Facilitator Practices for Problem-Based Learning in First-Year Engineering

Author: Hunter, Deirdre-Annaliese Nicole. (2015) Implementing Problem-based Learning in Introductory Engineering Courses:A Qualitative Investigation of Facilitation Strategies. Department of Engineering Education. Virginia Tech. Blacksburg, VA. Doctoral Dissertation.

Data Source: Observations (video and audio recordings) and field notes from a one-semester introductory engineering course employing problem-based learning. Five groups were each observed approximately six times during a complete problem cycle (6 weeks) with two observations per week in Weeks 1, 3, and 6. For full details on data collection, please refer to Hunter (2015).

Theoretical Framework: The model illustrated on the following pages was developed based on the Cognitive Apprenticeship framework (Collins, Brown, & Holum, 1991a). The relevant portion of Collin's original framework is shown in the table below:

Definitions and associated practices of the six constructs in the Method component of Cognitive Apprenticeship framework (Collins, Brown, & Holum, 1991b), as cited in Hunter (2015).

	Construct	Definition	Associated Practices
Method	Modeling	Teacher performs a task so students can observe and build a conceptual model of the processes that are required to accomplish it	▪ Think – aloud ▪ Verbalize heuristic and control strategies while completing a task ▪ Sharing of experiences that relate to the students' current situation
	Coaching	Teacher observes and facilitates while students perform a task and offering hints, scaffolding, feedback, modeling, or reminders	▪ Offer feedback or advice ▪ Offer encouragement ▪ Using questions to guide students
	Scaffolding	Teacher provides supports to help the students perform a task	▪ Perform tasks for the students that is beyond their ability ▪ Supply tools that can organize students understanding
	Articulation	Teacher encourages students to verbalize their knowledge, reasoning, or problem solving processes.	▪ Prompt students with questions ▪ Prompt students to verbalize or draw their understanding
	Reflection	Teacher enables students to compare their performance with that of an expert other student, or an internal cognitive model.	▪ Provide space for reflection ▪ Provide examples of which to compare
	Exploration	Teacher invites students to pose and solve their own problems	▪ Prompt students to scope problems or frame questions to solve

Collins, A., Brown, J. S., & Holum, A. (1991a, Winter 1991). Cognitive apprenticeship: making thinking visible. *American Educator*.

Collins, A., Brown, J. S., & Holum, A. (1991b). Cognitive Apprenticeship: Making thinking visible. *American Educator, 6*(11), 38-46.

