KeyCoNet (2012 – 2014) is a European policy network focused on identifying and analyzing initiatives on the implementation of key competences in primary and secondary school education. It is a constantly growing network of more than 100 members from 30 countries gathering together Ministries of Education/related agencies, universities/research institutes, European organizations, and practice related partners.

On the basis of the evidence collected through literature reviews, case studies, peer learning visits, country overviews, videos and exchanges between network members, the project's final objective is to produce recommendations for policy and practice regarding the enablers and obstacles to a holistic implementation of key competence development.
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ABOUT THIS CASE STUDY

Part of a series

This case study is part of a series of case studies being produced by KeyCoNet, to highlight various initiatives concerning key competence development, taking place across Europe. Each case study analyzes the initiative’s implementation strategies in depth, and will feed into the network’s recommendations for policy and practice on how to implement a key competence approach in schools most effectively.

How and why was this case selected?

Each year the KeyCoNet network identifies initiatives concerning key competence development across Europe, and a case note is produced providing basic information about each one. Following this, network partners participate in an online selection according to pre-established criteria, as well as an in-depth face-to-face discussion, in order to select the most interesting initiatives to develop into case studies. This Irish case was of particular interest to the network because of its system wide approach and its recent implementation in post-primary schools. This curricular reform in the development of mathematical competences set out to change the mathematics learning experience of all students age 11-18 in formal schooling. Following a review of post-primary mathematics education in 2007, the National Council for Curriculum and Assessment (NCCA) prepared a strategy, Project Maths, for the phased implementation of syllabus change in mathematics over a four-year period from September 2008. The main changes being introduced were the shift to the development of mathematical competences, the contextualisation of content, the change in teachers’ beliefs about mathematics, teaching and learning approaches and the evaluation of student comprehension. The challenges encountered around the implementation of this new approach to mathematics education in schools are interesting and the case study provides the opportunity to learn more about those implementation challenges.

Which methodology has been used?

Case studies are the main tool used by the network to probe beneath the surface of each selected initiative and provide a rich context for understanding the implementation issues involved. The initiatives selected by the network differ in many ways, according to the nature of the key competences addressed, the implementation process used, the number of students and teachers directly concerned, the type and number of actors involved, and the duration and stage of development etc. A multiple-case study design, whereby each initiative generates its own case study, but uses one single prism for a common analysis, was therefore chosen. This method makes it possible to explore diversity, as well as the enablers and obstacles to the initiative’s implementation, as perceived by the initiators and stakeholders interviewed. Moreover, through a multiple-case study design it is possible to identify choices, strategies, characteristics, situations or contexts leading to success or failure in a recurrent manner. This will particularly contribute to fuelling the set of recommendations for policy and practice at institutional, local, regional, national and European level, for the effective implementation of key competences in school education.

Each case study included interviews with the initiative’s coordinators and stakeholders, as well as desk research. In some cases, where considered feasible and fruitful, focus groups were also organized.

A representative sample of key stakeholders was chosen to give a broad perspective on this initiative. These included a Director in charge of Project Maths from the NCCA, a member of the mathematics inspectorate from the Department of Education and Skills, a representative from the State Examinations Commission, a representative from the teacher professional development team, the chair of the Board of Studies for Mathematics who oversaw the developments and a focus group of teachers which included a member of the NCCA syllabus development committee. A total of six interviews were conducted. A number of reports were used throughout this research which are referenced in the appropriate sections.
## BASIC INFORMATION

<table>
<thead>
<tr>
<th><strong>Country:</strong></th>
<th>Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title of initiative:</strong></td>
<td>Project Maths</td>
</tr>
<tr>
<td><strong>Coordinator/ Organization:</strong></td>
<td>National Council for Curriculum and Assessment (NCCA)</td>
</tr>
<tr>
<td><strong>Key competences addressed:</strong> (in original language and in English where possible):</td>
<td>Mathematical proficiency and the five key skills of the NCCA Framework of Key Skills (senior cycle) are also embedded in the curriculum. These are: information processing, communicating, being personally effective, working with others, and critical and creative thinking.</td>
</tr>
<tr>
<td><strong>Type of initiative and channels used for implementation (e.g. curriculum reform introduced through legislation etc.):</strong></td>
<td>Curriculum reform at lower and upper secondary level</td>
</tr>
</tbody>
</table>
| **Partners:** | National Council for Curriculum and Assessment (NCCA)  
Department of Education and Skills (DES)  
State Examinations Commission (SEC) |
| **Scope:** (student/teacher/school level; local/regional/national) | National |
| **Learning context:** (formal or non-formal) | Formal |
| **School education levels:** (primary, lower secondary, upper secondary) | Lower and upper secondary |
| **Target groups:** | All students of mathematics in secondary schools |

