Towards a sociological explanation of the success of the Back to Basics movement in Sweden, 1970–1980

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Abstract

In this paper we seek to understand how and why the Back to Basic movement could have success in Sweden in the 1970s. The case is a state sponsored research and development project (PUMP) whose results had impact on popular textbooks. The study concerns the development process leading up to the implementation, but also the implementation phase. The analysis has a sociological perspective and involves Bourdieu's concept of capital. Our material is interviews with key people involved in the PUMP-project. The main finding is that social capital, rather than academic and financial capital, appears to have been important in the development process. We also discuss how this finding can be used in future research

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Introduction

Back to Basics is often used as a label for the reactions that followed on New Math reforms, launched in several countries in the 1960s and 70s (cf. Herrera & Owens, 2001, p. 87; Malaty, 1988, pp. 57–58; Irvine, 2021, pp. 8–9; Schoenfeld, 2007, p. 542). It is an authentic label in the sense that it was used by the proponents of the reaction. Their common denominator was a wish to focus teaching on procedural skills in arithmetic and algebra, this in contrast to the New Math reforms' explicit emphasis on understanding and mathematical structures, not least structures related to set theory. Apart from this, the Back to Basics rhetoric also involved an extensive use of standardised testing (Fey & Graeber, 2003, p. 541). However, these shared desires of going back could go in different directions or programs as Fey and Graeber (2003, pp. 538–546) note in the US case. Thus, it is more appropriate to talk about a Back to Basics movement rather than a specific program.

As for Sweden, we know from previous research that the Back to Basic movement gained a foothold in the National Board of Education (*Skolöversyrelsen*, NBE) just some years after the launch of the New Math reform. This launch was done in connection to the 1969 national curriculum reform. In practice, this foothold resulted in a supplementary national curriculum document, published in 1973, emphasising arithmetic skills and downplaying the role of set theory. The very same year, a five-year research and development project

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concerning teaching and learning arithmetic, algorithms in particular, in school year 1 to 6 was started, financed by NBE (Prytz et al., 2022, p. 244–246). The name of the project was PUMP, which stands for *Processanalyser av Undervisning i Matematik/Psykolingvistik* (Process analysis of teaching in Mathematics/ Psycholinguistics). To great degree, PUMP also concerned diagnostic testing. The study presented in this paper concerns the PUMP project. For further details about PUMP, see the Background section.

Our previous research about PUMP (see Prytz et al., 2022) indicates that innovations developed in the project were picked up by authors of popular textbooks right after the end of the project in 1977, but also that it remained in popular textbooks well into the 1980s. The fact that the textbooks were popular indicates that the innovations reached the actual teaching. Thus, it is reasonable to consider it a success. In Prytz et al. (2022), we also sought to explain why the innovations could reach popular textbooks on the basis of implementation research theory (for further details see section *Background and previous research*).

In this paper, we expand this explanation as we ask why PUMP could succeed in developing sustainable innovations that reached popular textbooks. To answer this question, we now have looked closer at the preparation of PUMP and present some further empirical findings about the implementation process. We have applied a sociological perspective. Using Bourdieu's concept of capital, we have asked the following questions:

1) What types of capital did the PUMP people have and how much?
2) What was the significance of this capital in creating and implementing innovations?

The relevance of studying PUMP and the Back to Basic movement in Sweden lies in the fact that the period of 1980 to 1995 was a successful time for Swedish mathematics teaching, at least if we consider results in international large-scale assessments (ILSA). And the best results were achieved in arithmetic, which was the focus of PUMP. Perhaps it is time to recognize that Back to Basics did bring positive things to mathematics education and seek explanations as to why that could happen. This stands in contrast to how Payne (2003, p. 590) characterises the aftermath of New Math in the USA; according to him, the 1970s was the worst decade in the history of mathematics education, much due to the dominance of Back to Basics.

Theory and method

To achieve change in a school system is difficult, not least if you think of changes that are supposed to concern a majority of schools, teachers, and students. In their overview on implementation research, Century and Cassata (2016) identify a great number of factors that can influence attempts to create and implement innovations in education. These factors range from the nature of the innovations, over organisation, to underlying societal structures.

In this study, we focus on organisational matters, more precisely how and why the leading people of PUMP could manage school administration and bureaucracy.

In order to do so, we apply Bourdieu's capital theory and Broady's operationalisation of it (Bourdieu, 2000; Broady, 1991, 2002).

We understand capital as something that is an asset for a group of people. There are different types of capital, like financial assets and academic assets (including education), which are more easily distinguishable when they come across as amounts of money and academic degrees. But of course, there are also less observable aspects of academic capital such as a reputation of being trustworthy. On the other hand, trustworthiness is not detached from academic degrees, since both require scientific achievements. Another type of capital is the cultural, which can be for instance cultural habits and taste. A third type is social capital concerns a person's networks and connections with people. Family can of course be a part of this, but it includes all sorts of connections with other people.

