

# AN EXPERIMENTAL STUDY OF THE EFFECTS OF PORTFOLIO ASSESSMENT AND PAPER-AND-PENCIL TEST ON MATHEMATICAL CONCEPTS, MATHEMATICAL COMMUNICATING CAPABILITY, AND MATHEMATICAL LEARNING ATTITUDE

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Portfolio assessment was one kind of authentic assessments emerged in the late 1980s(e.g., Mitchell 1992; Wiggins 1995; Madaus, Raczek & Clarke 1997). This movement strongly challenged traditional tests. The purposes of this study were to compare portfolio assessment with paper-and-pencil test on mathematical concepts, mathematical communicating capability, and mathematical learning attitude. The subject matters of portfolio assessment, called mathematical journal, were designed according to the context of teaching and the reaction of students in classroom. Structural student self-evaluation, interchange-evaluation, working sheets selection and display were also used in spirit of mathematics standard and portfolio assessment. Otherwise paper-pencil tests included multiple-choice problems, filling-in-blank problems, calculating problems, constructing problems, word problems and so on as normal.

A twelve-week experiment was conducted on two classes of fourth-grade elementary students. One class was the controlled group, which received the paper-and-pencil tests; the other was the experimental group, which received portfolio assessments. The experiment was designed by the pre-/port-non-equal design model. Independent sample single factor co-variance analysis and problem solving styles analysis were methods chosen for analyzing the collected data.

The results on this experimental study included:

1. The performance on mathematical concepts between two classes showed no difference.
2. The capability of mathematical communication between two classes showed no difference. However, the mathematical problem solving styles of the class receiving portfolio assessments were more diverse than the one receiving paper-and-pencil tests.
3. The mathematical learning attitude of the class receiving paper-and-pencil tests was better than the one receiving portfolio assessment.

Besides, nine problem types of mathematical journal were classified, including (1) problem posing; (2) applied word problems; (3) creative and designing problems; (4) connecting and judging relationship among word, symbol, equation, and graph presentations; (5) communicating self's mathematical thinkings; (6) comprehending and judging with others' mathematical thinkings; (7) clarifying mathematical concepts; (8) constructing problems; (9) how students feel about mathematics course. And by analyzing responses from students receiving portfolio assessment, the solving categories and misconception were also found.

## References

- Harcourt Brace Educational Measurement (1997). *The New Standards Performance Standards.Vol,1 Elementary School*.
- Fischer C.F. & King R.M. (1995). *Authentic Assessment: A Guide to Implementation*. Corwin Press. Inc.