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POLITICS, POWER, PISA

A genealogy of mathematics education policy at second level in Ireland at the beginning of the 21st century

Elizabeth P. Kirwan

PhD Thesis

National University of Ireland, Cork.

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October 2012

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Abstract

This thesis traces a genealogy of the discourse of mathematics education reform in Ireland at the beginning of the twenty first century at a time when the hegemonic political discourse is that of neoliberalism. It draws on the work of Michel Foucault to identify the network of power relations involved in the development of a single case of curriculum reform – in this case *Project Maths*. It identifies the construction of an apparatus within the fields of politics, economics and education, the elements of which include institutions like the OECD and the Government, the bureaucracy, expert groups and special interest groups, the media, the school, the State, state assessment and international assessment.

Five major themes in educational reform emerge from the analysis: the arrival of neoliberal governance in Ireland; the triumph of human capital theory as the hegemonic educational philosophy here; the dominant role of OECD/PISA and its values in the mathematics education discourse in Ireland; the fetishisation of western scientific knowledge and knowledge as commodity; and the formation of a new kind of subjectivity, namely the subjectivity of the young person as a form of human-capital-to-be.

In particular, it provides a critical analysis of the influence of OECD/PISA on the development of mathematics education policy here – especially on Project Maths curriculum, assessment and pedagogy. It unpacks the arguments in favour of curriculum change and lays bare their ideological foundations.

This discourse contextualises educational change as occurring within a rapidly changing economic environment where the concept of the State's economic aspirations and developments in science, technology and communications are reshaping both the focus of business and the demands being put on education. Within this discourse, education is to be repurposed and its consequences measured against the paradigm of the Knowledge Economy – usually characterised as the inevitable or necessary future of a carefully defined present.

Key words: Foucault, discourse, genealogy, knowledge economy, neoliberalism, mathematics education, policy, PISA, governance, Human Capital, Project Maths, international assessment, critical analysis, politics.

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First and foremost, I would like to thank my supervisor, Professor Kathy Hall, whose unfailing support and advice has been invaluable in the writing of this thesis. My thanks must also go to my husband William Wall and my sons Illan Rua and Oisín for endless hours of discussion and argument about politics and critical theory.

Most importantly of all, this thesis is dedicated to my late mother Elizabeth Kirwan.

Declaration

I hereby declare that this thesis is my own work and has not been submitted for another degree either at University College Cork or elsewhere.

Elizabeth P. Kirwan

Genealogy is gray, meticulous, and patiently documentary

From *Nietzsche, Genealogy, History* by Michel Foucault

Discourse

is what the dogs in the street know

but we don't

until it's too late

From *Ghost Estate* by William Wall

Chapter 1

The Genealogy of Remodelling

I would like my texts to be a sort of tool-box in which others could search to find a tool which they may use as they please, in their field. (Foucault 1994, 523)

1.1 Introduction

The education discourse, within which the discourse of the reform of mathematics education is constructed, occupies a space within the fields of politics, economics and education. This discourse contextualises educational change as occurring within a rapidly changing economic environment where the concept of the State's economic aspirations and developments in science, technology and communications are reshaping both the focus of business and the demands being put on education. This changing environment, it is argued, calls for radical changes in education. The agents mobilised for this discourse suggest a nexus of power relations and the purpose of this thesis is to unwind that nexus and trace its effects. Within this discourse education is to be repurposed as a mechanism for generating profit and the consequences of education are to be measured against a new paradigm called the Knowledge Economy. This paradigm, usually characterised as the inevitable or necessary future of a carefully defined present, demands that education systems world-wide must be reformed, and in establishing the parameters of this reform process a global education policy field has developed. In all of this, mathematics, science and technology education, the most readily commodified kinds of knowledge, are valorised. Mathematics, in particular, is mobilised in the rhetoric as the engine of innovation, the means to developing problem solving skills and independent thinking, the key to the success of knowledge economies. This quasi-futurist imagery of intelligence, change, movement, growth, competition and development is a potent force in public debate, if only because no one can really be against it. In this rhetoric mathematics teaches young people to solve problems, to innovate and, together with the other science subjects, to be team players in the great technological corporations to which they are intended to aspire. However, despite the seemingly clean lines of these arguments, they are highly complex strategies and politicised in a

very profound way in their reimagining of the community and the subject. Their instantiation in local public policy is only now beginning to be understood but what is clear is that human growth in the social and cultural context is suppressed in the discourse. It is important to observe that this discourse seeks to supplant an existing educational philosophy which placed the student's well-being and development at the centre of the purposes of education. This philosophy remains as a viable alternative to the new economy centred approach, and need not be incompatible with the demands of the drive for a knowledge economy.

The particular catalyst for my research is the development of what I call a 'discourse of failure' which has engulfed the teaching, learning and assessment of school mathematics in Ireland. By 'discourse of failure' I mean the argument advanced by contemporary cognitive science and in particular Howard Gardner (Gardner 1993, 3) that 'even when a school appears to be successful, even when it elicits the performances for which it has apparently been designed' when the school produces students with 'good grades and high test scores' it still can be considered a failure since it produces students 'who do not display an adequate understanding of the materials and concepts with which they have been working'. The agents of this discourse are not normally those associated with educational debates – in Ireland, for example, they include the Organisation for Economic Cooperation and Development (OECD), the American Chamber of Commerce (ACC), Engineers Ireland (EI), and various CEOs of multinational corporations. They are, however, media friendly, and a conjunction of reports from special interest groups, international assessments and media coverage contribute to the development of a discourse that emphasises weakness and failure in mathematics education.

The thesis will set out to situate the discourse in its context, to examine the concepts it archives, to identify the agents behind it, and to attempt to understand how it became hegemonic and who stood to benefit from that hegemony. These are, I believe, classic questions for critical theory.

1.2 The Genealogy of Remodelling

This thesis presents a genealogy of the formation of mathematics education policy in Ireland at the beginning of the twenty first century. It sets out an analysis that is consistent with the power

relations involved in the development of a single case of curriculum change – in this case the changes under way in mathematics education at second level in Ireland in the present.

New curricula, new syllabi do not happen by accident, nor do they arrive fully formed, rather they are the effect of a continuous process of negotiation and compromise set within a framework of power struggles. Only certain voices are privy to these deliberations, 'only certain influences and agendas are recognised as legitimate' (Ball 2006, 45). Such a complex process – curriculum development or reform – cannot be realistically represented in simple terms. The language of 'reform' and 'development' needs to be problematised. The terms 'reform' and 'development' both imply, in some measure, a meta-narrative of progress. 'Evolution' is closer to neutral, but suggests that forces independent of human agency are at work, a kind of linear historical necessity. 'Curriculum change', or 'adaptation', perhaps completely neutral, seem rather weak by comparison when one considers the collective power of the forces – the market, the OECD, the World Bank, the International Monetary Fund, the state, the academy – brought to bear on schooling in this century. On the other hand the term 'remodelling' is attractive since it carries with it connotations of changing the model of curriculum or the pedagogical mode as well as the slightly frivolous sense of following fashion. I have opted to use a mixture of those terms as appropriate, and to include the latter in the mix for the reasons stated.

Historical and sociological studies of Irish education have already been published – those of O'Sullivan (2005) and Mulcahy (1981) are outstanding examples – but this thesis does not attempt a historical or sociological study. Rather it seeks to establish the power relations involved in the current remodelling of mathematics education and to present a critical analysis of the effects that constitute the discourse of education at the beginning of the twenty first century.

The discourse of education is not a singular, isolated event but rather it belongs to the discourse of the society at large in which it has developed. We live in a time when (as will be discussed in chapter 2) versions of neoliberalism as an economic system politically imposed form, at least among developed states, the hegemonic discourse (Olssen and Peters 2005, 314). That is not to say that a pure or consistent theory of neoliberalism rules the world, but rather that most western countries are dominated by a set of common senses which define the legitimacy of any statement or action; that these common senses produce narratives of power and acceptable

kinds of knowledge, and in a sense constitute the reality of everyday life; and that these common senses tend strongly towards the neoliberal understanding of human nature, society, the role of the State and the market. Thus, it makes sense to speak of discourses rather than theories. And, in fact, the term *discourse* is crucial to an understanding of critique. In this thesis *discourse* will be interpreted in the Foucauldian sense as that which is produced by a group of sequences of signs, constituted as statements and where a group of statements belongs to a single system of formation (Foucault 2008a, 121). The *rules of formation* of the system govern the conditions of existence (but also of coexistence, maintenance, modification, and disappearance) of statements (Foucault 2008a, 42), where the statements may be different in form and dispersed in time but refer to one and the same object (Foucault 2008a, 35). Elsewhere I have used terms like 'legitimate voices' (following the example of Stephen J. Ball) and 'official voices' to indicate the existence of these rules of formation.

Education reform in the 21st century is situated within a complex of power relations where the resultant policy resembles – 'the cannibalised product of multiple (but circumscribed) influences and agendas' (Ball 2006, 45). It reflects the effect of the multiplicity of force relations that are in operation in the discourse and which, 'through ceaseless struggles and confrontations, transforms, strengthens, or reverses' (Foucault 1979, 92) the resultant reform. Analysis of the discourse is analogous to a macro-level investigation of the inputs of those voices and influences, and an identification of the effect of the various compromises. The analysis will observe the presence of conflict, agreement and disagreement within the recommendations and findings of the diverse groups.

In the analysis of discourse Michel Foucault's 'toolbox' (see chapter epigraph above) is of unparalleled utility. This thesis does not seek to produce a linear narrative of the stages of curriculum reform nor to trace, what Foucault refers to as, 'the gradual curve of their evolution' (Foucault 1991, 76). The purpose of the work 'opposes itself to the search for origins' (Foucault 1991, 77) and thus what Foucault calls 'a genealogy' of the process is apposite.

Genealogy, according to Foucault, is an analysis 'which tries to reconstruct the conditions of appearance of a singularity on the basis of multiple determining elements, from which it arises not as a product, but as an effect' (Foucault 2007a, 64). As such, genealogy is 'a history of the present' (Foucault 1977, 31), an analysis of how things have come to be as they are which is

arrived at by the 'coupling together of scholarly erudition and local memories' (Foucault 2003, 8). Constructing a history of the present means working within the present; self-consciously writing within the field of power relations and the political struggle (Roth 1981, 43). It is a 'tactic which, once it has described…local discourses, brings into play the desubjugated knowledges that have been released from them' (Foucault 2003, 10-11). This is a crucial distinction. It is a constructive tactic since it aims to 'bring into play' the knowledge that had been subjugated within the discourse. It will permit the questioning of those 'taken for granted' assumptions that form the 'common sense' of society: the *crisis* in mathematics education; falling standards; poorly trained students; outmoded policies; ineffective pedagogies. Armstrong (2005) describes genealogy as a form of critical history that attempts a diagnosis of 'the present time, and of what we are, in this very moment' in order 'to question…what is postulated as self-evident…to dissipate what is familiar and accepted' (Foucault cited in Armstrong 2005). She draws our attention to how Foucault distinguishes between genealogical analysis and traditional historiography. Genealogy, as Foucault says, is 'a form of history which can account for the constitution of knowledges, discourses, domains of objects, and so on, without having to make reference to a subject which is either transcendental in relation to the field of events or runs in its empty sameness throughout the course of history' (Foucault 2002b, 118). The movement of history, Armstrong observes, cannot be explained by the intentions and aims of individual actors; rather one must employ genealogy to unpack the complex and shifting network of power-relations (Armstrong 2005). The thesis will avoid examining the aims of individual actors, concentrating instead on shifts in the relations that co-exist at the level of power and trying to identify how these power-relations form a network and constitute knowledge and install that knowledge as common sense. Societies and people need to be brought to accept the necessity of power and to subjugate their own knowledge to the hegemony. Therefore resistance is archived in the system itself, in how it exercises its power to persuade and in how it expresses its hegemony. 'The identification of the acceptability of the system cannot be dissociated from identifying what made it difficult to accept: its arbitrary nature in terms of knowledge, its violence in terms of power, in short, its energy' (Foucault 2007a, 62). Desubjugating such knowledge in relation to education, using the narrow field of mathematics education as a case-history, is one of the purposes of this thesis.

In addition to genealogy, the thesis will make use of another tool from Foucault's tool-box. According to Foucault '*archaeology* is the method specific to the analysis of local discursivities and *genealogy* is the tactic which, once it has described these local discursivities, brings into play the desubjugated knowledges that have been released from them' (Foucault 2003, 10-11). It is important to note that Foucault does not intend archaeology and genealogy to be successive levels of analysis with one derived from the other, but as depicting contemporaneous dimensions in the same analysis (Foucault 2007a, 65). There is a complex interplay between the two, between the excavated knowledge of the archaeology and its effect in the discourse. It is not a given, for example, that global economic theory, human capital theory and international assessment should come to be articulated in second level education, nevertheless these forces are present in the reform of mathematics education at second level in Ireland. It is therefore necessary to interrogate the givenness of the remodelling. Such an interrogation will analyse the nexus of knowledge-power in the system in order to understand what constitutes its acceptability (Foucault 2007a, 61) while simultaneously describing a network of conditions and elements which accounts for the appearance of the singularity which, in this case, is the reform (Foucault 2007a, 64). Thus the thesis will bring into play the local discursivities, the 'complex and shifting network of power-relations', that brought mathematics education reform into play. It will analyse these discursivities, through the ensemble of statements – documents, reports, press-releases, speeches, memos, public utterances – and their appearance in the media. Genealogy, as Foucault himself remarked, is 'grey, meticulous and patiently documentary' (Foucault 1991, 76).

The examination of acceptable statements in the discourse allows for a detangling of the knowledge-power nexus. The connections between business and the State, and between the State and global economic structures, and the role that such connections see for education, inevitably emerges from the mass. In the unfolding of the thesis I have attempted to avoid foreshadowing the emergence of such power-structures, seeking instead to reveal them, as closely as possible, as they revealed themselves to me. Thus the application of archaeology as a *method* and genealogy as a *tactic* allows me to interrogate the present reform or remodelling of mathematics education. It provides a framework within which all aspects of the process can be described and interrogated; a matrix for mapping a network of influence; and a context in which to interrogate the knowledge-power construct that 'nudges' the direction of reform in

mathematics education. Seeking out and isolating 'the different scenes where they engage in the different roles' (Foucault 1991, 76) will be part of this process. The objective is to analyse the process not in terms of its origins but in terms of power and effect, where power is understood as:

> the multiplicity of force relations immanent in the sphere in which they operate and which constitute their own organization; as the process which, through ceaseless struggles and confrontations, transforms, strengthens, or reverses them; as the support which these force relations find in one another, thus forming a chain or a system, or on the contrary, the disjunctions and contradictions which isolate them from one another; and lastly, as the strategies in which they take effect, whose general design or institutional crystallization is embodied in the state apparatus, in the formulation of the law, in various social hegemonies. (Foucault 1979, 92)

A complex of power relations exists among the agents of curriculum reform in which the citizen, the student and the worker figure as objects of power ensembles rather than agents in their own right. Global processes are refining educational purposes 'in terms of a narrower set of concerns about human capital development, and the role education must play to meet the needs of the global economy and to ensure the competitiveness of the national economy' (Rizvi and Lingard 2010, 3). Although national governments still retain their power to develop their own policies, education policies in general tend to reflect a distinct set of values 'whose authority is allocated at the intersection of global, national and local processes' (Rizvi and Lingard 2010, 3). It is within this global multiplicity of power relations that the reform in mathematics education in Ireland is being constituted and on which the genealogy must be brought to bear. These international forces are examined in chapter 5 and 6.