Just as people can have different amounts of financial capital (money), she or he can have different amounts of the other types of capital.

Moreover, there are relations between the capitals, for instance higher educational degrees (academic capital) can return higher salary (financial capital). Social capital can also return academic capital when for instance a young inexperienced researcher has good contacts with more senior and experienced researchers which can help the young researcher to accumulate more academic capital. Large amounts of capital of some sort can also give influence and authority when interacting with other people.

In our analysis we have been interested in three types of capital: financial, academic, and social capitals.

As to academic capital, we have considered academic degrees and scientific publications. Here it is important to recall that the point of recording academic degrees is to better understand how people managed to operate in the educational system. If a person has much academic capital (e.g., full professorship and a very long list of well-cited publications), she or he has quite different possibilities to act and convey people in comparison with for instance a school teacher with long teaching experience. Observe that we do not use academic degrees to make inferences about the quality of the PUMP innovations. The fact that the PUMP innovations found its way into popular textbooks, and furthermore remained there for a long time, speaks for itself in that respect.

Our empirical material has been interviews with the two leading innovators and researchers on the PUMP project, Wiggo Kilborn and Bengt Johansson. Also, Göran Emanuelsson was interviewed. He was not directly involved with the PUMP project, but had a position at the NBE's bureau for development of mathematics education. He also managed the journal *Nämnaren* (the Denominator), intended for the Swedish mathematics education community and other people interested in mathematics education (e.g., teachers, teacher educators, researchers, and policymakers). These three informants were deliberately chosen because they possessed unique knowledge and insights into the project. They are thus called *key informants* (Parsons, 2008) with extensive experience of the PUMP project.

Emanuelsson and Johansson were interviewed on December 2, 2021. The interviews lasted about one hour each. Kilborn was interviewed on January 13, 2022 for about 1.5 hours. The interviews were thematically semi-structured (Kvale, 1997) around the following themes:

1. Background of the PUMP project
2. Implementation of the PUMP project
3. What happened with the results after the PUMP project
4. The identified factors of influence in the implementation of the PUMP project

Since Kilborn and Johansson are well-known as the innovators of the PUMP project, at least in the Swedish mathematics education context, and Emanuelsson is a well-known editor of *Nämnaren*, there is no possible way to truly anonymize the informants. Therefore, we obtained approval to publish the informants' names in any publications that used data from the interviews. The informants were given the opportunity, to read and approve their statements before publication. The interviews were conducted together by the first and second authors, Prytz and Ahl. Drawing on the principles of Powell et al. (2003) for analysing video and audio data, the interviews were audio-recorded, and all parts were transcribed verbatim to Swedish. The translations to English were made by the first author. Data came from different time points in the three interviews. The material was used as a narrative source to construct a description of what the PUMP innovators actually did.

As to the choice of theory, a common argument for applying Bourdieu's capital theory is that it can bring understanding or insights concerning driving forces, but also that it connects individual actors with general structures. By identifying what capitals people accumulate, how it is useful to them, and which structures that makes the accumulation possible, we can understand a dynamic that influences people in certain directions. This is of interest when you want to make explanations about reform processes.

Our ambition in that respect, in this paper, is very modest. Hence, the title of this paper: *Towards a sociological explanation* … . We use only a small part of Bourdieu's theory. For instance, we leave out the field concept which concerns the relations between different types of capitals, but also the relations between different groups of people. In the end of the paper, however, we elaborate a bit about how an explanation can be developed.

Background and previous research

As mentioned, the Swedish New Math reform was launched in 1969. Only a few years later, the NBE received reports about poor student results, in arithmetic in particular. The immediate response to this was to produce a supplementary national curriculum document, published in 1973, emphasising arithmetic skills and downplaying the New Math ideas, especially those connected to set theory. This document was entitled *Basfärdigheter i matematik* (Basic Skills in Mathematics). In addition to arithmetic, it also focused on lifting the results of low performing students. A key element in that effort was to identify a core course in mathematics that also the low performers should master. The more able students should of course learn beyond that (Prytz et al., 2022, pp. 245–246).

Concerning the reports to NBE on poor student results, there are several data supporting that claim. However, there were variations, with poorer results in particular in school years 7 to 9. And there are data indicating somewhat improved results already in 1974 and 1975 (Prytz, 2018, pp. 206–208). Anyhow, the NBE had valid arguments to act.

A second step of NBE was to finance a research and development project dedicated to arithmetic in school years 1 to 6. The project was placed in the Department of Education at Gothenburg University and ran between 1973 and 1977. This was the PUMP project and it was supposed to solve some of the problems that had been identified during the production of *Basfärdigheter* … (Prytz et al., 2022, pp. 244–245).

