

EARLI SIG 4 & 11 - CONFERENCE

How Vocational Experience and Domain Knowledge Shape Students' Domain-Specific Online Reasoning

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TALK STRUCTURE

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01 · BACKGROUND

Motivation & Context

- Digitalization is transforming higher education
(Benavides et al., 2020; Alenezi et al., 2023)
- Since the Internet is the main source of information for students, critical online reasoning (COR) skills are crucial for their study success
(Maurer et al., 2020; Grothaus et al., 2021); e.g., using advanced online information search strategies is a significant and robust predictor of better grades among university students (Weber et al., 2018)
- Digital competencies are increasingly becoming part of vocational training curricula, particularly in commercial and technical occupations (KMK, 2022; BMBF, 2019)

≈25%

of German first-year students enter higher education with completed vocational education

(Bildungsberichterstattung, 2024)

02 · DISTINCT PREREQUISITES

Vocational Students: Distinct Prerequisites

Why prior vocational background may shape students' domain-specific (DOM) COR development

01

Students with vocational training have different learning conditions and (domain-specific) experiences than their peers who study directly after graduating from high school.

(Kuh et al., 2006; Rohde & Thompson, 2007; Brand & Xie, 2010; Happ et al., 2018)

02

Completed commercial training is a significant predictor of academic performance after three years.

(Kühling-Thees et al., 2021)

03

Students with completed vocational training may have practical experience and skills that can be transferred to the degree program, such as critical information gathering and evaluation.

(Brändle & Lengfeld, 2015)

02 · RESEARCH QUESTIONS

Research Questions

Objective: Examining how vocational background relates to students' DOM-COR skills at university entry and across the first academic year

RQ 1

How do students with and without prior vocational and/or commercial work experience differ in their initial levels of DOM-COR skills at university entry?



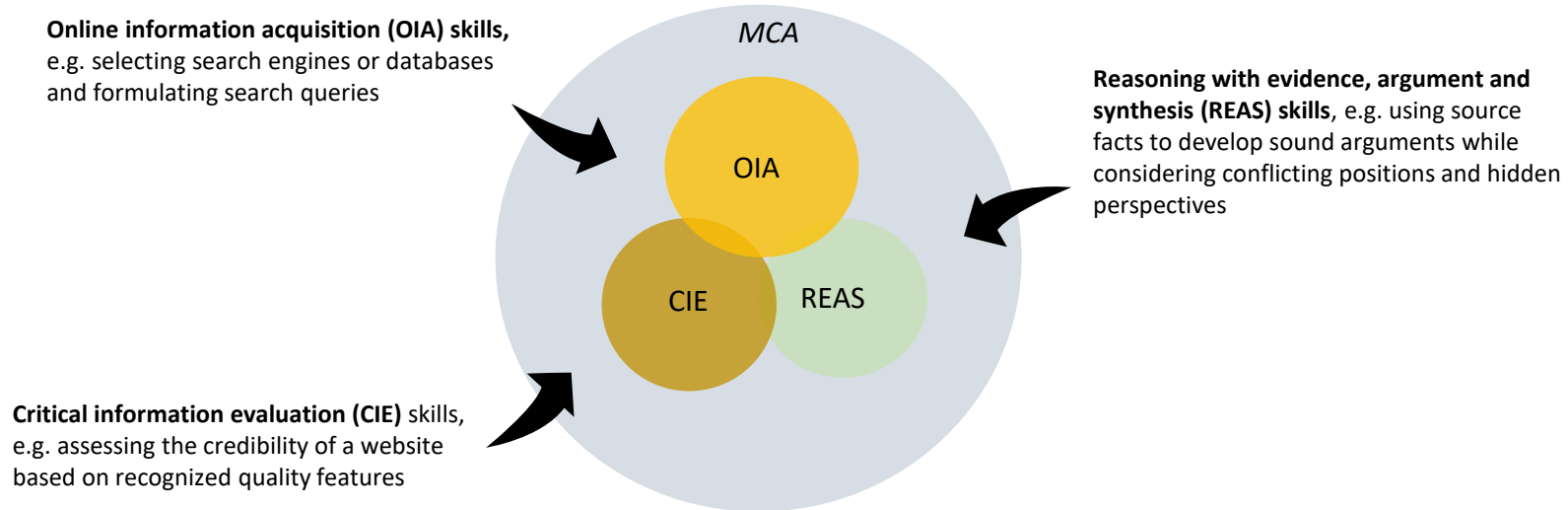
RQ 2

How do DOM-COR skills develop over the first academic year, and does vocational experience predict differences in gains?

