

# Political challenges for the implementation of research knowledge as part of educational reforms and mathematics textbooks

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*This paper reports an exploratory study of political factors that may influence the implementation of research knowledge in the formulation of educational reforms and mathematics textbooks in Mexico. The study is based on the analysis of an in-depth interview with a key informant, who has extensive experience as a textbook author and as an advisor in the Ministry of Education of Mexico. Two instances are identified in which there is an effort to implement research knowledge from the field of mathematics education in the study programs or the mathematics textbooks. The factors that appear to have hindered the implementation of such research knowledge are also identified.*

*Keywords: Implementation research, educational policy, mathematics textbook research.*

## Introduction

The implementation of any educational innovation is shaped by political factors. There are studies in the field of mathematics education that illustrate aspects of the interaction between policy and the implementation of innovations in mathematics instruction (Krainer, 2021; Prytz, 2021). These studies highlight the importance of having a better understanding of the political factors that influence the implementation of innovations in mathematics education. Lester (2018) notes that politics is centrally important to implementation for at least two reasons: First, it creates the legal authority, funding, and other capacities that are needed to implement a program effectively. Second, politics does not stop when a law has been enacted. It continues throughout the implementation process.

The importance of recognizing the political in implementation research has been pointed out by some educational researchers. McDonnell and Weatherford (2016) mention that there is little evidence in educational research about the political dynamics of implementation. However, it is also acknowledged that a problem with this empirical focus is that much of the political action takes place far from the public eye, making its analysis complicated. Thus, the study of the political factors that may shape the implementation of educational innovations tends to be elusive.

This paper reports on an exploratory study that focuses on identifying political factors that have the potential to shape the content of educational reforms, in particular the content of mathematics textbooks that are officially authorized for use in the lower secondary education system in Mexico. This study is based on the analysis of an interview with an experienced mathematics education researcher, who has extensive experience as a mathematics textbook author but also has an academic advisor to the Ministry of Education of Mexico (in the following called the ministry).

## Background and study aim

One of the main concerns of the TWG23 has been: how can we bring into practice the accumulated research knowledge produced within the field of mathematics education? (Jankvist et al., 2017). Addressing this concern implies acknowledging the existence of factors that influence the enactment of any educational innovation, but it also entails recognizing that some of these factors may be political in nature. The studies by Krainer (2021) and Prytz (2021) illustrate aspects of the intricate interrelationship between the implementation of innovations and policy.

Krainer (2021) refers to the IMST (Innovations in Mathematics and Science Teaching), which is a project triggered by Austria's modest performance in the TIMSS advanced mathematics and physics achievement test of 1995, and with the aim of fostering innovations and improving teaching and learning at secondary schools in Austria. Through the analysis of this project Krainer asserts that in the implementation of large initiatives such as the IMST project “*policy, research, and practice* need to be regarded as influential and closely interrelated communities regarding implementation.” (2021, p. 1185, emphasis in the original). In turn, Prytz's (2021) historical investigation provides evidence on how the role of researchers and the procedures that they followed for preparing three Swedish major development projects in mathematics education—the New Math project (1960–1975), the PUMP project (1970–1980), and the Boost for Mathematics project in (2012–2016)—, co-varied with the shift from centralization to decentralization that happened gradually in school governance policy from the mid-1970s to the 2010s.

The study reported in this paper addresses TWG23's expressed concern: ‘how can we bring into practice the accumulated research knowledge produced within the field of mathematics education?’, but placing special emphasis on the political factors that may influence the implementation of such research knowledge. Thus, the aim of this research study is *to identify possible political factors that influence the implementation of research knowledge produced within the field of mathematics education, as manifested in educational reforms and mathematics textbooks in Mexico.*

The empirical data for this study consists of an in-depth interview with a mathematics education researcher with a history of collaboration with the ministry as a textbook author and advisor. To make sense of the information contained in the informant's narration, some notions related to the politics of implementation were used. These notions are introduced in the following section.