The concrete aim of PUMP was to develop a diagnostic material in arithmetic for school years 1 to 6. This would enable the teachers to get a better picture of their students' knowledge in arithmetic and to provide guidance when designing the teaching for each student. Hence, individualisation was an important idea. The supposed innovative feature of the material was that it should have high precision and be easy for teachers to use (Prytz, 2021, p. 1040).

The development of the diagnostic material included several research components. The teaching process was thoroughly analysed by using audio recordings of teachers and students. The analyses concerned what content the students met and what were the possibilities for learning. Extensive studies of textbooks and the national curriculum, which was very influenced by New Math, was also made, which resulted in extensive critique. Both textbooks and curriculum documents were considered badly constructed with respect to how concepts and algorithms were introduced and the sequencing of tasks; in many cases, the progression was deemed too steep. The latter left many students behind, the PUMP people argued (Prytz, 2021, p. 1041)

An important part in the research studies and the development of the diagnostic material was the creation of so-called matrices, one for each arithmetic operation, see Figure 1 for example.

The matrices described in which order the students should encounter different types of tasks in arithmetic. Each cell represents a type of task and the entries (bottom and right side) specify the properties of the types of tasks. The pedagogical principle of the matrices was that when a student for the first time encountered a new type of task (number AB), then the student must have trained and automatized the knowledge and skills needed to solve all types of tasks in the cells above and to the left of the cell AB. This entailed that teaching could not proceed too fast; the students had to solve a number of tasks from each cell in order to automatize knowledge and skills (Prytz et al., 2022, pp. 249–250).

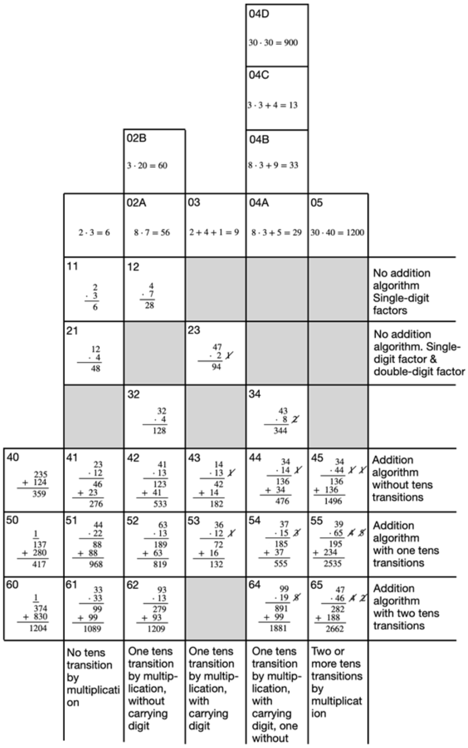

Figure 1. The PUMP matrix for multiplication

The scientific foundation of this was George A. Miller's theory on working memory capacity and its significance for learning. In some of the reports about PUMP (e.g. Johansson, 1975; Kilborn, 1979), there were references to a Swedish translation of Miller's book *The psychology of communication* (Miller, 1969). According to Miller's theory, the working memory has the capacity of handling, in average, seven pieces of information at the same time. If a person is in a situation where more pieces of information have to be handled, the working memory is overloaded, which hampers learning. Transferred to arithmetic and the PUMP matrices, each new cell means that students must handle an algorithm, computations, tens transitions, or carrying digits in a new way, which is handled by the working memory. In order not to overload the working memory, the knowledge and skills needed to solve the tasks of the preceding cells have to be automatized (Prytz, 2021, p. 1041; Prytz et al., 2022, pp. 249–251).

Apart from Miller's theory, the matrices were designed on the basis of empirical trials where students solved a number of tasks. The tried hypothesis was that the type of tasks in a cell AB should have lower solution frequencies, in average, than all other types of tasks in the cells above and to the left of AB. If that was not the case, the matrix was revised (Prytz, 2021, p. 1041).

When PUMP ended in 1977, it had resulted in a diagnostic material and a great number of research reports. And at that time, the NBE probably did not think it should be more than that; there were no plans or resources to implement the PUMP results and the critique of textbooks and curriculum. In fact, our interviews indicate that the critical attitude in some of the PUMP reports did not land well in the NBE.

However, the leading people at PUMP thought differently. In the years that followed, they engaged in what can be called informal implementation, which they did in part from positions within or linked to NBE. Through several channels, which they partly created themselves, they were able to reach teachers and textbook authors with the results from PUMP. The channels used were courses for active teachers, articles in teachers' journals and presentations at teacher conferences. The leading PUMP people also wrote their own textbooks, which came out on the market soon after the project ended. The PUMP people also had contact with other textbook authors (Prytz et al., 2022, pp. 276–278).