It is widely recognised that there is a need for new tools to replace older methodological and theoretical resources, (Ball 2012; Dale and Robertson 2007; Rizvi and Lingard 2010; Simons *et al.* 2009) in order to map the fast-changing networks of transnational relationships that shape education. The assembling of a genealogy of a remodelling of mathematics education needs to be grounded in a firm theoretical basis and Foucault provides this foundation.

In this respect, in approaching a genealogy, the work of Stephen J. Ball initially provides a useful template that can be modified to suit the work in hand. Ball has written widely on policy research and his conceptualisation of *policy as discourse* and *policy as text* (Ball 2006, 44) is an

attractive one, though he admits that they are, as he says, 'implicit in each other'. Policy discourses, he maintains, 'produce frameworks of sense and obviousness within which policy is thought, talked and written about' (Ball 2006, 44) and policy texts are set within these frameworks. This paradigm produces useful insights, but ultimately it is not possible to isolate 'reform' in two presentations as *discourse* and *text*, since both belong to the same discursive formation.

However, in Foucauldian terms, it is necessary to dismantle the presentation of unity, the reform, in order to subject it to critical analysis. Thus, I will create a rupture within the unity by first interrogating, in Ball's terms, *the text*; the official public narrative, an ensemble of documentary statements which have emanated from 'legitimate voices' in the process. The mass of empirical data for this analysis will come from written documents, official government publications, or government-commissioned publications, all in the public domain at time of access, and most of them sourced electronically. The data will be dealt with in chapters 3 and 4. I will follow the examination of the official narrative by an analysis of statements that arise from the initial interrogation of the *text*. This raw data for the second set of documents emanates from a more diverse range of sources, local, national and global, that shape the common sense and will form the empirical data for chapters 5 and 6. I will attempt to read the wider discourse surrounding those documents. This rupture in the unity of the discourse is intended to render it more readily amenable to analysis.

Initially, my empirical work will consider *text* as the overt text and its sources and influences, its theoretical framework as acknowledged by the framers of the text – in other words the official written public narrative as constructed by legitimate voices. I define *text* in this thesis and in this context, as already mentioned, as the set of official, published documents and acknowledged texts which are available to the public and relate in any way, either partly or in full, to mathematics education, and to the reform of mathematics curricula at second level in Ireland. The raw data will include reports, departmental papers, studies, strategic plans and annual reports, review documents etc., and the resulting syllabi. Media reports and opinion pieces will form the substance of Chapter 6. For the most part, these documents are now available on the internet. Almost all of my data will, therefore, be referenced to official internet sites and will have been found through the Google search engine – a source any concerned citizen might exploit. Unpublished documents such as minutes from meetings, memos and reports will be

excluded, despite the fact that the formative part played by these documents in the resultant publications is crucial. But such documents are not part of the 'official story' as they do not have a life in the public domain, even though, technically, they may be available to the public through freedom of information requests etc. As the freedom of information process has been designed to exclude the general public by its technical nature and the attendant financial cost (€20.95 per hour of research plus expenses in March 2012), such texts may not be regarded as part of the official, acknowledged public narrative. The *text,* therefore, is the published acknowledged process of curriculum reform in mathematics coming from 'legitimate voices' (Ball 2006) and resulting in the 'official story' and will be examined in chapters 3 and 4 of this thesis.

I will read the *text* therefore, as the 'official' acknowledged narrative, that which is developed and presented publicly through official sources. I contend that useful insights may be gained from attempting to understand the complex of documents that form the acknowledged archive in the terms in which the agents involved in their construction understand that construction. Curriculum reform, like policy, is a product of compromises (Ball 2006, 45; Bowe *et al.* 1992, 21) between the accepted approved contributors, such as, ministers, government departments, interested parties, expert groups, pressure groups, advocacy groups and social partners. On the other hand, the narrative of 'consultation' should not be taken at face value. Within the so-called 'consultation process' '[o]nly certain influences and agendas are recognised as legitimate, only certain voices are heard at any point in time' (Ball 2006, 45). This approach, as Hall & Kavanagh say in another context, makes 'the assumption that the way influential groups understand the purposes and forms…will bear both on the policy that is designed and on the nature of its implementation' (Hall and Kavanagh 2002, 263).

In the wider context, the influences, Ball's 'legitimate voices', come from both public and private sources, (a distinction that becomes increasingly blurred as one examines the discourse). In the development process, as the politics of a situation change so too the direction or proposed direction of reform is 'reworked and re-oriented' (Ball 2006, 45) over time. Changing ministers, changes in DES personnel, market demands, pressure from the media, changes in the requirements of social partners – all play a part in the shift. Nevertheless, it is worth remarking here that the forces involved in shaping the education of young people fall into two main groups – political and economic. The distinction between the nation state and the outside is disappearing, and, as Ball argues in *Global Education Inc,* an increasing number of states

are losing the ability to control their education systems (Ball 2012, 4). National education policy falls increasingly within the sphere of influence if not control of non-state or extra-state organisations and this trend will be analysed in chapters 5, 6, 7 and 8. In particular, chapter 5 will examine the influence of the OECD's education policies in the remodelling of Irish education, tracing this influence through official documents but also through the media.

In the process, the thesis will interrogate the construction of the accepted knowledge that there is an 'urgent need for reform' (DES 2010a, 2) and reform of a specific kind, the many assumptions and imperatives that underlie the education discourse. It will problematise the acceptability of terms such as 'knowledge economy' and 'smart economy' and the views that the 'knowledge economy' is dependant on mathematics; that 'across the developed world' there is a 'declining competence in mathematics' (TaskForce 2002, 111); that '[t]he key issues relate to male under-performance at second level, and more general under-performance in mathematics' (EGFSN 2003, 30); that in Ireland there is a 'decline in performance in mathematics at second level' (TaskForce 2002, 109); that '[i]nformation on school and student characteristics obtained through PISA will also help to inform educational developments' (NCCA 2002b); that 'it is important that Ireland moves beyond being 'average' at mathematics' (Flynn 2010b, *The Irish Times*, 10 May, 1) and, indeed, that Ireland *is* average at mathematics; that '[i]nternationally, there is concern about the low level of mathematical skills of students emerging from second level ' (NCCA 2005b, 3); that we should be concerned about 'the performance of students in state mathematics examinations and in international tests' (NCCA 2005b, 3) because they have a 'low level of mathematical knowledge and skills' (NCCA 2005b, 3); and that 'the future stock of mathematical capability is in sharp decline' (EGFSN 2007, 68). These represent no more than a sampling of the assumptions that underpin educational discourse in Ireland in relation to mathematics education.

It is important to emphasise again here that my reading of curriculum reform in mathematics is not an attempt to describe the process itself but rather an effort to read the complex of power relations that influence the process and their effects on the resultant curriculum. I envisage that the substantive chapters in the thesis will be inter-related; themes and concepts in one will ramify throughout the others. Ultimately it will be possible to read all as a theoretical unity.

Chapter 2

Context

Knowledge is the currency of the innovation economy and the education system is pivotal in making innovation happen. (The Innovation Taskforce 2010, 3)

2.1 Introduction

There is an intimate relationship between education, politics and economics, (Apple 2004; Ball 2008; Foucault 2008b; Gee *et al.* 1996; Olssen *et al.* 2004; Peters 2001) a relationship that is founded partly on the association between knowledge and power. This chapter considers the context – education, politics, economics and power – within which many education systems are being restructured. It establishes key general concepts for the thesis: education as a political act; human capital theory; neoliberalism and what it wants from education; the language of neoliberalism; and the significance of education in the concept of the knowledge economy or knowledge society with particular reference to developments in Ireland. These concepts will form the basis of my argument that the neoliberal discourse has permeated mathematics education reform in Ireland and in turn will allow me to interrogate the extent of the infiltration and to observe its effects.

An analysis of the influences and effects of neoliberalism on the reform of education, and in particular on mathematics education will involve a critical study of the relationship between neoliberal discourse and educational thinking. This chapter will establish that such a critical debate is taking place on a global and local level. An understanding of the processes at work will involve unpacking the underlying assumptions to be found among agents of reform, in particular the 'seemingly commonsense assumptions' (Apple 2004, 12) that form the foundations of many curricular innovations. Among these assumptions, 'the unsaid, the unspoken can be the clearest manifestation of hegemonic power, where 'common sense' goes unchallenged' (Rizvi and Lingard 2010, 12). Rizvi and Lingard call these the 'taken for granted' assumptions of a society which is 'simultaneously local, national, regional and global in terms of experience, politics,

effects and imaginaries' (Rizvi and Lingard 2010, 64). They argue that in such societies contemporary geopolitics and past political struggles are interwoven within the narrative of the present. It will therefore be necessary to identify the political, and economic interests that underlie what is taken for granted, and in order to do this I must first clarify some important concepts and terms that will reappear throughout the thesis.

It is particularly apposite in the present circumstances in which Ireland finds itself. Having committed itself to a strategy accurately characterised by a former Tánaiste and Minister for Enterprise, Trade and Employment, as 'closer to Boston than Berlin' (Harney 2000), a neoliberal rather than a social democratic strategy, the country now finds itself bankrupted by the very forces of capital that it relied upon – banks high on cheap credit under a 'light-touch' regulatory system. In theory, the market should regulate itself, requiring the merest touch at the helm from the state. In reality, banks proved no more intelligent than political parties. The preferred solution is 'austerity' for the working and middle classes, while making vast transfers of public wealth to private individuals, hedge and pension funds. Ireland is now in an International Monetary Fund programme. Very little money is available for education. A 'shock doctrine' approach to the public services has been adopted in an attempt to 'reset' pay and conditions for, among many others, teachers. Pay and pensions have been reduced. Pupil-teacher ratios have been increased. Long-term inducements to further study have been abolished. New teachers will no longer receive an additional pay benefit for post-graduate degrees. Hours have been increased. It is a strange strategy for a State hoping to create a knowledge economy. The example of Finland is regularly cited in the discourse, but very rarely does Finland's high spend on education and public services merit comment. We want Finland's education system, but we want to pick it up in an end-of-era sale.

2.2 Educating – a Political Act

The present dominant discourse in society – neoliberalism – seeks to maintain its position of privilege by the exercise of what Antonio Gramsci called 'hegemony'. The concept of hegemony is based on the premise 'that man is not ruled by force alone but also by ideas' (Bates 1975, 351). Hegemony involves the spread of an entire value system through every part of society, governing the moral, ethical and economic responses of the vast majority and tending

always to favour the broad thrust of the dominant class's policy, the intentions, as it were, rather than the detail. It is 'political leadership based on the consent of the led' (Bates 1975, 352). One of the agents of this diffusion and popularization is education where 'schools act as agents of cultural and ideological hegemony' (Apple 2004, 5) and the teacher functions as what Gramsci calls 'an intellectual' in that hegemony. Whether she is aware of it or not, the intellectual is charged with the responsibility of imparting, in Gramsci's terms, '*il senso comune*' – 'the common sense' (Gramsci 1971, 134). The intellectuals operate in 'civil society' through 'private' organisations, such as, the Church, schools, trade unions, etc. but are not necessarily confined to these organisations.

Liberal democracy requires a well-orchestrated hegemony to ensure cooperation with change and to sustain economic development. For this purpose, the appearance of freedom of choice of the individual in democracy must be maintained. Herbert Marcuse writing on 'mass democracy' considers the implications and costs of such a system: 'the people, efficiently manipulated and organised, are free; ignorance and impotence, introjected heteronomy is the price of their freedom' (Marcuse 1969, 12). In 'introjection', a psychoanalytic term, the subject identifies the patterns of action, fixations, affectations, or styles of thought of another and assumes them as their own. Thus introjected heteronymy, the process whereby the subject takes into herself the *nomos*, or laws and mores imposed on society, is essentially a statement of the Gramscian concept of hegemony from the point of view of the subject. Hegemony, where 'the intellectuals…extend the world view of the rulers to the ruled' and 'thereby secure the "free" consent of the masses to the law and order of the land' (Bates 1975, 353), implies the imposition of a discourse by agents acting on behalf of, or in sympathy with, the state. In a society where neoliberalism has successfully imposed its discourse on the public, its beliefs, ideals, claims and narratives are internalised by the majority as the norm, and are received as the only pathway to economic and individual success. These beliefs, ideals, claims and narratives often take the shape of 'ideological assertions' that are assumed rather than proposed as claims to be tested and debated (Rizvi and Lingard 2010, 33). Once a strong discourse has been established dissent becomes difficult as the newly constructed value-system determines the parameters of argument. Discussion takes place within the arena of neoliberal discourse where the parameters are pre-set by the discourse and from within this discourse it is difficult to be

objective and critical or to affect change. Historically such discourses tend to be self-affirming and self-perpetuating until a moment of rupture.

Apple contends that education is not a neutral enterprise, and that by the very nature of the institution the educator is involved in a political act, whether he or she is conscious of this or not (Apple 2004, 1). The educator is a mediator of the social, political and economic tensions of society, she is the arbitrator of both overt and covert curricula. She, according to Apple, is one of the 'intellectuals' in society. Thomas Bates also addresses the 'intellectual' and her role in the formation of social and political consciousness. He compares the 'intellectual' to a salesman. One such 'salesman' in civil society, he argues, is the teacher, and as 'the older generation always educate the young' (Bates 1975, 361), the teacher achieves for the ruling class the 'free, consent of the masses to the law and order of the land' (Bates 1975, 353).

