comparative Research on School Dropout

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Introduction

- Doctoral Study within RESL.eu Project
  - Comparative study in 9 EU member states (BE, ES, PL, PT, NL, SE, UK, (AU & HU)
  - Financed by EU 7th Framework Program
  - Period: February 2013 – January 2018

- Data used for this paper:
  - Survey data from first wave of a comparative survey collected in secondary schools across 14 urban areas in 7 EU member states (N=19522)

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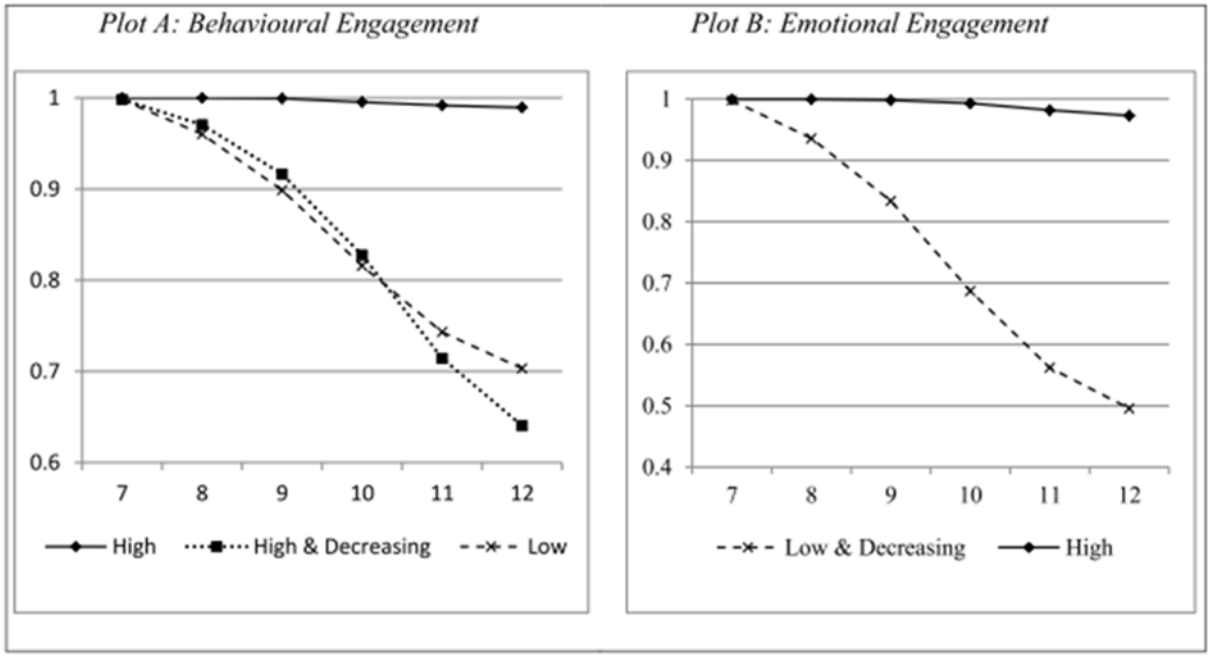
School Engagement as a Predictor for Early School Leaving

- Low school engagement predicts '*Early School Leaving*'

Figure 1: estimated survival probability of (a) behavioural engagement and (b) emotional engagement by grade.



Source: Lamote et al., 2013;
Based on Longitudinal Research in Flemish Secondary Education

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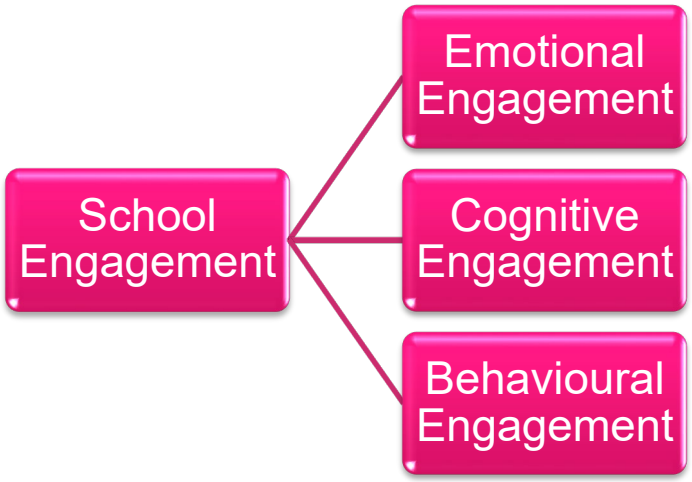
School Engagement as a Multidimensional Concept