As the 1980 curriculum reform was planned, the PUMP people were involved in the writing of the mathematics curriculum as well as the considerably more verbose commentary material, published in 1982. In the latter there was a direct reference to the PUMP reports (Prytz et al., 2022, pp. 245, 273–274). The fact that there was a clear sequencing of the arithmetic in the 1980 mathematics curriculum and in the commentary material is not surprising (cf. Prytz, 2020, p. 24). It is likely that this dimension of the curriculum originates from the PUMP project.

These changes appear to have left an impression on teaching, in fact even before the 1980 mathematics curriculum took effect. A study of popular textbooks published in the periods of 1970–1973, 1977–1980 and 1984–1993 indicates that the textbooks published already in the period of 1977–1980 had changed in accordance with the PUMP project's critique of textbooks. Both the criticism and the changes were about sequencing, more precisely types of calculation tasks, their degree of difficulty, and their order. And these changes seem to have largely remained in the later period (Prytz et al, 2022, p. 275–276). The fact that it is a question of popular textbooks indicates that the PUMP results were widely disseminated. And it seems reasonable that the teachers obtained textbooks to use in teaching and that the students were then faced with the sequences of tasks that PUMP had resulted in.

The circumstance that the change seems to have started even before the new curriculum came into effect can be explained by the fact that the informal implementation started soon after the PUMP project had ended. Both teachers and textbook authors could be reached by the results. Since the PUMP people authored their own textbooks, other authors had a competitor who showed what a textbook series designed according to PUMP's guidelines could look like and what the teachers thought of it.

In Prytz et al. (2022, pp. 276–280), we explain the successful implementation of PUMP by using Coburn's (2003) theory of scaling. Apart from highlighting an underlying demand for something different and simpler after New Math, the explanation follows two strands. One strand concern what Coburn calls "shift in reform ownership", which means that teachers embrace the innovations and use them after the implementation phase. This shift was facilitated by reaching teachers and textbooks authors through several channels at the same time, see above. The second strand concerns the nature of the innovations and that they did not challenge teachers' and textbook authors' beliefs about mathematics teaching. Using Coburn's concept of "depth", we argue the PUMP innovation had little depth as they were focused on certain sequences of different types of arithmetic tasks, rather than radical and broad changes of teaching practices. This too facilitated a "shift in reform ownership", we argue, but also improved the "sustainability" of the innovation. According to Coburn the latter is about getting the innovation to remain in teaching practice.

It is also important to see that the design of the PUMP project as a whole, but also the innovations, followed a general trend regarding school governing policy; a trend from centralist to decentralist governance. About the same time the New Math reform was launched, the idea of centralist governance started to be severely questioned within the Swedish state apparatus. And the New Math reform was very much a production of centralist governance. It was a grand reform as it concerned all school years 1 to 9 and it took aim at both content (whole courses) and teaching methods. Moreover, the reform was prepared in one science-like eight-year project where a completely new curriculum and completely new types of textbooks were developed. Finally, New Math was to be implemented nationwide through the national curriculum reform of 1969, accompanied by the existing mandatory textbook review that forced publishing companies in the same direction. The PUMP was in many respects the opposite of this. It was of a smaller scale as it focused on just arithmetic in school year 1 to 6. Even though the PUMP project resulted in precise guidelines concerning the sequencing of tasks, there were no guidelines regarding how to teach. Furthermore, much of the communication with teachers happened through voluntary courses (Prytz, 2021, pp. 1043–1045).

Analysis, part 1: Scarce financial and academic capitals

PUMP was a smaller project in the sense that it just concerned arithmetic and school years 1 to 6. On the other hand, we should not forget that arithmetic was and still is a very large part of school mathematics in school years 1 to 6. We can compare this to the New Math project which concerned the whole mathematics curriculum and all school years 1 to 12. Moreover, PUMP ran for five years, while the preparations of the New Math continued for eight years. The numbers of people involved were also very different (Prytz, 2021, pp. 1039–1041). Hence, the financial budget for PUMP was much smaller than the Swedish New Math project.

PUMP was financed by the NBE. From our interviews, the financial resources appear to have been scarce. Mainly three people were involved in the work of developing the innovations we are interested in; that is the diagnostic material and the matrices; doing the field studies; and authoring reports. This was also the centrepiece of PUMP. These people were Kilborn, Johansson, and a secretary. Funding for salaries were, however, just enough for two full positions. It appears Kilborn and Johansson shared one position and the secretary had the other. The work as secretary also involved doing research assistance, for instance transcribing audio recordings from a great number of field studies.

As to the implementation of PUMP results, there were no predestined financial resources for it, which adds to a conclusion about scarce financial resources.

In comparison, the ending of the New Math project continued with a planned process of authoring the actual curriculum documents, which was administered by the NBE. Thus, parts of the regular financing of the 1969 curriculum reform were used to implement New Math in Sweden. And when something was in the national curriculum, the financial resources allocated to the mandatory national textbook review kicked in. The national textbook review board, established in the late 1930s, had to approve all textbooks before they could be used and they checked for compliance with the national curriculum. Moreover, the NBE also financed an in-service training in New Math for teachers, the so-called Delta project (for further details see Prytz, 2018, p. 198–202).