In this analysis, schools are institutions of cultural preservation and distribution, which create and recreate forms of consciousness that enable social control to be maintained without the necessity of dominant groups having to resort to overt mechanisms of domination (Apple 1979, 3). This view of schooling is not new. It is, for example, the subject of P.H Pearse's essay *The Murder Machine* (Pearse 1924), in which he argued that Irish nationalists should wrest the educational indoctrination system from the hands of the British Government on behalf of Irish nationalism. It is also, for example, the subject of Dickens' novel *Hard Times*, (Dickens 1969) where the eminently practical Mr Gradgrind wants the children in his school inculcated with the utilitarian principle. As testament to the accuracy of Dickens' assessment, Roberts writes of the overt and covert curricula of British education of the industrial era (Roberts 2004). The overt curriculum of that era, he observes, concentrated on the 3 Rs, while the covert curriculum, instilled punctuality, tolerance of repetition and subordination in pupils; adherence to these values, in the nineteenth and early twentieth centuries, was important for the operation of capital intensive industry. Overt curricula are presented as being valuable for all while, covert curricula benefit particular positions: dominant elites or their powerful oppositional forces.

In this respect, Apple contends that, in order to understand the role of education in the present day, each of the agents involved must be situated within a larger nexus of relations, of which each is a constituent part. The knowledge taught, the social relations that dominate classrooms, the school as a mechanism of cultural and economic preservation and distribution, he argues, must be placed in context in order to carry out a true evaluation (Apple 2004, 3). Such an

evaluation, I contend, should not be satisfied with a historical sequence of relationship development, 'a search for origins' (Rabinow 1984, 77), rather it should strive to explore all influences, both obvious and hidden, the overt and the covert.

Hence, an education system cannot be studied in isolation; it must be studied within the context of the political system to which it belongs, '[e]ducation and politics are inextricably interwoven with each other, so that one cannot productively discuss education issues in a political vacuum' (Kelly 1989, 146). A knowledge of the politics is essential if we are to understand and critically assess declarations such as Carnoy's (Professor of Education and Economics at Stanford University, US) that 'the main function of the nation-state in the new world economy is to educate its citizens for participation in the new world economy' (Carnoy 1993). Inevitably, in the western world including Ireland, the context must include neoliberal theories of the State and the State's functions in education.

In the Irish context, Kieran Allen discusses the effects of Irish politics on the education system and describes what he calls 'the corporate take-over of education in Ireland' in his book of the same name (Allen 2007). He documents a powerful shift towards utilitarianism and lack of real education in the present system, a trend, which he links to the emergence of the concept of the 'knowledge economy' (Allen 2007, 136) and the 'commercialization of knowledge' (Allen 2007, 136). Post-industrial capitalism envisages the commodification of knowledge in the 'knowledge economy' as a solution to the slow but steady decline of profits from manufacturing. It involves a reorientation of the education system towards the production of 'human capital' in the form of 'knowledge workers' for an economic system where people themselves can become 'profit levers' (Fitz-enz 2000, 1). The leverage of these 'profit levers', and correspondingly the actual value of human capital as measured by the market, is recognised by the stock market through its awarding of a market value for service and technology companies that exceeds their book value ('leverage' is the use of certain fixed assets to enhance the return on investments or sales (Fitz-enz 2000, 1)).

The reorientation of education policies and practices is inherently political (Apple 2006), it is affected by many interested parties who attempt to influence the definition and social purposes of education (Bowe *et al.* 1992, 19) and are prime movers in the creation and construction of the initial discourses which lead the direction of change. In western society where, since the 1980s, Welfare State policies are being dismantled in favour of neoliberal small-state reforms,

the relationship between education and the State is being altered and many governments are restructuring their national education systems according to the perceived demands of the knowledge economy/society and 'guided by neoliberal theories of human capital' (Peters 2001, 1). The spread of new technologies and the development of knowledge-based societies has resulted in a re-examination of the role of education in preparing young people for working life. It has 'put a premium on human skills for the competitive vitality of enterprises' (Papadopoulos 1994, 175) and it has changed the kind of skills needed. In essence, knowledge intensive industries need new skills from their workforces and education must provide those skills. I will return to the concept of the knowledge economy and its affects on education in 2.7 but first it is necessary to consider what is meant by the term 'neoliberalism'.

2.3 Neoliberalism

The use of the term 'neoliberalism' to describe the present state of post-industrial capitalism is now relatively uncontentious. It is, however, one that requires elucidation as many of the policies pursued in individual states are not native to pure neoliberal economic theory. In many ways, the term has to be understood as signifying a certain range of policies and philosophical positions with regard to the relative functions of the state and capital, a discourse, rather than a strictly prescriptive ideology. Olssen *et al* describe neoliberalism as 'a politically imposed discourse, which is to say that it constitutes the hegemonic discourse of western nation states' (Olssen and Peters 2005, 314). Since neoliberal discourse has a great deal to say about limiting the role of the state, it would be surprising if an ideological position in relation to education did not emerge from it. Many writers have observed that neoliberalism as a political project is, in fact, deeply concerned with education (Apple 2004; Ball 2012; Peters 1996; Rizvi and Lingard 2010). I contend that this concern, at an international, national and local level, stretches to an attempt to manage curriculum, its development and even its subject matter and methodologies and this will form a central argument of my thesis. It is significant that science, technology and education are regarded as the key sectors that will increase long-term national advantage in the global economy (Peters 1996, 80).

David Harvey suggests that the neoliberal political project first became a reality in the years 1978 to 1980, a 'revolutionary turning point in the world's social and economic history'

(Harvey 2005, 1). At that time, Harvey notes, Deng Xiaoping moved China towards economic liberalisation, Margaret Thatcher became Prime Minister of England, Ronald Reagan came to power in the USA and Paul Volker took charge of the US Federal Reserve. By the time the consolidation of neoliberalism as 'a new economic orthodoxy' (Harvey 2005, 22) regulating public policy at the state level in the advanced capitalist world, became practice, the theory had been well-developed by the conservative academy beginning in the 1940s with the Mon Pelerin society that included Von Hayek and Karl Popper. Harvey describes the theory as one of 'political-economic practices that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterised by strong private property rights, free markets and free trade.' (Harvey 2005, 2). We get a more complete view when we complement this with Rizvi and Lingard's observation that neoliberal globalisation has 'a preference for the minimalist state, concerned to promote the instrumental values of competition, economic efficiency and choice, [and] to deregulate and privatize state functions' (Rizvi and Lingard 2010, 31). The State does have a function in neoliberal theory however, it is required to create 'the appropriate market by providing the conditions, laws and institutions necessary for its operation' (Olssen 2009, 433), it must construct the space in which the market can operate. The neoliberal canon fiercely rejects state interventionist theories – although the recent collapse of financial institutions points to the fact that the State is the guarantor of the profits of the elite at all times, and that the true function of the State in neoliberalism is to regulate the power relations in a way that is favourable to profit. Thus neoliberal ideology prioritises individual freedoms, choice, competition, efficiency, entrepreneurialism, and skills – all focused on the market – within a specified institutional framework provided by the minimalist state. It must protect the rights of individuals, particularly those rights which concern property ownership, and it must protect the operation of the market. This language of protecting the rights of individuals must be seen as tightly constrained around the protection of profit-making and private property while simultaneously – or perhaps consequently – imposing policies of reducing labour costs, reducing public expenditures, making work more flexible (Bourdieu 1998) as well as limiting or eliminating the right of workers to combine and take industrial action. It shuns all discussion of class, and promotes the notion of the classless state while simultaneously vitiating those fragile structures established under nascent social democracies to promote egalitarianism. Neoliberal theory, while appearing to the objects of its power as monolithic, is in fact relatively complex. It

encompasses, for example, Monetarism, Human Capital Theory, Public Choice Theory, Agency Theory, Transaction Cost Economics and various forms of managerialism (Olssen *et al.* 2004, 138). These theories are

> variants of neoclassical liberal thought and share many of its major presuppositions: that subjects are economically self-interested; that competitiveness is a mechanism for quality and efficiency; that governments should rule from a distance through devolved management; that there should be a reduction of state services through privatisation via user-charges, contracting out, vouchers, and so on; that individuals are rational optimisers and are the best judges of their own interests and needs; that a "flexible", that is, deregulated labour market provides the same opportunities for people to utilise their skills and therefore optimise their life goals; that free trade and open economies are required perquisites for economic growth; and that tariffs, subsidies and controls on foreign investments or markets should be abolished. (Olssen *et al.* 2004, 138)

The political-economic practices of neoliberal governments are now widespread and we in Ireland have experienced their spread. In recent decades, Irish society has been transformed. The move from Social Democracy Irish style to the 'new economic configuration' (Harvey 2005, 2) of neoliberalism has been swift, a configuration – in Ireland as elsewhere – often 'subsumed under the term globalisation' (Harvey 2005, 2). We sometimes think of Ireland as an isolated and insular society. But the country was not immune to the influence of the new philosophy. The 'Celtic Tiger' years created a new native elite that benefited from new markets or markets which were opened up to competition or privatised – in finance, telecommunications, technology, consultancy. Social Partnership, as well as bringing advantages for unionised and some non-unionised workers, also limited the ability of Unions to manoeuvre and saw the gradual erosion of workers rights and the reappearance of precarious labour. In turn new pressure groups suggested that education needed to adapt to the production of 'human capital' neoliberal-style. They argued that traditional work practices were no longer appropriate. A 'flexible' – for which read precarious – labour market was required and the Irish state, if it is to take seriously its duty to produce the conditions necessary for the market, must 'extend the parameters of the Irish education system in an attempt to equip students for life, work and citizenship' (Department of Education 1992a). The meaning of 'life', in this context, is a contentious one and the right to define how a young person will experience 'life' in the Irish

state is the matter of the struggle between the left and right, and between unions and employers. The neoliberal version of society 'seeks to strip away the protective coverings' (Harvey 2005, 168) that formerly existed in the social democratic state in however imperfect a form. It seeks to replace the concept of education 'as a public good available to all' with a 'competitive individualistic gearing of education as a marketable commodity operating in an arena of free competition' (Olssen 2009, 433). This, the argument goes, is the new reality for which the young person must be prepared. Thus neoliberalism seeks to bend the education system to the production of what it regards as suitable human capital.

Neoliberalism and globalisation have been instrumental in the development of education policy. However the influences and effects of this policy are not interpreted in the same way in all societies or nation-states. While the nation state plays a crucial role in the public policy making process (Brine 2006; Rizvi and Lingard 2010) the policies produced must be favourable to global capital accumulation (Rizvi and Lingard 2010). Rizvi and Lingard argue that a 'global field of education policy' (Rizvi and Lingard 2010, 67) has been established and central to this field is the measurement of educational performance. This 'field' does not affect all states equally and each state is positioned differently in terms of its power, and each state has 'to relate to these global fields in terms of their own economic, social and political conditions' (Rizvi and Lingard 2010, 67). They contend that the policy created will be directed by the priorities of the globalised economy and by the need to defer to the 'global process' because national educational policymakers must consider the imperatives of globalisation and align these with values negotiated at local or national level.

Hence, I will argue that policymaking is always a matter of compromise between the political, social and economic demands of capital and the state (Ball 2006; Rizvi and Lingard 2010). The effects of neoliberal globalisation are being felt by national and indeed by local policymakers in Ireland. The observation that globalisation is always mediated at a local level will be duly noted and I will seek to establish what the product of that mediation might be in the context of Irish mathematics education.

The advocates of neoliberalism 'occupy positions of considerable influence in education (the universities and many think-tanks), in the media, in corporate boardrooms and financial institutions, in key state institutions (treasury departments, the central banks), and also in those international institutions such as the international monetary fund (IMF), the World Bank, and

the World Trade Organisation (WTO) that regulate global finance and trade' (Harvey 2005, 3). The internalisation of the values of neoliberal discourse by society, to the extent that they seem natural and spontaneous, has been central to its success. It has succeeded in producing popular consensus whereby the majority accept as 'common sense' that which is happening in society as the best and possibly the only way of running society. The role of 'education as a hegemonic form' (Apple 2004, 19) has always been part of the baggage of an education system. We should not be surprised to find that neoliberalism wants to get its hands on it. The famous apocryphal lines often attributed to St Ignatius Loyola, founder of the Jesuit Order are as apt for neoliberalism as for any other dominant thought system: Give me the child for his first seven years and I will give you the man.

2.4 What Neoliberalism wants from education

'The new-capitalist reformer places the world of work at the centre of education, not in any old-fashioned sense of 'job skills', but in terms of learning to learn, mastering technical tools, and understanding complex systems.' (Gee *et al.* 1996, 165) This new discourse is having a profound effect on education and on its reform, in many countries national education systems are being restructured under the influence of neoliberal theories (Peters 2001, 1) and much education policy-making is being oriented by '[t]he hegemony of neoliberalism as an economic doctrine' (Bonal 2003, 173). The changes include the reduction of state investment, the encouragement of marketization, international assessment, the prioritisation of science, mathematics and technology and a concentration on the development of specific learning techniques.

In this discourse education is organised around themes, systems, problems and is not centred on the disciplines (Gee *et al.* 1996, 165). There is a shift from the concept of 'education' as a service provided by institutions to 'learning' which is something that people must do for themselves (Skilbeck 2004) as well as a demand for new types of learners, and ultimately new types of workers who will continue to be 'learners' regardless of age or experience (Farrell 2001, 58). Education and learning in this context are seen as a lifelong enterprise (Gee *et al.* 1996, 164). These demands are founded, not in any theory of childhood development, but in company restructuring and re-orientation, niche marketing and retooling. Hence, much of the

language of this debate has its origins in the business-school and the terms applied to companies are applied with similar intent to workers and young people. As a consequence the language and metaphors of 'business speak' have become familiar, almost household terms in schools and public discourse. Consider the following statement: 'Today's managers need to learn their way out of problems rather than apply known solutions to them'. This innocuous sentence comes from *The Academy of Management* (Baldwin *et al.* 1997, 49). Substitute the words 'young people' for 'managers' and the sentence could have come from any pronouncement on 'education for the twenty-first century', from business, expert groups or government. So-called 'expert groups' continually inform educational discourse and will reappear throughout the thesis. According to Skilbeck, the learning experience of managers (substitute 'young people') should be 'self-directed, on-the-job, experiential' (Skilbeck 2004, 39). It may well be argued that this is, in fact, the language of education permeating business, but in any case the concepts and language are interchangeable and often mask a sinister intent.

For example, the competition to establish ones company as 'intellectual leader' (Hamel and Prahalad 1994, 73) of industrial foresight, is predicated upon the concept of the company as a 'learning organisation'. Since the business environment is constantly changing not only does a company need to create a 'learning organisation', it also needs an 'unlearning organisation' where it can unlearn some of the habits that will hinder its future success. It needs its 'learning curve' and its 'forgetting curve' (Hamel and Prahalad 1994, 60). Again this language looks relatively innocuous. But the 'forgetting curve' frequently involves lay-offs, factory closures and relocations and consequently an increasingly precarious form of employment.

