The differential development of epistemic beliefs in psychology versus computer science students

A four-wave longitudinal study

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Epistemic beliefs

- Individual conceptions about knowledge and knowing (Hofer & Pintrich, 1997)
  - *How is knowledge justified?*
  - *How "simple" is it?*
  - *How stable is it?*
  - etc.

- Different levels of specificity (Bråten & Strømsø, 2010; Buehl, Alexander, & Murphy, 2002; Muis, Bendixen, & Haerle, 2006):
  - Domain-general
  - Domain-specific
  - Topic-specific

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Stage models

Developmental stage	**Description** (Kuhn & Weinstock, 2002; Hofer & Pintrich, 1997)
Absolute beliefs	Knowledge … - is based on facts → „objective“ - is conceptualized in dualistic contrasts (right-and-wrong or truth-and-untruth) - is stable and permanent
Multiplistic beliefs	Knowledge … - is based on personal opinion and the generation of own ideas → „subjective“ - is dynamic, tentative, and preliminary - Truth does not exist and everything is subjective (extreme form)
Evaluativistic beliefs	Knowledge … - is more or less objective resp. subjective – depending on the issue in question and on its context - Individuals realize themselves to be part of the process of knowledge by evaluating and weighting knowledge claims

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Epistemic “sophistication”

Stage models: Absolute and multiplistic beliefs as “unsophisticated” and obstructive for learning (Hofer & Pintrich, 1997)

But: It strongly depends on **context** (e.g., the instructional environment) whether a certain belief may be seen as … (Elby & Hammer, 2001)

- “correct” (according to an expert consensus), and
- “productive” (helping students to learn).

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Epistemic beliefs in computer science

Well-defined knowledge structure (King, Wood, & Mines, 1990)

- Axiomatically founded and derived from formal reasoning
- Many claims can be proven mathematically
- Large consensus over accepted proofs and theorems

Absolute beliefs as **"correct"** and **"productive"** (Elby & Hammer, 2001) in computer science

Discipline-specific socialization towards a view of science as means of finding objective, demonstrable truths

A linear increase in absolutism over the computer science curriculum is likely **(Expectation 1)**

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Epistemic beliefs in psychology (1)

Ill-defined knowledge structure (Muis et al., 2006)

- Concepts are loosely structured
- Theories are often inconsistent
- Controversial findings are frequent

Central challenge for psychology students (Rosman, Mayer, Kerwer, & Krampen, 2016)

- "Cope" with this ill-defined knowledge structure
- Evaluativistic beliefs as most correct and productive (Elby & Hammer, 2001) in psychology

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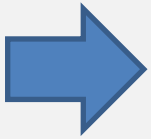
Epistemic beliefs in psychology (2)

"Coping" with ill-defined knowledge is hard for **freshmen** due to low domain-specific knowledge (Rosman et al., 2016)

- Reason: Students lack the skills to weigh evidence and evaluate theories and findings
- **Consequence:** Multiplism increases

More advanced students learn to weigh evidence and evaluate theories (Rosman et al., 2016)

- Reason: Increase in research skills, information literacy, etc.
- **Consequence:** Multiplism decreases, evaluativism increases



Inversely U-shaped developmental trajectory of multiplism in psychology students **(Expectation 2)**

