The Development of Complex Problem Solving and its Relation to Reasoning, Age and Gender.

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The Development of Complex Problem Solving (CPS)

- Introduction
  - Theory
  - Research Questions
- Methods
  - Design and Procedure
  - Statistical Analyses
- Results
- Discussion
Introduction

- How do cognitive abilities develop in general?
  - Cognitive abilities progress from birth until the end of late adolescence (Nettleback & Burns, 2010)
  - Development of basic cognitive skills (e.g. Processing speed & Working Memory) enhance the development of more complex cognitive skills (e.g. Reasoning Ability; Fry & Hale, 1996)

PS = Processing Speed; WM = Working Memory; RA = Reasoning Ability
• Introduction

  - Implications for CPS development
    - CPS skills progress with students growing older
    - Development of CPS may rely on less complex cognitive abilities (e.g. Reasoning abilities)
    - Age plays an important role in CPS development
The Development of Complex Problem Solving and its Relation to Reasoning, Age and Gender.

• Research Questions (RQs)
  - RQ 1: How does CPS develop over time?
    - CPS should develop linearly over time (Stelzl et al., 1995)
  - RQ 2: Prediction of CPS by Reasoning Ability (RA)
    - RA should show positive relations to initial CPS skills (Wüstenberg, Greiff & Funke, 2012)
    - b) RA should predict CPS development positively
  - RQ 3: Age and Sex differences in CPS & CPS development
    - a) Older students should have better CPS skills but show less CPS development (Nettleback & Burns, 2006; Molnár, Greiff, & Csapó, in press)
    - b) Males are expected to show better CPS performance than girls, regarding development no specific assumptions were made (Wüstenberg, Greiff, Molnár, & Funke, submitted)
• **Methods**
  
  – Participants: 277 students (56.0 % female, M(age) = 13.6)
  
  – Measures:
    
    ➢ CPS: 8 MicroDYN Tasks
    
    ➢ RA: Culture-Fair Test (CFT); Cognitive Abilities Test (CAT)
  
  – Design:
    
    ➢ 3 Measurement Points (about a year apart)
    
    ➢ CPS was assessed at all measurement Points
    
    ➢ CFT on first measurement point; CAT on second measurement point
• Methods
  - Statistical Analyses
    - CPS development was analyzed with latent-growth curve models (LGCM; Muthen & Khoo, 1998) and RA, age and sex as time invariant predictors
• Results
  
  – Measurement Models (MM)
    - For CPS MMs were computed with the scores of all items aggregated to three parcels
    - For RA the MM was computed with global scores of CFT & CAT

<table>
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<th>MM</th>
<th>$\chi^2$</th>
<th>$df$</th>
<th>p</th>
<th>$\chi^2/df$</th>
<th>CFI</th>
<th>TLI</th>
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• **Results**

RQ 1: Development of CPS

Model Fit: $\chi^2(149) = 205.715$, $p < .01$, CFI = .962, RMSEA = .037

- CPS developed linearly over time (Mean linear slopes - L)
- Initial CPS performance was related positively (Correlation between intercepts)
- CPS development was related positively (Correlation between linear slopes)
- Initial Performance in CPS was related negatively with CPS development

Discussion
• **Results**

RQ 2: Relation of RA to CPS and its development

Model Fit: $\chi^2(205) = 261.111$, $p < .01$, CFI = .965, RMSEA = .031

- RA predicted initial CPS performance positively
- RA predicted CPS development only partly (due to large standard errors)
• Results

RQ 3: Relation of age and gender to CPS and its development

Model Fit: $\chi^2(205) = 261.111$, $p < .01$, CFI = .965, RMSEA = .031

- Age showed positive relations to initial CPS & partly negative relations to CPS development
- Sex showed small mostly non-significant relations to initial CPS and CPS development
Summary of all Results

- RQ 1: CPS showed linear development over time
- RQ 2: Prediction of CPS by Reasoning Ability (RA)
  - a) RA positively predicted initial CPS skills
  - b) RA partly predicted CPS development positively
- RQ 3: Age and Sex differences in CPS & CPS development
  - a) Older students had better initial CPS skills but showed less CPS development
  - b) No gender differences were indicated in present results
• Discussion

  – Negative Relation of CPS Intercept and Slopes
    - Students with better initial CPS showed less CPS development
    - Negatively accelerated development

  – Large standard errors
    - Population is maybe too small
    - Replication is needed

→ Nevertheless the present investigation showed some promising results regarding CPS development
Thank you very much for your attention!

Further Questions?
References