### Time frame: (start and end date)
- September 2008 in an initial group of 24 schools (phase one schools)
- September 2010 in all other schools (non-phase one schools)
- Ongoing

### Relevant links:
- [www.ncca.ie/projectmaths](http://www.ncca.ie/projectmaths)
- [www.projectmaths.ie](http://www.projectmaths.ie)
SUMMARY

Following a review of post-primary mathematics education in 2007, the National Council for Curriculum and Assessment (NCCA) prepared a strategy, Project Maths, for the phased implementation of syllabus change in mathematics over a four-year period from September 2008. This change involved the review of mathematics syllabuses at both junior cycle and senior cycle and a complete change in the approach to the teaching and assessment of mathematics.

The focus has been on the development of mathematical competence, while the five key skills (communicating, working with others, critical and creative thinking and information processing and being personally effective) have also been embedded in the curriculum.

Beginning with an initial 24 (phase one) schools, the Project Maths initiative was unique in Ireland in that it placed teachers at the centre of the curriculum development process. Teachers’ experiences and feedback informed refinements and subsequent revisions as the new curriculum was being rolled out. This initiative has now been mainstreamed in all Irish schools.

Project Maths can be summarised as the desire to allow students to learn mathematics by thinking mathematically, particularly in concrete, real-life situations. The biggest changes were the contextualisation of content, the change in teachers’ beliefs about mathematics, teaching and learning and the evaluation of student comprehension.

1. CONTEXTUAL INFLUENCE

Which contextual factors have been perceived as enablers to the implementation of the initiative and why?

Recognition by all stakeholders that something needed to be done to raise the mathematics standards in Ireland was seen as an enabler to the Project Maths initiative. This recognition was brought about by a series of reports and studies that highlighted undisputed problem areas in mathematics education in Ireland.

The united front and the collaboration between policy stakeholders also played a significant enabling role:

- National Council for Curriculum and Assessment (NCCA)
- Department of Education and Skills (DES)
  - Maths Inspectorate
  - Teacher Education Section (TES) (includes the Project Maths Development Team)
- State Exams Commission (SEC).

Traditionally these various bodies have worked relatively independently, with a linear progression: NCCA prepares the syllabus, DES implements, and SEC examines. This linear progression and limited coherence in policy development was cited as a possible obstacle to previous reform initiatives.

we had changed the Junior Cert Syllabus some years before that and it hadn’t particularly resulted in a change in approach to learning. That might be because the assessment didn’t quite reflect the intended approach to learning in maths [interviewee].

Introducing the initiative in a representative sample of 24 schools was regarded as a significant enabler, as was the fact that the initiative was a post-primary one not limited to junior or senior cycle. The allocation of a Regional Development Officer (RDO) to the phase one schools meant they received intensive support over five years. Teachers in these schools engaged in a higher level of debate about mathematics, teaching and learning. Inspectors report that the use of the resources developed was considered more effective in these phase one schools and a culture of collaboration within the maths department in these schools is now well established. Their experiences informed the mainstreaming or national roll out.

Which contextual factors have been perceived as obstacles to the implementation of the initiative, and why?

The fact that mathematics was the only school subject being reformed

Despite the recognition that something needed to be done to raise mathematics standards, the system was not ready for the significant change required by the student-centred connectionist model of learning proposed by the Project Maths initiative. This new model challenged the traditional transmission approach to education prevalent in second level Irish classrooms with its strong allegiance to ‘teacher exposition’ and student ‘drill and practice’. It required a reconceptualization of mathematics, teaching and learning by all the stakeholders in mathematics education: teachers, students, parents, inspectors, examiners, text-book authors and those with an interest in the STEM agenda from both third level education and industry. A change in mind-set was required, from a view that mathematics education is a teacher-centred endeavour with teachers covering a fixed body of knowledge in a linear way with their students, to a view that it is about challenging students and engaging them with an interconnected body of ideas and reasoning processes collaboratively with their teacher and peers. This reconceptualization proved to be a significant challenge and an obstacle to the success of the initiative. Mathematics teachers and students felt isolated and wondered why so much was being asked of them. Students were finding it difficult to adjust to the new approaches to learning mathematics and complained how unlucky they were to be in that year. Mathematics teachers were feeling under severe pressure, and reported spending every waking hour thinking about mathematics.