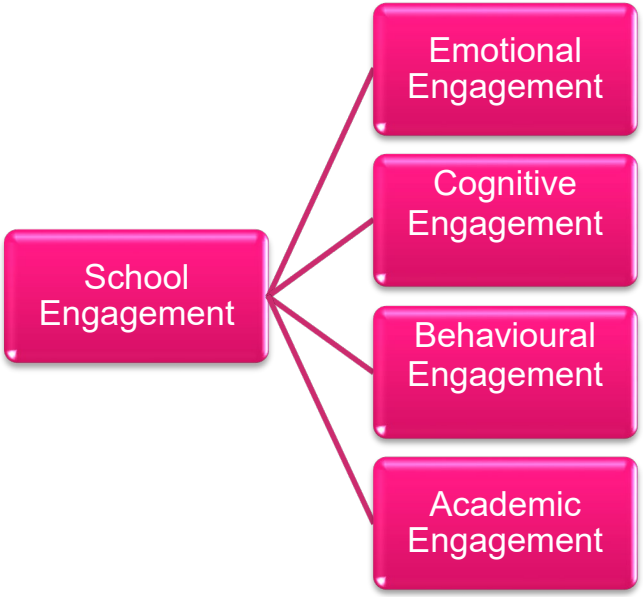


- **Fredricks** et al. (2004) proposed a 3-dimensional concept
  - **Emotional** component: identification with 'the school'/'education'
  - **Cognitive** component: self-regulated/strategic learning approach
  - **Behavioural** component: participation in school-related activities

School Engagement as a Multidimensional Concept

- More recently scholars made distinction between (Appleton et al., 2008):
  - **Behavioral engagement**: both positive (e.g. participation in extra-curricular activities) as well as negative (e.g. non-compliance)
  - **Academic engagement:** more specific study related behavior like paying attention in class and putting time and in effort in study work