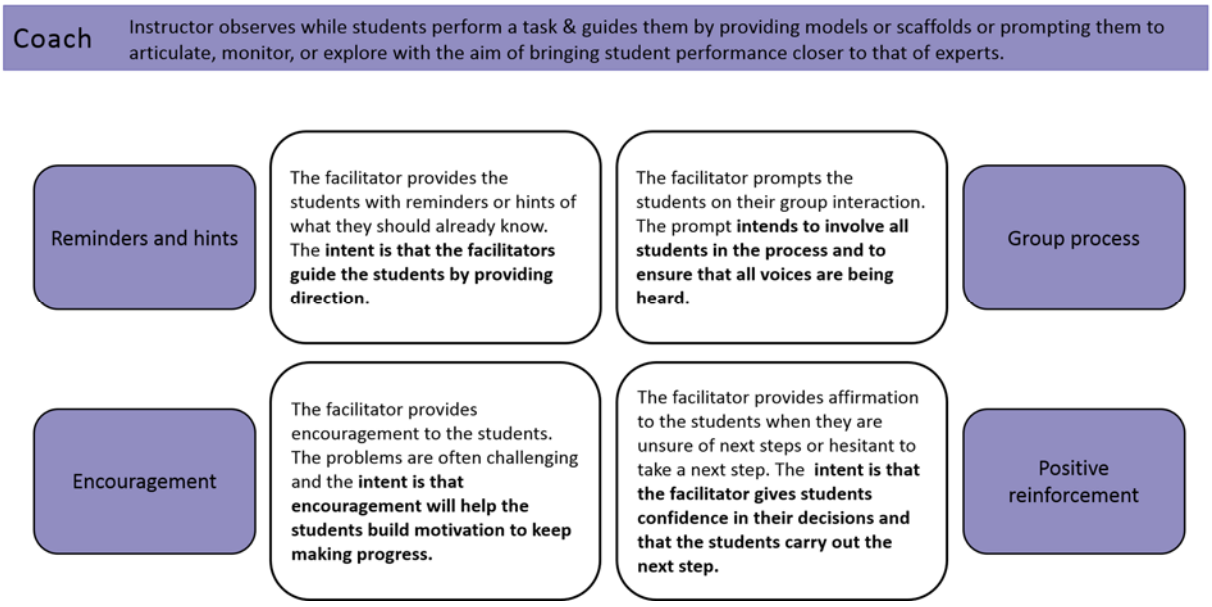

Figure 1 - Definitions of the Coach Subcategories.