Important to note here is that the mandatory textbook review in mathematics and some other topics disappeared in the 1970s. Thus, when the PUMP people actually got some of their innovations into the national curriculum of 1980, the textbook review was a weaker instrument for pushing textbook authors to adopt their innovations.

Regarding the academic capital, it must be considered low if we count academic degrees at the start of PUMP. The scientific leader of PUMP was Ulf P. Lundgren, then a fresh PhD in Education and with a successful academic career and a great number of publications ahead of him. Much of the actual work in PUMP was done by Kilborn and Johansson. Both had a degree as upper secondary school teachers in mathematics. Kilborn, the somewhat older of the two, had a position as teacher in Gothenburg teacher college. He actually had Johansson as a student. In the teacher college, Kilborn took part in the efforts of creating a mathematics department. Later on, Johansson also joined the teacher college staff. In connection to the PUMP project, Kilborn started as a PhD graduate in Education.

We can compare this to the leading people of the Swedish New Math project. The leading person (Lennart Sandgren) had a PhD in mathematics. Matts Håstad, the executive leader, had a PhL in mathematics.[1] And among the group of experts we find several professors and associate professors, both in mathematics and education (NKMM 1967, pp. 220–222).

Despite this scarcity of academic and financial capital, the PUMP people managed to develop and successfully implement their innovations.

[1] A PhL (Philosophie Licentiate) is a Swedish academic degree between Masters degree and PhD.

But not only that, they did this while being in conflict with leading people of the NBE, our interviews reveal. One of the PUMP reports was very critical about the process of preparing curriculum reforms. Another one was critical about current textbooks. A third displayed poor student results. These reports also got media attention. This did not sit well among some of the leading people at the NBE and they rejected some of the conclusions in the PUMP reports. Despite this, the PUMP people managed to get involved in the authoring of the mathematics curriculum of 1980 and the commentary material.

So, how could this happen? We believe the answer lies in large amounts of social capital.

Analysis, part 2: Large amounts of social capital

One thing that stands out in the interview material is the number of contacts, not least the number of different types of contacts, the PUMP people had. This we see as large amounts of social capital. Below, we will describe further what this capital consisted of, how it was acquired, and in what respect it was important when innovations were developed and the latter implemented.

In the development phase, the PUMP peoples' connection to the Department of Education in Gothenburg seems to have been important. A key figure in this context was professor Urban Dahllöf. Around 1970, Dahllöf had his scientific breakthrough in the field of education. His curriculum theory, later known as frame factor theory, received a broad and positive reception, also outside Sweden (Broady, 1999, pp. 112–114). The importance of Dahllöf's theory became great in Sweden; even one of the more critical commentators, Broady (1999, p. 112), uses the label "canonical" as he describes the influence of Dahllöfs' theory in Sweden.

Between the PUMP people and Dahllöf there were two connections. One was that Lundgren, as PhD candidate, was supervised by Dahllöf. Lundgren's research concerned the frame factor theory, which he also developed in his dissertation and later works. Broady (1999, p. 112) also sees the works of Lundgren as essential in the canonisation of the frame factor theory in Sweden. The other connection was that Dahllöf supervised Kilborn's candidate thesis in Education, the interview with Kilborn reveals. It was also in connection to this, Kilborn got to know Lundgren.

> [Kilborn:] I started studying pedagogy in my spare time and it was in that way that I then came into contact with Urban Dahllöf and it was about when I wrote my three-grade essay so, so, so Urban Dahllöf lit up, so it matched what he was interested in. ... At the same time as this, I then clearly came into contact with Ulf P Lundgren, with whom I worked with, with Urban Dahllöf

For the creation of PUMP, the contacts with Dahllöf were significant both financially and scientifically. According to Kilborn, it was not possible to get research funding at the teacher college in Gothenburg where he was working. So, being attached to the Department of Education at Gothenburg University opened up such possibilities. But knowing Dahllöf was probably extra important since he had good contacts at the NBE, Kilborn tells us; it was through Dahllöf the NBE funding of PUMP was secured.

> [Kilborn:] … and it was also in that way, that Urban Dahllöf had very good contacts at the National Board of Education. So we were up there and talked to people at the National Board of Education, there were no problems I got the money straight away.

From a scientific perspective, Dahllöf and the research environment around him at the Department of Education appears to have been important for PUMP in two ways.

First of all, the scientific approach of PUMP took shape in critical discussions of the PhD thesis of Lundgren (1972), which to great degree had mathematics teaching as a case. Kilborn's critique, in brief, took aim at Lundgren's very thorough analysis of what happened in the classroom and teachers' communication with the students.