  ➔ *Our data supports this using Confirmatory Factor Analysis (CFA)*



Operationalisation of School Engagement concept based on Wang et al., 2011

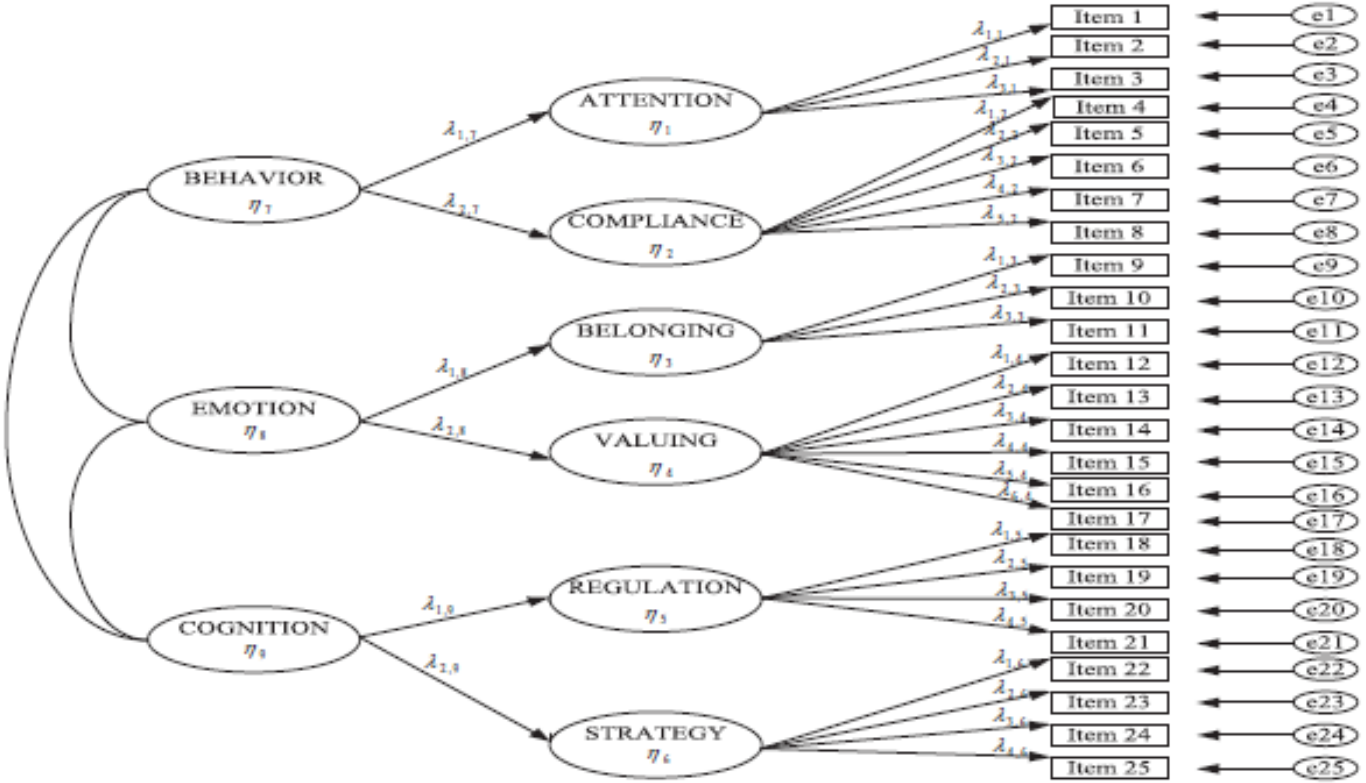


Fig. 1. Factor model of school engagement depicting the second-order factor structure hypothesized to underlie the six first-order factors.

Data were drawn from Maryland (US) Adolescent Development in Context Study (MADICS, 1998)

Article by Wang et al. (2011) showed measurement invariance across ethnic and gender groups

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Exploratory Factor Analysis (EFA)

- The EFA distinguished the same 6 first order factors.

Rotated Factor Matrix

1	2	3	4	5	6	
0,838	0,186	-0,073	0,114	0,054	0,037	Belonging - I think this is a good school
0,736	0,2	-0,031	0,094	0,046	0,043	Belonging - I feel like a real part of this school
0,849	0,141	-0,059	0,047	0,034	0,028	Belonging - I would recommend to other kids that they go to my school
0,169	0,728	0,003	0,05	0,083	0,015	Valuing - Trying hard at school will help me to get a good job
0,107	0,63	-0,06	0,092	0,092	0,011	Valuing - Trying hard at school will help me to go to college/university
0,076	0,688	-0,017	0,09	0,078	-0,007	Valuing - Getting a good education is the best way to get ahead in life
-0,029	-0,102	0,779	0,023	-0,044	-0,051	Compliance - how often have you hit someone for what they said/did?
-0,017	-0,106	0,925	0,027	-0,028	-0,038	Compliance - how often have you been involved in a physical fight?
-0,086	-0,08	0,592	0,005	-0,069	-0,117	Compliance - how often have you been sent to office for doing something wrong?
0,052	0,041	0,01	0,68	0,051	0,044	Regulation - I believe I am mentally tough when it comes to exams
0,037	0,022	0,022	0,79	0,1	0,103	Regulation - I think I am good at dealing with schoolwork pressures
0,077	-0,016	0,008	0,621	-0,036	-0,01	Regulation - I am good at dealing with setbacks at school (e.g. bad marks, negative feedback on my schoolwork)
0,05	0,139	0,011	0,545	0,108	0,11	Regulation - I am good at figuring out problems and planning how to solve them
0,016	0,093	-0,041	0,092	0,597	0,013	Stategy - When I do my homework I try to decide what I am supposed to learn, rather than just read the material
0,043	0,063	-0,071	0,038	0,785	0,03	Strategy - When I do my homework I try to plan what I have to do before I get started
0,056	0,118	-0,027	0,051	0,701	0,119	Strategy - When I do my homework I make sure that I get started on it early
0,047	0,112	-0,12	0,075	0,069	0,712	Attentiveness - I often have trouble paying attention to the teacher in class - reverse scored
0,03	0,136	-0,076	0,167	0,085	0,793	Attentiveness - I often find it hard to keep my mind on my work at school - reverse scored

Extraction Method: Maximum Likelihood.