Among the conditions that influence the company's ability to learn from the past are the problem-solving capabilities of its employees and the existence of a forum where employees can identify common problems and work in teams to find 'higher-order' solutions (Hamel and Prahalad 1994, 167). These employee qualities – problem-solving, team-work, learning to learn and life-long learning – are now prioritised in school curricula and resurface in the discourse surrounding mathematics education and in polemics emanating from organisations such as the Irish government's 'skills' think-tank, the Expert Group of Future Skills Needs (EGFSN). I will return to this group in chapter 4. They imply a future for young people that is precarious and involves continuous investment of time, energy and savings in upskilling, in 'lifelong learning'. The sententious, carefully affirmative language also masks the salient fact

that vocational training formerly invested in by companies has been outsourced to the state and the individual. Such training was a legitimate cost to companies and represented an investment in labour, rendering the labour itself more valuable in the process. If workers are to be part of the 'unlearning process', clearly it is better not to have invested too much in them in the first place.

Gee *et al* , writing in 1996, observed this growing alignment between the business world in 'new capitalism' and school reform (Gee *et al.* 1996, 49). Some time later Skilbeck, writing in the Irish context, observed rather belatedly that there is 'a wider realisation that some fundamental conditions have changed and that the conventions of schooling no longer suffice' (Skilbeck 2004, 36). In the intervening period the relationship between school and market has strengthened to the extent that a market-friendly restructuring of education is accepted by many as the common sense position.

It is necessary to understand the kind of a market for which learners are being prepared. Key concepts are Bourdieu's idea (via Marx) of a 'reserve army of the unemployed' (Bourdieu 1998) coupled with that of 'lifelong learning'. Unemployment is the sword that hangs over everyone in employment. Lifelong learning (or reskilling) is the price they must accept if they are to survive. The language appears neutral or even affirmative and terms like 'reskilling' and 'upskilling' are often confused with the kind of voluntary self-education represented by, for example, nineteenth century working men's libraries or 'Mechanics Institutes', or simply the commitment required to keep up to date with ones trade or profession. However reskilling and upskilling and so-called 'labour market activation' are not really voluntary activities as seen in recent government threats 'to sanction [unemployed] individuals who fail to engage with the 'Pathways to Work' approach' (Government of Ireland 2012, 18). In many cases they represent significant commitments in time, money and effort at a time when the worker is ill-prepared to make such commitments.

At a cultural level, capitalism establishes a metric that measures everything by the ability to produce wealth and by success in earning it. Those who do not contribute to the production of profit are morally reprehensible. Hence they require 'activation' measures, the implication being that work is available – there are 302,000 on the Irish live register as I write (Central Staistics Office 2012) – and only laziness prevents the unemployed person from finding it. In fact, neoliberal theory holds that unemployment is always voluntary: labour has a 'reserve

price' below which it 'prefers' not to work and this 'reserve price' is determined by the level of social welfare payments (Harvey 2005, 53). Thus reduction in state welfare payments becomes a mechanism for reduction of labour costs. Simultaneously, the state is required to undertake pre-emptive training to acculturate the future worker to this state of precariousness in which their labour will be bought and discarded many times during their lives. Bourdieu describes the realities of this labour market as a 'struggle of all against all at all levels of the hierarchy, which finds support through everyone clinging to their job and organisation under conditions of insecurity, suffering, and stress' (Bourdieu 1998). He contends that the 'ultimate foundation of this entire economic order placed under the sign of freedom is in effect the structural violence of unemployment, of the insecurity of job tenure and the menace of layoff that it implies' (Bourdieu 1998).

A useful shorthand for these developments in work is the term used by Gee *et al*: 'new work order'. The new workplace of global companies requires 'professional' workers who are educated, autonomous, problem solving entrepreneurs (Farrell 2001, 57) capable of exploiting niche markets at local level. Gee *et al* describe this new work order as one which does not require or want the traditional two-tiered workplace of mass-market capitalism with its alienated workforce supervised by middle managers who are working within heavily hierarchical corporations passing information between top and bottom. The new workplace attempts to dispense with this middle tier altogether and aims, ostensibly at least, to create a workplace where control and responsibility rest at the lowest possible level. This demands that workers 'learn and adapt quickly, think for themselves, take responsibility, make decisions, and communicate what they need and know to leaders who coach, supply and inspire them' (Gee *et al.* 1996, 19). The new worker must be capable of teamwork; the team, which is collectively responsible for output, in turn demands that each member takes on individual responsibility. The success of the team depends on the commitment and dedication of its members. Each worker must 'interface with technical information and sophisticated technology' (Gee *et al.* 1996, 19). She must apply the programme, analyse and interpret the results. The worker will be concerned only with her own area of work and will not be in a position to question or influence any aspects of the project or business that do not affect her directly. Ostensibly the new worker is not, in Marxist terms, alienated and her workplace is fluid and flexible, but in

reality her role is closely defined and her level of commitment and dedication is predicated upon the presence of 'the reserve army of the unemployed' at her back.

Within this state of precariousness global companies require human capital – ostensibly workers who are educated, autonomous, problem solving entrepreneurs. But, as Judith Butler argues:

> [N]eo-liberalism works through producing dispensable populations; it exposes populations to precarity; it establishes modes of work that presume that labour will always be temporary; it decimates longstanding institutions of social democracy, withdraws social services from those who are most radically unprotected – the poor, the homeless, the undocumented – because the value of social services or economic rights to basic provisions like shelter and food has been replaced by an economic calculus that values only the entrepreneurial capacities of individuals and moralizes against all those who are unable to fend for themselves or make capitalism work for them. (Butler 2011, online)

Guy Standing, punning on proletariat, has christened this new social grouping 'the Precariat – a growing number of people across the world living and working precariously, usually in a series of short-term jobs, without recourse to stable occupational identities or careers, stable social protection or protective regulations relevant to them. They include migrants, but also locals' (Standing 2012).

The new workplace will not offer the precariat a permanent, pensionable job for life, the concept of permanency is not part of its 'genetic coding' (Hamel and Prahalad 1994, 49). Rather it will offer 'fewer stable, lifelong occupations working for a single employer' (DeSeCo Project 2005, 14). It will maintain rigid control of its hiring and firing policy offering fixed-term contracts or hiring people on a temporary basis. This employment policy facilitates company restructuring, 'unlearning' and its 'painful work of genetic reengineering' (Hamel and Prahalad 1994, 67), which must be carried out periodically in order to maintain market position. Companies must be willing to 'jettison', some of their past – the term naturally includes its employees – in order to create the future. Workers must be 'eager to stay', but also 'ready to leave' (Gee *et al.* 1996, 19). In the process, employee interests become a very low priority ranked well below director, shareholder and customer interests. The threat to a firm's 'profit engine' sparks a reaction in terms redolent of eugenics:

> What if the company is already full of out-of date 'clones'? In such cases there is need for 'gene replacement therapy'. Genes that are defective, in the new industry context, must be supplanted by healthy ones. In business terms, removing defective genes is best described as 'unlearning' (Hamel and Prahalad 1994, 59).

Behind the masking metaphors of *Competing For The Future* – 'clones', 'gene replacement therapy', defective genes and healthy ones – is the reality that older workers or workers of longer standing who know or remember different work practices, who may be used to collective bargaining, who cost too much or who are not familiar with new technology, need to be sacked. The Irish government's 2012 early retirement package for Civil Servants (Public Service Agreement 2010), enforced by the Croke Park Agreement which promised smaller pensions for those who remained on, may be read as an example of this 'gene replacement therapy' at work [1].

This global reform movement, driven by the powerful forces of capitalism, stands in contrast to the usual development of educational policies and traditions which evolve somewhat organically over time. The overt aims of the traditional development and the philosophy underpinning it are rarely, if ever, reflected exactly in the practice, or even in the understanding of such aims at the lower levels of the hierarchy, and, in fact, very often are merely a sugaring of the policy pill when more sinister or less well-intentioned motives are at play. Nevertheless, the complexity of the philosophical underpinnings of Irish education must be understood in contradistinction to the rather brutal demands of the hegemony.

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[1] Threats implied in the Croke Park Agreement. The 'threats' must be interpreted from the apparently positive language of the Agreement. The relevant clauses are 1.15 and 1.17:

1.15 There will be no further reductions in the pay rates of serving public servants for the lifetime of this Agreement. This commitment is subject to compliance with the terms of this Agreement.

1.17 Discussions will take place on the method of determining pension increases for existing Public Service pensioners and current public servants in the context of the review of pay policy in Spring 2011. There will be an extension of the period by a year within which the January 2010 pay reductions will be disregarded for the purposes of calculating Public Service pension entitlements.

1.15 implies that there may be reductions in pay rates after the lifetime of the agreement. This was widely interpreted as 'will be' within the public service and helped to create a sense of urgency among those in a position to retire.

1.17 is a departure from existing practice where public service pensions increased automatically with wage agreements. Furthermore, the second sentence indicates the government's policy of applying pay reductions to public service workers and using the reduced pay to calculate pensions. Thus, anyone retiring after the 'extension' would automatically have her pension calculated on the lower rate.

For many years, for example, Irish education was ostensibly motivated by a plebeian version of the ideals of John Henry Cardinal Newman an advocate of the 'Liberal Education' of gentlemen, and a considerable influence on the early shaping of the Irish education system, who, in his 1852 lectures in Dublin proposed the following definition: (Newman 1960, 115)

> This process of training, by which the intellect, instead of being formed or sacrificed to some particular or accidental purpose, some specific trade or profession, or study or science, is disciplined for its own sake, for the perception of its own proper object, and for its own highest culture, is called Liberal Education.

This view influenced the tradition of Irish education, one of whose main tasks has been, as Mulcahy says, 'the provision of a general education as preparation for life' (Mulcahy 1981, 73). It is worth quoting O'Sullivan on the *Report of the Council of Education On the Curriculum of the Secondary School (1962)* (cited in D. O'Sullivan 2005, 133):

> In its statement of general educational aims it conceived of the school in terms of cultural and religious transmission, it stressed its subsidiary and complementary relationship with family and church, and proclaimed the ultimate purpose of education to be the overall development – religious, moral, intellectual, physical – of the person.

However, from 1963 onwards that pseudo-Newmanian vision, which suited the mainly theocratic state that had pertained hitherto, co-existed with a developing economy-oriented practice introduced on foot of the OECD sponsored *Investment in Education* (*IIE*) project. This report saw, for the first time, the application of economic principles of analysis to the education system. That the *IIE* report did not overtly challenge the view of education expressed in the *Report of the Council of Education*, but concerned itself with the curriculum, should not come as a surprise. My thesis will contend that a similar process of re-orientation by stealth is underway presenting Project Maths and that such changes to curriculum are ideologically freighted.

It is not my intention to suggest that the Newmanian ideals were ever perfectly reflected in the practice, and in any case they were refracted in the lens of a theocentric, predominantly Catholic, mainly agricultural and isolationist state. Mulcahy himself expresses scepticism about how well second level education succeeded in preparing students for life, employment and university education and summarises the complex real structure of Irish education after 1963 thus:

> No worthwhile attempt was made clearly to identify and enunciate the educational aims and objectives of…post-primary education; no attempt was made to assess the extent to which the demands of economic and technological growth should influence or determine the overall aims and philosophy or orientation of post-primary education; and less still were any attempts made to assess the relative merits of education for economic and technological growth and those of education for personal growth of the individual and his preparation for life, the traditional aims of secondary, and to a somewhat lesser extent of continuation education. Consequently such attempts at educational and curriculum reform as took place at post-primary level were conducted largely within a philosophical or moral vacuum. (Mulcahy 1981, 67-68)

It is clear that, since at least 1963, it has become politic not to meddle with philosophy. Nevertheless I advance the Newmanian view merely to instance the alteration at a fundamental level that has occurred in the thinking of government about what an education system should be doing. The philosophy that guided Irish education of the time, putting the development of the intellect or the child at its centre, whatever its actual outcomes, contrasts very sharply with one which at the outset envisages students as customers and consumers of educational services in the marketplace and prepares them to take their place in that market both as provider and consumer. The Irish Department of Education puts this latter point of view succinctly on the 'Customer Service' (DES 2009, website) page of its website when it declares: 'The Department is committed to delivering quality services that meet the needs of our customers, particularly learners, in achieving its mission and high-level goals.' Its vocabulary of services, customers, mission and high-level goals belongs to the lexicon of new capitalism.

2.5 Human Capital

We have observed that neoliberalism is a complex discourse and within this discourse there are many competing and supporting theories of human behaviour, of economic behaviour and of the function and relevance of the state. Olssen, as previously noted, instances Monetarism, Human Capital Theory, Public Choice Theory, Agency Theory, Transaction Cost Economics and managerialism as some examples. However, Human Capital Theory is central to Irish

educational reform of the present day, and this thesis will interrogate that centrality. Theodore Schultz, one of the originators of the term declares:

> I propose to treat education as an investment in man and to treat its consequences as a form of capital. Since education becomes a part of the person receiving it, I shall refer to it as human capital…it is a form of capital if it renders a productive service of value to the economy. (Schultz 1960 quoted in Olssen *et al.* 2004, 146-47)

Lauder *et al.* observe that there are many assumptions made in theorising human capital, including: that it is in the self-interest of individuals to pursue education because it will lead to higher economic returns; that greater levels of education lead to higher incomes; that education leads to a meritocratic economy where the educated succeed; that employers will invest in technology to take advantage of an educated workforce. Theoretical and empirical evidence suggest these assumptions are highly contestable (Lauder *et al.* 2012, 52).

In neoliberal theorising of the relationship between the state, the citizen and education, each person is held responsible and accountable for his or her own actions and well-being (Brine 2006, 654; Harvey 2005, 65), a seemingly innocuous, even common sense assumption. Within this discourse traditional education systems are criticised for leading to 'a culture of dependency' (Peters 1996, 89) while neoliberal theories see education as 'the producer of the required human capital' (Rizvi and Lingard 2010, 18) and investment in human capital is one of the accepted characteristics of the neoliberal knowledge economy (Peters 2001, 3). Human capital has variously been described as 'competencies' (Peters 2001, 8), 'abilities-machines' (Foucault 2008b, 229), 'profit levers' (Fitz-enz 2000, 1), and in 2009 the OECD refined its definition of human capital to 'the sum of what the individuals in an economy know and can do' (OECD 2009c, 3). In economic terms, these abilities, competencies, skills, represent for the worker her 'capital', something from which she cannot be separated, something from which she can earn an income or wage (Foucault 2008b, 224). In Foucault's terms, in this conception of 'capital-ability' which receives a wage, the worker herself appears as a sort of enterprise of herself (Foucault 2008b, 225), she is 'the individual that is an enterprising and competitive entrepreneur' that the neoliberal state seeks to create (Olssen and Peters 2005, 315). In passing, it is worth remarking that this renewed emphasis on individualism must be considered against the problem identified by Olssen: in a world faced with an existential threat our only hope of survival is through cooperation (Olssen 2009, 451).