> [Kilborn:] At the same time as this, I then clearly came into contact with Ulf P Lundgren, who I worked with, with Urban Dahllöf and I saw, I have studied his, his thesis work and I was involved and helped a little with, with the data there. But I then discovered that there was a very big difference between what pedagogues did when it came to research and what the need really was, at teacher level. So if we take a few points like this, that, what Ulf studied it was actually communications, like language games and he, he what is it called, is often attached to Wittgenstein in that case and you can then say that much like in most of the American research that took place at the same time, so mathematics was a case, you could direct it to anything, now you chose mathematics, but the problem is for those who are mathematicians at bottom, it thus becomes quite obvious that you can thus as, as an pedagogue then not determine whether what is being taught is relevant or not, and that's what I wanted to get at.

Kilborn argued that Lundgren's analytical categories were not specific to the taught mathematical content, which caused ambiguities as to how the content was relevant for learning. This is something the PUMP people tried to sort out. As to methodology, there were clear similarities between PUMP and Lundgren's PhD thesis. For instance, reliance of cognitive theories (but not exclusively), focus on sequencing, large amounts of data from classroom observations and quantitative methods, even though the quantitative methods of PUMP were descriptive rather than inferential. Thus, the PUMP people began their work in a context where their questions and methodology could both occur and develop in a stable way.

Secondly, Dahllöf had a broad international network, our interview with Kilborn reveals, which could be supportive for PUMP. One of many researchers that visited the department in Gothenburg was George A. Miller.

> [Kilborn:] 1900, now we'll see, 72, 1971 or 72 we had, so Urban Dahllöf had invited a man named George Miller , ... Yes, we can say that that, that, that environment that I was invited to, that, that so was absolutely incredible. For one thing, Urban Dahllöf found it quite easy to get money for projects, but he also had money left over for that kind of invitation. So that pretty much every semester we had visitors from somewhere, that is, …

Thus, the PUMP people had direct access to Miller and could discuss their use of his research findings. This probably facilitated a swifter and relevant application of Miller's theory. If we compare with Lundgren's PhD thesis, he did not use Miller's theory the way it was later done in PUMP. Our point here is that when the PUMP people needed to go outside Lundgren's previous work, they could get relevant support through Dahllöf's network.

We now turn to the implementation of the PUMP innovations. As already mentioned, the PUMP people were able to reach teachers and textbook authors through several channels, which were important for a successful implementation of PUMP innovations. This is discussed in Prytz et al. (2022). So, this type of social capital and its significance is already documented. Here we will focus on how this social capital could be created and a bit about its significance.

The important circumstance in that perspective is that Kilborn and Johansson had several positions in the educational system. They were teacher educators and Kilborn had a position at the NBE. Also, their colleague at the teacher college – Emanuelsson – had a position at the NBE, more precisely the bureau of in-service training (FBA, *Fortbildningsavdelningen*), located in Gothenburg.

In creating contacts (social capital), FBA must be considered important. According to our interview with Emanuelsson, one of FBA.s functions was to facilitate cooperation between people responsible for mathematics teaching in the teacher colleges, the regional school authorities (RSA, *Länsskolnämnder*), and the NBE.

> [Emanuelsson:] We were given a framework budget [for FBA], and when I started they increased that framework budget considerably, I think we had almost half a million. There was a lot of money at the time, for skills development initiatives, and then I came up with this idea, I was young and green and didn't really know what, what would end up with the *Nämnaren*, although it was called *Matematik aktuellt* [Mathematics Current Affairs] at the time, and the basic idea from the beginning was to bring up these discussions that existed between the in-service training consultants [of the RSAs] and the NBE, the NBE had an in-service training consultant, or a school consultant and, and obtained information from these in-service training consultants [of the RSAs], in writing and orally, and how to maintain a continuous discussion with the teacher training colleges then , it mainly applied to the class teacher lines, i.e. up to and including grade six. And, and in that way, the *Nämnaren* became a means of communication, where you described both misery and success, and eventually this developed, you may know the *Nämnaren*.

The RSAs were responsible for both in-service training and school inspection. One part in the efforts to facilitate cooperation was to start a journal dedicated to mathematics teaching, it was later on named *Nämnaren*; Emanuelsson was its first editor. Important to note here is that people from the different teacher colleges in Sweden met regularly, so did the people at the RSAs.

According to our interviews with Johansson and Emanuelsson, the RSAs were important for spreading information to teachers, but also for being invited to schools to talk about PUMP. Emanuelsson also indicated that the RSA school inspectors used the PUMP-matrices.

> [Emanuelsson:] Yes, the NBE then had both evaluation and development on their table, so to speak, they developed the curriculum they were supposed to be responsible for in-service training and national bodies so they took, they took the cue themselves so to speak, but otherwise they had this in-service training organization, The RSAs were their own authorities, although they cooperated with the NBE, they were not subordinate to the NBE. They were, and they had inspections of everything from the pots in the *bamba* [local name for school canteen], to PUMP matrices, you see.

