

# IMPLEMENTING 'MODERN MATH' IN ICELAND – INFORMING PARENTS AND THE PUBLIC

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*'Modern math' was implemented in Icelandic schools at all levels in the 1960s. It was introduced to parents at meetings and by media articles, interviews and a television programme in 17 episodes. It is argued that the information was presented by unrealistic convictions of the quality of the 'modern math' programme, that the timing of the presentations was not optimal, and that more information was needed when the programme had reached the majority of pupils at the primary level.*

## INTRODUCTION

In the 1950s questions arose in many countries about mathematics teaching in schools. In November 1959, the OEEC (later OECD) arranged a meeting on reform of school mathematics in Royaumont, France (OEEC, 1961), whereby the reform ideas became an international movement. The dominant ideas were that the theory of sets, uniting the different branches of mathematics, commonly referred to as 'Modern Mathematics', would be the basis for school mathematics.

The 'Modern Math' movement hit Iceland in a standstill situation (Bjarnadóttir, 2006). Education Act of 1946 was to ensure compulsory schooling of all children aged 7–15 and equal access to higher education, while mathematics textbooks created in the 1920s were still in use. The legislator failed in 1946 to ensure university access for teachers and there was a serious shortage of secondary school mathematics teachers (OECD, 1961, p. 158; Bjarnadóttir, 2007, 184–192, 238–239). Research revealed that Icelandic syllabi in mathematics and science for 13–15 year old pupils, who had only eight month schooling a year, were behind those in the other Nordic countries (Björnsson, 1966). Textbook production was then, as it still is, cared for by a state enterprise, which was in a serious financial crisis at that time.

Implementation of 'modern math' in other countries have been explored, e.g. in Denmark, Norway and England (Gjone, 1983, Cooper, 1985, Bjarnadóttir, 2008). A reason often mentioned for implementing the 'modern math' was the fear to lag behind other countries in a progress towards modern society (Cooper, 1985, p. 76), also in Iceland (Sigtryggsson, 1964, p. 146). A remark from Brazil may express this:

Modern math achieved high levels of publicity, what is uncommon when one thinks about other curricular reforms. The wideness of its audience can be partly due to the fetish school mathematics was invested with, but was also related to the enthusiasm towards modernization that permeated national beliefs and minds ... The teaching of mathematics had to be modern, such as Brazil wanted and expected to be. (Búriço, 2008).

In the following a part of the implementation process will be analyzed; in particular the information offered to parents and the public. The question to be explored is “What went wrong in the implementation? Was it the publicity process? Was the timing not right, could more have been done, or was the “modern math” a cause too weak to defend? Why did the syllabus disappear completely so quickly?”

The research method is historical; searching information in newspapers, journals, leaflets, archive documents and films by the Public Broadcasting Service, and by personal communication in emails and telephone interviews.

The questions are of interest, not only to understand the past, but also for present times. Much time, effort and resources are devoted to centrally organized curriculum development for the relatively small market in Iceland, about 4000 children in a year cohort. How should the limited means be allocated? Should the main emphasis be on quality of the content by calling upon experts to review the work of authors who must accept low royalty, on the appearance, such as colours in prints etc., or on publicity and then to whom; teachers, parents, financial providers? A complete answer cannot be expected, while the study might offer some hints of relevance.

### **‘MODERN MATH’ IN ICELAND**

After the Royaumont meeting, the Nordic countries – Denmark, Finland, Norway and Sweden – established cooperation on mathematics reform, each appointing four persons to a Nordic committee for modernizing mathematics teaching, Nordiska kommittén for modernisering af matematikundervisningen (NKMM) (Gjone, 1983, II, p. 78). Information from the NKMM was transmitted to Iceland through personal contacts.

One of Denmark’s two members was Agnete Bundgaard, a primary teacher and the author of a ‘modern math’ textbook series for primary level on behalf of the NKMM. Ms. Bundgaard was the sister of mathematics professor Svend Bundgaard, the main advocate for ‘modern math’ in Denmark and a friend of G. Arnlaugsson, associate professor and high school mathematics teacher, educated in Copenhagen.