In knowledge-based companies however, the inherent value of knowledge locked into systems or processes is of greater significance than the knowledge in workers (Peters 2001, 8). For such companies, the systems and processes must be preserved even during relocation, while the workers are interchangeable. On the other hand 'it is undeniable that people are the profit lever' (Fitz-enz 2000, 1) in such companies because the knowledge locked into systems or processes must be extracted and interpreted. The knowledge-worker is the essential ingredient as the interpreter of knowledge:

> All the assets of an organization, other than people, are inert. They are passive resources that require human application to generate value. The key to sustaining a profitable company or a healthy economy is the productivity of the workforce, our human capital. (Fitz-enz 2000, 1)

In neoliberal theory the worker is responsible for her own well-being, she must invest in her own human capital – as Carnoy remarks: '[i]n the human capital model, labour could actively enhance its own value by choosing to invest in education and training' (OECD 2000, 211). The success or failure of a worker is no longer attributed to circumstances, such as social class or economic situation, inherited wealth or social deprivation, but rather it is considered a function of one's 'entrepreneurial virtues or personal failings' (Harvey 2005, 65). This is a significant point for neoliberal theorists, since it evades the classical Marxist construction of class and class struggle. Accordingly, politicians, worldwide, have adopted a version of human capital theory to legitimate the 'conversion of social and economic inequalities into educational problems' (Coffield 2007, 16) and it is widely reported that a country's economic success or failure will be determined by the education of its human capital.

It is important to see this construction of the condition of labour in contradistinction to the Marxist analysis which argues that the worker sells her labour power 'for a certain time against a wages established on the basis of a given situation of the market corresponding to the balance between the supply and demand of labour power. And the work performed by the worker is work that creates value' (Foucault 2008b, 221). Throughout the late nineteenth century this analysis proved a powerful weapon in the hands of organised labour, suggesting that workers could combine against the power of the employers and effect changes for the better in their pay and working conditions. The neoliberal construction proposes an alternative analysis in which the worker is herself a form of capital, an entrepreneur of herself, in Foucault's memorable

words, who contends that 'if capital is thus defined as that which makes a future income possible, this income being a wage, then…it is a capital which in practical terms is inseparable from the person who possesses it' (Foucault 2008b, 224). In neoliberalism:

> *homo œconomicus* is an entrepreneur, an entrepreneur of himself, being for himself his own capital, being for himself his own producer, being for himself the source of earnings. (Foucault 2008b, 226)

The production of human capital, according to Foucault, relates directly to education since it is:

> A policy of growth focused precisely on one of the things that the West can modify most easily, and that is the form of investment in human capital. And in fact we are seeing the economic policies of all the developed countries, but also their social policies, as well as their cultural and educational policies, being orientated in these terms. (Foucault 2008b, 232).

Thus in neoliberalism, human capital is analogous to any other form of capital in that the worker brings herself to invest in a company in the same way that an investor brings capital, and both receive a dividend from the success of the company – that of the worker in the form of wages. The theory elides the actual power relations that divide the investor and the worker, and this is perhaps its primary intention, though, of course, it also renders labour more amenable to accounting procedures, so that the value of labour can be quantified more readily.

Denis O'Sullivan explores human capital theory in considerable detail in relation to Ireland in his book *Cultural Politics and Irish Education* (O'Sullivan 2005). He argues that, in Ireland, the theory of human capital entered public discourse in the 1960s with the proposition that 'investment in people produced a greater rate of return than investment in physical plant' (O'Sullivan 2005, 143) which, according to O'Sullivan translated for Irish government practice into 'expansion of education provision, supported by funding' (O'Sullivan 2005, 144). The theory has not remained static and has been adapted to suit evolving economic demands. O'Sullivan identifies the Irish government practices of *Second Wave Human Capital Theory* of the 1990s as providing 'selective investment in education in high technology and management areas' (O'Sullivan 2005, 144), which morphs into present day practices, in what he describes as '*Market Liberal Human Capital Theory'* (O'Sullivan 2005, 144), which includes second wave practices but also programmes that encourage 'self-managing individual investment' (O'Sullivan

2005, 144). The OECD uses its Programme for International Student Assessment (PISA) to assess the stock of human capital internationally by testing the knowledge and skills of student populations at the end of compulsory schooling. The OECD defines 'human capital' as '[t]he knowledge, skills, competencies and other attributes embodied in individuals that are relevant to personal, social and economic well-being' (OECD 1999a, 11). Ireland participates in this testing process. In passing, it is worth remarking, that a striking consequence of the dominance of human capital theory in educational policy-making here, is the renewed interest in education.

In chapter 5 I will interrogate OECD/PISA, its influence on education policy, its role in the reform of school curricula, its assessment of human capital and as components in the circulatory system of ideological hegemony, etc..

One effect of the neoliberal theory of human capital is that 'education is expected to carry the lion's share of the burden of reform' (Coffield 2007, 11). In this version of human capital theory, education is a service delivered to the market and citizens become customers who choose what they can afford to buy (Lynch 2006, 3). Failure belongs to the individual and the blame for failure lies with the victim. I contend that such market values have permeated the public discourse in Ireland and have percolated into the education debate, becoming, in time, the objects of educational reform. Schools come to embody such values as institutions of cultural preservation and distribution. Human capital is neoliberalism's theory of labour.

2.6 Empty Metaphor – The Language of Neoliberalism

The double life of commonplace words – clones, genes, learning, skill, knowledge – that makes neoliberal language so obscure to most people needs to be set in its cultural and philosophical context. The enthusiasm with which teachers and the public embrace the concept of lifelong learning, for example, has its roots in a deeply held belief that it is never too late to fulfil a cherished ambition to acquire a language, learn to paint, adopt a new trade or profession, or to simply engage in the act of learning. In this way of seeing things, people literally 'live and learn' and formal educational environments are simply a means to providing certain kinds of new learning. In fact, the acquisition of knowledge is seen by most people as a good in itself, reflected in the old saying that 'knowledge is no load'. This folk memory-based desire sees knowledge as a form of personal fulfilment and liberation. One of neoliberalism's successes has

been to adapt positive language to its more sinister purposes, so that now, for example, 'lifelong learning' is a synonym for continuous retraining in particular during periods of enforced unemployment. In the same way the expression 'flexible workforce' translates as 'compliant' or 'precarious' workforce.

Those involved in education find themselves, on the one hand, increasingly dealing with managerial and financial matters and on the other operating within a dynamic that is defined by the language and values of the market. Terms such as 'individualism', 'excellence', 'performance', 'benchmarking', 'innovation', 'efficiency', 'skills training' and 'entrepreneur' are now an accepted part of the language of education. This shift in language has been underway for some time and terms appropriated from psychology, science, sociology, warfare, and the arts have been undergoing a radical reapplication. Neoliberalism understands that control of the language is, at least largely, control of the discourse, and it has sought to impose its terminology on every aspect of cultural and political life. It is significant, for example, that in a recent article defending the arts against budgetary cuts, the poet Peter Sirr, found it necessary, first of all, to justify arts expenditure as 'the value of publishing, theatre, visual arts and all of the education-related arts activity that takes place, the value of cultural tourism revenue, the thousands of jobs in the arts, and the financial contribution of the arts', before continuing to justify it on the grounds of its 'imaginative footprint' (Sirr 2009, *The Irish Times*). The language of neoliberalism has penetrated even to poetry.

This change in the language of capitalism is not merely cosmetic; it lies at the core of the hegemony. Language is central to the spread and acceptance of the discourse. In Foucauldian terms we are talking of 'discourse' defined 'as a group of statements that belong to a single system of formation' (Foucault 2008a, 121). Thus we can talk of a neoliberal discourse in which the subversion of common words allows for the gradual downward percolation of the language of subjection and its establishment as 'common sense' in society.

Several major thinkers have concerned themselves with the language of neoliberalism most notably Michel Foucault in his recently translated series of Collège de France lectures on biopolitics.

Pierre Bourdieu and Loic Wacquant identify the 'cultural imperialism' associated with the 'neoliberal revolution' as a form of '*symbolic violence*' relying on constrained communication to extort submission (Bourdieu and Wacquant 2001). It is worth quoting the following passage in

full:

> [T]oday many topics directly issued from the particularities and particularisms of US society and universities have been imposed upon the whole planet under apparently dehistoricized guises. These commonplaces (in the Aristotelian sense of notions or theses *with* which one argues but over which there is no argument), these undiscussed presuppositions of the discussion owe most of their power to convince to the prestige of the place whence they emanate, and to the fact that, circulating in continuous flow from Berlin to Buenos Aires and from London to Lisbon, they are everywhere powerfully relayed by supposedly neutral agencies ranging from major international organizations (the World Bank, International Monetary Fund, European Commission and OECD), conservative think-tanks (the Manhattan Institute in New York City, the Adam Smith Institute in London, the Fondation Saint-Simon in Paris, and the Deutsche Bank Foundation in Frankfurt) and philanthropic foundations, to the schools of power (Science-Po in France, the London School of Economics in England, Harvard's Kennedy School of Government in America, etc.).

Versions of neoliberalism are written by such 'philanthropic foundations' and handed out to business 'gurus'. Examples abound: Clayton Christensen at http://www.claytonchristensen.com/; or Jim Collins at http://www.jimcollins.com/ for example. An internet search turns up dozens, as CEOs, managers and intellectuals strive to create the new image, the theory and the practice.

These versions of neoliberalism, which share a common linguistic pool defined as much by its omissions as by its appropriations, provide us with a written discourse that sets out the language, ideals, values and goals together with the work-order of neoliberalism. The authors themselves are among the 'intellectuals' who function in society to bring about the consent of the masses of the population to the general direction imposed on society by the dominant group. The discourse of the intellectuals, in its various manifestations, becomes an important element in chapters 5, 6 and 7.

Bourdieu *et al,* borrowing from Orwell's *Nineteen Eighty Four,* identify what they call 'Newspeak' the vocabulary of the new type of imperialism, which includes terms now in common usage such as: 'globalization' and 'flexibility', 'governance' and 'employability', 'underclass' and 'exclusion', 'new economy' and 'zero tolerance', 'communitarianism' and

'multiculturalism', not to mention their so-called postmodern cousins, 'minority', 'ethnicity', 'identity', 'fragmentation', and so on. They also remark on the omissions of this vocabulary: 'the terms "capitalism", "class", "exploitation", "domination" and "inequality" are conspicuous by their absence.' (Bourdieu and Wacquant 2001). The technique at work here is what the writers call 'universalizing the particularisms bound up with a singular historical experience'. The totalising effect of this deluge of language is remarkable. It is possible to believe that these terms describe the common sense view, the true and only state of affairs, and that any criticism is the work of 'cranks' or 'ideologues'.

Words that have become central to the developing language of what Gee *et al* call 'the new work order' (Gee *et al.* 1996) and whose context and interpretation have altered include: 'empowerment', 'teams', 'vision', 'trust', 'collaboration', 'ownership', 'self directed learning', 'lifelong learning', 'agent', 'customer', 'coach', 'learner', 'facilitator'. Words that suggest authority or hierarchy have been dismissed or dropped from the new vocabulary; teachers have been replaced by facilitators, and pupils by learners, managers by coaches and workers by team members all of whom ultimately are not citizens but customers of a state bringing their purchasing power to bear to effect change. The concept of 'embracing change' and 'ownership of the process' are central to persuading people to accept the often radical alterations in their working lives or in how they experience their community or the nation state.

This language gradually percolates downwards from the ideologues until it finds a place in the everyday discourse. In the process it undergoes inflation, as evidenced by the usual company 'mission statement' which inevitably declares that the company aims to be the best at what it does. An advertisement for a 'store assistant' in the Lidl group of stores required the following 'profile' of its applicants (Lidl Group 2009):

- You have excellent customer service skills and are team-orientated
- You are highly motivated and work well under pressure
- You enjoy working in a fast paced environment
- You are at least 18 years of age

- You have an outstanding sense of ownership and responsibility
- You are looking for a part-time opportunity
- You have excellent communication skills

What a prospective store assistant 'looking for a part-time opportunity', even one with 'excellent communication skills', would make of the requirement that he/she should have 'an outstanding sense of ownership' is anybody's guess, but sooner or later the language will have established itself to such an extent that a translation will not be required. Most of the requirements are empty metaphors. It is doubtful if the management or whoever conducts the interviews could explain what they mean.

The authors are outside the workplace, they are the academics, theorists, think-tank members, corporation elites; they are the decision makers, the ones who demand loyalty and commitment to the corporation/company but who decide when the worker is no longer necessary, when she has outlived her usefulness or has become too expensive. They are the business intellectuals, the business managers, the elite, the subalterns of power in what is portrayed as a system without power hierarchies.

In the new discourse, the word 'knowledge' has been appropriated and given new meaning. In Newspeak, the important knowledge is 'the knowledge it takes to innovate, design, efficiently produce, market, and transform products and services as symbols of identity and lifestyle in a high risk world' (Gee *et al.* 1996, 28). For the OECD it is scientific and technological knowledge (OECD 1996, 21-22). Robertson identifies a particular set of 'knowledges' privileged by the World Bank Knowledge for Development programme – western science and technology, enabled by ICTs and the institutional structures that support a liberal market economy (Robertson 2009, 242). In Ireland 'knowledge is the new currency of the innovation economy' (The Innovation Taskforce 2010, 25) and much of this knowledge is scientific and technological in nature (Forfás/ICSTI 1999a, 7). We have the 'knowledge economy', 'knowledge society', 'knowledge capitalism', 'knowledge work' and 'knowledge workers'. These crucial terms all adopt the new language of knowledge as something with a measurable economic value, another commodity among many commodities, part of the 'human resources' of a state, rather than the more general traditional conception defined by the Oxford English

Dictionary (OED) as 'acquaintance with a branch of learning, a language, or the like; theoretical or practical understanding *of* an art, science, industry, etc; skill *in*, or *to do* something'.

There is no rigorous definition of what is meant by the term 'knowledge', an explosive and contested philosophical term to which virtually the whole of thousands of years of epistemology is devoted. Knowledge and technology have always been central to economic growth but the increase in high-technology investments and developments in high-technology industry have resulted in the acceptance of knowledge 'as the driver of productivity and economic growth' (OECD 1996, 3). In the context of a continuing decline in returns from manufacturing and commodity investment, 'knowledge' is seen as the new source of wealth, a new commodity, and ensuring the necessary conditions for generating a knowledge-based wealth has become an imperative for international capitalism. In its capacity as an economic entity, therefore it must be possible to analyse knowledge, calculate its use-value and quantify its contribution to the economy.