Apart from this, the PUMP people got in contact with teachers through summer courses sponsored by the NBE, but also through articles in *Nämnaren*.

The efficacy of this network in spreading the PUMP innovations and convincing teachers about their qualities becomes visible if we consider the textbook market in the late 1970s.

Johansson and Kilborn authored their own textbook series (*Min Matematik*, My Mathematics), published in 1977, which of course was very much based on their PUMP results. Since it was published in 1977, the authoring began earlier than that. It was published by the smaller company *Stegelands*, which soon went bankrupt, however. They then transferred to another small publisher, *Biblioteksförlaget*. In 1980, that company was purchased by the major company *Natur och Kultur*.

Thus, around 1976 and 1977, the major publishing companies were not interested in investing in complete textbook series based on PUMP.

But textbook authors appear to have been interested. As shown by (Prytz et al., 2022, pp. 275–276) authors of popular textbook series did pick up PUMP innovations in the period of 1977 to 1980. Some of these series were published by major publishing companies (*Almqvist & Wiksell*, *LiberLäromedel*, and *Esselte studium*). Note that this was before the 1980 mathematics curriculum and the commentary material which was influenced by PUMP; the commentary material was published in 1982. Consequently, it was not only the national curriculum that forced the publishing companies in this direction.

Important to note here is that major publishing companies had well developed marketing divisions, which meant plenty of financial resources, trained staff, and good contacts with teachers (Prytz, 2018, p. 198). So, if they had wanted to market other types of textbooks, they could have done so.

Conclusions

In this paper we seek to understand how and why the Back to Basic movement could have success in Sweden in the 1970s. Our case is the so-called PUMP project, whose results had impact on popular textbooks. Our interest has been the process leading up to the implementation.

In the study presented in this paper, we investigated what capitals the key people involved in the PUMP project had and how much. On the basis of

Bourdieu's capital theory, three types of capitals were considered: academic, financial, and social capital. We found that the people involved in PUMP had relatively small amounts of academic and financial capital, not least in comparison to the previous New Math project. In contrast, the key people of PUMP had large amounts of social capital. More specifically, this consisted in a great number of contacts with researchers, school administrators, teacher educators, textbook authors, and teachers. Thus, it was a multifaceted kind of social capital.

We also investigated the significance of the capital in the process of creating and implementing innovations. Here we conclude that large amounts of academic and financial capital were not significant to successfully create and implement innovations. Our findings rather suggest that large amounts of social capital were significant. As to a successful creation process, we presented evidence suggesting the PUMP people's access to a rich research environment at Gothenburg University was significant. Regarding the successful implementation process, our evidence suggests the PUMP people's contacts with school administrators, teacher educators, textbook authors, and teachers facilitated a successful implementation. On the basis of our material, we further suggest that the PUMP peoples' positions within the National Bureau of Education was important for the creation of this social capital.

So, in our attempt to explain the success of the PUMP project, we suggest that social capital was a key factor, and in different ways. But there may of course have been other factors in play.

As mentioned above, we use only a small part of Bourdieu's theory for our study and our explanation. For further research it can be relevant to also involve the field concept. That part of the theory concerns how different groups of people behave on the basis of the types of capital they possess and value. This could open up for an analysis of the reception of the PUMP innovations among teachers. In that case we analyse the relation between the field of production (in this case. researchers, textbook authors, and policymakers) and the field of consumption (in this case teachers). What is being produced and consumed here is innovations in mathematics education. An interesting concept in this respect is the so-called field specific capital, which is a capital that only can be earned in a particular field. It is often a matter of getting recognition by peers. In relation to Coburn's (2003) theory of scaling, which we use in a previous study of PUMP (Prytz et al., 2022), we believe that this approach can deepen the understanding of the process where teachers embrace innovations and use them after the implementation phase. Coburn calls it a "shift in reform ownership".

Another topic for further research concerns the reception of Miller's theory about working memory in different contexts of mathematics education. As mentioned above, textbook authors and in an indirect way also teachers appear to have embraced innovations based on this theory. Our impression is that Miller's theory did not land equally well in the emerging research field of mathematics education connected to the Swedish teacher education institutions. The dominating theorists in those institutions in the 1980s was Piaget and later on in the 1990s it was Vygotsky (Fransson, 2016, p. 20–24). To be more than an impression, though, further studies are needed. Perhaps these studies also can shed light on why development efforts, sometimes, are valued differently by teachers and people in teacher education.

References

Bourdieu, Pierre (2000). *Konstens regler. Det litterära fältets uppkomst och struktur*. Stockholm: B Östling publishing house. Translation of: Bourdieu, P. (1992), *Les règles de l'art. Genèse et structure du champ littéraire*. Paris: Seuil.

