

1 2  **High School Mathematics Teachers' Use of Calculators in Classrooms**

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3  **Introduction**

- ▶ Technology integration has been broadly defined as use of calculators and computers in math classrooms since 1980s.
- ▶ Principles and Standards for School Mathematics (NCTM, 2000) and Nation's Report Card also indicated this integration trend (NCES, 2001).
  - ▶ Between 1996-2000, the percentage of students having calculator access increased by 20 percentage at Grades 4, 8, and 12 (NCES, 2001).
- ▶ Calculator use can provide learning opportunities and tasks which facilitate reasoning and sense-making process, that is, higher levels of generalization or abstraction (NCTM, 2000).

4  **Literature Review**

- ▶ Dion et al.'s (2001) Study of Calculator Use in High Schools
  - ▶ Sampling:
    - ▶ 4,568 mathematics department heads or mathematics teachers
    - ▶ 39% return rate (4,568 out of 11,776)
  - ▶ Research Questions:
    - ▶ Are calculators an integral part of the high school mathematics curriculum?
    - ▶ Are calculators allowed for testing in the classroom?
  - ▶ Findings: (compared to Maroney, 1990)
    - ▶ 99.9% of schools required or allowed calculators for some part of college preparatory mathematics courses, which increased by 29.9%.
    - ▶ Calculator use on tests was also reported relatively higher.

5  **Literature Review**

- ▶ Ellington's (2003) Meta-Analysis of Effects of Calculators on Students' Achievement and Attitudes in Precollege Mathematics Classes
  - ▶ Sampling:
    - ▶ 54 empirical studies from 1983 to 2002, featuring calculator use in mainstream K-12 classrooms
  - ▶ Findings:
    - ▶ Students' operational skills and problem-solving skills improved when calculators were integrated into instruction.
    - ▶ Students using calculators reported more positive attitudes toward mathematics than non-calculator counterparts.

6  **Controversies**

- ▶ Loveless and Coughlan (2004)
  - ▶ Calculator overuse would hinder students, especially at elementary level, from developing arithmetic skills.
  - ▶ However, 8<sup>th</sup>-grade students and higher could benefit from its use.
- ▶ Goldenberg (2000)

- ▶ “Allow calculator use when computational labor can get in the way of the purpose of the lesson. When learning how to perform the computation is the purpose of the lesson, calculators may be a bad idea” (p. 3).

## 7 Methodology

- ▶ Participants
  - ▶ 29 mathematics teachers from five high schools distributed over two counties in Indiana (5 department chairs and 24 teachers)
- ▶ Selection Criteria
  - ▶ High school mathematics teachers who taught Algebra I, Geometry, Algebra II, or Pre-calculus/Trigonometry

## 8 Methodology

- ▶ Data Collection and Instrument
  - ▶ Email (with survey questionnaire link) was sent to the five mathematics department chairpersons. Then they distributed the linked email to teachers for participation.
  - ▶ The survey questionnaire consisted of three sections:
    - ▶ (1) Demographic information (items 1-6)
    - ▶ (2) Calculator use in instruction (items 7-12)
    - ▶ (3) Calculator use in assessment (items 13-15)
- ▶ Data Analysis
  - ▶ Quantitative data were analyzed using descriptive statistics to describe general tendencies about mathematics teachers’ calculator use.

## 9 Research Questions

- ▶ To what extent do high school mathematics teachers use calculators in instruction?
- ▶ To what extent do high school mathematics teachers use calculators in assessment?

## 10 Findings

## 11 Findings

## 12 Findings

## 13 Findings

## 14 Findings

## 15 Findings

## 16 Findings

## 17 Discussions

- ▶ RQ1: To what extent do high school mathematics teachers use calculators in instruction?
  - ▶ Most school policies either required or allowed calculator use in instruction with different emphasis.
  - ▶ Scientific calculators were *required* with more than 50% (52%-74%) of teachers’

reporting, whereas such requirement was less seen for graphing calculators. Even so, graphing calculator were *allowed* with high percentage, ranging from 47% to 94%.

- ▶ In line with school policies, teachers reported relatively higher use of scientific calculator in instruction *at least half the total of class periods* (18%-48%) *and almost every class period* (22%-64%) and relatively higher use of graphing calculator only *occasionally* (29%-53%).

## 18 Discussions

- ▶ RQ2: To what extent do high school mathematics teachers use calculators in assessment?
  - ▶ Most school policies either allowed (36%) or partially allowed (61%) calculator use in assessment.
  - ▶ Teachers reported relatively higher requirement (30%-90% of test items) of scientific calculator in Algebra II (72%) and Precalculus/Trigonometry (84%) assessment, given overall test items requiring its use in all four areas.
  - ▶ The findings also indicated relatively higher requirement (30%-90% of test items) of graphing calculator in Algebra II (26%) and Precalculus/Trigonometry (60%) assessment, yet its use was reported less than 30% or none by most teachers in Algebra I and Geometry.

## 19 Implications

- ▶ School policies on calculator use are crucial to teachers' integration of calculator into instruction and assessment.
- ▶ Types of calculator should be determined and used based on the demands and purposes of courses and tests.
- ▶ Future research may want to investigate how calculator use and students' achievement relate.

## 20 References

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