The pervasive emphasis placed on the high stakes Leaving Certificate examination

This was probably the biggest obstacle constraining reform efforts. Although the emphasis of the initiative was on the development of mathematical proficiency, teachers were having difficulty seeing beyond getting the students through the exam and they perceived mathematical proficiency as procedural fluency:

..really teachers at the end of the day, we look to the exam. You can have as many aspirations as you want to for teaching maths that’s [the exam] at the end of the day is what we are judged on by our students and parents. So we have to think of that ......it doesn’t matter how you tell us not to think of that we will think of it. [Mathematics teacher comment]
Seeing their role in this way, as that of exam coach, places mathematical authority with the exam looming in the future rather with teachers themselves. Positive aspects of the reform such as the closer alignment of the assessment with the syllabus aims are viewed negatively by teachers. Teaching reasoning and problem-solving skills significantly challenges teachers used to preparing students for what they feel is a predictable examination. It puts additional time pressure on those who feel they need to cover all eventualities and teachers lack confidence in their students’ ability to solve problems that they have not covered in class.

Then the fear factor, were you covering it [the syllabus] to the depth that was required? What else do we have to cover? I’ve done this I’ve done that and next thing something else comes up [in the examination]. [Mathematics teacher comment]

It was reported by a representative from the DES that there is a fear that as more examination questions become available teachers may become proficient at gaming the examination and the initiative will have been successful only in moving from one type of teach to the test to another.

This emphasis on examinations also leads to the perception that there is a lack of information, we just don’t know what is on [the examination]. Teachers view the syllabus through the lens of the previous examination and find it vague and unhelpful:

I know the syllabus was there but it is limited in the information that it provides. [Mathematics teacher comment]

Teachers and students, look then to third party texts and past examination papers for messages about teaching and learning.

It was noted that the developments under way at junior cycle with its emphasis on learning and key skills development and a move away from high stakes testing in all subject areas will help teachers greatly with their reconceptualization of mathematics teaching and learning.

Changes at junior cycle assessment will have a huge beneficial effect they [teachers] can spend time in 1st year and 2nd year teaching through a different lens... [DES inspector comment].

Photo 1. Teachers facilitating collaborative classwork (St Mark’s Community School).
2. Substance Related Issues

Which substance related issues have been the most difficult ones to fix when deciding on the content of the initiative, and why?

Rebalancing content and skills

The removal of content to make way for the development of skills such as reasoning and problem solving was heavily criticised by some in 3rd level institutions involved in the delivery of courses with a significant mathematical component. A paper critical of the initiative was published by the mathematics department in UCC and was the subject of significant media attention. In Ireland grinds or private tuition, to supplement schooling, is a lucrative business and those involved in this industry, added their voice to the media criticism. This negative media attention fuelled by misinformation was distressing for students, teachers and parents. They reported panic which had a negative impact on the initiative. In an effort to ameliorate this negative media interest the NCCA published a paper Project Maths: Responding to Current Debate and embarked on a series of information sessions in 3rd level institutions nationally to provide accurate information and to address the criticisms.


Introducing the new mathematics simultaneously at junior and senior cycle

The decision to introduce the initiative simultaneously in both junior cycle (1st year) and senior cycle (5th year) was not regarded favourably. *If it had been introduced just in first year it would have been much easier. In hindsight that simultaneous introduction in first and 5th year was a great obstacle to the acceptance of it [Project Maths].* [Mathematics teacher comment]

The revised syllabuses at senior cycle build on students’ experiences in junior cycle. It was identified in the phase one schools that students engaging with the revised syllabuses at senior cycle for the first time needed an element of backfill in order to be ready to embark on the new material. The NCCA acknowledged this issue by deferring some of the material at senior cycle until those coming through from junior cycle had experienced the revised material.

Introducing the curriculum strands in phases

Each syllabus document comprised five curriculum strands which were introduced over three phases. The phased implementation of the curriculum strands did not support the reconceptualization of mathematics. Professional development workshops tended to focus only on the strands being implemented at the time and textbooks presented the material in discrete strands and did not make the connections within mathematics explicit. As a result students and teachers continued to see mathematics as a series of chapters that needed to be covered rather than an interconnected body of ideas and reasoning processes. The focus on the last PD workshop was on making connections across the strands. Now that all the strands are being implemented in all schools teachers are beginning to see the
connections across the strands but find it difficult to exploit these links in their teaching.

*Links support the development of the competency – it’s good for students but from a teachers point of view it is difficult to teach.* [Mathematics teacher comment]

**The initiative exposed weaknesses in the system**

Early in the implementation of the initiative it became apparent that there were gaps in the mathematical content knowledge of the teachers.