03 · THEORETICAL FRAMEWORK

Theoretical Framework: COR

Critical Online Reasoning involves three core skill facets (Molerov et al., 2020)

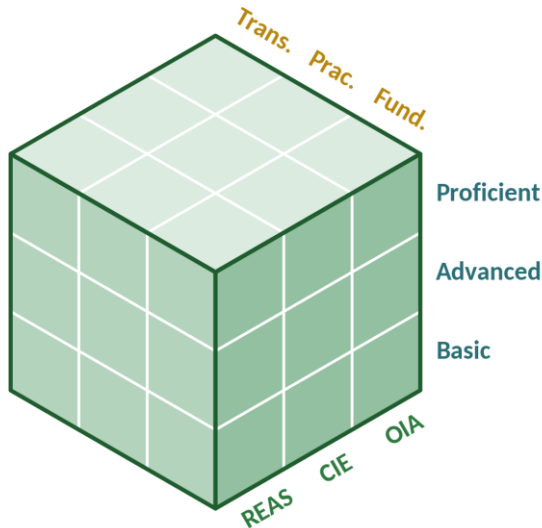


(Molerov et al., 2020)

03 · THEORETICAL FRAMEWORK

Theoretical Framework: DOM-COR

Development of a digital domain-specific **COR Assessment** in evidence-centered design (Mislevy, 2018)



Transdisciplinary reasoning context

accurate recognition, interpretation, and application of core economic concepts such as *opportunity cost, break-even point, or price elasticity*

Practical reasoning context

Solving real-world economic problems, e.g., resolving contradictory financial data or planning under uncertainty, by integrating information from multiple, often conflicting, online sources

Fundamental reasoning context

Applying economic reasoning to complex, multi-perspective real-world problems, e.g. making decisions about costly life-extending medical treatments within limited budgets

Each cell = one facet at one competence level within one requirement context (Zlatkin-Troitschanskaia et al., in review).

The study assesses DOM-COR (economic domain) across these dimensions.

04 • METHOD

Method: Tasks & Assessment

*Performance-based, scenario-based digital tasks
(Zlatkin-Troitschanskaia et al., in review).*

7 authentic tasks

Simulating real-world economic problem situations

Open Internet searches

Students write reasoning responses based on the sources they find

Multimodal process data

Search history, clicks, and scrolling are captured in real time

Trained raters + validated scoring scheme

Grounded in evidence-centered design (ECD)
(Mislevy, 2018; Zlatkin-Troitschanskaia et al., 2019)

EXAMPLE TASK • NUDGING

The Ministry of Economic Affairs is considering nudging measures to reduce electricity consumption. One proposal is to require cell phone manufacturers to implement intelligent display systems that show users their daily energy use. This information could appear either as a default display when the phone is turned on or as a daily reminder pop-up. The aim is to encourage energy-saving behavior without imposing strict regulations, while preserving individual freedom of choice. You have the task of preparing an exposé for a draft resolution. This involves the following three assignments. You have a maximum of 25 minutes to complete these assignments.

1. Which economic factors should be taken into account when regulating energy consumption through nudging measures under current economic developments? In the next 10 minutes, research two current sources on the Internet. **[OIA Facet]**
2. Write a concise statement in which you outline the key economic factors, which may positively or negatively influence the effectiveness of the measures mentioned above on energy saving (150-250 words). Base your answer on at least two of the sources you found in your search (max. 10 min.). **[REAS Facet]**
3. Your colleague asks why you have chosen the above sources. Please name at least the three most important criteria for your choice (max. 5min.) **[CIE Facet]**.