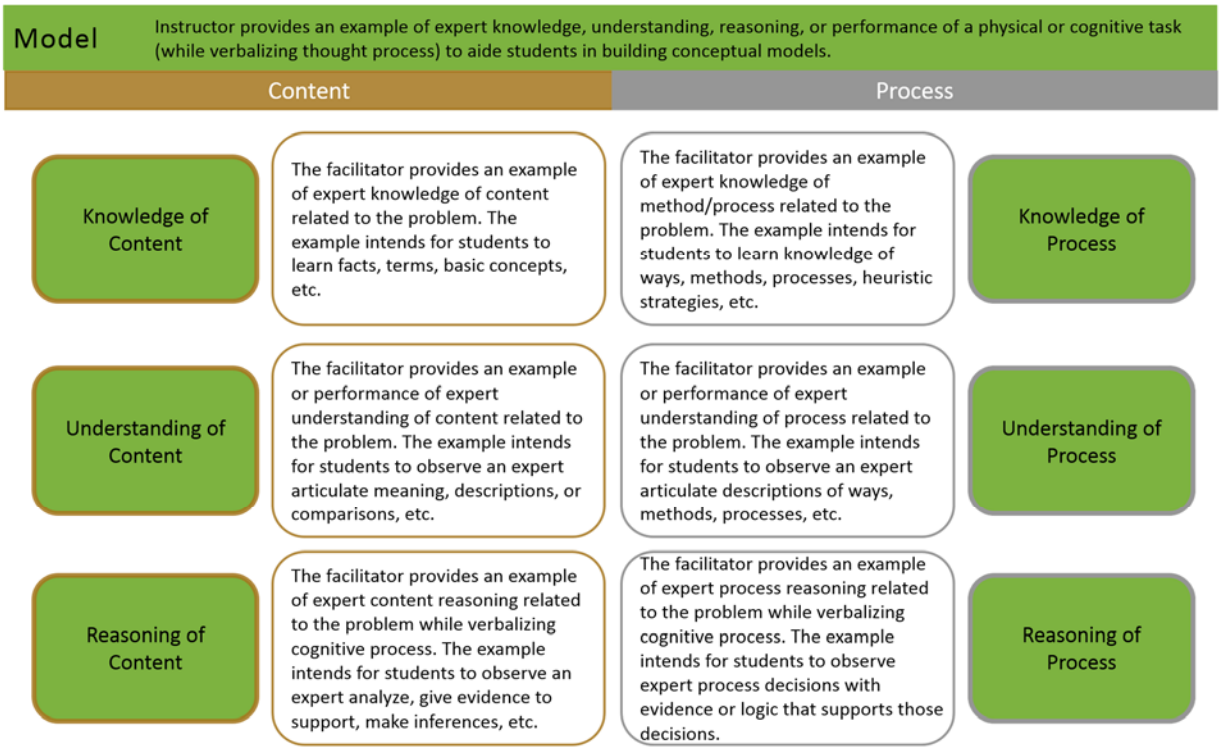

Figure 2 - Definitions of the Model Subcategories

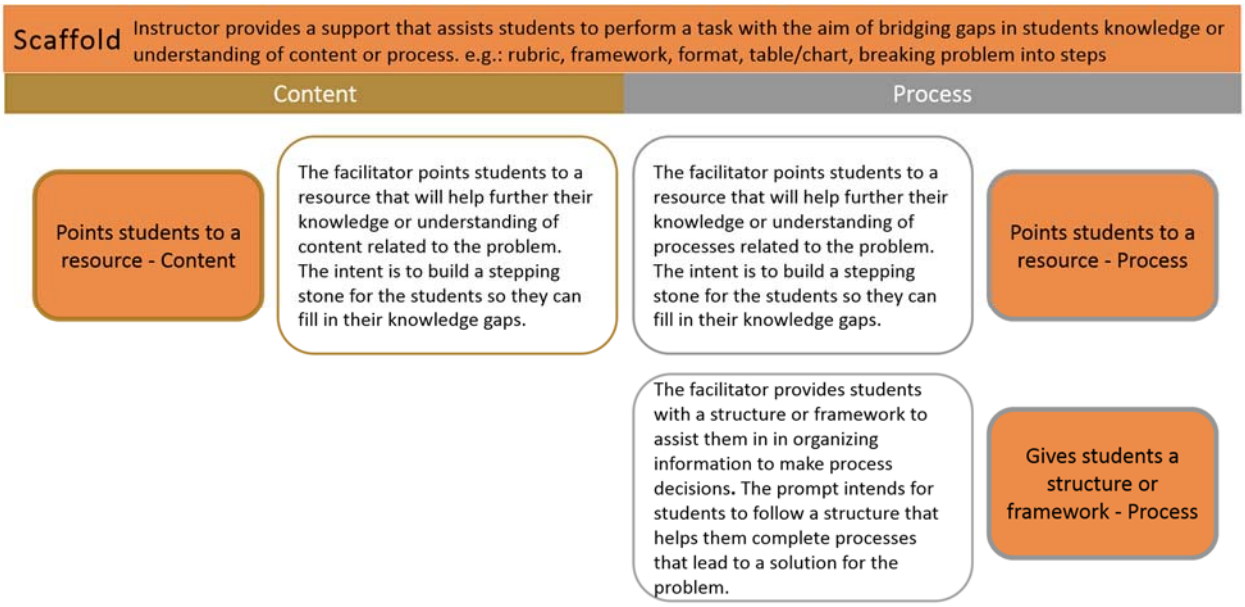