*We never did some of this stuff in college yet we were meant to teach it.* [Mathematics teacher]

In response to requests from teachers for additional support in content knowledge, a series of workshops focusing on content were designed, these workshops were complemented by a range of optional evening courses, run in local Education Centres, which dealt mainly with mathematics topics (content) and/or with using ICT in the teaching and learning of mathematics. These supplementary courses, which were attended by significant numbers of mathematics teachers, were facilitated by trained teachers who were supported in their role and who were drawn mainly from the membership of the Irish Mathematics Teachers’ Association. In response to the fact that a significant number of practicing mathematics teachers are ‘out of field’, that is their mathematics qualifications are not up to a sufficient standard, a two year part-time Post-Graduate Diploma in Mathematics Education was made available to these teachers by the National Centre for Excellence in Mathematics and Science Teaching and Learning (NCE-MSTL) and funded by the DES.

### 3. PARTNERSHIP RELATED ISSUES

**Which key aspects should be taken into consideration when defining the partnership?**

**The perceived lack of information**

While partnership was a significant feature of the initiative and the curriculum committee developing the syllabus had representatives from all the stakeholder bodies involved in Irish education, including four teacher representatives and representatives from 3rd level, there was still an impression that there was a lack of information in the system and evidence that the key messages of the initiative were not being heard. Teachers reported being at sea and not knowing what was on or off and third level personnel criticised the lack of consultation. The learning from this experience was that the lead-in time to implementation of the initiative was too short. More time was needed to gear up the system in advance of the initiative.

*This was so new, people just didn’t understand that things would be different. The NCCA video was very informative but it should have been available at the start.* [DES inspector comment]

**Partnership between the professional development team and the phase one schools**

The partnership between the RDO’s (from the professional development team) and the phase one schools was seen as having been successful. Although it did mean that the phase one teachers...
felt better supported and were in some ways more informed than their non-phase one peers, from an initiative perspective it developed dependency rather than empowerment and was unsustainable on a large scale. One RDO commented that they were available to the teachers in the phase one schools 24/7.

Management within the initiative

Having the professional development team under a separate management structure to the curriculum development team added to the perception that no-one knew what was happening. The partnership between the NCCA, the professional development team and the SEC was not evident to the teachers. The perception was that these were separate organisations working in isolation.

The messages were disjointed. If you asked them [RDOs] could you get this on the exam, they didn't know. We didn't get support as to how to figure out what we could be asked or how to interpret the syllabus. [Mathematics teacher comment]

The workshop model of professional development

Teachers were critical of the workshop model and reported that in the translation of the syllabus ideas to the teachers on the ground there was something missing. They reported that the workshop model meant that isolated topics were exemplified which was fine but there were many other sections that weren’t.

In-school partnership

The role of the maths department in schools changed as a result of the initiative. Teachers reported partnerships developing between one another albeit out of desperation. However, this did move their business away from purely administration issues to sharing ideas and experiences. While at this stage the collaboration seems to be very examination focused, the next phase of the initiative should focus on building on this partnership and the experiences of the phase one schools by engaging teachers collaboratively in activities focused on planning for teaching and learning that are more likely to support their reconceptualization of mathematics, teaching and learning. Department inspectors reported that schools where planning was good saw the highest common level of teaching.

Partner between the school principal and the mathematics department was seen as a key enabler. Teachers reported that sympathetic principals would find ways to help them with their immediate challenges which was hugely supportive.

A desirable partnership

Interviewees observed that an important partnership that needs to be formed is a positive relationship between the Inspectorate and the schools. Schools need to become comfortable inviting inspectors to their classroom and engaging in dialogue with them around issues of teaching and learning. Thus seeing the inspectors’ role in the system as supporting teaching and learning rather than simply evaluating it.

4. STRATEGY RELATED ISSUES

Which aspects of the strategy implemented for the initiative have proved to be particularly effective and which have proved to be most problematic, and why?

In hindsight some strategies chosen for the implementation of the initiative did not fully support teachers’ reconceptualization of mathematics, teaching and learning.

