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Summary of the Dissertation (Summary of Dissertation Contents)

論　文　題　目
Dissertation title

EXAMINING VENEZUELAN SECONDARY SCHOOL MATHEMATICS TEACHERS' STATISTICAL KNOWLEDGE FOR TEACHING: FOCUSING ON THE INSTRUCTION OF VARIABILITY-RELATED CONCEPTS

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The fundamental role that statistics has in today's knowledge-based society is unquestionable. Given this, it is by no means surprising the incorporation of several statistical contents into the school mathematics curriculum at all levels—particularly at secondary school—by the recent curricular reforms that have been carried out in many countries. In the case of those statistical contents studied in secondary school mathematics—all of them related to the idea of variability—, they are likely to be the last exposure that many students will have to statistics, and then it is expected that a big proportion of those students will develop their statistical literacy skills, knowledge base, attitudes and beliefs about statistics from these courses. Thus, given the general agreement among specialists in the field of statistics education that acknowledgement, understanding, explanation, and quantification of the variability in data is fundamental to statistical literacy, and due to critical role played by secondary mathematics teachers in the promotion of statistical literacy among their students, it is natural the importance to conduct research on secondary mathematics teachers' professional knowledge to teach variability-related concepts, as an important first step in making any future improvement in the teaching and learning of statistics at any school level.

Despite all the aforementioned facts, there is a scarcity of studies focused on the professional knowledge entailed by teaching variability-related contents at secondary school. This is particularly true in the case of Venezuela. In order to deal with this gap in the literature, a research having the following main objectives was performed:

・ To propose a conceptual framework for *statistical knowledge for teaching*—henceforth SKT, the professional knowledge needed to carry out effectively the work of teaching statistics—, aiming to examine the professional competencies—i.e., professional knowledge and affective-motivational characteristics—held by secondary mathematics teachers to teach variability-related contents.

・ To examine the knowledge base of SKT held particularly by Venezuelan in-service secondary school mathematics teachers, using a survey designed on the basis of the framework proposed in this research.

In order to develop a conceptual framework for SKT, an extensive literature review was conducted at first, aimed to identify several components that are agreed to be potential indicators of teachers' professional competencies for teaching statistics from the viewpoint of variability. From this review, eight traits were identified; two in the affective domain—*conceptions of variability* and *statistics-related beliefs*—, and six in the cognitive domain—*statistical literacy*, *specialized content knowledge*, *horizon content knowledge*, *knowledge of content and students*, *knowledge of content and teaching*, and *knowledge of content and curriculum*. Moreover, twelve indicators associated to the latter six traits—two per trait—were identified and listed, in order to provide a comprehensive assessment framework for teachers' professional knowledge to teach variability-related ideas at secondary level. The consideration of not only six cognitive traits simultaneously, but also of teachers' conceptions and personal beliefs on statistics teaching and learning—which have been highlighted to have an inextricable relation with teachers' knowledge and curriculum implementation—, is an original feature of this framework, which cannot be found within any of the few frameworks of SKT proposed to date.

Based on the conceptual framework previously outlined, a pen-and-paper instrument was developed. Such instrument, designed to be completed in one hour, was comprised of a task addressing—by comparing the histograms of two distributions—many variability-related ideas present in the secondary school mathematics curriculum. This task was accompanied by seven SKT-related questions, aimed to elicit and gather information about each one of the eight traits indicated previously.

The next phase of the research was carrying out the survey on a purposive sample of 53 Venezuelan in-service secondary school mathematics teachers working in the metropolitan area of Caracas, who were asked to anonymously and voluntary fill in the designed questionnaire between July and September 2012. After carrying out the survey, a qualitative analysis of the collected answers was made, using as assessment framework the aforementioned twelve indicators related to SKT. This analysis provided a comprehensive picture of the current state of Venezuelan secondary school mathematics teachers' knowledge base on SKT, conceptions of variability, and beliefs about statistics teaching and learning. Moreover, the analysis of the gathered data revealed a number of strengths and weaknesses of the surveyed teachers to effectively teach variability-related concepts in the area of descriptive statistics, as well as interesting relations among and within the cognitive and affective-motivational characteristics considered in this study. In addition, specific issues regarding the secondary school mathematics curriculum—at both intended and implemented levels—were identified; theoretical, methodological, and practical implications of the study findings were discussed; and recommendations for the systematic improvement of the statistical knowledge base for teacher education and the professional development of mathematics teacher educators regarding statistics in Venezuela were offered, based on all the information that emerged out of the aforementioned data analysis.

In its current form, the framework for SKT proposed here can provide a fair qualitative characterization of in-service secondary school mathematics teachers' SKT related to the instruction of statistics, in particular, variability-related contents. However, this study has the following limitations: (1) the developed survey instrument only deals with variability-related contents in the area of descriptive statistics, leaving aside probability and sampling, the other important statistical areas considered in secondary school mathematics; (2) prospective teachers were not included in the present study.