2.7 Knowledge and the Knowledge-Based Economy

The elevated role of knowledge and technology in the present-day economies has led to the conceptualisation of certain economies as *knowledge-based* where 'production, distribution and use of knowledge and information' (OECD 1996, 7) are central to their functioning. According to an OECD 1996 publication '[k]nowledge is now recognised as the driver of productivity and economic growth, leading to a new focus on the role of information, technology and learning in economic performance' (OECD 1996, 3) and the term *knowledge-based economy* 'stems from this fuller recognition of the place of knowledge and technology in modern OECD economies' (OECD 1996, 3). According to the World Bank, the knowledge-based economy 'relies primarily on the use of ideas rather than physical abilities and on the application of technology rather than the transformation of raw materials or the exploitation of cheap labor' (World Bank 2003, xvii). It is not my intention to interrogate this concept here, merely to point to its existence, some salient features and its influence on what is expected of education.

The OECD and the World Bank have been described by Robertson as 'the self appointed "midwives" giving birth to this bright new future' (Robertson 2009, 235) of the knowledge economy. The framework for the project as created by the OECD, she says, was picked up by

the World Bank in its Knowledge for Development Program and the whole concept has been influenced by human capital theory and *new growth theory*. Both organisations agree on the centrality of education but they differ on how education systems should develop (Robertson 2005, 151). For the OECD '[e]ducation will be the centre of the knowledge-based economy, and learning the tool of individual and organisational advancement' (OECD 1996, 14). For the World Bank, sustaining economic growth and competing in the global economy requires a well-educated workforce with opportunities for lifelong learning, where 'limited government resources' can be stretched by tapping the private sector (World Bank 1998, 101). The presumption here is that governments will take the political decision to 'limit' the resources they are prepared to expend on education in order to facilitate the marketisation of those educational products from which profit can be extracted. The decision to limit any government resources is always political and is really a decision to allocate such resources in a particular way – lower taxes, for example, rather than spending on education. Thus it is a market-led approach to education with the emphasis on individualism that is favoured by the World Bank.

In a conference paper on the OECD work on knowledge and the knowledge economy (Ásgeirsdóttir 2005, 2) the OECD Deputy Secretary-General, Berglind Ásgeirsdóttir, selected innovation, new technologies, human capital and enterprise dynamics as the pillars upon which the knowledge economy depended. Globalisation, she said, was the 'driver' (sic) that influenced these 'pillars' and she identified a further four factors 'research and development', 'Internet', 'highly skilled' and 'multi-national companies'. In a bizarre set of mixed metaphors, she chose the image of a Greek temple to illustrate her remarks, the pillars being those that support the knowledge economy. It may be a step too far to conclude that Ásgeirsdóttir believes the knowledge economy is a sacred institution, but the imagery has certainly achieved the status of a liturgical language for adherents of the knowledge economy concept. All of the above terms, together with others from her speech, are the stock-in-trade of politicians, businesspeople, expert groups and commentators in Ireland where, since the 1990s a move has been afoot to shift away from industrial methods of production and towards that of a knowledge-based economy.

In this context, in 1996, Forfás[2], the Irish government think-tank, identified the move from 'natural resource endowment' to 'knowledge and skills' as a prerequisite for future competitive advantage and it recommended that a strategy be put in place in Ireland to support the development of an *information society* (Forfás 1996, 2.13). Subsequently, in language redolent of the OECD knowledge-based economy publications, the Forfás annual report 1998 outlined the details of a Technology Foresight exercise which dealt with the matching of technology development to national needs. This exercise was prompted by the belief that 'global competition and economic development will be driven by unprecedented growth in knowledge in many areas of technology' (Forfás 1998, n.p). Thus, in line with 'modern OECD economies' and conscious of the place of knowledge and technology in the economy, Forfás recommended that Ireland should reposition itself as an internationally acknowledged *knowledge-based economy* (Forfás 1998, n.p.) and with this move a new relationship between education, human capital, the economy and the social partners was established. An examination of the Forfás documents reveals the genetic code of OECD policies, and this thesis will argue that much of Irish government education policy is founded upon principles laid down by the OECD.

The new theory recognises that 'the diffusion of knowledge is just as significant as its creation' (OECD 1996, 24). Education therefore, is crucial to an economy's ability to diffuse innovations throughout society and maximise the import of technology in people's lives. The Irish think-tank absorbed this lesson well. Forfás argued that:

> It is of key importance that the increased emphasis on such development is reflected by the education system in the development of effective, modern and meaningful STM education provision in schools. (Forfás/ICSTI 1999a, 2.3)

Ball observes that the discourse of knowledge economy has privileged innovation as the 'only comparative advantage…a nation can attain' (Ball 2008, 19). Foucault made a similar observation in 1979, adding that neoliberals see innovation as the income of human capital, a return on the set of investments at the level of man himself (Foucault 2008b, 231). Forfás marked out innovation as the key to international competitiveness and throughout the 1990s stressed the need for Irish-owned industry to reposition, innovate and compete, to adapt itself to a changing competitive environment (Forfás 1996a; b; Forfás/ICSTI 1999a). Ironic then that

[2] Forfás is the policy advisory board for enterprise, trade, science, technology and innovation. It was established as a government agency of the Department of Enterprise, Trade and Employment in 1994.

the so-called 'boom' between 2000 and 2008 was really an old-style bricks-and-mortar housing bubble predicated upon over-production of housing units and ultimately 'ghost estates'.

The perception of Forfás, based on international trends, was that major changes in education and training were needed in order to create a skilled and innovative workforce that would meet the requirements of a successful, knowledge-driven enterprise sector (Forfás 1996, 5.12). The understanding was that demand for new skills was increasing, that the nature of these skills was changing rapidly, that new patterns of employment would mean that people would be required to re-skill many times during their working lives, and consequently that lifelong access to education and training would be necessary for all workers.

In contrast to the World Bank's vision of future education which favoured 'the market and individualism' (Robertson 2005, 135) as the means for developing knowledge and skills, the proposed Irish model was more in line with that of the OECD and concerned itself with human capital formation. Present state investment in primary, secondary and tertiary education was to continue. However, it was recommended that the State should invest in education and training in consultation with other agencies, the partners in education. Industry was to become a major partner in the process and in this capacity it was to have 'a role to play in supporting change in education through giving practical help and advice to second and third-level institutions' (Forfás 1996, 5.18). The State was to have 'an important enabling role' in this undertaking by 'removing obstacles and preferentially directing resources towards institutions that are seen to be responsive' (Forfás 1996, 5.18). The conception of government as having an 'enabling role', rather than an active or constructive one, is central to neoliberalism. The involvement of industry in education was to become a prominent feature in the discourse surrounding mathematics, in particular its influence would be felt at second level where the Institution of Engineers of Ireland (IEI) positioned itself as the giver of 'practical help and advice', and the government, in its 'enabling role' granted it significant influence. Engineers of all persuasions permeate both the straight manufacturing sector and the 'knowledge-based' sector in a striking way. However before analysing the involvement of IEI in the discourse (chapter 6) I will look a little further at how Irish education policy became focused on science, technology and mathematics and how its course was directed by the ambition to become a successful knowledge-based economy and how in the process it fell under the influence of the global field of education policy.

2.8 Benchmarking

The question of how Ireland should focus its education system in order to facilitate the development of a national science and technology infrastructure was addressed by the Irish Council for Science, Technology and Innovation (ICSTI), a sub-board of Forfás. In 1998 ICSTI initiated an international benchmarking study of science, technology and mathematics (STM) education in Ireland, Scotland, Finland, Malaysia and New Zealand. Benchmarking in the study was defined as 'the use of systematic methods to compare yourself with others and find better ways to do your work' (Forfás/ICSTI 1999a, 4). To this end, ICSTI contracted the multi-national 'audit, tax, consulting, and financial advisory service' Deloitte & Touche (Deloitte 2011, website) who, under the direction of the steering group, developed and administered an extensive questionnaire from a list of benchmarking parameters.

Based on the presupposition that the evolution of countries into knowledge-based economies and societies is critically dependent on their education systems (Forfás/ICSTI 1999a, Foreward), from the outset the survey unsurprisingly focused on countries where this presupposition appeared to be demonstrably true. It choose, for example, countries where STM education was moving from 'talk and chalk' to experiential methods with an emphasis on developing problem-solving skills and learning-by-doing (Forfás/ICSTI 1999a, 3). It attempted to formulate a systematic way of describing the qualities that made up the education system of a knowledge-based economy. Its assumptions about 'knowledge' and what the qualities were that created it were not interrogated. If the ICSTI engaged in a prolonged meditation on the nature of 'knowledge', 'economy', 'society' or 'education' it is nowhere evident in the survey. It appears to have adopted a standard set of assumptions and procedures which trivialise psychological and philosophical explorations of knowledge. Its purpose was to describe the education system in Ireland and that of 'other successful knowledge-based economies' under a common set of benchmarking parameters, to raise awareness of STM education and to provide an evidential basis for advice to the education establishment (Forfás/ICSTI 1999a, 29). The decision to develop Ireland as a knowledge-based economy had been made and thus ICSTI compiled its policy-based evidence. The fundamental assumption is that STM education is 'for' the economy.

With its findings ICSTI aimed to 'assist government and its agencies, teaching professionals and representatives of parents in making the difficult decisions required to ensure effective STM education provision in Ireland' (Forfás/ICSTI 1999a, 4). Yet there is no discussion regarding what these 'difficult decisions' might be or indeed why they are perceived as being difficult, but the concentration on 'effective' STM education is an agreed prerequisite for the future direction of education here. The transformation of a country into a knowledge-based economy or knowledge-based society (no distinction is made between the terms) depends, the report claims, on the provision by its education system of adequate levels of scientific, technological and mathematical literacy. Proficiency in these literacies will prepare individuals 'to fulfil active and critical roles as citizens and to make well-founded decisions on issues affected by science and technology' (Forfás/ICSTI 1999a, 28), contributing to the success of the knowledge-based economy/society in global terms.

Thus, I contend that the conditions, under which the new discourse in Ireland relating to mathematics education was constructed were of an economic nature, focusing on the shift towards a certain kind of economic development and the expected role of citizens in pursuit of national economic goals. Under these conditions a number of issues were introduced by the ICSTI survey which were subsequently taken up by other agents in the discourse and used as tools or evidence in the construction of the problem of mathematics in Irish education or, in some cases, studiously overlooked. The way in which the issues were used varied and depended to a large extent on the objectives of the agents involved.

Ultimately the survey represents a point of inflection in the development of STM education in Ireland with a recommended shift from the philosophical pedagogical position of 'teaching for learning' to 'teaching for doing', a move from 'fact-based teaching' to 'problem-based learning'.

On foot of its concerns that Ireland may not be in a position to take a full part in the emerging knowledge-based society the ICSTI made its recommendations to Government, the education sector, the business sector and others on improving science technology and mathematics education, in second level schools. Its produced a statement on *Science in Second Level Schools* (Forfás/ICSTI 1999b) in which it highlighted three key issues identified by the benchmarking survey: how to develop and implement STM education policy on a relevant time-scale; how to recruit, train and retain high quality STM teachers, particularly in the physical sciences and

mathematics; and how best to teach and assess STM (Forfás/ICSTI 1999b). The latter two issues of teacher training and teaching and assessment of STM are very much in evidence in my analysis of the official and legitimate voices relating to the development of the mathematics curriculum and are strong features of the discourse. However, the development and implementation of policy 'on a relevant time-scale' is more subtly applied. It is probable that the application of a 'relevant' time-scale may help to explain why concerns raised by the Irish Maths Teachers Association (IMTA) (examined in detail in Chapter 7) relating to the time-scale under which Project Maths[3] was being implemented were dismissed by the Department of Education in the Spring of 2010 (DES 2010a; IMTA 2010).

2.9 Conclusion

In this chapter we have considered education as a political act and seen that the neoliberal discourse in relation to education policies must be read as part of a complex of political and economic relations. The spread of new technologies and the development of knowledge-based economies have resulted in a re-examination of the role of education in preparing young people for working life. We have seen how the purpose of schooling has been altered, schools have become the producers of human capital where demands for new skills are affecting the type of human capital that schools are expected to produce. We have considered how the pressure from the concept of the knowledge-based economy is dictating the type of knowledge that should be taught. We considered the labour market for which students are being prepared where the 'reserve army of the unemployed' is always in evidence and lifelong learning is really self-funded retraining for the precariat. We briefly looked at the language of neoliberalism with its subversion of common words which aids the downward percolation of subjection together with its establishment of the common sense.

The concept of 'knowledge economy' appears in the vast majority of documents that will be examined in this thesis and permeates the narrative of mathematics education policy, yet it is rarely if ever interrogated in Ireland. Consequently, it was necessary to examine the concept as

[3] Project Maths is an NCCA designed mathematics syllabus for junior cycle and senior cycle in second level schools. A pilot scheme involving 24 schools which commenced in 2008 runs until 2013. The main project was rolled out nationwide in 2010 and will involve a phased introduction of 5 strands of mathematics which will be completed in 2015.

it was localised. This chapter traced the imprint of the OECD in the Irish approach and tracked its use in a government-commissioned 'benchmarking' exercise. Finally it identified some issues from these early documents that will reappear in later chapters and assume greater importance. In the next chapter we will examine the role of what Ball calls 'legitimate voices' in the shaping of educational discourse where many of the themes raised in this chapter will reappear.

Chapter 3

Legitimate Voices

Power produces; it produces reality; it produces domains of objects and rituals of truth. The individual and the knowledge that may be gained of him belong to this production. (Foucault 1977, 194)

3.1 Introduction

This chapter and the next present a reading of the acknowledged narrative of the reform process in mathematics education in Ireland, a narrative developed by officially appointed bodies and constituting the acknowledged or official process. The chapters will attempt to determine the role of 'legitimate voices' in the discourse. To this end they will examine the mechanisms that are driving the change, the process itself and the initial outcomes. The two chapters will approach the official narrative, insofar as is possible, on its own terms, and clearly a narrative, if it is to be credible, must be reasonably consistent and comprehensive. These are the strictures with which we will read the official text. The construction of this narrative must include the salient published material stemming from officially recognised agents in the policy process. For chapters 3 and 4, these agents include representatives of business, trade and industry, government agencies, education and other interested parties whose interests are represented in clusters of officially constituted bodies and forums that centre on The Expert Group for Future Skills Needs (EGFSN), The Task Force on Physical Sciences, the National Council For Curriculum and Assessment (NCCA) and the Department of Education and Science (DES). Each of these groups enters the process with its own history and imperatives. Thus the discourse contains a particular construction of the problem to be addressed and an ideological tendency towards a particular set of solutions.

It would be easy to see a simple historical process at work here – the problem is identified, it is evaluated and a solution is proposed – and this is more or less how the official agencies involved would wish it to be portrayed. However, the reality is that the solution often comes first. The agents involved, frequently for reasons that do not appear to bear directly on the policy but

relate closely to the discourse in which they come to power, have a vision of a new position and they set out to create the evolution that will bring this new position about. Thus the 'problem of the problem' (McLaughlin 2006, 210) assumes a position of great importance in the policy process. Rizvi and Lingard maintain that '[p]olicies are often assembled in response to perceived problems' (Rizvi and Lingard 2010, 6) and, conversely, we conclude, that perceived problems are often constructed in order to give validity to desired change.