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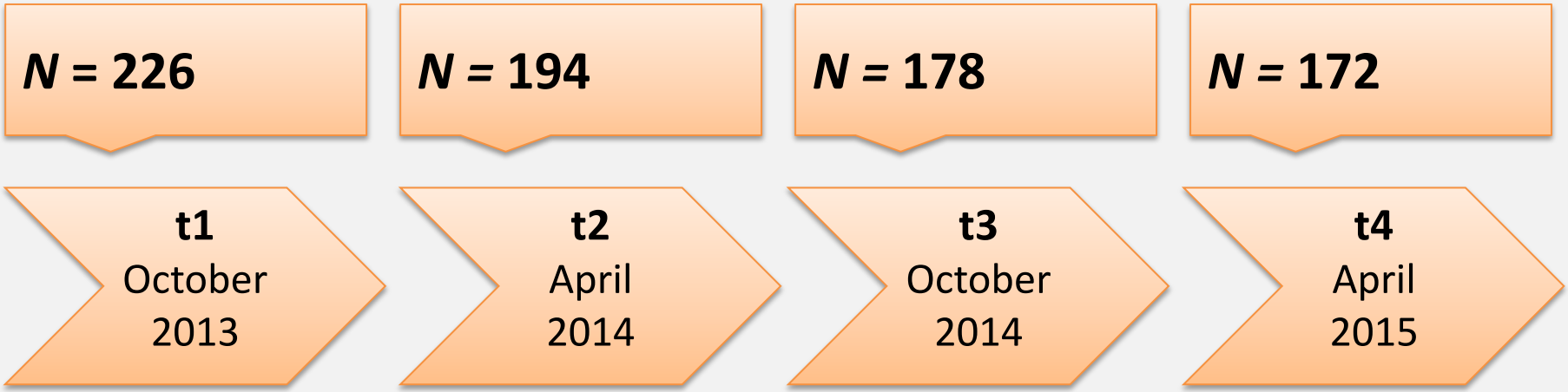
Study Design

The WisE Study (Mayer, Rosman, Birke, Gorges, & Krampen, in press)

- Four-wave longitudinal study
- *N* = 226 first-semester Bachelor students (first wave)
- 137 psychology students (one single institution) and 89 computer science students (three different institutions)



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Assessing epistemic beliefs

Primary Measure: EBI-AM (Peter, Rosman, Mayer, Leichner, & Krampen, 2015)

23 epistemic statements; 5-point Likert scales; discipline-specific:

- **Absolute scale:** e.g., "*There is always a true answer to questions in this subject.*"
- **Multiplistic scale:** e.g., "*In this subject, only uncertainty appears to be certain.*"

Secondary measure: CAEB (Stahl & Bromme, 2007)

Semantic differential with adjective pairs of opposing terms; 5-point Likert scales:

- **Texture dimension:** e.g., "*exact – vague*"
- **Variability dimension:** e.g., "*stable – unstable*"

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Data analysis strategy

Multi-group growth modelling for parallel processes (Muthén & Muthén, 2015)

Model development involved three steps:

(1) explore if changes in EBI-AM (and CAEB) generally differ between disciplines

(2) assess the pattern of change for the EBI-AM (and the CAEB) subscales separately (linear vs. quadratic vs. cubic trajectory)

(3) specify and investigate, based on this assessment, target (i.e., "final") model(s) for both questionnaires.

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Results – Target models

EBI-AM target model:

- includes linear slope factor for absolutism and linear, quadratic and cubic slope factors for multiplism
- $\chi^2 = 50.25$, $df = 47$, $p = .346$, CFI = .994, RMSEA = .025, SRMR = 0.095

CAEB target model:

- includes linear and quadratic slope factors for both texture and variability
- $\chi^2 = 71.11$, $df = 46$, $p = .010$, CFI = .962, RMSEA = .070, SRMR = 0.095