## Conceptual framework

The Oxford Advanced Learner's Dictionary define *politics* as “the activities involved in getting and using power in public life, and being able to influence decisions that affect a country or a society”. This definition conforms to the conception of ‘politics’ used in this study. However, we are aware of the existence of early efforts to formulate a notion of ‘implementation politics’:

Implementation politics is, I believe, a special kind of politics. It is a form of politics in which the very existence of an already defined policy mandate, legally and legitimately authorized in some prior political process, affects the strategy and tactics of the struggle. (Bardach, 1977, p. 37)

Political scientists such as the previously cited Eugene Bardach (1977) and Pressman and Wildavsky (1973) are pioneers in the study of implementation as part of policy processes. In the field of

educational research, McDonnell and Weatherford (2016) take these early works as a reference to argue that politics permeates the implementation process, but they also warn about the importance of distinguishing between the politics of enactment and the politics of implementation, as a first step in integrating the analysis of political sustainability into implementation research.

The *politics of enactment* refer to politics that come into play during the process in which a policy or reform is configured and becomes official. The *politics of implementation* refer to the process of translating a policy or reform into educational practice. McDonnell and Weatherford (2016) pinpoint three cross-sectional characteristics to identify political factors “that influence whether a policy option gets on decision makers’ agendas and is eventually enacted” (p. 235), namely: (1) the time frames and (2) the decision venues for policy design and enactment as compared with those for implementation; and (3) the interest-based coalitions active during each phase. Table 1 shows a comparison of how these three characteristics can be manifested in the politics of enactment and in the politics of implementation.

**Table 1: Comparison of how the time frame, decision venues and interest-based coalitions can be manifested in the politics of enactment and in the politics of implementation. Taken from McDonnell and Weatherford (2016, p. 235)**

Comparing the Politics of Enactment With the Politics of Implementation		
	Enactment	Implementation
Time frame	<ul style="list-style-type: none"> <li>• Episodic; proposals on and off the policy agenda, sometimes over long periods</li> <li>• Proposals modified as policy problems and political coalitions change</li> <li>• Once on a decision agenda, proposal passed or rejected quickly</li> </ul>	<ul style="list-style-type: none"> <li>• Continuous process, typically over several years or longer</li> <li>• Variation comes from different interpretations, not changes in formal provisions</li> <li>• Long time frame for implementation may be bad politics</li> </ul>
Decision venues	<ul style="list-style-type: none"> <li>• Contained within one or two venues, with clearly defined decision rules</li> <li>• May be visible only to policy elites</li> <li>• Information available from a limited number of well-known sources</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple venues, with considerable variation</li> <li>• Many small decisions by implementers aggregate to become agency policy</li> <li>• Information typically diffuse and anecdotal</li> <li>• Localized, varied, and unpredictable policy feedback</li> </ul>
Interest-based coalitions	<ul style="list-style-type: none"> <li>• National interest groups dominate the process</li> <li>• Enactment coalitions and resulting policy create incentives for whether winners and losers remain mobilized postenactment</li> </ul>	<ul style="list-style-type: none"> <li>• State and local affiliates and grassroots groups often have incentive to mobilize</li> <li>• Groups active during enactment may modify issue position</li> <li>• Interests may support or oppose the policy by attaching other policies and political issues to it</li> </ul>

The notions contained in this section were used to give meaning and structure to the narration provided by the key informant who participated in this exploratory study. The characteristics of this key informant and other components of the research method are discussed in more detail in the next section.

## Method

The exploratory research reported in this manuscript uses as source of information an in-depth interview with a key informant with extensive experience as an author of mathematics textbooks and as an educational advisor. In the following sections we provide details about this key informant and the interview conducted.

## **The key informant**

Key informant refers to the person with whom an interview about a particular organization, social program, problem, or interest group is conducted. According to Fetterman (2008), key informants “are individuals who are articulate and knowledgeable about their community. They are often cultural brokers straddling two cultures” (p. 477). The importance of brokers in the development of national mathematics curricula has been acknowledged, as they are individuals who “act as conduits for introducing elements of one practice [research] into another [mathematics teaching]” (Potari et al., 2019). They are insiders that typically provide information through in-depth interviews and informal conversation, and their experience is important to assess their quality as a source of information.

The key informant participating in this study is a broker. He is an experienced mathematics education researcher who has 20 years of experience as a mathematics textbook author. He has also been part of disciplinary commissions invited by the ministry, which provide advice on the disciplinary content that should be included in the national educational reforms and the study programs. For 36 years he has held a researcher position in a mathematics education research department in Mexico City. The key informant was emphatic in clarifying that he knows first-hand most of the information provided in the interview, however, he also acknowledges that there is part of the information that he knows second-hand through third parties directly involved in the process.