04 · METHOD

Rating the REAS Facet: General & Context Criteria

ACROSS ALL CONTEXTS (F · A · T)

- **Problem** — references the problem (1 pt)
- **Coherence** — coherence of argumentation (up to 3 pts)
- **Conclusion** — reaches a clear conclusion (1 pt)
- **Sources** — 1 pt per clearly cited source (max 4)
- **Arguments** — 1 pt per argument with clear reference (max 4)

CONTEXT-SPECIFIC

- **Argumentation** — stringent economic argumentation · Fundamental & Applied (1 pt)
- **Balance** — lists pro and con arguments · Applied & Transdisciplinary (1 pt)
- **Perspective** — other disciplines / consequences considered, e.g. social, political · Transdisciplinary (1 pt each, max 2)

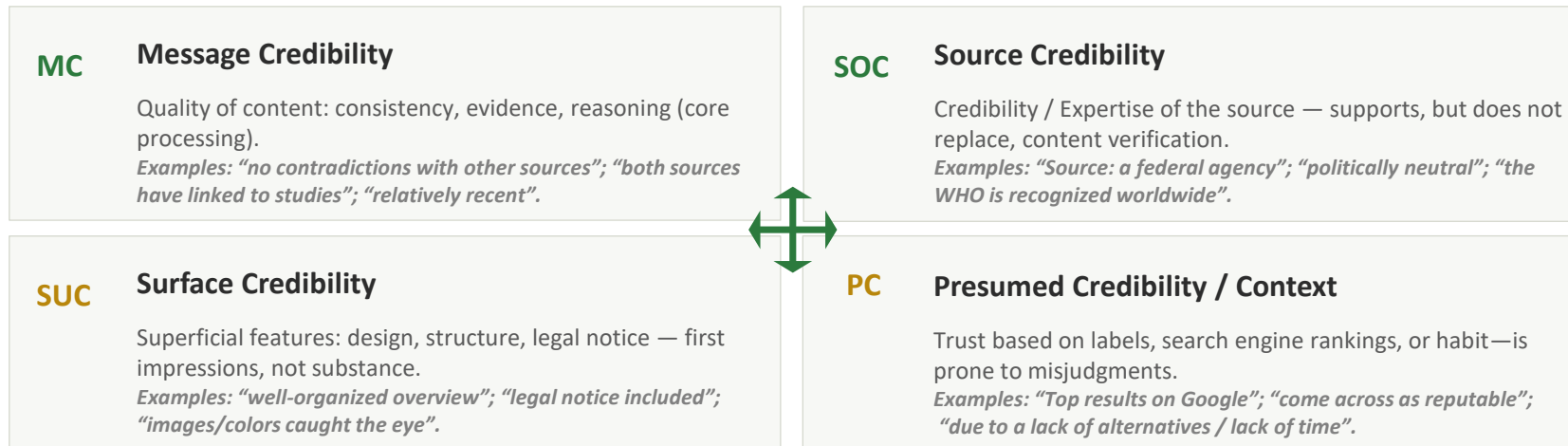
Excerpt from the rating scheme category “Coherence of argumentation”. Rating of Response Texts.

Level	Short Description
0	The statement is wholly incoherent. It contains only incoherent statements / information or is so short that no connections can be made.
1	The statement is mostly incoherent. It contains partially consecutive statements / information, but also incoherent elements or internal contradictions.
2	The statement is mostly coherent. The transitions between individual statements / information are mostly coherent, although there are repetitions and/or possible leaps in the thought process.
3	The statement is coherent. It has a consistently comprehensible structure in which the information/arguments cited follow from one to another.

04 • METHOD

Rating the CIE Facet: Four Credibility Dimensions

- Based on Wathen & Burkell (2002), a 20-criterion coding scheme was developed to rate students' written justifications for trusting and selecting a source.
- Each criterion is mapped to one of the four credibility dimensions — Message (MC), Source (SOC), Surface (SUC), and Presumed/Context (PC).
- Students' open responses were coded criterion by criterion; the criteria met per source feed into the four dimension scores.