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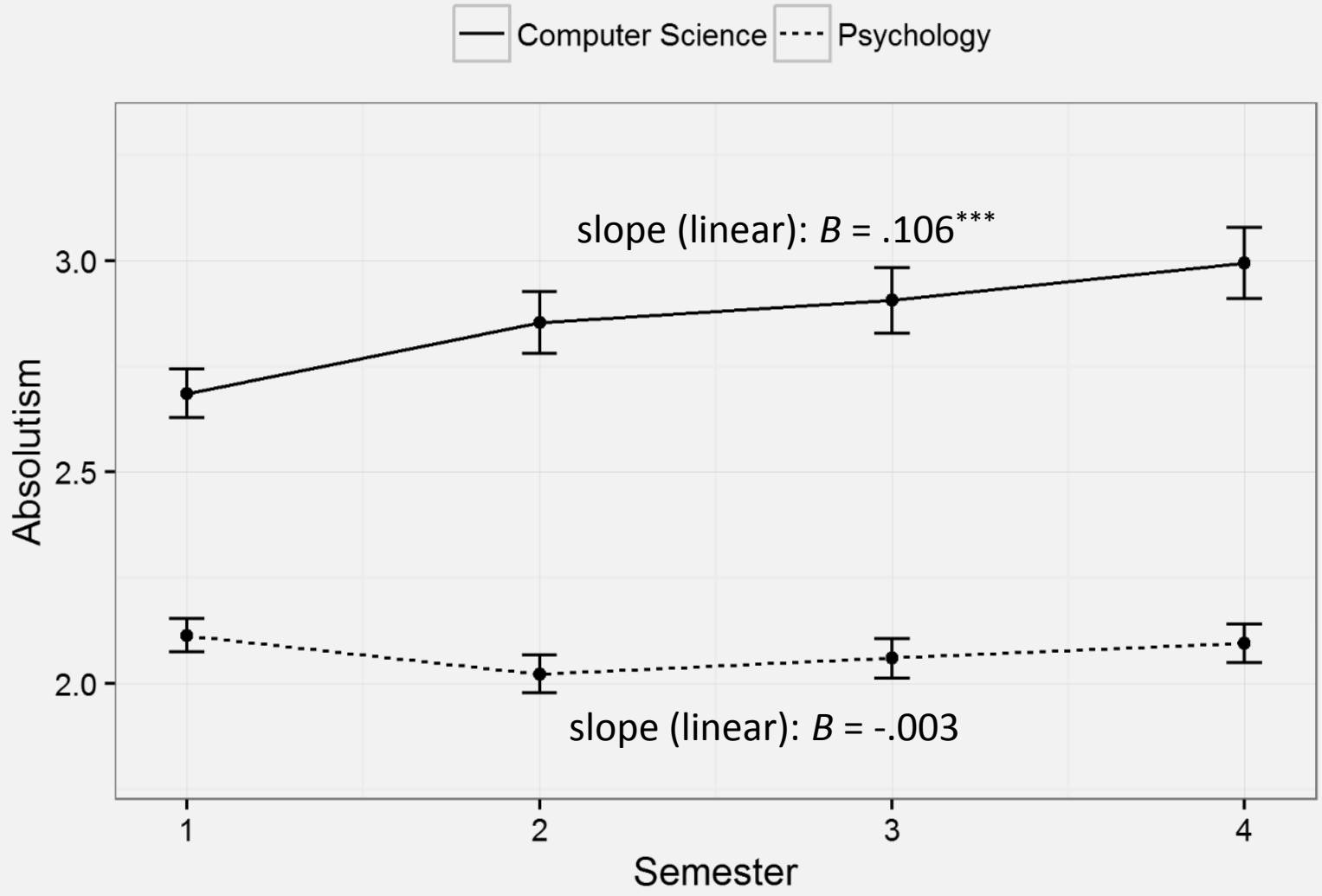
Results – Absolute beliefs (EBI-AM)