Beginning the initiative with an initial group of schools

The intention of this strategy was that teachers in the phase one schools (24 schools) would receive intensive support and their experiences and refined materials would then be available to provide more effective professional development for teachers in the other, non-phase one schools. The strategy has proved more beneficial to the phase one teachers due to the intensive nature of the support, which provided for dialogue and discussion around the purpose and nature of mathematics as well as the purpose and nature of the initiative. In addition there were no commercially available text books for these teachers and although they put pressure on the system to provide them with increasing supplies of examination exemplification material, evaluation of the initiative has shown a larger proportion of these teachers would be considered willing adopters. Although teachers in the non-phase one schools received professional development a year before they were due to engage with the new syllabus, there was a lot more material available commercially such as text books and sample examination questions which hadn’t been available to the phase one teachers. This meant they were still relying heavily on third party texts which supported a transmission approach to mathematics teaching and learning. Teachers support was limited to two workshops a year and they reported that workshops gave them good ideas but just dipped into stuff and they never felt they got the full picture of what was required of them. Although they reported that resources such as teaching and learning plans gave them an idea of where the initiative was heading they didn’t find the material itself particularly useful. Again the emphasis on the high stakes examination constrained any inclination to engage with material that wasn’t directly linked to examinations and teachers saw the phase one examination papers as the most useful output from the experience of these initial schools.

Photo 3. Collaborative learning during a Maths class (St Mark’s Community School).

The phasing in of the curriculum strands

The strategy of phasing the introduction of the different strands of the curriculum over time also proved to be very problematic for teachers. In any one year they could be working from up to five different syllabuses (one for each class they were teaching) and varying
amounts of what they referred to as the old material (material from the previous syllabus). This not only made it difficult to exploit the connections across the strands it also left teachers with conflicting conceptions. On one hand they were in the comfort zone, covering a fixed body of knowledge with their students and preparing them for what they perceived to be a predictable examination assessing procedural fluency, and on the other hand they were struggling to engage their students with an inter-connected body of ideas and reasoning processes and prepare them for what they perceived to be a very unpredictable examination that would assess concepts and skills as well as contexts and applications. Teachers argue:

*If all strands had been introduced together in first year it would have been better. That would have helped with the connections across the strands.* [Mathematics teacher comment]

The revised assessment model

It was strongly argued by teachers that the new assessment model, with its perceived unpredictability, that assessed concepts and skills as well as contexts and applications did not support the development of the desired competences. The structure of certain questions was criticised and it was noted that students could get the wrong answer despite the fact that they knew the mathematics. It was claimed that the extraneous language in some questions confused students. It was noted that the marking schemes for the examinations had been open to a lot of criticism and that the assumption was that students are doing so badly in the examination that they are getting marks for anything which gives credence to the claim that maths has been dumbed down.

Other strategies were considered enablers: Other policy initiatives

Other policy initiatives

The literacy and numeracy strategy*(DES 2011)* that began in schools in 2011 was regarded as a strategy that supported the *Project Maths* initiative because it gave school leaders an opportunity to allocate more teaching time to mathematics.

The introduction of bonus points

The decision to introduce bonus CAO points*(for entry to higher education)* for A-D grades for Higher level Leaving Certificate maths was effective. This incentive attracted many students who wouldn’t normally have considered engaging with higher level mathematics.

5. Mainstreaming related issues

If the key competence initiative aims/aimed at mainstreaming, what are/have been the major obstacles encountered to generalise it?

As previously outlined *Project Maths* began with an initial group of 24 schools. Schools applied to become involved in the initiative and


6. Central Applications Office (CAO) points are awarded to students based on their achievements in the Leaving Certificate examination.
a sample of 24, which was representative of all schools in Ireland, was chosen. The new syllabus was introduced in three phases to this group. While the work in the initial schools was developmental, many aspects of the model were replicated to the wider system.

**Scaling up issues**

A number of scaling up issues were identified by the interviewees. These included the type of support available to schools, the effectiveness of the teaching and learning resources, teacher readiness for change and the collaboration of maths departments in schools. Initial schools had a direct contact person from the professional development team and received in-school training which was relevant to the school context. This kind of intense support was seen as being an enabler to the effective implementation of the initiative with the phase one schools, but would have been difficult, and very expensive, to replicate on a system-wide basis. Both the inspector and the representative from the professional development team noted that the teaching and learning resources which were produced were used more effectively in the initial schools. This was attributed to the fact that the one-to-one link with a Regional Development Officer (RDO) ensured the resources were used as they were intended, whereas in the national roll-out these resources were either not used at all or not to their full potential. Despite this, learning from the experiences of the teachers in the initial schools and the availability of resources developed for these schools were viewed as positive factors in the up-scaling of the project.

**Collaboration among teachers as an enabler**

Collaboration among teachers was reported as being an enabler to adopting the new approaches recommended by the syllabus. This was observed as a regular practice in the phase one schools. Teachers cited this collaboration as being extremely valuable and as something that developed as a direct result of being a phase one school. This kind of support and discussion was identified by the Inspector as being one of the major differences between the working practices of the phase one schools and those involved in the national roll-out (non-phase one schools).