Arnlaugsson became a leader of those concerned about mathematics education. In 1964 he began acting towards implementing ‘modern math’ in Iceland together with colleagues. His activities were in several steps: In 1964 he asked to be appointed as consultant in mathematics teaching at the Ministry of Education in a half-time position to continue until 1966 (Minister Gíslason, personal communication, Jan. 10, 2002). He began to organize week-long in-service courses for teachers on the ‘modern math’ in 1965. In 1966 he published a mathematics textbook for the secondary level, *Tölur og mengi / Numbers and Sets*, on introduction to numbers, and to set theory, both novelties (Arnlaugsson, 1966). Furthermore, he pointed out the textbooks by Ms. Bundgaard to be translated and tested in seven groups in two primary schools in Reykjavík during 1966–1967.

The primary school project was planned with regular meetings of leaders of the project and the teachers, and information meetings with parents. The following spring the project was presented to school leaders, who became quite enthusiastic. By that time only the first year-course material had been finalized in Danish, the second had been tested for two years and the third was being tested for the first time (Gíslason, 1978) so it was not known how the project would proceed.

## **PUBLIC INTRODUCTION TO THE ‘MODERN MATH’**

The first presentation of the ‘modern math’ to the public was characterized by optimism. Articles were written and a television programme was made to introduce the modern ideas, to parents in particular. Later sources indicate concerns.

An interview with one of two leaders of the experiment of teaching ‘modern math’ to primary school pupils, K. Sigtryggsson, was published in 1967 in *Foreldrablaðið / Parents’ Journal*. Sigtryggsson remarked that only the teaching methods were being changed, not the content, while various topics were introduced earlier than before. Mechanical working methods had been too much emphasized at the cost of the time that teachers had available to discuss basic concepts of mathematics itself, and to train logical thinking and accuracy in presentation. It was explained to parents that their children were to have no homework (Stefánsson, 1967).

Later this year, 86 teachers attended a course to prepare for teaching the new syllabus and the majority of first grade pupils in Reykjavík primary schools were to be introduced to the new textbooks (NN1, 1968, p. 95). The leaders did not have capacity to keep in contact with all the teachers and arrange information for parents. The television programme this autumn must have been expected to reach a greater number of parents than else would have been possible.

At the time of the decision, the content of the latter part of the series was not known. It turned out to be extremely theoretical (Høytrup, p. 59). The commutative and associative laws, Roman numerals and place-value notation to the base five, prime numbers, permutation of three digits, the transverse sum and its relation to the nine times table were introduced in the third grade. Set theory with pairing, subsets, intersection and union, more place-value systems and geometry in a set-theoretical framework were added in fourth grade (Bundgaard, 1967–1972).

By April 1968, around 200 secondary school pupils gathered outside the parliament building with protest banners, claiming ‘Down with obsolete textbooks’, ‘Better teaching methods’, ‘We are not parrots’, ‘No dry-book learning’ and ‘The youth today is the public tomorrow’. The protest was peaceful and the Minister of Education, G. Þ. Gíslason, invited members of the group to his office and discussed with them for most of the day. B. Gröndal, MP, spokesman of the minister, recited this event in a semi-yearly general political radio discussion, admitting that much was needed in the school system, while listing what had been achieved in modernizing it. ‘Modern math’ was

taught widely, and the public television had brought information to parents. Television teaching was a topic of the near future, while expensive as most remarkable novelties in this area (Gröndal, 1968).

In 1970 a newspaper, *Morgunblaðið*, published an interview with the textbook author, Agnete Bundgaard, and her colleague, Karen Plum, who had come to Iceland to give a course to 65 teachers (NN2, 1970). By then the ‘modern math’ material was used in 141 classes in 1<sup>st</sup> to 4<sup>th</sup> grades in primary schools. Ms. Bundgaard said that the main emphasis was laid on promoting the pupils’ understanding of the nature of the tasks and on training them in using their own judgement in cracking their tasks and problems. The ‘modern math’ had been introduced in many countries and influenced the way of teaching mathematics. The experience of other nations pointed to that its concepts and symbols would be of great use in training pupils in clarity in thinking and communicating. The ‘modern math’, Ms. Bundgaard said,

is as a new language, totally different from the mathematics the parents of modern school-children learnt themselves. Many parents have hard time in accepting not being able to know exactly what their children are working on at school and assist them. But that can have very bad consequences for the child if its parents are trying to help, more by being willing than able to guide the child. This can lead only to confusion. Therefore it has been decided to not to assign homework to the children and even not to allow them to take their books home. However, to increase the parents’ understanding of what their children are working on, special books have been published, admittedly not available in Icelandic, where the new mathematics is explained and it should pacify the parents until the moment, when the children have reached enough understanding of the project to be able to explain to their parents what is happening there (NN2, 1970, pp. 23–24).