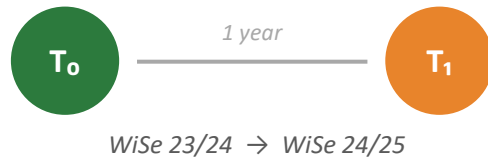
Scoring (Wathen & Burkell, 2002): MC and SOC are scored positively (central processing); SUC and PC are scored inversely—reliance on surface/contextual cues results in a lower score. These four scales appear as MC, SOC, SUC, and PC in Results II.

04 · METHOD

Method: Design & Sample

Longitudinal Design

- Two measurement points across the first academic year
- First-year students in Economics and Sociology
- Predictors: vocational education and commercial work experience
- Outcomes: DOM-COR performance (REAS & CIE) and domain knowledge (DOM Economics)



	No voc. ed. (n = 110)	Voc. ed. (n = 14)
N	110	14
Sample	<i>Longitudinal sample: N = 124, valid REAS at both waves (WiSe 23/24 & 24/25)</i>	
Age (M)	19.8 (SD 2.0)	23.9 (SD 3.9)
Entrance grade	1.89	2.15
Female / Male	46% male / 54% female	57% male / 43% female
Domain	34% SoSci / 66% Eco	21% SoSci / 79% Eco

05 · RESULTS

Results I: REAS Skills

Vocational education and work experience predicting REAS performance and its development

Predictor	Outcome	N	B	SE	t	p	R ²
Voc. education	REAS Development	121	-0.045	0.057	-0.80	.426	.005
Work experience	REAS Development	121	-0.028	0.035	-0.79	.434	.005
Voc. education	REAS T ₀	123	0.058	0.046	1.27	.208	.013
Work experience	REAS T ₀	123	-0.030	0.028	-1.06	.290	.009
Voc. education	REAS T ₁	122	0.008	0.043	0.19	.850	.000
Work experience	REAS T ₁	122	-0.059	0.027	-2.18	.031 *	.038

Note: + $p < .10$ · * $p < .05$ · ** $p < .01$ · *** $p < .001$.

- Work experience predicts lower REAS at T₁ (B = -0.059, $p = .031$), a very small effect ($R^2 = .038$).
- No effects at T₀ and on development, and none for vocational education (all $p \geq .21$).

05 • RESULTS

Results II: CIE Skills

Four credibility dimensions (MC, PC, SOC, SUC) at T_0 and T_1 — each predicted separately by vocational training and work experience

Scale	Predictor	N	B	SE	t	p	Sig.
MC T_0	Voc. Ed.	122	0.166	0.107	1.553	.123	n.s.
MC T_0	Wor	122	-0.013	0.067	-0.190	.850	n.s.
MC T_1	Voc. Ed.	96	0.155	0.158	0.984	.328	n.s.
MC T_1	Work Exp.	96	0.082	0.101	0.814	.418	n.s.
PC T_0	Voc. Ed.	122	0.159	0.129	1.236	.219	n.s.
PC T_0	Work Exp.	122	-0.077	0.080	-0.958	.340	n.s.
PC T_1	Voc. Ed.	96	0.068	0.150	0.450	.654	n.s.
PC T_1	Work Exp.	96	0.177	0.094	1.887	.062	+

Scale	Predictor	N	B	SE	t	p	Sig.
SOC T_0	Voc. Ed.	122	0.083	0.126	0.660	.510	n.s.
SOC T_0	Work Exp.	122	0.150	0.077	1.947	.054	+
SOC T_1	Voc. Ed.	101	0.093	0.178	0.522	.603	n.s.
SOC T_1	Work Exp.	101	0.084	0.111	0.762	.448	n.s.
SUC T_0	Voc. Ed.	122	0.006	0.124	0.051	.960	n.s.
SUC T_0	Work Exp.	122	0.136	0.076	1.787	.077	+
SUC T_1	Voc. Ed.	101	0.107	0.161	0.663	.509	n.s.
SUC T_1	Work Exp.	101	0.139	0.100	1.396	.166	n.s.

