Evaluation of Norway's 2020 Curriculum Reform using PISA Data

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Project Proposal

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Introduction and Rationale

The curriculum revision (*fagfornyelsen*) in 2020 (K20) marks a major change in how students are taught in Norway (UDIR, 2020). It was the first time a substantial reformation of curricula was implemented since the 2006 reform (*kunnskapsløftet* 2006, K06). In mathematics, one major change was the establishment of core elements (*kjerneelementer*) across all curricula spanning from Year 1 to 10. These core elements, namely, inquiry and problem solving, modelling and applications, reasoning and argumentation, representation and communication, abstraction and generalisations, and mathematical domains, to a large degree resemble the PISA mathematics framework (OECD, 2018)—both share genesis with the eight competencies firstly proposed by Danish mathematician and educator Mogens Niss (Niss, 2003; Niss & Højgaard, 2011, 2019).

The implementation of the core elements in K20 and their close alignment with the PISA framework provides a golden opportunity to study Norwegian students' learning outcomes using one cycle of PISA *before*, and one *after*, the introduction of K20. Since mathematics was the major domain in PISA 2012 and once again in 2022, these two time points may serve as the pre-test and post-test in an "experiment" with K20 being the "treatment" (Shadish et al., 2002). Two factors, however, complicate this quasi-experimental interpretation. First, K20 was implemented *concurrently* with the COVID-19 school closures and the resultant home schooling. Separating effects attributable to the pandemic from those of K20 is therefore a chief task in this project. Second, PISA employs a cross-sectional rather than longitudinal design, limiting any causal inferences. Yet, PISA data sets, and especially when combined with Norwegian register data, are the best data sources available in Norway to study the effect of K20.

Mapping students' knowledge, understanding and skills within these core elements, in particular, *problem solving*, *modelling* and *reasoning*, is important for students, teachers, and curriculum evaluation purposes. First of all, an in-depth understanding of students' mastery of these key capabilities would provide insight into their command of 21st Century skills (OECD, 2018, p. 31). Secondly, teachers may also benefit from a clearer understanding of competency demand (Pettersen & Nortvedt, 2018), a pedagogical factor shown to be associated with learners' outcomes (Pettersen & Braeken, 2019). Lastly, since its initial introduction into the Norwegian school curriculum in K06, *competencies* and the ability to communicate one's knowledge and skills in a context, have been further elevated towards the work of Niss in K20. It is therefore important to examine the consequences of these policy shifts for students and to build on previous examinations of competency-based pedagogy (Pettersen & Nortvedt, 2018).

Overall Aim and Research Questions

In this PhD, I wish to address this knowledge gap and the need to [insert more] through this overarching aim: To examine students' competencies within the core elements of K20 with specific focus on problem solving, modelling and reasoning using primarily PISA 2012 and 2022 data.

This aim can be operationalised through the following research questions:

1. What is the alignment between (a) PISA 2012 and 2022 mathematics framework and (b) the mathematics curriculum of K20?

2. How have students competencies in the core elements of K20, especially *problem solving*, *modelling* and *reasoning*, changed from 2012 to 2022, and what characterises these changes?

3. Are changes in students' achievement related to changes in the curriculum of K20, having controlled for the pandemic effects.

Theoretical Framework

The Norwegian Education System

Norway follows the Nordic education model characterised by qualities such as social justice, equity, equal opportunities, inclusion, education for all, and nation building (Imsen et al., 2017). Young Norwegians are expected to complete seven years of primary schools (*barneskole*) followed by three years of lower secondary schools (*ungdomsskole*), typically reaching 15 years of age upon completion. Students may then choose to either continue academic pathways through upper secondary schools (*videregående skole*) in order to enter universities, or to undertake vocational education in training schools (*fagskole*). PISA's targeted population of 15-year-old learners happens to match young Norwegians' completion of their lower secondary schooling, making comparison with register data particularly desirable.

Norway's Recent Curricular Changes

Over the decades, Norway has experienced multiple reforms to school curricula. Since the 1997 expansion of compulsory education into ten years, the old-school knowledge-based practices (e.g. *puggeskole*, learning by heart) have given way to a more competence-based curriculum where *communication* of knowledge and skills, as well as *applying* them in different contexts became important (Imsen et al., 2017). The major reform of K06 firmly established *competence* at the centre of modern-day curriculum design, a trend reaffirmed by the recent K20.

Mathematical Competencies

Mathematical Modelling

Mathematical Reasoning and Argumentation

Problem Solving

Methodology

Data and Sample

The present study will primarily use data sources from the Program for International Student Assessment (PISA). PISA is a major international large-scale assessment project conducted by the Organisation for Economic Co-operation and Development (OECD) every three years that aims to assess 15-year-old students' literacy in reading, mathematics and science, with one literacy being the main focus in each cycle. Mathematics served as the major domain in 2012 and 2022, giving stakeholders significant insight into mathematics teaching and learning around the globe. PISA uses the two-stage sampling procedure and rotating booklet design to produce multiple plausible values (five for the 2012 cycle and ten for 2022) to represent candidates' competency (Rust, 2014). Statistical analyses often need to accommodate complex design features by incorporating weights, scalings and the hierarchical data structure. Although differ in wording, both the 2012 and 2022 PISA framework for mathematics recognise the interrelated aspects of process, content and context (OECD, 2013). The process aspect refers to an individual's capacity to formulate situations mathematically, then to employ mathematical concepts, facts, procedures, and reasoning to interpret, apply and evaluate mathematical outcomes (OECD, 2013, p. 28). The 2022 framework, furthermore, highlighted the mathematical reasoning and problem solving elements of the process aspect, and introduced 21st Century skills into the context dimension in recognition of youth as consumers of quantitative, sometimes statistical, arguments (OECD, 2018).

Methods of Analyses

Articles

Article 1

Article 2

Article 3

Article 4

Progress Plan

I submit the following table summarising my proposed PhD progression:

Table 1

PhD Candidacy Time Frame

Milestone	2022H	2023V	2023H	2024V	2024H	2025V	2025H	2026V
Coursework	✓	✓	✓	✓	✓			
Align K20 and PISA	✓	✓						
Merge with register data	✓	✓						
Article 1		✓	✓					
Article 2			✓	✓	✓			
Article 3					✓	✓	✓	
Article 4						✓	✓	
Kappe								✓

Note. H (*Høst*) = Autumn semester; V (*Vår*) = Spring semester.

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