Figure 3 - Definitions of the Scaffold Subcategories

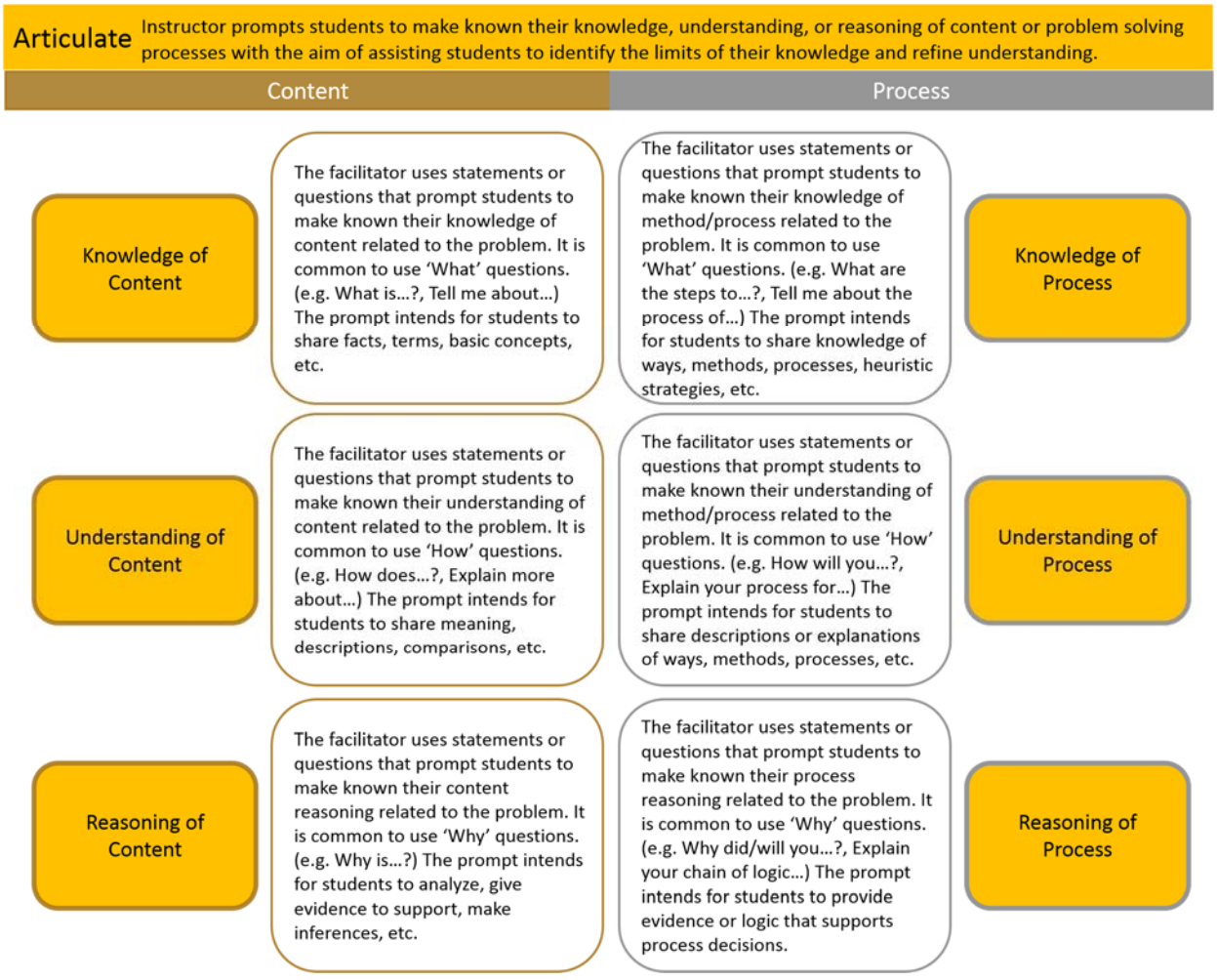

Figure 4 - Definitions of the Articulate Subcategories

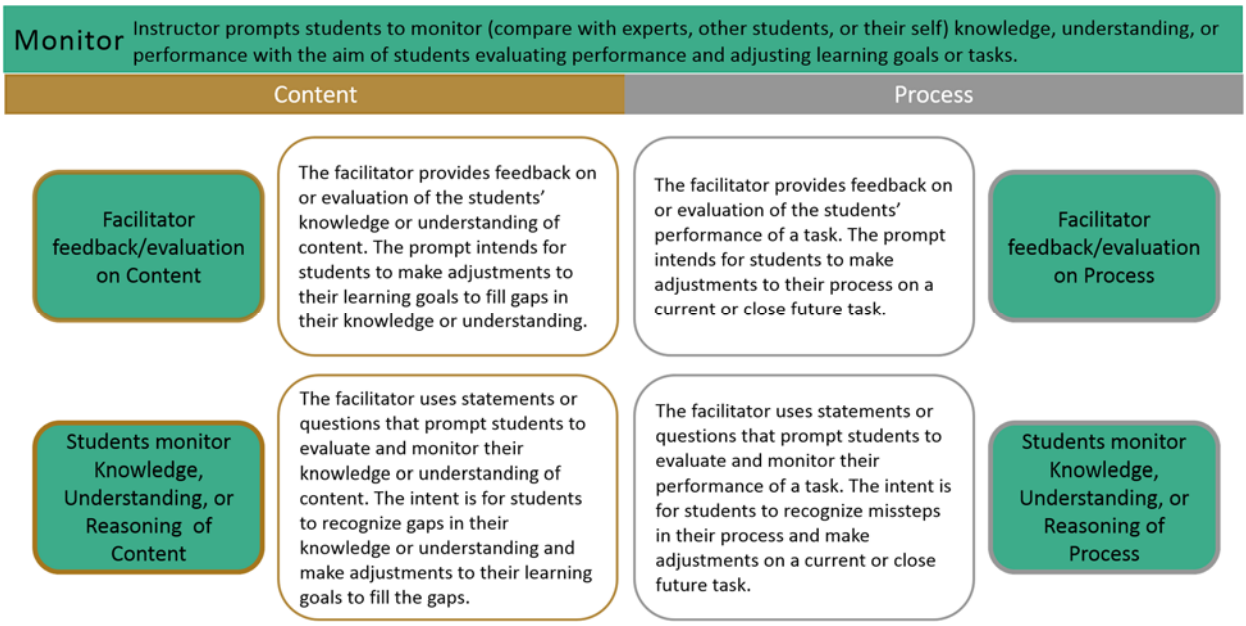

