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The cognitive process of Chinese abacus arithmetic.

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Summary: Based on the literature review about abacus arithmetic, this study proposes a model of the cognitive process of Chinese abacus arithmetic. This model describes three methods for solving abacus arithmetic problems: retrieval method, procedure method, and mental arithmetic method and three external factors that affect the choice of those methods: level of expertise, level of difficulty, and type of operation. The experiment in the study invited 36 participants including 12 vocational high-school students as junior experts, 12 ordinary high-school students as novices, and 12 bank clerks as senior experts to validate the $3 \times 3 \times 2$ experiment. The results of this study indicate that (1) the retrieval method, procedure method, and mental arithmetic method are the three main calculation methods of abacus arithmetic, each of them having some variations; (2) experts tend to use the retrieval method, while novices tend to use the mental arithmetic method; (3) the retrieval method and mental arithmetic method are applied more for simple operations and addition problems, while the procedure method is applied more for complicated operations and subtraction problems.

Classification: F30 U60 C30

Keywords: abacus arithmetic; cognitive process; mental arithmetic method; procedure method; retrieval method

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