In this and the following chapter, the *problem* of mathematics as constructed by each of the official voices will be interrogated, but the 'problem of the problem' will be revisited throughout the thesis as each of the agents attempts to construct their version according to their own internal discourse.

We will begin the analysis by looking at the problem as framed by the Expert Group for Future Skills Needs (EGFSN), The Task Force on the Physical Sciences and the Institution of Engineers of Ireland (IEI). Over time these agencies become significant voices in the development of educational policy in Ireland.

3.2 Expert Groups

From the early 1990s and up to 2007 Ireland experienced a period of extraordinary economic growth, its 'Celtic Tiger' era, where for a number of years it experienced 'high and sustained economic growth, low inflation, a current account balance of payments surplus, falling unemployment, net immigration and a growing budget surplus' (Murphy 2000, 3). For policy makers sustaining economic growth into the future was seen as being 'critically dependent upon an adequate supply of suitably qualified people' (Forfás 1998, n.p.). As we have already seen Forfás (the policy advisory board for enterprise, trade, science, technology and innovation) on foot of a Technology Foresight exercise had recommended that Ireland's information society should be repositioned to become a world-class knowledge-based economy with the attendant demands on education. In chapter 2 we saw that positioning itself to become a knowledge-based economy meant that a new relationship between education, human capital and the economy was established. A successful knowledge economy demanded a skills-based approach to education and prioritised science, technology and mathematics. Thus a metamorphosis of STM education in Ireland was required. The ICSTI, as we have seen, carried out a benchmarking exercise with

a view to identifying, for policy makers, an appropriate model of STM education. Around this time, when the number of school-leavers was declining as a consequence of demographic changes (EGFSN 1998, 2), the Government established a Business Education Partnership structure (Forfás 1998, n.p.) to address issues of economic growth and the adequate supply of suitably qualified people. The Partnership was to develop national strategies that would tackle the issues of skills needs, manpower forecasting and education and training for business. (Forfás and H.E.A. 1999, 5). Thus it was constituted from the outset as an agent with a contribution to make towards educational change within a knowledge-based economy. It was instituted by Mary Harney, (Tánaiste and Minister for Enterprise, Trade and Employment) and Micheál Martin, (Minister for Education and Science). There were three elements to the partnership: The Expert Group on Future Skills Needs; The Skills Implementation Group; The Business Education and Training Partnership Forum.

The remit of the Expert Group on Future Skills Needs (EGFSN) was to inform Government policy-makers, and education and training providers, and to address labour market development and skills needs for enterprise in Ireland. The initial EGFSN consisted of representatives of the technology and finance industries, government departments and third level education and training bodies (EGFSN 1998, 33-35). Although their recommendations would bear directly on second level education, there was no representative of that sector, nor of primary level. Their mandate was to analyse the issues relating to the supply of skills required by industry and to make policy recommendations (EGFSN 1998, 2). This mandate was strengthened in 2001 when the expert group was positioned as the 'central resource for advising the Government on skills needs' and its membership and the resources available to it were increased (EGFSN 2001a; b, iv; 2001c) though it still did not include representatives of second level . The group was to report to the Minister for Enterprise, Trade and Employment and to the Minister for Education and Science. The Skills Implementation Group was responsible for ensuring implementation of the recommendations proposed by the Expert Group and the Business Education and the Training Partnership Forum allowed all interested parties to have an input into the work of the Expert Group. This latter group was created to promote dialogue between Government, business and the education and training sectors. It also provided the Expert Group with a platform to report its perspective on skills opportunities and related issues within the economy to a wide audience (Forfás and H.E.A. 1999, 5).

At face value, the EGFSN should be central to government policy for the future, however whether or not its expert advice enters into policy decision-making obviously depends on how it is valued. It will thus be necessary to look for the trace of EGFSN recommendations in government policy in order to evaluate its contribution. But to make such an evaluation we must consider how expert groups in general function in relation to government. A good place to begin such an evaluation is at the European Commission which makes considerable use of such groups.

A body of theory on expert groups, mainly of a managerial nature, has developed in the years since the European Commission first began to convoke them to guide policy development. The Commission relies heavily on expert advice for the preparation and implementation of policy as it considers that 'expertise is crucial for sound policies' (European Commission 2011, website). It is reasonable to assume, in the absence of any clear indication to the contrary, that the Irish Government subscribes to a similar philosophy to that of the EC.

The Commission defines an expert group as 'a consultative entity comprising national and/or private-sector experts' whose function is 'to provide…expert advice' (European Commission 2010, website). The power of the European Commission 'among the institutions of the European Union depends on resources that help to solve problems' (Böhling 2009, 1). These resources include expert knowledge which in turn is used to frame the discourse (Böhling 2009, iii) and the composition of an expert group depends on the 'type and scope' of expertise required and includes scientists, public and private practitioners and other 'stakeholders'. According to the European Commission, the 'knowledge' provided by the expert group 'should not only be excellent from a scientific viewpoint, it also needs to be in phase with practical legal, social, economic and environmental considerations' (European Commission 2010, website). It must be understood that the use of terms like 'expert' and 'excellent', while frequently simply descriptive, also, and crucially, serve to close down discussion of the political content by predetermining the advice as the best and most rational available. In addition, we may gloss being in phase with legal, social and economic considerations as favouring the status quo.

Donegan, in a paper on the use of expert groups in international trade organisations, observes that such groups established by governments are not in any sense objective, but rather they 'make their judgements and prescriptions on the basis of conceptualisations of the space,

subjects and objects with which they are concerned, which they take to be universally-accepted as 'reality' but which are in fact contingent, local, and specific to the neoliberal political rationality.' (Donegan 2006, 43). Neoliberal politics has virtually fetishised the idea of expert knowledge and expert groups are a natural corollary of that fetishisation.

Initially, membership of the EGFSN was drawn from representatives of the technology and finance industries, government departments, and education and training bodies. We should assume here that a high-level of in-house expertise is available to Government and that much of this expertise is to be found in its departmental appointees. Nevertheless, just as the in-house capacity of the European Commission is limited (European Commission 2010, website) so too Government departments require external experts when the knowledge required becomes increasingly technical and highly specialised (European Commission 2010, website). It is clear from the external appointees nominated that the Government interest in perceived 'future skills needs' lies in the area of technology and finance (EGFSN 1998, 33-35). David Harvey identifies technology among the central concerns of neoliberalism. He suggests that the vast development of the financial services is both a product of, and driver in, technological advancement and argues that '[i]nformation technology is the privileged technology' (Harvey 2005, 159) precisely because it is a fundamental requirement in the 'market-driven financialisation that was the hallmark of neoliberalisation' (Harvey 2005, 157).

We can read interest in providing for the future skills needs of technology as an indicator of the neoliberal trend in evolving policy in Ireland, a move that is facilitated by the introduction and application of expert advice to the political arena. Donegan argues that the expert group is generally constructed in such a way as to reflect the government's interests in the business and industrial world. Such a grouping can be reliably expected to reflect back government policy with all the force of the expertise that it is presumed to have. In addition, it may be assumed that the in-house expertise appointed to work with representatives of industry and finance in such an expert group will be broadly friendly to this agenda. This collusion with dominance is proffered through expert advice, support and legitimation of the power elites (vanDijk 1993, 254).

As constituted, containing a membership weighted in favour of specific interests, it is inevitable that the EGFSN will conceptualise problems in a way that is consistent with the demands of the sectors from which they come. The group thus constitutes a kind of prior declaration of future

skills policy by government and a vision for how it intends to shape society. There is, for example, no arts representation though it could be argued that writers, artists and musicians are necessary to society and some categories of artists are in short supply. The constitution and remit of the EGFSN expert group and its satellites is designed to provide a focus for the demands and concerns of external groups that are considered as consumers of, among other things, the educational establishment and which therefore may be considered in neoliberal terms as having certain consumer rights to influence the product and the production process. In the European Commission's extensive use of expert groups Böhling argues 'that expert group involvement helps the Commission to accommodate interests and present itself as the Community's conscience with ideas that reflect the European concerns' (Böhling 2009, 1). The EGFSN provides the Irish government with a similar platform allowing it to legitimately and openly acknowledge and apparently accommodate the interests of business and industry.

As already observed, the remit of the EGFSN expert group was specifically to inform government action. The policy makers who construct such groups are, in fact, the principle audience for their deliberations, and if, as Donegan observes, 'their judgements and prescriptions are accepted by an audience of policymakers, their effects will be political.' (Donegan 2006, 43). Such expert groups serve two primary functions: 'through a combination of discursive and material practices' they establish 'the terms for debate and…depoliticise decisions and issue-areas.' (Donegan 2006, 27). I contend, however, that 'depoliticise' is not an exact term, insofar as these groups tend to obscure the political content of the advice they give, rather than remove that political content. In management terms, the setting up of an expert group is an attempt to externalise the political risk. When the expert group reports, government can then decide to act or not act upon some or all of its recommendations, taking cognisance of the force or otherwise of public reaction. Such public reaction, however, will always be modified by the widely-held perception that this advice is the advice of experts and therefore constitutes the rational analysis. The perception is that no matter which party is in power, such a group would give the same rational advice – the expert group transcends party politics and brings only the power of their expertise to bear. However, a simple thought experiment in which a radical socialist government reconstitutes the EGFSN according to its own projections will show that the 'truth', as declared by the experts, depends on who is declaring it and on whose behalf it is being declared. I contend that the constitution of such

groups, the construction of the problem and the kind of statements they are permitted to make are always political and ideological and stem from the dominant political discourse of the time. Despite his use of the term 'depoliticise', it is my understanding that Donegan intends it in this sense: that governments seek expert advice that will confirm or reinforce their own ideological position, and that they seek this advice in order to legitimate political choice with the white coat of science.

This brief discussion of the political content of the group and its conceptualisation of the problems can only serve to inform our reading of the official narrative. The purpose of this chapter is to examine the official narrative – in its own terms as far as possible. Thus, the work of the EGFSN and its satellites will be examined for its analysis, authority, consistency, interpretative power and practicality. However, it would be remiss not to maintain a watching brief on the political content of that advice. As I have previously argued, I believe that education policy is always political.

Accordingly, this chapter will describe the process whereby the teaching and learning of mathematics, the content of mathematics curricula and its assessment became problematised in a particular way by the EGFSN, and gradually came to dominate as a 'fundamental requirement for the growth of the knowledge economy and the development of a world-class research and innovation system in Ireland' (EGFSN 2008b, 1).

3.3 The EGFSN

As already stated the EGFSN was established to analyse the perceived future skill needs of the knowledge economy and to advise on any policies that should be put in place to ensure that these skill-demands were met. Initially it selected information technology skill needs as its priority and it estimated that the supply chain for new skills in this and other areas could take up to four years (EGFSN 1998, 2). The time scale suggests that post second level skill training was envisaged and it is to be assumed that the development of such skills was intended to be carried out by the third level suppliers of education and training. Its brief to identify the changing needs of the economy led to a concentration on the demand for skills in Science, Technology and Engineering. The emergence of the information age, it was argued, must have implications for education; students would need to develop skills that would enable them to fully participate in

the 'knowledge economy' (EGFSN 1998, 3). This statement gradually takes on the appearance of an *a priori* term in an argument whose logic ultimately points inexorably towards radical changes in science and mathematics education at all levels.

A number of EGFSN reports have appeared since its inception. They deal with specific aspects of business, education and enterprise and make many policy recommendations. The reports cover issues as diverse as E-Business, Engineering, Mathematics, the International Digital Media and Financial Skills, among others. The recommendations of these reports are far-reaching though the effects on the lives of ordinary citizens may not be immediately apparent. In her forward to the fourth report, Mary Harney, Tánaiste and Minister for Enterprise, Trade and Employment acknowledged that since its inception the Expert Group has 'had a considerable input to skills and education policy' (EGFSN 2003, iv) and I contend that one area affected directly by this policy input is second level mathematics education. My interest in the reports of the EGFSN, therefore, concentrates on their references to mathematics education and so my exploration will focus on the reports and those sections of reports that refer specifically to mathematics education or where the discussion, proposals or recommendations affect mathematics policy or practice either directly or indirectly.

The first report of the EGFSN, as mentioned above, prioritised information technology skill needs but did not concern itself directly with mathematics. It identified a growth in the demand for technologists, which it describes as encompassing a wide variety of skill categories – Engineering Professionals, Engineering Technicians, Computer Science Professionals, Computer Science Technicians – and also a substantial demand for skilled and semi-skilled operatives in the IT sector. However, a decline in the proportion of students taking science subjects at second level meant that there was a decreasing pool of candidates eligible to take technical courses at third level (EGFSN 1998, 28). The perceived 'science problem' needed to be addressed if the increased demand for technologists was to be met. The report recommended that a major effort be put into changing attitudes and perceptions of second level students in relation to the study of science. It proposed that a study (building on the existing work of the Economic and Social Research Institute (ESRI) and others) be carried out into the factors affecting student choices at second level and especially their choice of technology careers. (EGFSN 1998, 10). In his forward to the second EGFSN report in 2000, the Minister for Education and Science, Michael Woods, took up this discussion and he expressed his

concern about the 'decreasing number' of second level students who chose to pursue a range of science subjects at Leaving Certificate level (EGFSN 2000, 3). Then in November of that year the Minister (still Mr Woods) established the Task Force on Physical Sciences (Physics and Chemistry), thus introducing another legitimate voice to the official narrative. It was intended that the Task Force would address concerns about the declining numbers of students opting to study the physical sciences in Irish secondary schools, universities and colleges.

3.4 The Task Force on The Physical Sciences and The Rise of Maths Anxiety

The Task Force was set up at a time, it was argued, when the country's economic future depended on the supply of an increasing number of people qualified in engineering and science (Task Force 2002 Foreward) as a way of supplying the multinational companies being enticed to Ireland as part of the foreign direct investment strategy. This strategy was a lynchpin of government employment plans under the direction of the Industrial Development Authority. Employment of science, engineering and technology graduates had, it was argued, become the hallmark of the Irish economy (Task Force 2002, i) and the EGFSN, in its first report, had identified a shortage of possible suitable candidates willing and able to pursue careers in these areas, thus threatening future prosperity. In this construction of the problem, the narrative runs as follows: in preceding years the government had wisely positioned Ireland to take advantage of advances in technology by encouraging inward investment of high-tech industries and in order to sustain and enlarge the sector, continuity in the provision of a highly-educated, appropriately-skilled workforce was required. However the number of students interested in pursuing careers in these areas was declining and changes in the demographic were also causing problems. There was, therefore, a numbers problem.