Rotation Method: Varimax with Kaiser Normalization.

a Rotation converged in 6 iterations.

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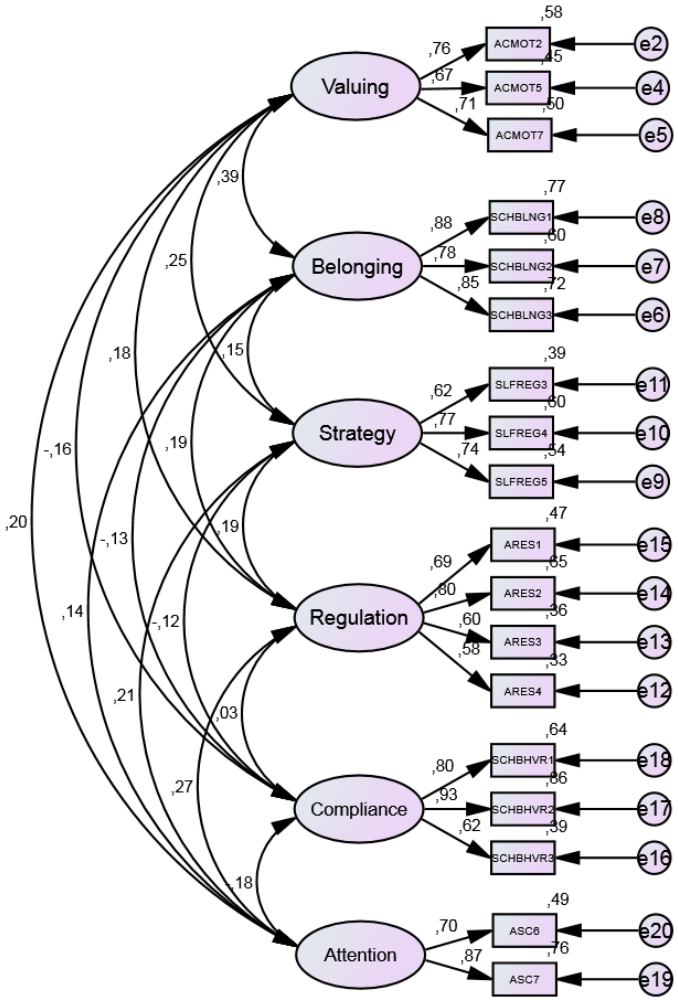
CFA – 1st order factors