*It’s the level of conversation between the two about maths. The initial schools have reached a much higher level of debate about mathematics and what constitutes a good mathematics lesson. [DES Inspector comment]*

It is likely that having the in-school support of an RDO contributed to greater teacher collaboration, discussion about mathematical pedagogy and encouraged teachers to use resources to help students develop key competences in maths.

**Teacher readiness for change**

Teacher readiness for change and maths teachers’ qualifications were seen as obstacles to the mainstreaming of the initiative. Teachers involved in the national roll-out cited the concurrent introduction of some aspects of the new syllabus in upper secondary at the same time as they were introduced in lower secondary as a major difficulty with the mainstreaming. This stems largely from the fact that students are faced with a high stakes terminal exam at the end of upper secondary education and this exam is directly linked to college entry. However, it should be noted, that this was identified by the curriculum designers and those involved in implementation as being both an obstacle and an enabler. An NCCA representative

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noted that previous curriculum reform in maths had happened only at lower secondary and had largely failed to bring about changes in maths teaching which focused on the development of mathematical proficiency. The high stakes nature of the exam and the fact that the assessment was now supporting teaching approaches which focused on competency development, meant that new approaches had to be adopted. The move from a perceived predictable high-stakes exam to one which assessed problem-solving and application was cited in the interviews as a huge factor in the resistance to change. Many teachers felt outside of their comfort zone, lacked self-efficacy and some reported gaps in content knowledge. One teacher commented:

*There was a huge workload, stuff we did in college but hadn’t seen since, there was a huge fear factor.* [Maths teacher comment]

Teacher qualifications

In some ways the initiative exposed a weakness in the system, a significant number of teachers who were teaching maths at lower secondary did not have the necessary qualifications and consequently adopting the proposed methodologies and teaching for understanding posed a problem. This was identified by a number of stakeholders in their interviews as an obstacle. The system responded by putting in place a state-funded Post-Graduate Diploma for “out of field” teachers. This is viewed as one of the important enablers in the implementation of the initiative.

Project Maths as an isolated reform

A major obstacle to the mainstreaming of the initiative was the fact that maths was an isolated reform, the new syllabus was focusing on more than the mastery of content and the examinations were assessing key competences in maths. This was viewed as being unique to mathematics in the context of post-primary education at the time.

6. SYSTEMIC ASPECTS

To which extent has the initiative been designed as a systemic one from the starting point, i.e. introducing changes in several areas related to the student curriculum (such as teacher training, assessment, school organisation, etc.)?

From the outset *Project Maths* was planned as a system-wide reform of mathematics education in post-primary schools. It involved all maths teachers and the changes were introduced at both junior cycle and senior cycle. In the years leading up to the development of *Project Maths* there was a strong recognition from all parts of the system that reform was needed. These included third level colleges, industry, politicians, employers’ groups and various other educational institutes. Research carried out by the University of Limerick identified a low level of mathematical knowledge and skills shown by some students proceeding to further and higher education, and an inability to cope with basic concepts and skill requirements in the mathematical aspects of their courses⁸. Chief Examiners’ reports on State Examinations, repeatedly pointed to an over-reliance on procedure and a lack of mathematical understanding by candidates⁹. Similarly, research carried out by the NCCA echoed

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these concerns from the system. The research recommended that, in order for real change to happen, the syllabus, assessment and the teaching and learning of maths had to change in tandem.

What have been the enablers encountered during the implementation because of the systemic aspect of the initiative?

A number of enablers were identified in the interviews as a result of the systemic approach to reform. These include teacher professional development and support from third level, a more hands-on role for the NCCA, joined up thinking within the system, in particular the alignment of the assessment with the syllabus and the link between the new syllabus and the primary maths curriculum. In the interviews all stakeholders identified the provision of professional development for teachers in the area of mathematical content knowledge and maths methodology as a crucial lever in bringing about the proposed changes. It became apparent that extra courses were needed to help teachers improve their content knowledge and as a result modular evening courses, provided by local facilitators were held throughout the Education Centres. The number of workshops and the unified response from the system to the needs of teachers were particularly lauded. A number of interviewees identified the change in role of the NCCA, from being mainly advisory to a much more hands on role, as a significant enabler to implementation. Visits to third level colleges by NCCA personnel, direct contact with both the initial schools and those in the national roll-out through phone calls and emails were seen as being particularly helpful in supporting the system to change.

