Knowledge Building Measures that Matter

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Challenges to Researchers

Traditional learning	Knowledge building
• Individual	▪ collaborative processes and outcomes;
• Pre-designed	▪ emergent goals;
• Content coverage	▪ depth of understanding;
• Standard content	▪ diverse expertise.

Measuring Collaborative Knowledge Building

- Content-based analyses (e.g., Hakkarainen, 2003; van Aalst & Chan, 2007; Zhang et al., 2007);
- Behavioral measures that look at student participation and interaction (Aviv, Erlich, Ravid, & Geva, 2003; Hewitt & Teplovs, 1999; Howell-Richardson & Mellar, 1996; Zhang, Scardamalia, Reeve, & Richard, in press);
- Linguistic and rhetoric analyses (e.g., special vocabulary, sharing of control) (Hong & Scardamalia, 2008; Sun, Zhang, & Scardamalia, in press).

Significance? Interconnections?

This Study

- A secondary analysis of knowledge building measures applied to the same dataset.
- 22 fourth-graders
- Four-month knowledge building on light, supported by Knowledge Forum

Socio-behavioral, Content-based, and Linguistic Measures

Category	Measures
Socio-behavioral measures	Note contribution
	Note reading percentage
	Note reading network: in-degree and out-degree
	Note linking network: in-degree and out-degree
	Note linking network: cliques
Content-based measures	Inquiry threads
	Problems
	Incorporating new resources
	Use evidence
Lexical measures	1st 1,000 words
	Academic words
	Domain-specific words

Students' Knowledge Gains (Portfolio Notes)

- Breadth: Knowledge diffusion (Brown et al., 1993).
  - Identified 25 common inquiry themes (e.g., eclipse, rainbow)
  - Coded each student's portfolio note, e.g.,

"There are two kinds of eclipses[,] one is a lunar eclipse which happens when the earth gets between the sun and the moon and a solar eclipse is when the moon gets in between the sun and earth." (by RI, about "eclipses")

Students' Knowledge Gains

- Depth of understanding: epistemic complexity X scientific sophistication
  - Epistemic complexity: 1 - unelaborated facts, 2 – elaborated facts, 3 – unelaborated explanations, and 4 - elaborated explanations;
  - Scientific sophistication: 1 - pre-scientific, 2 - hybrid, 3 - basically scientific, and 4 - scientific.

Results

Correlations (Pearson r and p) between the Socio-Behavioral Measures and Understanding

	Notes written	% of notes read	Note reading in-degree	Note reading out-degree	Note linking in-degree	Note linking out-degree	Cliques belonging to
Depth of understanding	.437* (.042)	.398 (.067)	.519* (.013)	.398 (.067)	.431* (.045)	.214 (.338)	.469* (.028)
Breath of understanding	.198 (.377)	.105 (.644)	.308 (.164)	.061 (.788)	.364 (.096)	-.068 (.765)	.159 (.478)

Note. * p<.05

Correlations (Pearson r and p) between the content-based measures and understanding

	# of inquiry threads/themes contributed to	# of notes contributing personal ideas	# of notes identifying deeper problems	# of notes incorporating new resources	# of notes using evidence
Depth of understanding	-.034 (.879)	.365 (.095)	.582** (.004)	.403 (.063)	.260 (.242)
Breadth of understanding	1.000*** (.000)	.288 (.193)	.296 (.182)	-.009 (.970)	.056 (.806)

Note. ** p<.01, ***p<.001

Correlations (Pearson r and p) between the Lexical Measures and Depth of Understanding

	Total words written	Total domain words	Unique domain words	% of the academic words	% of the 1st 1,000 words
Depth of understanding	.646** (.001)	.660** (.001)	.458* (.032)	.506* (.016)	-.646** (.001)
Breadth of understanding	.250 (.262)	.218 (.329)	.594** (.004)	.226 (.313)	-.302 (.172)

Note. * p<.05, **p<.01

Characterizing Productive Knowledge Building

- Active contribution to the community knowledge space, indicated through the number of notes and words written;
- Awareness of contributions developed through note reading;
- Idea-centered, progressive discourse; and
- Collaborative and distributed engagements, achieved through actively building on to the efforts of various members and forming into dynamic teams.

Thank you!

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