

Abstract Submitted
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Qualitative Understanding of Magnetism at Three Levels of Expertise FRANCESCO STEFANI, JILL MARSHALL, University of Texas at Austin — This work set out to investigate the state of qualitative understanding of magnetism at various stages of expertise, and what approaches to problem-solving are used across the spectrum of expertise. We studied three groups: 10 novices, 10 experts-in-training, and 11 experts. Data collection involved structured interviews during which participants solved a series of non-standard problems designed to test for conceptual understanding of magnetism. The interviews were analyzed using a grounded theory approach. None of the novices and only a few of the experts in training showed a strong understanding of inductance, magnetic energy, and magnetic pressure; and for the most part they tended not to approach problems visually. Novices frequently described gist memories of demonstrations, text book problems, and rules (heuristics). However, these fragmentary mental models were not complete enough to allow them to reason productively. Experts-in-training were able to solve problems that the novices were not able to solve, many times simply because they had greater recall of the material, and therefore more confidence in their facts. Much of their thinking was concrete, based on mentally manipulating objects. The experts solved most of the problems in ways that were both effective and efficient. Part of the efficiency derived from their ability to visualize and thus reason in terms of field lines.

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