We had an open line of communication with the syllabus and assessment creators, the NCCA and the DES. That was very important and helped us gather lots of feedback. [RDO, Teacher Education Section comment]

Aligning assessment with syllabus aims

One of the most significant aspects of the design of the initiative was the alignment of the assessment to the aims of the syllabus. It was seen as essential that the final assessment examined key competences in maths, that students would be required to problem-solve, to deal with real world applications and to show conceptual understanding in mathematics. This was achieved by all parts of the system working very closely together.

The manner in which competences are assessed is in harmony with the pedagogical approaches that have been promoted by the project. We stayed in close contact with the NCCA, to ensure that the kind of tasks and questions on the examination reflect the learning outcomes and are also reflective of how students might engage in those activities. [Chief Examiner, Mathematics, SEC comment]

Addressing the transition from primary school

Explicitly addressing the transition from primary school to post-primary school with a Bridging Framework which connected syllabus areas in upper primary with the new strands, and a Common Introductory Course for all first year students were identified by the majority of interviewees as an effective strategy.


What have been the obstacles and/or challenges encountered during the implementation because of the systemic aspect of the initiative?

Systemic aspects which were reported as obstacles to the successful implementation of the initiative include reluctance to change, new assessment instruments, communication with the system and the vocalism of those with vested interest in preserving the old system. The pervasive nature of the final examination and the link to college entry were identified as key barriers to change. Major changes to the final assessment in maths were a contributing factor to the aversion to the reform at school level. Research carried out by the NCCA with teachers in the initial schools highlighted that teachers were reluctant to change as they felt outside of their comfort zone

![Photo 4. A group of students takes notes on the outcome of an experiment during Science class (St Colmcille’s Community School).](image)

This theme was evident throughout the interviews. The perception of the syllabus through the lens of the exam paper was problematic and teaching to develop mathematical competences as well as procedural fluency and computational accuracy was perceived as a huge challenge. The reconceptualization of what maths teaching and learning should involve was perhaps easier to espouse than to adopt in the classroom. Alongside this, interviewees referred to a number of vested interests in the system who viewed the reform as a threat. These included ‘grind schools’, textbook authors and publishers. Often these groups were very vocal in the media, especially in the run up to state examinations and they campaigned tirelessly to block the initiative. The counter argument was often not heard by the general public. All of those interviewed cited communication with the wider system, by those steering the initiative, as something which should be a major focus of any future curriculum reform.

7. EVALUATION RELATED ISSUES

The impact of Project Maths on student achievement, learning and motivation in both the phase one and non-phase one schools was independently evaluated by the National Foundation for Educational Research, on behalf DES and the NCCA. Other evaluations included teachers’ assessment of the professional development, research carried out by the NCCA on the experiences of teachers in the 24 schools and the Report on the Trialling of Leaving


Certificate\textsuperscript{14} Sample Papers for Phase 1 of \textit{Project Maths} in the twenty-four initial schools, carried out by the State Examinations Commission. The purpose of the trialling process was to measure the effectiveness of the draft sample papers and the marking schemes. Feedback from the trialling exercise informed the curriculum development and the teaching and learning approaches that should be adopted.

\textbf{Real-time evaluation of the initiative}

The real-time evaluation of the initiative and on-going feedback from the phase one schools, meant that the curriculum development was directly informed by practice in the classroom. Teachers in the phase one schools viewed their involvement in syllabus development as a positive aspect of the reform\textsuperscript{15}. However, these teachers also reported that the real-time changes to the syllabus caused confusion as to the required learning outcomes for different cohorts of students. It is worth noting that teachers in the non-phase one schools may not have the same sense of inclusion in the curriculum development process:

\textit{That research didn’t feedback to us or impact on us... The teacher’s job isn’t fully understood by policy makers. Teachers feel very neglected, it needs to include the teacher who is implementing. \textit{[Teacher and member of Course Committee comment]}}

This indicates that significant teacher buy-in can be gained by adopting a developmental approach to curriculum development, which is informed by the experiences of the classroom.

\textbf{Further evaluation}

There was a general consensus among all stakeholders interviewed that it is too early to judge the impact of the initiative and a further evaluation is needed. This should focus on students who have met the complete new syllabus from first year. Teachers in the focus groups identified a number of issues with the assessment of the syllabus, in particular that the marking schemes are having a backwash effect on teaching and learning, that the language is overly complicated and that questions don’t adequately assess the broad range of skills promoted by the syllabus.

\textit{The marking scheme had been open to a lot of criticism, the assumption is that kids are doing so badly that they are giving them marks for anything. It gives credence to the fact that maths has been dumbed down. \textit{[Teacher comment]}}

\textit{It’s not testing properly, other questions are better and they are using the thinking process and they do match the aspirations of the syllabus. \textit{[Teacher and course committee member comment]}}

They suggest that an evaluation of the assessment, in particular how it is aligned with the aims of the syllabus is also required.


