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ABSTRACT

In this quasi-experimental study mathematical proof writing is views as a problem-solving activity success at which requires adequate knowledge of relevant mathematical content and logical rules of inference, familiarity with heuristic proof-writing techniques, metacognitive skills, and positive effects towards self and mathematics. The extent to which two types of classroom assessment – traditional (TA) and learner-centered (LCA) – provided these cognitive and affective requisites is described on the basis of a quantitative and qualitative analysis of their effects on the quality of students' mathematical proofs and selected affective variables such as attitudes towards mathematics, motivation, self-confidence, mathematics anxiety, and test anxiety.

Two intact undergraduate classes of fifty-one (51) students in Linear Algebra at the University of the Philippines Visayas Main Campus in Miag-ao, Iloilo during the Second Semester, 2002-2003, constituted the sample for the study. The traditional and learner-centered classroom assessments were randomly assigned to the control and experimental groups, respectively.

Each member of the experimental (LCA) and control (TA) groups wrote proofs for seven propositions which were scored blind by two raters using 4-point criteria (key mathematical understanding, logical validity, mathematical communication, and clarity and simplicity) specified in a researcher-constructed anaholistic proof-writing rubric. The proofs were also qualitatively assessed to determine the nature and extent of the subjects' understanding of the key mathematical content and identify logical fallacies committed as well as instances of inappropriate use of language, mathematical terminology and notation. The long-term effects of classroom assessment on proof quality were determined through a comparison of the mean index values obtained by the two groups in all criteria indicators, including the frequencies of manifestations of validity, soundness, consistency, and fallacious reasoning in these profs.

On the other hand, the differential effects of classroom assessment on the effect were analyzed based on the subjects' pre-and post-test instruction responses in a 38-item Affective Inventory and clarified in greater detail by interview data on the perception and impressions of a sample of the subjects from the TA and LCA groups about their learning experiences in the course.

Four categories of learning difficulties encountered by the TA and LCA groups in relation to proof-writing were identified and addressed: (a) difficulty with the form and substance of a proof, (b) difficulty in understanding a proof for a theorem and theoretical exercise, (c) difficulty

in understanding the key content and their relationships in a proof, and (d) difficulty or confusion with associated mathematical terminology and notation.

The findings of the study show no significant differences in the quality of TA and LCA proofs for Propositions 1-5. However, despite the greater difficulty of proving Propositions 6 and 7 as compared to Propositions 1-5, the LCA proofs for Propositions 6 and 7 obtained consistently higher ratings than those of the TA group. This difference was found to be significant in proofs for Proposition 7. This provides evidence of a consistent and significant improvement in the quality of LCA proofs during the last three weeks of the teaching experiment.

The comparison of the mean index values obtained by both groups for the different criteria measures, as well as the frequencies of manifestations of validity, soundness, consistency, and fallacious reasoning in their proofs, reinforce the above findings. In all criteria measures, the cumulative change in LCA mean index values in Proofs 5-7 are greater than the TA groups. These indicate a greater cumulative improvement in the LCA group's proof-writing skills over time as a result of classroom assessment.

Moreover, as a result of their learning experiences in the course, the LCA subjects more significantly liked mathematics and regarded it as their most favorite subject in school and felt more challenged to solve difficult problems in mathematics. They too more strongly agreed on a teacher's influence on their mathematics performance and felt less motivated to perform at their best in mathematics by material incentives like money. On the other hand, the TA subjects experience resulted in a significant reduction of their level of frustration with their previous learning of mathematics, a greater interest to know more about the subject and preference to discuss and learn mathematics with others, and a better understanding of geometry and trigonometry than algebra, along with increased levels of test anxiety and discomfort when dealing with numbers and mathematical symbols.