CFI = 0,971

RMSEA = 0,038

AIC = 3685,085
BCC = 3685,219

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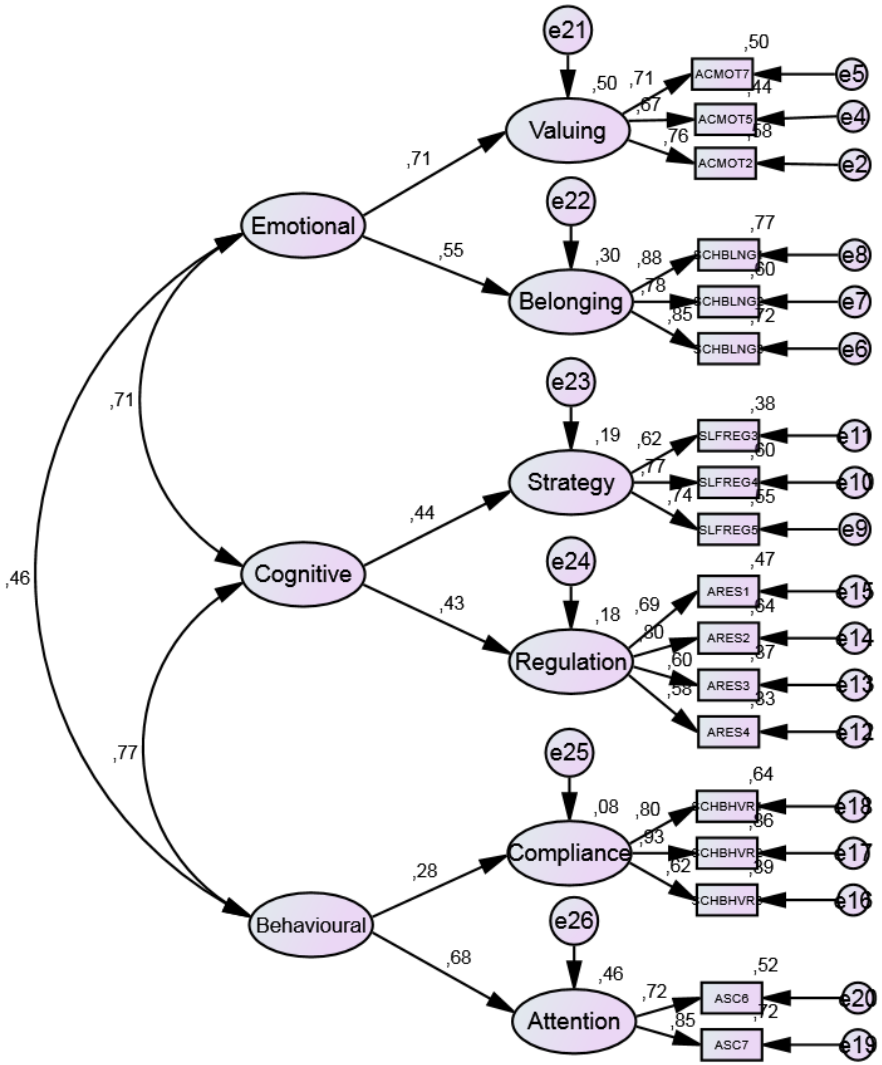
CFA – 2nd order factors (3)



CFI = 0,967

RMSEA = 0,040

AIC = 4185,041
BCC = 4185,164

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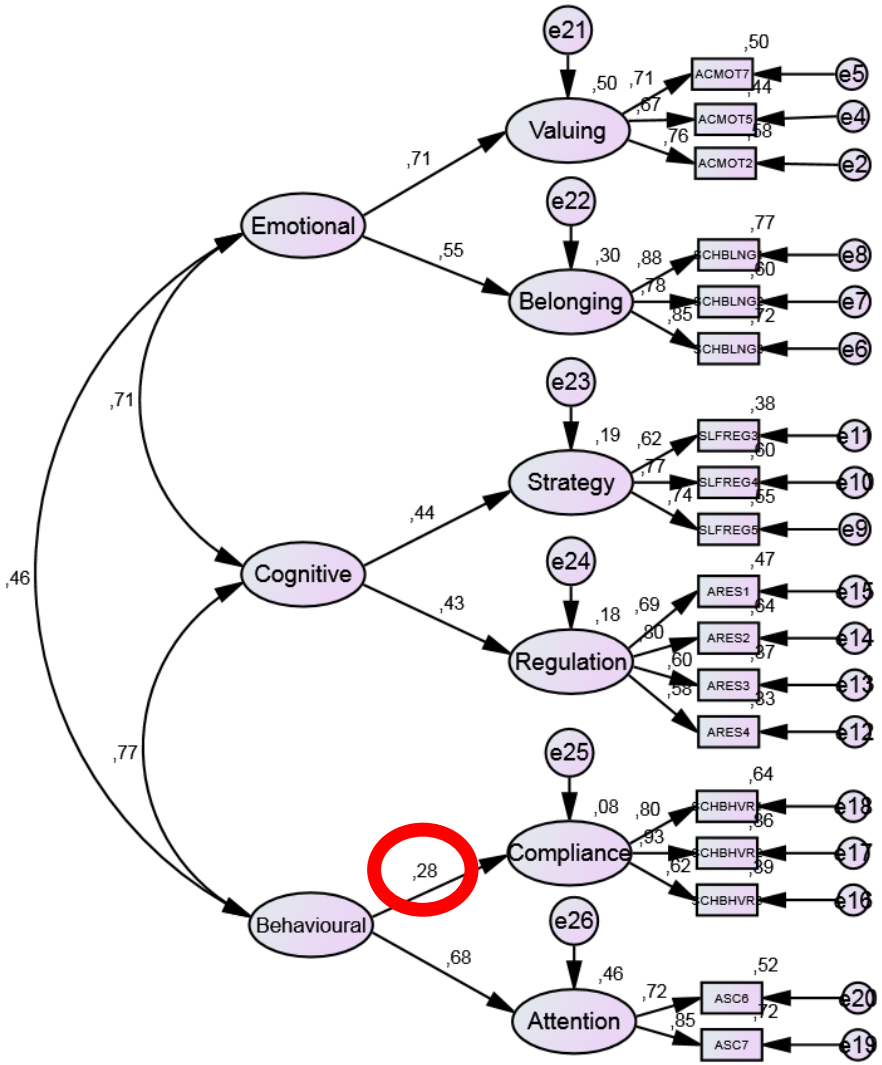
CFA – 2nd order factors (3)