Figure 5 - Definitions of the Monitor Subcategories

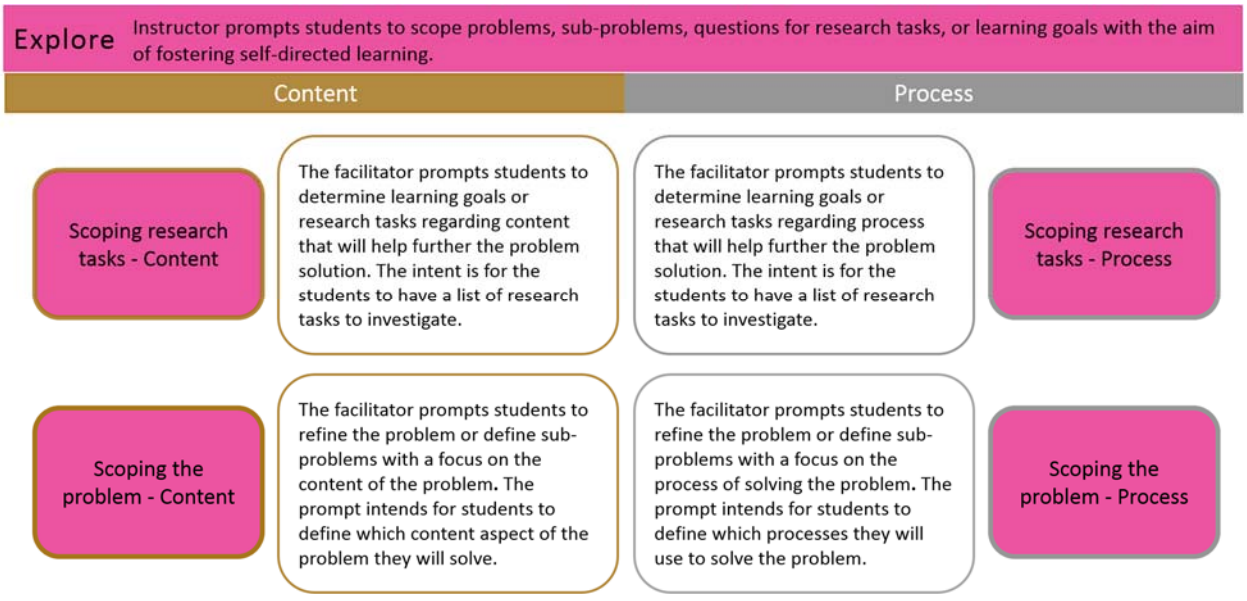

Figure 6 - Definitions of the Explore Subcategories