8. ACHIEVEMENT OF INITIATIVE’S AIMS

Have the original aims of the initiative been achieved?

While the overarching brief of Project Maths was to change the syllabus, assessment and teaching and learning of maths, the more specific aims can be summarised as:

- changing the culture of the classroom, shifting the emphasis from drill and practice to problem-solving, reasoning and sense-making
- making maths more relevant to the lives of young people
- improving students’ attitudes to maths
- developing teacher competency in relation to mathematical content knowledge and pedagogy

Slowly moving in the right direction

The interviews carried out for this research revealed mixed views as to whether the aims of the initiative have been achieved. However, there was a general recognition that the reform is moving in the right direction, making positive progress, slowly over time. This perception is in line with the findings of the external evaluation which reported that while progress is being made, at this stage of the curriculum’s implementation, the revised mathematics syllabuses taken as a whole do not appear to be associated with any overall deterioration or improvements in students’ achievement.

Developing mathematical proficiency

From the teachers’ perspective, the aim of developing mathematical proficiency is more evident in lower secondary, where students are now studying the complete new syllabus. At upper secondary teachers report that students are having difficulty with some aspects of the key competences, particularly reasoning and sense-making and applying their knowledge to unfamiliar situations. Again the pervasive nature of the final exam and the negative impact on the learning experience is cited here as a major obstacle to achieving the aims of the syllabus.

I am trying more to teach the maths but at certain times of the year it is just the exam; we want to approach things in Project Maths style but we fail under pressure of exam structures.

On a positive note, teachers interviewed reported that their ability to help students achieve the syllabus aims, has improved with time and experience.

The perspective of those involved in the design and implementation of the syllabus is slightly more reticent. While these stakeholders recognised that the aims of implementing a revised syllabus


and assessment on a phased basis and the provision of continual professional development has been achieved, there were questions asked as to whether the aim which is at the heart of the initiative—helping students develop mathematical proficiency—has yet been realised.

I don't think the aims have been achieved yet, the curriculum change has taken place, the corresponding changes at examination has taken place, the professional development for teachers has run more or less as planned but I think we don't see the evidence in the classrooms and the classroom practice that would have been intended at the outset. [Director of Curriculum and Assessment, NCCA comment]

External evaluations validate this concern, highlighting that while students report being involved in activities which are in line with the revised syllabus, traditional teaching approaches are still widespread. Likewise, the processes promoted by the revised syllabus aren't yet evident in the students' work, suggesting that at the moment teachers are focusing on the new content to a greater extent than the mathematical processes.

**Teacher competence**

Evidence suggests that teachers in the phase one schools have made more progress on the continuum of teacher competence needed for the implementation of the new approach to mathematics than in the non-phase one schools. The DES inspector observed that the level of professional dialogue around mathematical education is significantly higher in the initial schools. Research carried out by the Educational Research Centre in to the experiences of teachers who participated in PISA 2012 revealed that those involved in the pilot group were using ICT to greater effect, employing collaborative group strategies and perceived improvements in their students understanding of maths to a greater level than those in the other schools.

**Ground-breaking but still some way to go**

Interviews revealed that those with a direct role in the development and implementation of the initiative feel that there is still a long way to go to achieve the more specific aims of the project. However when viewed through the lens of a stakeholder who is more removed from the process, the project is seen as a success, as a reform that has been unique in Irish education, an example of how partnership can work effectively, where targets were achieved without compromising on the overarching aims.

It was rolled out nationally very successfully...slowly the nay-sayers came round...the model was a successful one which should be used again...there are good lessons to be learnt. [Industry Representative and Chair of Board of Studies comment]

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9. NEXT STEPS

What is planned next for the initiative?

It has been recognised by all stakeholders that more teacher support is required if the aims of the initiative are to be fully realised. The DES have committed to an extra two years of national teacher professional development. The form of this support has not yet been decided but it is likely that it will focus on developing communities of practice in schools emphasising the reconceptualization of mathematics, teaching and learning. The policy change at junior cycle (lower secondary), due for implementation in 2014, will also support this reconceptualization.

10. ADDITIONAL INFORMATION

Bibliography


European Schoolnet is the coordinator of the KeyCoNet project.

European Schoolnet is a network of 30 Ministries of Education from across the European member states, leading educational innovation at European level. As a major international think tank, European Schoolnet operates key European services in education on behalf of the European Commission, member Ministries of Education and industry partners.

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