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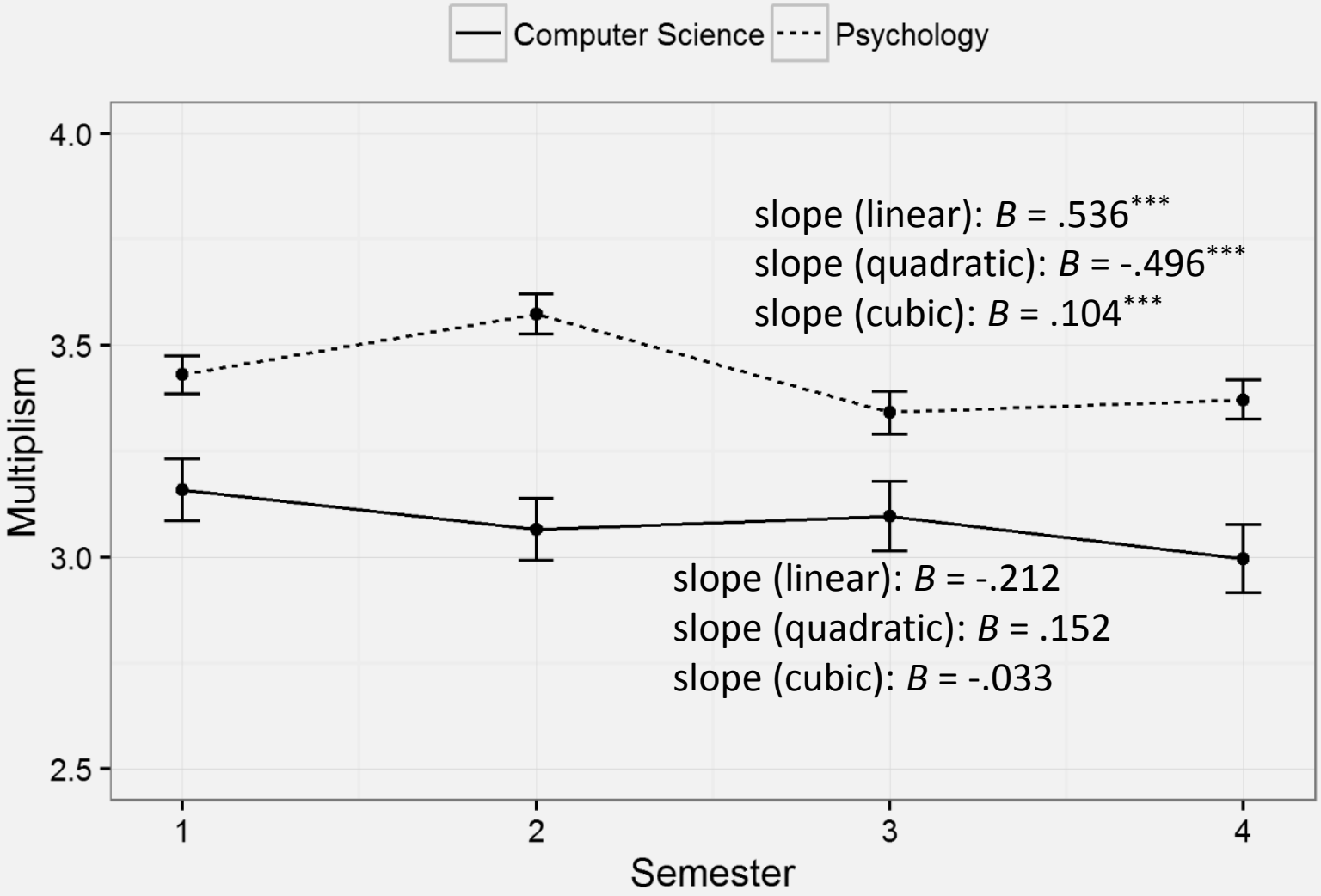
Results – Multiplistic beliefs (EBI-AM)



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Conclusions

Fixed developmental sequence assumed in stage models (Kuhn & Weinstock, 2002) vs. flexible adaptation of epistemic judgments to contexts (Bromme, Kienhues, & Stahl, 2008)

What are “sophisticated” beliefs?

Disciplinary differences should be taken into account when …

- conceptualizing interventions to change students’ epistemic beliefs
- Developing theoretical models on the development of epistemic beliefs

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Thank you for your attention!