CFI = 0,967

RMSEA = 0,040

AIC = 4185,041
BCC = 4185,164

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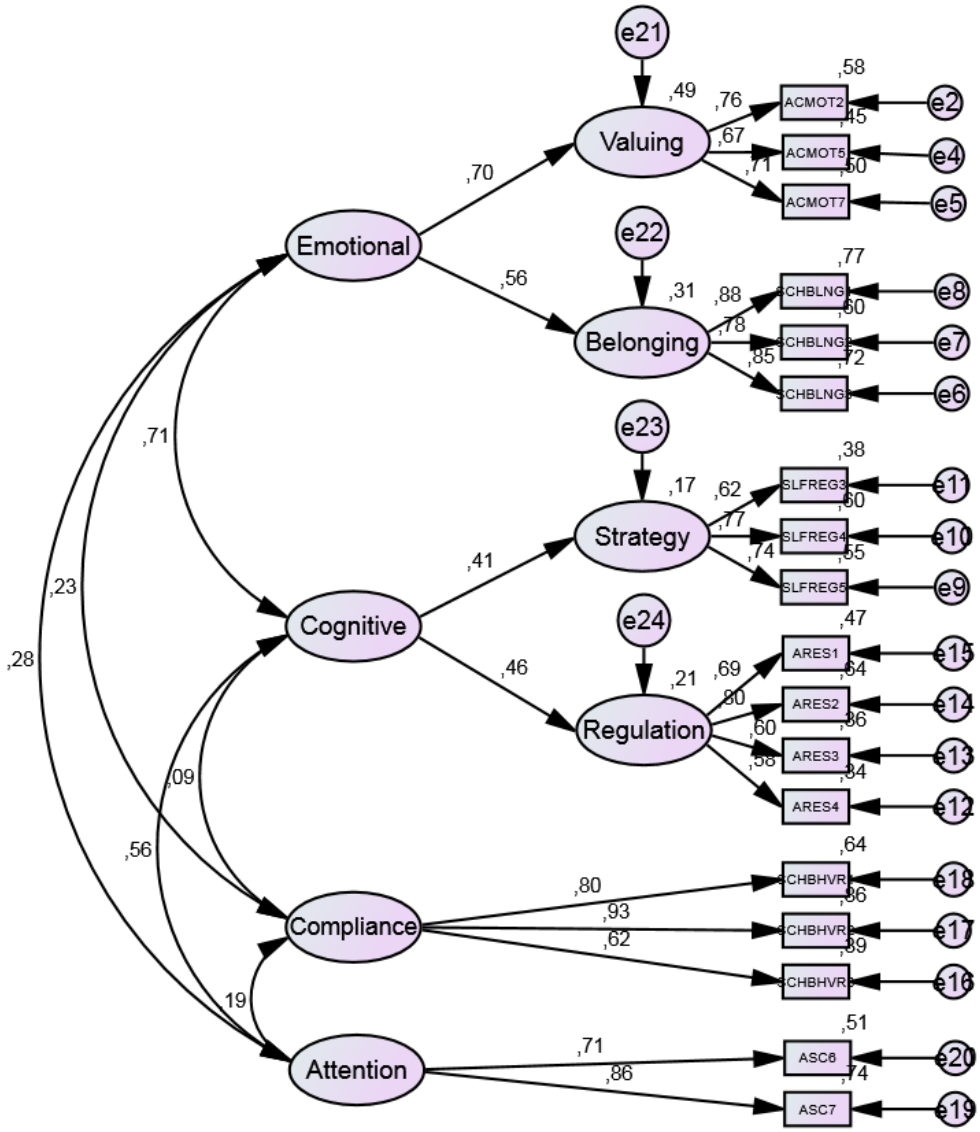
CFA – 2nd order factors (2)