## **The interview and its analysis**

As mentioned before, an in-depth interview was used as a research instrument for this study. It was carried out on September 3, 2021 via Zoom, and lasted 1 hour and 10 minutes. The two authors of this paper participated in the interview. There was no script for the interview, but rather an informal chat between the three people involved. Before starting the interview, an attempt was made to communicate to the informant the purpose and meaning of the research study. The interview was recorded for later analysis.

A tape-based analysis (Onwuegbuzie et al., 2009) was applied to the interview recording. Here the researchers first became familiar with the data—by listening to the interview repeatedly—in order to identify the parts of the interview that provide information about the political factors that may influence the implementation of research knowledge produced within the field of mathematics education in mathematics textbooks. This procedure was applied independently by each of the authors of the study. Subsequently, a meeting was organized between the researchers to exchange their views on which moments of the interview provided relevant information for the study. These key moments of the interview were identified and agreed upon through a discussion among the researchers. The results of this analysis are presented in the next section.

## **Results**

The interview with the key informant was rich in information. Through the analysis of his account, it was possible to identify a structure that interrelates different political actors involved in the design of the study programs for primary and lower secondary education in Mexico, which are official documents from which the mathematics textbooks are derived. The analysis of the interview also allowed us to identify two instances in which there is an effort to implement research knowledge from

the field of mathematics education in the study programs or the mathematics textbooks. The factors that appear to have hindered the implementation of such research knowledge were also identified.

Next, the structure that interrelates different political actors involved in the design of the study programs for secondary education in Mexico is presented, which will be used as a reference to illustrate the two instances in which there is an unsuccessful effort to implement research knowledge from the field of mathematics education.

### **The political structure underlying the development and establishment of study programs**

When planning an educational reform, the ministry is in charge of producing the *study programs* for secondary education. Study programs are guiding documents aimed mainly at teachers from all over Mexico, which contain the topics that must be covered for each discipline—including mathematics—, as well as the teaching approaches that must be used to communicate them. These study programs are the foundation for developing the textbooks. For the ministry to approve the national use of a mathematics textbook, it must adhere to the contents and procedures expressed in the mathematics study program.

According to the key informant, there are different groups of stakeholders involved in the configuration of the study programs. There are *disciplinary commissions*, which are groups of specialists from different areas of knowledge who act as counselors to the ministry about the contents and approaches that should be reflected in the study programs. There are also the *teachers' associations*, who through workshops and consultation forums obtain previews of the potential contents of the study programs, and express their opinions to the ministry about them. In turn, the ministry considers these opinions to define the study programs.

When the study programs are approved they are published and made available to the public<sup>1</sup>. It is then that *textbook writers*—sponsored by publishing houses—can read, interpret and translate the ideas of the study programs into their textbooks. These textbooks must be evaluated and approved by *expert evaluators*, which are scholars hired by the ministry to verify that the textbooks adhere to the authorized study programs.

### **Unsuccessful efforts to implement research knowledge—and hindering factors**

The analysis of the interview led to the identification of two instances where there are unsuccessful efforts to implement research knowledge from the field of mathematics education. These instances are named: (1) it is important to include probability as part of the mathematics education of primary school students, and (2) it is necessary to distinguish between a 'problem' and an 'exercise' when adopting a problem-solving approach. The following sections illustrate what each of these instances consisted of, and what are the factors that seem to hinder their materialization.

(1) *It is important to include probability as part of the mathematical education of primary school students.* The informant recalls an educational reform in 2009, in which the ministry decided to remove the teaching of probability from the study program for primary education—indeed, the 2009

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<sup>1</sup> The current study programs are available at <https://www.planyprogramasdestudio.sep.gob.mx> (information in Spanish).

study program for primary education in Mexico does not include the teaching of probability (see Secretaría de Educación Pública, 2009). However, research suggests an intuitive approach to the teaching of probability where children start from their intuitive ideas related to chance and probability. There are also recommendations related to understanding and applying basic concepts of probability for children in Grades 3–5 (see Batanero et al., 2016). Our key informant—at that time a member of the disciplinary commission for mathematics—was part of the opposition to this measure. He considered it inappropriate and in opposition to world trends in probability teaching.

Informant: When I was participating [in the disciplinary commission] I said that this could not be, that this was an issue that did not correspond to what all countries did. Rather, all countries incorporate probability from the beginning of primary school, and we did not have probability throughout primary school! [...] In fact, I invited Carmen Batanero to give some talks there at the ministry and I had discussed this issue with her. And she mentioned that it did not seem like a good idea that probability was not in elementary school.