Note: Each scale regressed separately. Cases with outcome = 0 retained to keep N stable across scales. + $p < .10$ · * $p < .05$ · ** $p < .01$ · *** $p < .001$.

Three marginal trends ($p < .10$), all for work experience: **SOC T_0** ($p = .054$), **PC T_1** ($p = .062$) and **SUC T_0** ($p = .077$), all positive. Vocational education shows no association; $R^2 \leq .036$.

05 · RESULTS

Results III: Domain Knowledge

Vocational background predicting economic domain knowledge at university entry and after one year (longitudinal sample, N = 124)

Predictor	Outcome	N	B	SE	t	p	Sig.	R ²
Voc. education	DOM EC T0	118	1.214	0.661	1.84	.069	+	.028
Work experience	DOM EC T0	118	0.546	0.431	1.27	.208	n.s.	.014
Voc. education	DOM EC T1	123	-0.275	0.891	-0.308	.758	n.s.	.001
Work experience	DOM EC T1	123	0.806	0.529	1.523	.130	n.s.	.019

*Note: Longitudinal sample (N = 124). Outcomes: dom_ec_tel_sum (T0) and t1_dom_ec_tel_sum (T1). + $p < .10$ · * $p < .05$.*

At the start of their studies, vocational school graduates appear to have a slight edge in domain knowledge, but with only a small effect ($p = .069$). After one year, this difference is no longer detectable.

06 · DISCUSSION, LIMITATIONS & IMPLICATIONS

RQ I: Differences at university entry

- At entry, the only positive effect of vocational education is on domain knowledge: vocationally trained students start with somewhat **higher economic knowledge** (DOM EC T₀, B = 1.21, p = .069), but this is a very small effect; commercial work experience shows no knowledge advantage (p = .208). This is in line with evidence that commercial vocational training builds economic knowledge (Winther et al., 2016; Ma et al., 2024).
- For **critical information evaluation (CIE)**, vocational education is unrelated to all four credibility dimensions at entry. In contrast, work experience shows two weak positive tendencies (source credibility, p = .054; surface credibility, p = .077), suggesting that work-experienced students lean slightly more on explicit credibility cues when justifying their source choices.
- For the **REAS facet**, neither predictor matters at entry (p ≥ .21): the groups start essentially equal in how they argue with online information.
- Entry differences are **small and facet-specific**. There is a marginal knowledge edge tied to vocational education and a few weak evaluation tendencies tied to work experience, but no head start in actual critical reasoning.
- Vocational background relates more to what students know than to how they reason online, consistent with the distinction between domain-linked and domain-specific competence (Ma et al., 2024).

06 · DISCUSSION, LIMITATIONS & IMPLICATIONS

RQ II: Differences at university entry

- Vocational background does **not predict growth in reasoning**: neither predictor explains REAS development (both $p > .42$, $R^2 \approx .005$), so prior experience does not accelerate gains.
- The only significant effect indicates that **more work experience predicts slightly lower REAS** at T_1 ($B = -0.059$, $p = .031$). This may reflect the time constraints of working students or the chance of many tests.
- The entry knowledge edge is gone by T_1 (both n.s., $p \geq .13$), so the groups converge as **regular students catch up**.
- Vocational experience seems not to speed up DOM-COR skill growth; the picture is one of equalization, with the early edge fading and no lasting reasoning advantage.
- DOM-COR behaves as a distinct higher-order ability that does not simply transfer from prior knowledge or experience (Molero et al., 2020; Shavelson et al., 2019).

06 · DISCUSSION, LIMITATIONS & IMPLICATIONS

Limitations

1

Sample power

Only 14 students have completed vocational training, which severely limits power for vocational subgroup effects and makes the T_1 estimates imprecise. (Cohen, 1992)

2

Domain restriction

Tasks were embedded in economic problem situations; generalisability to other domains (e.g., natural sciences, humanities) remains to be tested. (Willingham, 2007)

3

Self-selection of T_1 completers

Students who completed both measurements may differ systematically from those who dropped out — potentially biasing developmental estimates. (Goodman & Blum, 1996)

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