Ms. Plum continued that in many places the ‘new math’ had caused dispute, and that

many years will go until its advantages can be proved statistically, as all comparison is difficult. But surely the ‘modern math’ teaches children to think logically and however the world will change, logical thinking will always be necessary. Besides, children have proved to like the ‘modern math’ and they show more interest in it than do children at the same age, who learn by the old methods, and these two items weigh not so little (Ibid.)

## **THE TELEVISION PROGRAMME**

To promote the compulsory school ‘modern math’ project, Arnlaugsson gave a series seventeen 20-minutes long episodes in a television programme on school mathematics, aimed at parents and the public, in the recently established television station during October 1967–January 1968, with a break during the holiday season.

Copies of the programme do not exist anymore. All remarks on it are therefore based on memoirs. There was a tradition of adult education in languages on the public radio so mathematics on the television was a natural continuation. In this second year of the television broadcasting, over 92% of 10–14 year old children in Reykjavík and

Vestmannaeyjar reported in a sociological survey that their homes had a television set (Broddason, personal communication, Aug. 23, 2010), while the broadcasting had not reached further than the south and south-west area of Iceland.

Each episodes of the mathematics programme lasted about 15–18 minutes. It was sent out on prime time at 20:50 after news magazine every Tuesday. The author of this paper had no TV-set and could only watch a few episodes of the series, but with great interest, as a student mathematics teacher. Most owners of TV-sets at that time are now around their seventies or older, and they, or their adolescent children, are the few likely to remember the content. Referees (Bjarnason, personal communication, Aug. 28, 2010; Magnússon, Sept. 2, 2010; Gunnarsdóttir, Sept. 3, 2010) and the author of the paper, remember that the content was closely connected to Arnlaugsson's secondary level textbook, *Numbers and Sets*. The first half of the book was introduction to numbers, their divisibility, prime numbers and prime factoring, and later number notation in place-value systems to various bases, such as 6, 8 or 2. The



binary system received special attention with respect to the new computer technology. The second half of the book concerned sets and accompanying logic: definitions of set operations, open sentences, implications, negations, introduction to Boolean algebra, etc. (Arnlaugsson, 1966). The episodes focussed on one or two topics at the time.

Figure 1. G. Arnlaugsson on the TV-programme.

The programme was well presented in the newspapers. The picture in Fig. 1 was attached to the television programme in one of the newspapers with the text that Arnlaugsson's programmes had been very well received and many had expressed that they had learnt quite a lot from them. A special TV-leaflet introducing the programme remarked twice (NN3, 1967) that the episodes were excellent, Arnlaugsson was a born TV-celebrity and the explanations were clear.

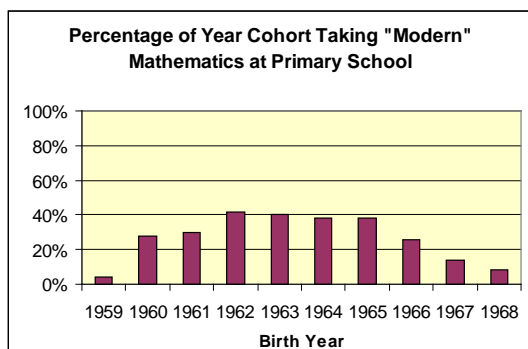
J. I. Magnússon, then 14 years, now mathematics professor, and V. Bjarnason, 15 years, now economy professor, remember that they watched the programme closely, as did their fathers, both teachers, but their mothers did not. Bjarnason remarked that he liked the base-two algorithms and the Boolean algebra, and the implications were a revelation to him. The programme had without doubt a good influence on his mathematics studies as he was preparing for an entrance examination to upper secondary school level. Magnússon and Gunnarsdóttir remember also that their elder siblings, then at upper secondary schools, were very interested in the programmes, and in general, they had a good reputation in their homes, theoretical as they were.