CFI = 0,968

RMSEA = 0,039

AIC = 3961,886
BCC = 3962,011

In line with theoretical developments that distinguish behavioural from academic engagement

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Between and Within Country Measurement Invariance (MI) Testing

- Using multi-group CFA to test for MI
  - Between countries: data from 7 EU member states
  - Within country: between educational tracks in Belgium
    - Testing for **configural invariance**
      - No equality constraints between groups = Baseline Model 1
    - Testing for **metric invariance**:
      - Testing for first-order factor loading invariance (Model 2)
      - Testing for second-order factor loading invariance (Model 3)
    - Testing for **scalar invariance:**
      - Testing for intercept of observed variables invariance (Model 4)
      - Testing for means of first-order latent factorial invariance (Model 5)

…by comparing nested models

"… the difference in the Satorra–Bentler scaled chi-square statistic is sensitive to large sample sizes"

(Wang, et al., 2011)

➔ rely on guidelines who suggested that

"*a difference of larger than .01 in the CFI indicates a meaningful difference in model fit for testing measurement invariance."*

(Cheung & Rensvold, 2002; Chen et al , 2005)

Between County MI: Testing for configural invariance (Model 1)

- Multi-group CFA with no equality constraints (=baseline model; CFI = 0,959)

  2nd order factor for cognitive engagement under pressure for Belgian and Polish data due to low factor loadings of self-regulated learning ('regulation')

- This unconstrained multi-group model serves as a baseline model against which we evaluated the model fits of successively more restrictive models (models 2 → 5).

Between county MI: testing for 1st and 2nd order Metric and Scalar Invariance

Model		CFI	ΔCFI *(*)*	
Model 1	Unconstrained	0,959	-	
Model 2	1st order factor loadings	0,951	0,008	Metric invariance
Model 3	2nd order factor loadings	0,947	0,012	
Model 4	Intercepts of obs. variables	0,864	**0,095**	Scalar invariance
Model 5	1st order factor means	0,864	**0,095**	

(*) Represents difference to unconstrained model (Model 1)

