Student discovered papers for Chi and Van Lehn

"Investigating how student's cognitive behavior in MOOC discussion forums affect learning gains" by Wang et al. (GG)
"Wang et al. [1] examine student behavior in MOOC discussion forums. They aim to answer three main questions:

Does discussion forum participation correlate with learning?
Are discussion posts about the course material, rather than administrative details, a greater indicator of learning gains?
Are certain types of cognitive behaviors involved in discussion posts strongly correlated with learning?

At the foundation of this study is the ICAP framework, which was also discussed by Chi and VanLehn [2]."
[1] Wang, X. et al. "Investigating How Student's Cognitive Behavior in MOOC Discussion Forums Affect Learning Gains." EDM (2015)

The ICAP Active Learning Framework Predicts the Learning Gains Observed in Intensely Active Classroom Experiences (CO)
Interactive methods were designed such that the individuals of a group were given a portion of a task, and were required to interact and discuss with members of the group to procure a complete solution. In constructively designed tasks, these elements were all addressed by the individual, although discussion and interaction was not prohibited or discouraged. ... I was a bit disappointed
1. Wiggins B, Eddy S, Grunspan D, Crowe A, The ICAP Active Learning Framework Predicts the Learning Gains Observed in Intensely Active Classroom Experiences, AERA Open, 2017
2. Chi M, Wylie R, The ICAP Framework: Linking Cognitive Engagement to Active Learning Outcomes, Educational Psychologist 4, 219-243
Response by DG: One tangential question I had when reading the Chi and Van Lehn paper was: does the ICAP framework hold true machine learners as well as human learners?

Conceptual Structure for Mathematical Teaching (ES)
the most effective countries in mathematics education participate in “struggle” time, which is defined as “students expend effort to make sense of mathematics, to figure out something that is not immediately apparent.” When students find the explanations themselves rather than be provided with them by the teacher, they learn much more effectively. The American system of education emphasizes facts and procedures over analytical reasoning for mathematics..."
[1] Lindsey E. Richland, James W. Stigler & Keith J. Holyoak (2012): Teaching the Conceptual Structure of Mathematics, Educational Psychologist, 47:3, 189-203
Response by SC
"it is clear that the students mostly rely on the surface features or the first-order cues. They try to find these cues in the given problem, but without forming any relationship with these cues,

Teaching the conceptual structure of mathematics (SC)
Though Chi et al. suggest that people need to find out the correlations between the first-order cues to form some second-order cues, it is not always easy to form these cues for several mathematics problems because there could be some exceptional cases, or maybe people need to know something else to form the second-order cues from the first-order cues. That’s why Learning Schemas via analogical reasoning does not work for mathematics problems [p 193][2].
[2] Richland, L. E., Stigler, J. W., & Holyoak, K. J. (2012). Teaching the conceptual structure of mathematics. Educational Psychologist, 47(3), 189-203.

Resisting Overzealous Transfer (BD)
This paper [1] focusses on what happens if we apply excess of background knowledge. Negative transfer refers to the overgeneralization of prior learning. Overzealous transfer (OZT) is the phenomenon of people transferring solutions that appear to be positive because they are working well enough, but they are nevertheless negative with respect to learning what is new.
[1] Schwartz, Daniel L., Catherine C. Chase, and John D. Bransford. "Resisting overzealous transfer: Coordinating previously successful routines with needs for new learning." Educational Psychologist 47.3 (2012): 204-214. --- reliance on Tell & Practice

Deep Learning of Representations for Unsupervised and Transfer Learning (DG)
A few interesting insights might be gained by the analogy between machine learning transfer and psychological transfer. First off, the authors this paper show that abstract features on multiple levels (i.e. deep learning) are useful for informational transfer [Bengio page 18-19]. A parallel insight in the psychology domain would be that informational representation on many levels is useful, which I think is supported quite well by Chi and Van Lehn's paper.
1. Bengio, Yoshua. "Deep learning of representations for unsupervised and transfer learning." Proceedings of ICML workshop on unsupervised and transfer learning. 2012.

Machine Learning and Deep Learning (JR)
"even a small amount of computation would greatly automate and improve many of the strategies Chi and Van Lehn discuss to achieve deep learning. The framework discussed in this paper is still very much in the conceptual level with more work to be done on understanding the relationship among factors to be utilized in the union of machine learning and deep learning."
[1] Zheng R., Greenberg K. (2018) Effective Design in Human and Machine Learning: A Cognitive Perspective. In: Zhou J., Chen F. (eds) Human and Machine Learning. Human–Computer Interaction Series. Springer, Cham.

Rating understanding of concept knowledge based on brain activity patterns (AO)
they propose a method to rate the brain activity using the so-called neural score. The higher the neural score, the better/deeper the student's understanding of the concept. ... The fMRI images indicate that different parts of the brain are in works and different activity patterns are observed for experts and novices. The authors also showed that their model can predict the quality of learning.
[1] Cetron et al. (2019)

Cognitive Modeling in Problem Solving + Further Thoughts on Chi,Van Lehn -- Pantsar (2019) (NK)
"this week's article Pantsar (2019) looks at the computational complexity as it relates to the cognitive complexity--specifically in the case of mathematical problem solving [2].

Pantsar notes that one single definition for competence is misguided, as there are cultural differences and various ways of measurement of expertise."

[2] Pantsar, Markus. "Cognitive and computational complexity: Considerations from mathematical problem solving." Erkenntnis (2019): 1-37.

Relation of Chess Problem Solving (CV)
Guntz describes how chess beginners tend to fixate on individual pieces while experts tend to focus on clusters of pieces (chunks) and the board states that they form. This relationship would also explain the rapid emotional variations seen in experts but not in intermediate players. Since novice players do not utilize second order features, there would be no emotional variations associated with seeing the recognizable chunks.

[1] Thomas Guntz, James L. Crowley, Dominique Vaufreydaz, Raffaella Balzarini, and Philippe Dessus. 2018. The role of emotion in problem solving: first results from observing chess. In Proceedings of the Workshop on Modeling Cognitive Processes from Multimodal Data (MCPMD '18). Association for Computing Machinery, New York, NY, USA, Article 12, 1–8. DOI:https://doi.org/10.1145/3279810.3279846