There were also different voices. The reporter of the foreign news magazine (A. personal communication, September 19, 2010), remembers to have had a feeling of inferiority not being able to help his children with this new math, and the managing

director of the broadcasting service (G., personal communication Sept. 23, 2010), said that the series did not appeal to him, he preferred the old math.

## REACTIONS TO THE 'MODERN MATH'

By the time of Ms. Bundgaard and Ms. Plum's visit, authorities had realized that things were going wrong, the mathematics teaching experiments in the primary schools had become far too voluminous, too difficult to run in respect to guidance to teachers, and even in a few cases close to being disastrous (R. Bjarnadóttir, personal communication, Sept. 16, 2003). A School Research Department, SRD, of the Ministry of Education had been established. It laid down a certain procedure for adopting school reforms; i.e. to set goals, write national curricula, and from there compose learning material on an experimental basis. In the crisis that had come up, the department decided in 1971 to skip the step of setting goals and writing a curriculum, and go directly ahead to create a new set of home-made mathematics textbooks within the SDR (Ísaksson, personal communication, March 10, 2003). In their final editions, sets were hardly mentioned. Enthusiasm for the 'new math' seems to have passed its peak at the primary level in Iceland before 1972.



The cohort born in 1965, entering first primary grade in 1972, was the last large cohort taking the Bundgaard material. After that authorities began gradually to pull it out, while the new state-made material was introduced after careful testing, keeping in mind the difficulties of the rapid implementation of the 'modern math'.

Figure 2: Percentage of year cohort taking Bundgaard material up

through grade 6.

H. Lárusson, a mathematics consultant at the Ministry of Education knew of the new problems but attempted to defend the 'modern math', also as he himself was writing a series as a continuation of the Bundgaard material. He wrote in the teacher journal:

Among parents, teachers and others ... there have been many discussions about a new syllabus in mathematics ... People have had very different views on this new syllabus ... There has been no general publicisation of the syllabus as a whole, nor of its goals, and this may partly cause the criticism which has emerged. This innovation became far more widespread far quicker than was planned ... (Lárusson, 1972, p. 9).

Institutes in society, such as Námsflokkar Reykjavíkur, an evening school for adults, reacted to parents' need for support and offered course for parents of children in compulsory schools (Árnadóttir, 1975).

## AFTERMATH

The home-made mathematics textbook series prepared in the early 1970s was implemented slowly and carefully. In 1976 a TV-programme on school activities, such as mathematics, was broadcasted, including an interview with a primary teacher who was very happy with the new material and the handbooks for teachers. The handbooks were an improvement from the handbooks attached to the Bundgaard series, which had been difficult, as was the material itself, and not been much used by teachers. Asked to compare to the traditional E. Bjarnason (1937) series [used up to the ‘modern math’ wave], she said that there had been no handbooks and the teachers had taught as they had been taught (Jónasson, 1976).

In December 1988, educational matters were brought up in the parliament, where M.P. Guðnason embraced a number of matters concerning compulsory school. Many reforms had gone wrong:

Who does not remember the experiment with the ‘modern math’ which has in fact meant that whole cohorts know very little in mathematics and cannot do mental mathematics? The ‘modern math’, or the set theory, is one of the most serious mistakes with great consequences that have been made in the Icelandic school-system ... it was a step forward to reuse the [1937] Bjarnason series, even if it was 25 or 30 years old (Guðnason, 1988).

Minister of Education, G. Þ. Gíslason, stayed in office during 1956–1971. He had to cope with the great increase in number of pupils in schools of the after-war baby boom and the rebellious currents in the late 1960s. In a personal communication (Gíslason, Jan. 10, 2002) he expressed a great confidence in Arnlaugsson as a school leader, but that he had doubts about his role in introducing the ‘modern math’.

A confidential source told a story of another minister in the same government, Emil Jónsson, an engineer and a renowned mathematics student during World War I, had expressed a doubt that he would be able to solve an O-level examine equivalent of the 1970s, when the ‘modern math’ had been implemented.

