

Changes in the North Carolina Mathematics Curriculum: A Comparative Study, 1920s, 1930's with 2003

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Abstract

The purpose of this paper is to compare curriculum documents for K-12 education from the state of North Carolina from two time periods, 1920s and 2003. The historical development of the mathematics curriculum in North Carolina provides a snapshot of the shifts in mathematics teaching and learning. North Carolina, a state in the southeast of the United States, has had a statewide standard course over a period spanning more than eighty years. A document analysis of printed curriculum standards from allows a description of the mathematics concepts and tasks that were expected of students in those years. The analysis revealed stark contrasts in the focus of mathematics from a very computational emphasis to one of problem solving. The analysis also highlighted the understanding of algebraic concepts and ideas as an essential outcome of current mathematics programs.

Introduction

Curricular documents in the United States, though the country lacks a national curriculum, provide pivotal resources that guide instruction and assessment in schools. The National Council of Teachers of Mathematics provides a comprehensive view of goals and expectations for students relative to five content strands: number and operations, measurement, data analysis and probability, algebra, and geometry (NCTM, 2000). This document also includes five process strands: problem solving, reasoning and proof, communication, connections, and representation. Our discussion will focus on mathematics standards constructed to guide the teaching and learning of mathematics at the state level. While acknowledging the influence of such national efforts, the focus of this study is to conduct a content analysis of curriculum standards for one state to provide a micro-level description of the conceptual and structural differences found in the documents. The results will describe major shifts in mathematics teaching and learning and provide an important historical context for the current priorities.

Research Design

Selection of documents was based primarily upon availability. Though the state of North Carolina has used a standard course since 1899, copies of such documents were not readily available even through a search of state historical archives. The current curriculum document was created in 2003 and though changes are proposed, such changes will likely not become instituted for several years due to financial limitations faced by governmental agencies in the current financial uncertainty.

This study employed qualitative document analysis procedures involving emergent and theoretical sampling of documents, development of protocols for systematic analysis, and constant comparative processes to clarify themes, frames, and discourse (Altheide, Coyle, DeVriese, & Schneider, 2008). This dynamic process allowed the researchers to identify themes and issues in the curricular documents across different periods of time.

Results

Computation as the Fabric of Civilizations

A striking contrast in the documents is the place given to computation in the early curriculum documents. The value and focus given to skills related to computation in the earlier curriculum documents is best illustrated in a discussion of the "Cardinal Principles of Secondary Education," (NC Department of Education, 1935) for principle II "Relation to the Command of Fundamental Processes." The principle includes the "Ability to compute accurately and with reasonable speed. Without this ability on the part of the people generally, civilization would relapse into barbarism" (p. 172).

The 1923 NC document title *Course of Study: Arithmetic* reflects the overarching importance of computation in the mathematics preparation of students in elementary through secondary school. One of the aims and principles of the program of study is "to develop habits of skill and accuracy in computation as well as the power to reason out problems he is apt to meet in everyday life" (p. 293). Initially, the mention of problem solving appears promising, until the next principle suggests that the "knowledge of facts and processes necessary to interpret and solve problems – to apply arithmetical knowledge to the solution of problems of his own everyday experiences as well as the types of problems in ordinary business transactions." Even in grade seven, arithmetic is seen as an "accurate means for measuring, clarifying, and understanding ... a vital means for accurately solving problems arising in the daily life" (p. 331). Current standards documents present a divergent view of arithmetic. Current perspectives emphasize the development of 'number sense' though there is still some

emphasis on developing fluency (NCDPI, 2003) though the document reflects a movement away from set procedures to an emphasis on understanding multiple strategies. The philosophy reflected in the current standards is that:

The early grades focus on building a strong understanding of number and fluency with mathematics to solve problems. Fundamental to these skills is knowledge of number facts, the computational processes, and the appropriate use of each operation. Together with an emphasis on using mathematics to solve problems, elementary students will build a depth of understanding enabling them to apply the content in a variety of contexts. (NCDPI, 2003, p.4)

The 1930's emphasis on computation is woven throughout the curriculum for students through secondary school. Arithmetical power is identified as one of the objectives for secondary students. Included is the ability "to read and understand numbers, to use accurately and with a moderate degree of speed the fundamental processes with whole numbers, and common and decimal fractions... to determine the number of figures to be retained in a computation, and to estimate the approximate results of a problem" (NCDE, 1935, p. 175). The current standards present a different set of priorities related to number for high school students. Objectives included for developing number sense for the real numbers are defining and using irrational numbers, comparing and ordering, using estimates of irrational numbers in appropriate situations. Also emphasized is developing flexibility in solving problems by selecting strategies, using mental computation, estimation, and calculators or computers as well as paper and pencil (NCDPI, 2003).

Problem Solving: Moving from Procedure to Process

Another major distinction in the documents from the two time periods was the treatment of problem solving. Such differences are highlighted by Hiebert et al. (1997) who argued that reform in mathematics curriculum and instruction should be based on an emphasis of having students problematize the subject. Such an emphasis would emphasize problems solving rather than the mastery and application of skills.

Algebra: The New Milestone for Mathematics Proficiency

The third major finding from the document analysis was the major emphasis on algebra in the current standard course of study and the absence of goals or objectives related to algebraic content in the earlier documents.

The colossal transformation to a mathematics curriculum where algebra holds a place in the core foundation of mathematics is clearly visible in the current report from the National Mathematics Advisory Panel ([NMAP], 2008) who identified algebra as a primary concern in terms of difficulties students experience with learning mathematics. The panel further posits that algebra is the gateway for later mathematics achievement, completion of formal courses in algebra is tied to later individual economic productivity, and that a formal course in algebra should be required of the majority of students before they leave middle school. The NMAP also argued that whole numbers, fractions, and particular aspects of geometry and measurement are the critical foundations for studying algebra and provided a list of topics that should be included in algebra.

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