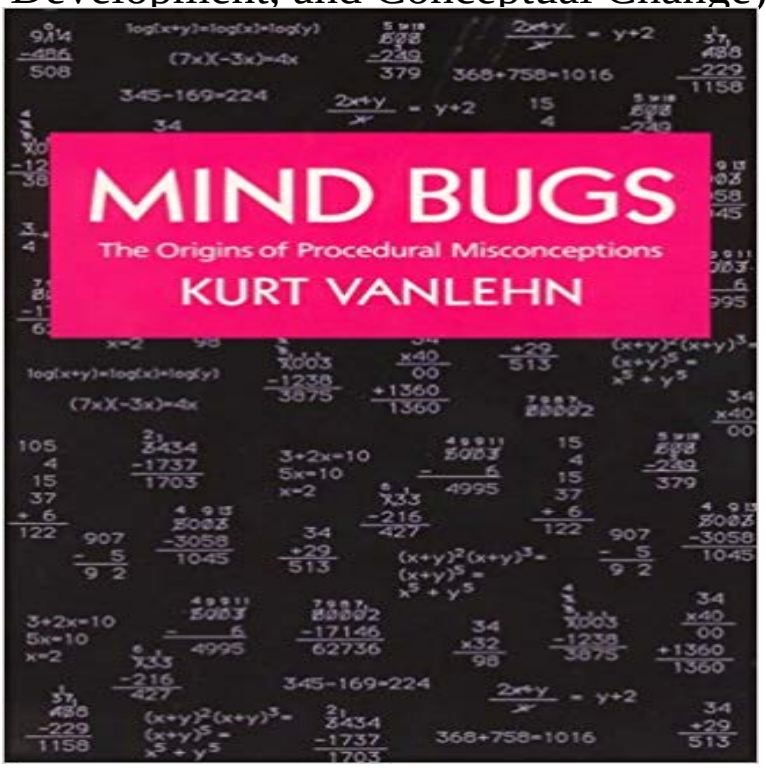
Mind Bugs: The Origins of Procedural Misconceptions (Learning, Development, and Conceptual Change)



As children acquire arithmetic skills, they often develop bugs - small, local misconceptions that cause systematic errors. Mind Bugs combines a novel cognitive simulation process with careful hypothesis testing to explore how mathematics students acquire procedural skills in instructional settings, focusing in particular on these procedural misconceptions and what they reveal about the learning process. VanLehn develops a theory of learning that explains how students develop procedural misconceptions that cause systematic errors. He describes a computer program, Sierra, that simulates learning processes and predicts exactly what types of procedural errors should occur. These predictions are tested with error data from several thousand subjects from schools all over the world. Moreover, each hypothesis of the theory is tested individually by determining how the predictions would change if it were removed from the theory. Integrating ideas from research in machine learning, artificial intelligence, cognitive psychology, and linguistics, Mind Bugs specifically addresses error patterns on subtraction tests, showing, for example, why some students have an imperfect understanding of the rules for borrowing. Alternative explanatory hypotheses are explored by incorporating them in Sierra in place of the primary hypotheses, and seeing if the program still explains all the subtraction bugs that it explained before. Mind Bugs is included in the series Learning, Development, and Conceptual Change, edited by Lila Gleitman, Susan Carey, Elissa Newport, and Elizabeth Spelke. A Bradford Book

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