Despite the opposition, the teaching of probability was not included into the study programs. The informant identifies teacher associations as a possible obstacle in the incorporation of probability teaching in primary school. According to the informant, the teaching of probability was postponed to the middle school level on the argument that primary school teachers have many difficulties in understanding probability and therefore were not well prepared to teach the topic.

Informant: What was the justification for this? X told me [he mentions a ministry official] that it is because the teachers did not understand probability. They had complained that they did not know what to do, and that is why it was removed. I think that was a very strong decision that it was due to the teachers' complaints in the different workshops.

Instance (1) serves as an illustration of the politics of enactment that can take place during the configuration of a study program or curriculum. It illustrates how decision venues are reduced—only some selected individuals have access to the configuration of the study program—, but it also shows the existence of interest-based coalitions (such as mathematics teachers and their associations) that can hinder the enactment and implementation of research knowledge due to various reasons, such as the lack of adequate mathematical knowledge for the teaching of certain topics.

(2) *It is necessary to distinguish between a 'problem' and an 'exercise' when adopting a problem-solving approach.* In the educational reform of 2011, the study program for lower secondary education indicated a problem-solving approach to the teaching of mathematics. The analysis of the interview suggests that the lack of clear guidelines on what it means to adopt a problem-solving approach in a mathematics textbook, is a factor that seems to minimize the fidelity and homogeneity of implementation of a problem-solving approach to mathematics textbooks.

According to the informant, the study program contains only general guidelines on how instruction should be, and these guidelines are primarily aimed at teachers. The lack of clear and specific guidelines for the preparation of textbooks opens a space for different interpretations of the study program. Writers should interpret the study program and translate it into a textbook, hoping that their interpretation matches that of the expert evaluators (for their book to be approved by the ministry) and that of the mathematics teachers (for them to purchase the book).

An illustration of this is our informant's interest in having his textbooks clearly distinguish between an 'exercise' and a 'problem', as suggested by the fundamentals of problem-solving in mathematics education (e.g., Schoenfeld, 1985). However, implementing this distinction in his textbooks may have negative consequences. For instance, the informant thinks that his textbooks are not popular among mathematics teachers, precisely because they include actual problems and not exercises, which makes his textbooks more difficult for teachers and students to use.

- Informant: I, for example, think that my textbooks are difficult for students and teachers [...] Because I try to pass on mathematical messages like the ones that are promoted... For instance problem solving. I try to make the problems actual problems in the sense that research says, that is, they are situations that the student will not know how to solve from the start, and that they may have to make an effort to solve it. Well, just that idea makes the textbook that I write different from other textbooks where for them [the other authors] a problem is an exercise.
- Interviewer: It is easier for the teacher to use this second kind of book than yours.
- Informant: Exactly, exactly.

Instance (2) illustrates aspects of the politics of implementation as experienced by a textbook author when trying to implement research ideas as part of the contents of a mathematics textbook. The textbook author who participated in this study claimed to receive diffuse and non-explicit information about the specific contents of the textbooks, which requires interpretation. However, the author's interpretation of the specific contents may be in opposition to the interpretation of the expert evaluators who have an influential opinion on which books are authorized by the ministry.

## Conclusion

We have tried to illustrate the potential of the concepts of "politics of enactment" and "politics of implementation" to illuminate the intricate relationships between the implementation of innovations in mathematics education and politics. These theoretical notions bring to the fore the issue of political sustainability into implementation research. In particular, this theoretical framework allowed identifying and situating two political factors that may influence the implementation of research knowledge from mathematics education: (1) interest-based coalitions —such as mathematics teachers and their associations, and (2) issues of (mis)communication within decision venues. It would be necessary to analyze other implementation experiences to corroborate the potential of this conceptual framework for the uncovering of the intricate relationships between implementation initiatives and politics.

We are aware that the empirical method used in this study—which is based on an in-depth interview of a single key informant—may have some reliability issues. However, it is possible to enhance the rigor and reliability of this method. One way to do this is by increasing the number of key informants, and trying to corroborate and triangulate the consistency of their testimonies and interpretations. Another possible strategy is to use the "respondent validation" technique where the interviewee is asked to assess whether the researchers are accurately interpreting their experiences that were the focus of the study.

Our intention is to continue and expand the study reported here, interviewing more key informants (brokers) and implementing strategies to enhance the rigor and reliability of the research method.

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