Not everyone had bad memories, however. Mathematics professor J. I. Magnússon wrote in necrology of Arnlaugsson on behalf of the Icelandic Mathematical Society:

His programs on the television about ... ‘modern math’ are ... unforgettable, and many people were as glued to the TV-set when they were programmed (Magnússon, 1996).

The ‘modern math’ programme at least inspired this young man and eventually led him to undertake the serious studies of mathematics.

The experience of the ‘modern math’ had a long aftermath. A governmental report on the development of education policy in European environment, dated in 2010, says:

Teaching methods must be made more attractive. This is, however, a complex matter. Thus, teaching the ‘modern math’ in the 1960s and the 1970s failed. The teaching must

connect understanding and computing, these are not contrasts. ‘Problem based learning’ must be used and begun early. (Menntamálaráðuneytið, 2010, p. 46).

And only recently a retired primary teacher remarked: “It is always the same problem in this country. We took up this material when the Danes themselves had discarded it.” (S. Jóelsson, personal communication, Nov. 27, 2010).

## **DISCUSSION**

What went wrong? The problem this time was not to take up something that other nations had discarded, as Icelanders often fear in their linguistic and geographical isolation. On the contrary, the Bundgaard material had only been finalized for the first grade and its continuation for grades 4–6 had not been created. The books for first two grades by Ms. Bundgaard and the Finnish Eeva Kytta were not too complicated, while the hardcore mathematics began to emerge in the third grade. One may clearly conclude that the consequential decision was not well grounded.

Was any serious harm done? The ‘modern math’ was an intellectual surprise to a nation which had been relatively homogeneous in most respect, educational as well as ethnical. Everyone knew the same algorithms and people who had learnt differently abroad were much scarcer than at present times. Probably some number of pupils did not learn any algorithms, but pocket calculators were coming soon. On the positive side was that teachers experienced that more mathematics could be taught to children than the four operations in whole numbers and fractions, presented in the long-lived Bjarnason series. A group of teachers began to create new material in a favourable climate of SDR, supported by all governments for more than a decade. A great lesson was learnt to avoid too great enthusiasm for hastily considered novelties. Resources were made available to choose teachers to test it and implement it slowly with proper introduction, at least to teachers.

From the quotes above it is clear that an effort was made to publicise the ‘modern math’ in the media, not without remarks that it was a part of a modernizing process, necessary to not be left behind other nations. Publicisation, such as the television programme in 1967–1968, may therefore have created too great expectations. It may not have been well timed either. Arnlaugsson’s TV programme was of help to some of the 30% of the 15-year olds preparing for an entrance examination into the upper secondary level. For parents of primary school children it might have fitted better in 1969–1970, when place-value notation to different bases, prime numbers etc. were introduced to the first great cohort, or the year after, when the concepts of set theory were implemented. And finally, Arnlaugsson was an academic, a professional mathematician, famous for his radio talk shows on the widely practiced game of chess, but his mathematics may have failed to reach the great majority.

The interview with Ms. Bundgaard and Ms. Plum, had doubtlessly the aim to inform parents and the public, now that the majority of primary school children were studying their material. However, expressions as that information in a foreign language was ‘to



pacify the parents' witness a lack of sense of the situation and respect for the parents, as well as the decision not to let the pupils bring their textbooks home as it 'can have very bad consequences for the child if its parents are trying to help, more by being willing than able to guide the child'. That, and remarks that "the 'modern math' teaches children to think logically" to a higher degree than earlier, and that parents should wait "until the moment, when the children have reached enough understanding of the project to be able to explain to their parents" witness unrealistic convictions of the quality of the programme.

Now, forty years after the eventful period of the late 1960s, a new state-made syllabus has replaced the one of the 1970s. It has not been uniquely well received. The authors have been guided by experts, while resources have not been allocated to test the material before it was sent out to the whole cohort. Many teachers have tacitly protested by photocopying the old material. In the 1960s, the Ministry of Education organized centralized week-long courses for teachers, while presently they are offered half-day meetings, if their schools choose to allocate funds for courses on such specialized subjects rather than general ones, such as class discipline. Ministers and directors of ministries have come and gone, while the ministry has no permanent staff in mathematics curricular matters. The lessons learnt from the 'modern math' of the 1970s have gradually faded out, while its failures are blown up in meaningless anecdotes.

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