Broady, Donald (1991). Sociologi och epistemologi. Om Pierre Bourdieus författarskap och den historiska epistemologin (Sociology and Epistemology. On Pierre Bourdieu's work and the historical epistemology). Stockholm: LHS förlag.

Broady, Donald (1999). Det svenska hos ramfaktorteorin (The Swedish of the frame factor theory). *Pedagogisk forskning i Sverige*, *4*(1), 111–121.

Broady, Donald (2002). French prosopography. Definition and suggested readings. Poetics, 30, 381–385.

Century, Jeanne & Cassata, Amy (2016). Implementation research: Finding common ground on what, how, why, where, and who. *Review of Research in Education*, *40*(1), 169–215.

Coburn, Cynthia E. (2003). Rethinking scale: Moving beyond numbers to deep and lasting change. *Educational Researcher*, *32*(6), 3–12.

Fey, James T. & Graeber, Anna O (2003). From the New Math to the Agenda for Action. In Kilpatrick, J. & Stanic, G.M.A. (eds.) (2003). *A history of school mathematics. Volume 1.* Reston, VA: National Council of Teachers of Mathematics, pp. 521–558.

Fransson, Ola (2016). *Lärande som policy* (Learning as policy). Uppsala: Institutet för arbetsmarknads-och utbildningspolitisk utvärdering (IFAU).

Herrera, Terese A. & Owens, Douglas T. (2001). *The* "New New Math"?: Two Reform Movements in Mathematics Education, *Theory Into Practice*, 40:2, 84–92, DOI: 10.1207/s15430421tip4002_2

Irvine, Jeff (2021). BLAST FROM THE PAST! THE NEW MATH. *Gazette - Ontario Association for Mathematics, 60*(1), 8–9.

Johansson, Bengt (1975). *Aritmetikundervisning: en rapport om en datainsamling* (Arithmetic teaching: a report on a data collection). Mölndal:

Kilborn, Wiggo (1979). *PUMP-projektet: bakgrund och erfarenheter*. (The PUMP project: background and experiences) Stockholm: LiberLäromedel/Utbildningsförl..

Kvale, Steinar (1997). *Interview – En introduktion til det kvalitative forskningsinterview* (Interview – An introduction of the quantitative research interview). Hans Reitzels Forlag.

Lundgren, Ulf P. (1972). *Frame factors and the teaching process: a contribution to curriculum theory and theory on teaching*. Diss. Göteborg : Univ.. Stockholm.

Malaty, George (1988). What is wrong with the "back-to-basics" movement, and what was wrong with the "new-math" movement, *International Journal of Mathematical Education in Science and Technology*, 19:1, 57–65, DOI: 10.1080/0020739880190105

Miller, George A. (1969). *Kommunikation och psykologi* (The psychology of communication). Stockholm: Beckman.

NKMM (Nordiska kommittén för modernisering av matematikundervisningen) (1967). *Nordisk skolmatematik*. Stockholm: Nordiska rådet.

Parsons, J. A. (2008). Key Informant. In P. J. Lavrakas (Ed.), *Encyclopedia of survey research methods* (p. 407). Sage.

Payne, Joseph N. (2003). The New math and Its Aftermath, Grades K–8. In Kilpatrick, J. & Stanic, G.M.A. (eds.) (2003). *A history of school mathematics. Volume 1*. Reston, VA: National Council of Teachers of Mathematics, pp. 559–598.

Powell, Arthur B., Francisco, John M., & Maher, Carolyn A. (2003). An analytical model for studying the development of learners' mathematical ideas and reasoning using videotape data. *The journal of mathematical behavior*, *22*(4), 405–435. https://doi.org/10.1016/j.jmathb.2003.09.002

Prytz, Johan (2018). The New Math and school governance: An explanation of the decline of the New Math in Sweden. In *Researching the History of Mathematics Education* (pp. 189-216). Springer, Cham.

Prytz, Johan (2020). Framing for success: Governance of Swedish school mathematics, 1980–1995. *Nordic Journal of Educational History*, *7*(1), 3–32.

Prytz, Johan (2021). When research met policy: A history of innovation and a complicated relationship in three Swedish development projects in mathematics education, 1960–2018. *ZDM–Mathematics Education*, *53*(5), 1035–1046.

Prytz, Johan, Ahl, Linda M., & Jankvist, Uffe T. (2022). An Innovation's Path to Mathematics Textbooks: A Retrospective Analysis of the Successful Scaling of the Swedish PUMP Project, *Implementation and Replication Studies in Mathematics Education*, 2(2), 241–288. doi: https://doi.org/10.1163/26670127-bja10005

Schoenfeld, Alan H. (2007) Problem solving in the United States, 1970–2008: research and theory, practice and politics. *ZDM Mathematics Education* **39**, 537–551 (2007). https://doi.org/10.1007/s11858-007-0038-z