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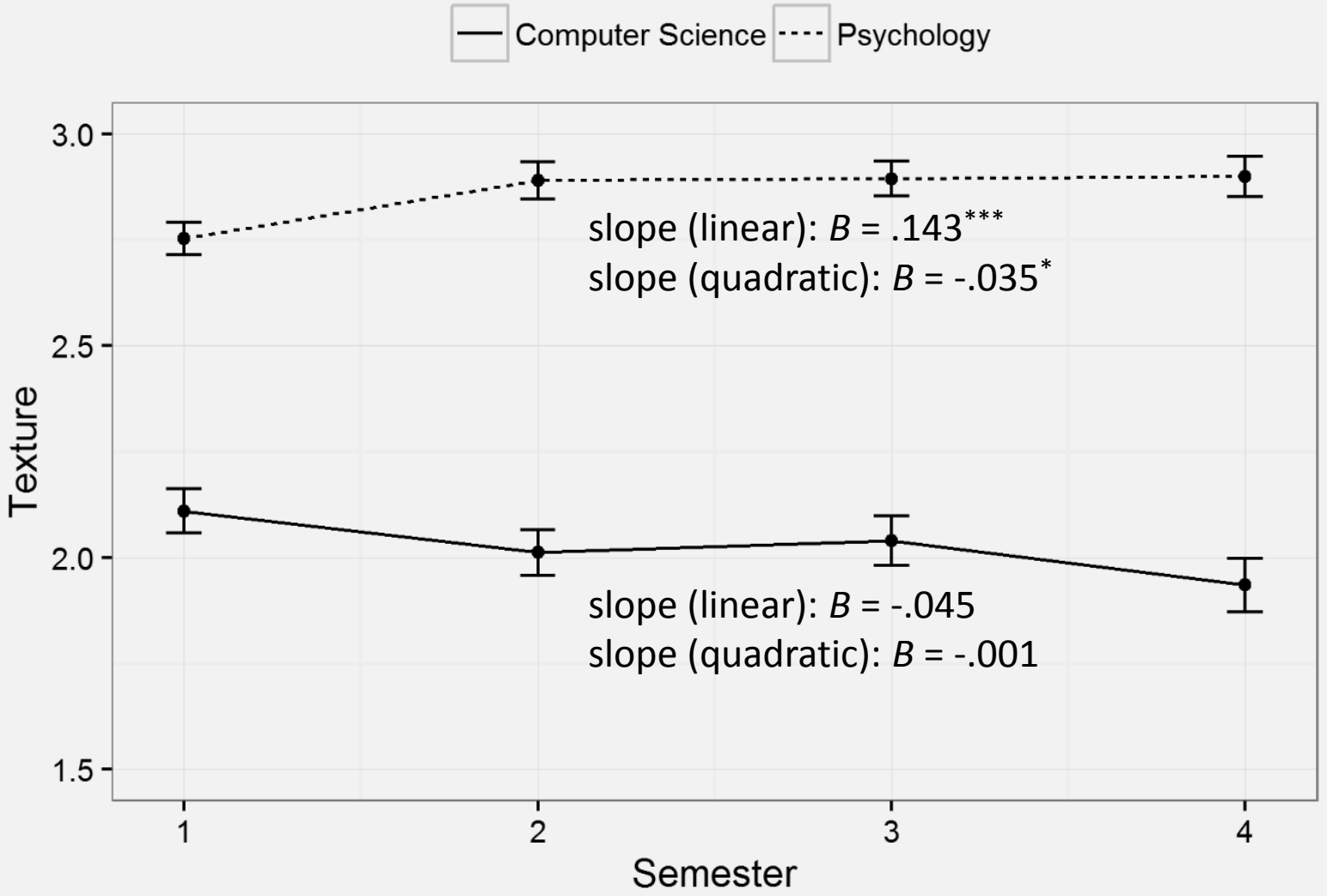
Results – CAEB-Texture