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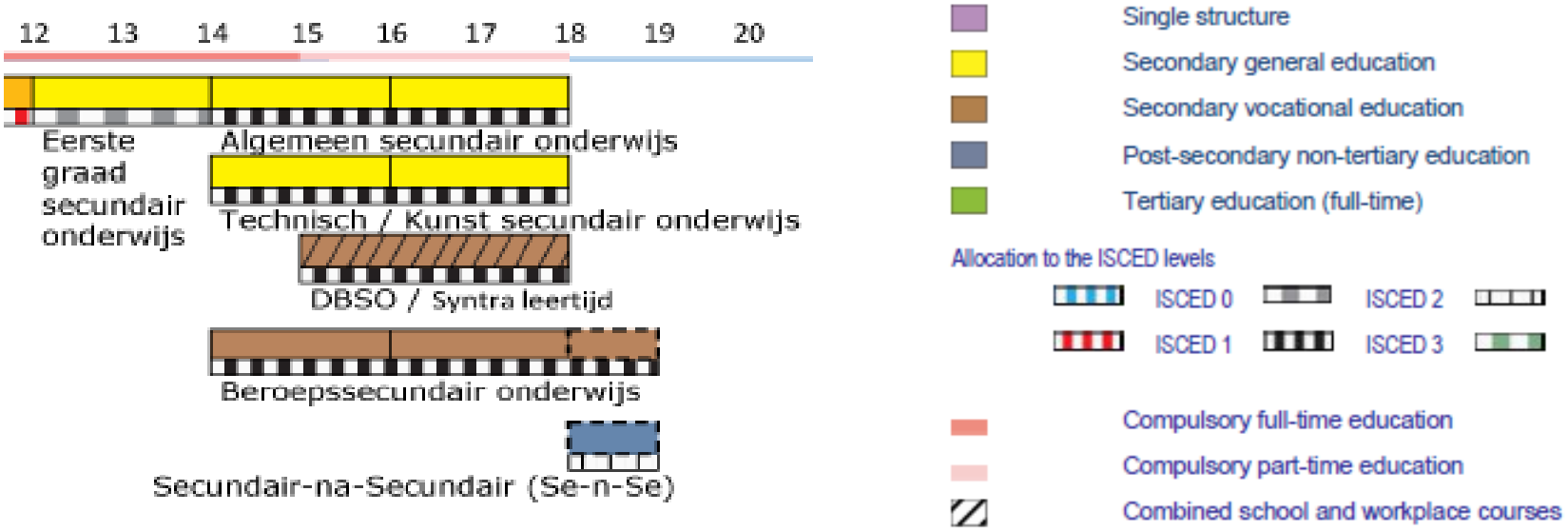
Within Country MI – Between educational tracks in Flanders (BE)

- Educational tracking in Flanders:



Source: Eurydice, 2014

Educational tracking (in Flanders) is strongly associated with:

- socio-ethnic school segregation (Wouters & Groenez, 2014)
- academic culture among staff and students in general versus VET schools (Van Houtte, 2004 & 2006)

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Within County MI: Testing for configural invariance (Model 1)

- Multi-group CFA with no equality constraints (baseline model; CFI = 0,947)
  - The unconstrained multi-group baseline model for the different tracks in the Flemish data is inferior to the multi-group model for different countries using the EU level pooled data (CFI=0,959). Mostly related to the issue of the 2nd order factor for cognitive engagement (see supra).

- Again, the unconstrained multi-group model serves as a baseline model against which we evaluated the fits of successively more restrictive models (models 2 → 5).

Within county MI: testing for 1st and 2nd order Metric and Scalar Invariance

Model		CFI	ΔCFI *(*)*	
Model 1	Unconstrained	0,947	-	
Model 2	1st order factor loadings	0,946	0,001	Metric invariance
Model 3	2nd order factor loadings	0,945	0,002	
Model 4	Intercepts of obs. variables	0,925	**0,022**	Scalar invariance
Model 5	1st order factor means	0,925	**0,022**	

(*) Represents difference to unconstrained model (Model 1)

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Conclusion

- Between country MI (7 EU countries):
  - Weak but acceptable metric equivalence for 1st (and 2nd) order factor loadings
  - Weak and unacceptable scalar invariance for both intercepts of observed variables as well as 1st order factor means
- Within country MI (3 Flemish educational tracks):
  - Strong metric invariance between tracks
  - Weak and unacceptable scalar invariance

Discussion

- What to do now? ➔ I'm here to learn…

"Davidov et al. (2012) have introduced a multilevel structural equation modelling (MLSEM) approach that can be used to interpret deviations from scalar equivalence substantively by modelling how cross-national differences in item intercepts are linked to contextual variables."

  - Not possible because of low number of groups (7 countries/ 3 tracks)

- Questions for discussion:
  - What are the implications of the scalar non-equivalence between tracks for using MLSEM with students clustered by schools?
  - Include type of school (e.g. provision of tracks, socio-ethnic student composition, shared school culture) as contextual variables at the school level?

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