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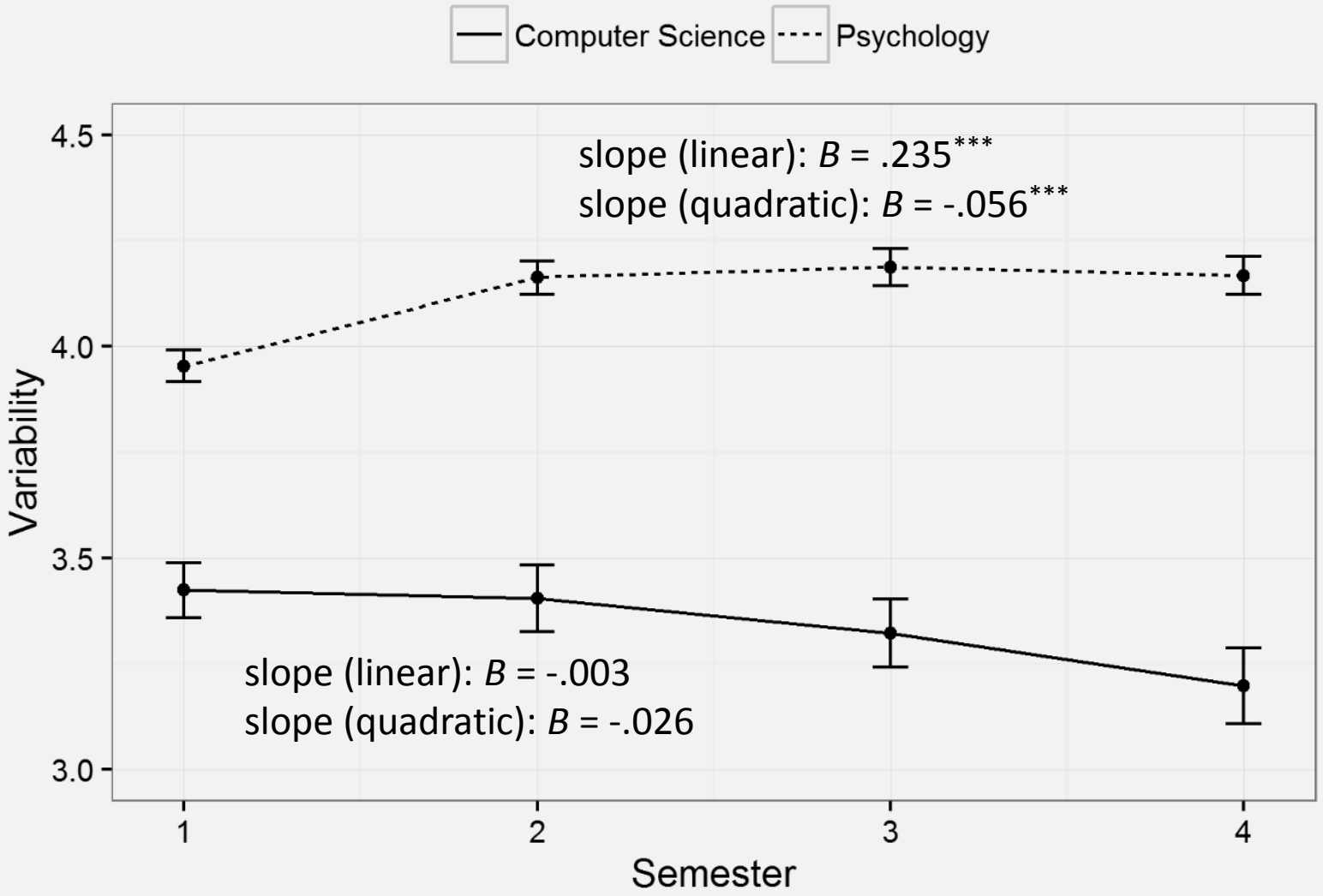
Results – CAEB-Variability



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