There are other analyses less favourable to government of the inward investment or foreign direct investment (FDI) strategy. Conor McCabe, for example, in his book *The Sins of The Father* observes that the determination of successive Irish governments to support speculative building, from the 1920s onwards, siphoned investment away from indigenous industry towards property, bleeding the industrial sector dry. This collapse of local initiative forced government to devise a policy of luring multinational corporations to Ireland, the aim being to fill the gap in

industrial investment left by policies such as the infamous Section 23 tax reliefs. In this version of events the inward investment drive is not seen as a brilliant strategy to raise the bar in Irish industry but a desperate attempt to balance policies that had worked to undermine indigenous industrial activity (McCabe 2011). I instance this analysis merely to underline the fact that the official narrative is just that – a narrative of events constructed so as to cast government policy in a certain light, to construct a problem favourable to government policy and to justify the analysis that it required.

The Task Force was constructed so as to represent a wide range of science-related educational and industrial interests, a new 'expert group' – the 'partners' in education: Government departments, third level education colleges and training institutions, second level schools, the Economic and Social Research Institute (ESRI), Forfás, the Irish Business and Employers Confederation (IBEC), the National Parents Council, teachers unions and the Royal Irish Academy (RIA). The report and recommendations of the Task Force were published in 2002. The report concluded that the perceived science problem, identified by the EGFSN, was 'real' and argued that unless it was addressed any other money spent on attracting overseas investment would go largely to waste (Task Force 2002 Foreward). In its search for the causes of this problem the Report identified the 'effects of decreasing competence in mathematics' (Task Force 2002, 110) as an influence on declining student participation in science at second level and it cited the extraordinary failure rate in the 2001 Leaving Certificate Mathematics Lower Course[4] examination in support of the 'decreasing competence' claim. It did not, however, refer to the other extraordinary result of that year, where at Leaving Certificate Mathematics Higher Level over 21% of candidates achieved grades A1 or A2 (85% or over) compared with 14% the previous year! I will return to this subject later and will argue that the 2001 results were an anomaly. Nevertheless it was claimed that:

> Students' perception of the difficulty of mathematics and their poor performance in the subject both act as barriers to participation and success in the sciences at second and at third level. The risk in not addressing the problem with mathematics is that of undermining reform in science education. (Task Force 2002, vii)

[4] The Leaving Certificate examination is the terminal examination of post-primary education. It is held at the end of the Senior Cycle in post-primary schools. Mathematics is offered at three levels, higher, ordinary and alternative.

Thus it was as a result of the risk it posed to the reform of science education that mathematics itself was established as a 'problem' in the new education debate. This, I contend, was a turning point in mathematics education in Ireland, afterwards the 'problem of mathematics' was never off the national agenda and in time it became an issue for the 'experts' of the EGFSN.

The Task Force recommendations included four strands for action in the area of mathematics: an investigation of the decline in performance in Mathematics to be carried out by the Department of Education and Science (DES); increased input by third level into the second level curriculum, with the recommendation that a higher education science, engineering and technology (SET) group, nominated by the universities and institutes of technology, be appointed to consult with the National Council for Curriculum and Assessment (NCCA) course committee on Leaving Certificate Mathematics; an NCCA review of Leaving Certificate mathematics; credit for Foundation Level Mathematics[5] (Task Force 2002, 130).

Significantly, many of the mathematics-related concerns of the Task Force were focused on the Ordinary Level Leaving Certificate programme, a point that needs to be borne in mind when assessing the influence of the Task Force on subsequent EGFSN reports and on the 2005 NCCA review of Post-Primary mathematics. This focus is shifted radically when the influence of Engineers Ireland (see 3.5 below) comes to bear, another 'legitimate voice' to make its appearance in the narrative. In addition, the recommendations echoed those of the 2001 Chief Examiner's Report on Ordinary Level Leaving Certificate Mathematics which was commissioned by the Minister for Education and Science to investigate the high level of failure at Ordinary Level in 2001.

Rizvi and Lingard advert to the importance of examining the evidence adduced by groups such as the Task Force (Rizvi and Lingard 2010). The claim regarding mathematics made by the Task Force is that there is 'a problem with the growing decline in mathematics performance' (Task Force 2002, 109) in secondary schools. Firstly, it must be observed that a 'growing decline' implies a rate of acceleration rather than a steady deterioration and, as such, can be read as either a sloppy construction or a deliberate attempt to represent the 'decline' as new and urgent and requiring an urgent response. The report misleadingly refers to 'the highest failure rate in Ordinary Level Leaving Certificate Mathematics…16.7%' (Task Force 2002, 109), however

[5] Foundation Level Mathematics did not attract CAO points for entry into 3rd level STM courses.

failure rates of 22%, 18.5% and 21.3% were recorded in the years 1989, 1990 and 1991 respectively (figures from the State Examinations Commission). An examination of more recent figures reveals an oscillating series of results as opposed to a decline. Secondly, the evidence adduced for the perceived decline is selective and does not look at the overall situation regarding mathematics at second level and the achievements of students, particularly at Leaving Certificate. The report employs as evidence a single set of results, from one segment of the mathematics programme, in an exceptional year – the 2001 Ordinary Level Leaving Certificate mathematics. It is remarkable that the Chief Examiner's report for that year, commissioned by the Minister for Education to investigate the extraordinary high failure rate in the exam, identified a number of possible reasons for the unusual results, including the 2000/2001 academic year's industrial action by teachers, and the lack of recognition of grades awarded to foundation level students by 3rd level colleges and employers, but the Task Force chose to ignore all but two – possible difficulties with the older Junior Certificate syllabus and 'a lack of continuity in learning due to increased part-time work by students' (Task Force 2002, 110). The latter reason (in the Chief Examiner's Report) was based solely on anecdotal evidence from teachers (SEC 2001, 4). That the failure rates of that year in the Lower Course Leaving Certificate exam were extraordinary is true; however, if we examine the results between 1992 and 2001 we will see that the failure rate in the examination did not follow any single trend; instead it oscillated from high to low and no regular pattern is to be perceived. Subsequently the unusually high failure rate of 2001 was not replicated in later years (to 2012). Equally the Task Force did not address itself to the other extraordinary results of that year – the remarkable increase in the number of higher level students achieving an A grade, also not replicated in the succeeding years. In terms of results, 2001 was clearly an anomalous year, as remarkable for its successes as for its failures. I contend that a select single set of results in an unusual year is not sufficient to prove the existence of 'a problem with the growing decline in mathematics performance'. The argument that the failure rate is too high and that the original targets have never been met can be made quite simply and consistently from the statistics relating to the other 'normal' years. In fact, relying on the statistics of an anomalous year for their shock effect undermines the legitimacy of the general argument. It is interesting to note that in the same anomalous year the Physics marking scheme at Leaving Certificate was withdrawn and a new scheme put in its place because the initial Physics results were 'seriously out of line with the 'curve' in previous years' (Walshe 2001, *Irish Independent*, 22 December, 4). The marking

scheme for Biology was also changed. Why then were the Mathematics results allowed to stand? It is tempting to speculate that the reason was political, a 'shock therapy' that would enable the construction of the failure of mathematics that was to follow. In any case the anomalous 2001 results formed part of the attack on mathematics education for several years to come.

The Task Force also asserts that 'there has been a growing concern in education circles across the developed world about the declining competence in mathematics' (Task Force 2002, 111). It mentions the USA, (where it merely cites the fact that the government has given priority to mathematics) the UK and Finland. No supporting study of the Irish situation has been cited and therefore it is impossible to extrapolate from these relatively unexamined and haphazard examples to the Irish system. Although the assertions here belong to the worldwide panic about mathematics, the case for 'growing concern' is simply not made. Instead the evidence cited shows that in these particular countries mathematics education at secondary level does not support science education at third level. No argument is made here to support the worldwide 'declining competence' narrative (Task Force 2002, 111).

In summary, the main 'problem with mathematics' as constructed by the Task Force concerns 'the problem of decline in mathematics performance' (Task Force 2002, xvii) in one examination. This decline is generalised and viewed as both national and international. With respect to the national decline, the evidence upon which the claim is based relates to the extraordinary Ordinary Level Leaving Certificate results of 2001 and anecdotal evidence from Institutes of Technology. As previously argued, I consider the argument from the 2001 results as spurious. It is difficult to assess anecdotal evidence.

One other issue raised by the Report concerns a preliminary report to the Task Force on the comparability of grades awarded to different subjects in the Leaving Certificate examination. The research had been commissioned in order to investigate the claim that 'certain LC subjects are more easy or difficult than others and that students are being influenced in their choice of subjects by such perceptions' (Task Force 2002, 164). The report, prepared by the Education Research Centre (ERC), concluded that '[s]tudents sitting the physical sciences, along with Mathematics and French, do less well on average than students sitting other subjects' (Task Force 2002, 173).This issue was not new and had been previously addressed in the late 1990s by The Commission on the Points System (DES 1998) and an NCCA Longitudinal Study (Task Force 2002, 52) had been carried out. The ICSTI Benchmarking survey had also addressed the

issue. That the perceived difficulty of achieving high grades in certain STM subjects has a direct impact on the uptake of these subjects was to become a recurring theme in the mathematics discourse in particular, with calls coming from the Task Force, Engineers Ireland and EGFSN, (EGFSN 2008b; McIver Consulting/EGFSN 2003; Task Force 2002) among others, to address the 'problem' relating to the 'grading penalty' that is perceived to be suffered by students taking Higher Level Mathematics in the Leaving Certificate. However the 1999 ICSTI had reported that concerns about falling levels of uptake of STM subjects were experienced by all the benchmarked countries regardless of grading difficulties. Student choice accounted for much of this decline and choice was influenced by attitudes to, experiences of, and the perceived usefulness of STM (Forfás/ICSTI 1999a). There is no simple solution to this problem. In mathematics a reduction in the level of difficulty of the courses, as we shall see later, is opposed by the Institution of Engineers of Ireland and interference with the marking scheme of the examinations is opposed by the Chief Examiner and the State Examinations Commission.

The conclusions and recommendations of the *Report of the Task Force on the Physical Sciences* regarding mathematics were to feature in many subsequent reports from the EGFSN and elsewhere and became, in many cases, a feature of the constructed 'problem'.

3.5 Engineering Maths

Unlikely as it seems, the Institution of Engineers of Ireland (IEI)[6] which represents the engineering profession in Ireland across all disciplines, in all industry sectors and in the public service (IEI 2000b, 1) is, I contend, a force that must be included in any analysis of the development of policy in relation to mathematics education in the 21st century. Its place as a voice in the official narrative is easily traced. The IEI carried out an impressive campaign, producing reports, reviews and suggestions which it presented to Government and in the process it constructed itself as a legitimate voice in the discourse, heeded by government. This section will trace these contributions to the discourse. It also campaigned in the media where it positioned itself as an active voice in the creation of the common sense, we will meet these public contributions in Chapter 6. However at this point it is worth quoting in full a reply to a parliamentary question in 2000 relating to the supply of engineers to meet the demands

[6] The Institute later changed its name to the simpler Engineers Ireland.

imposed by the national development plan, which indicates the attention paid to IEI publications and the important position of this particular special interest group:

> *Minister for Education and Science (Dr. Woods):* The Institution of Engineers of Ireland, IEI, published a discussion paper entitled *A Review of our Engineering Manpower Shortages at Degree and Technician Levels* in March 2000. This paper was subsequently considered by the expert group on future skills needs which concluded that the concerns of the IEI in relation to civil engineering manpower, other than in the area of civil engineering, had been addressed through the group's work.
>
> On the specific issue of the demand for civil engineers, the IEI paper highlights the increase in demand that will arise in the implementation of the infrastructural developments set out in national development plan and the unprecedented level of activity in the Irish construction industry. The expert group on future skills needs has established a specialist sub-group to address the skills needs in the construction sector and the civil engineers will be considered in this context.
>
> I have also met the IEI to discuss skills needs in the engineering sector. Arising out of these discussions, my Department is co-operating with the IEI on an initiative to promote engineering as a career and to attract more young people into the profession. (Woods 2000).

Following the response to the *Review of our Engineering Manpower Shortages at Degree and Technician Levels*, IEI made a submission to Government entitled *Solving the Shortage of Engineers Problem* (2000). In this report IEI put forward its version of the problem of mathematics. It claimed that 'the decline in the numbers of students choosing engineering and science as their career options at third level seriously threaten[ed] future industrial and economic growth' (IEI 2000b, 1) and it identified a number of 'problems' relating to mathematics at second level which had a direct impact on the engineering profession. It claimed that mathematics and science subjects were 'increasingly perceived as more difficult and less attractive than other subjects and are not being taken as Leaving Certificate subjects by sufficient numbers of students' (IEI 2000b, 7). These problems, they said, were exacerbated by the significant reduction in the number of maths and science graduates taking up teaching as a career – they cited opportunities for higher-paid careers available in industry as a reason for this situation (IEI 2000b, 7). Incidentally, a similar claim was made in relation to engineering *graduates* choosing

to take up 'the financially-attractive jobs' (IEI 2000b, 8) available in industry rather than pursuing post-graduate studies. In the report IEI made a number of recommendations to government which they considered would alleviate the 'problem' at second level . These included the allocation of extra points[7] to students of mathematics and a review of teaching methods. In time these suggestions would begin to sound like a mantra in the case for change in mathematics education, and in due course both suggestions would become a reality. However a third suggestion, increasing the salaries of teachers of mathematics to make them comparable to those in industry, was rejected by Government and teacher's unions and rarely referred to afterwards.

In 2002 the IEI formally responded to the report of the Task Force on the Physical Sciences, having already nominated a representative to the Task Force and also made a submission to it in 2000. While this response was largely supportive of the report's findings it was critical of the fact that 'the Task Force was not more specific and detailed in its recommendations in relation to mathematics' (IEI 2002, 2-3). It recommended the 'urgent review of the decline in student performance in mathematics and what is needed by way of reform' (IEI 2002, 1) thus echoing the formulation employed by the Task Force. Hitherto the IEI had expressed concerns regarding 'a decline in the interest which suitably qualified 2nd level students show in engineering as a career' (IEI 2000b, 6). They had publicly attributed this decline to the growing perception that the required subjects of maths and science, particularly at higher level, were more difficult and less attractive than other subjects and that they were not being chosen as Leaving Certificate subjects by sufficient numbers of students. Unlike the Task Force and the Chief Examiner in 2001, the main concerns of the IEI, in relation to second level mathematics, privileged the problem of 'higher level' students.

By 2002 IEI had a representative in the membership of the Expert Group (ESRI 2002, 76) and in the following year a report concerning '*The Demand and Supply of Engineers and Engineering Technicians',* with a foreword by the president of IEI was published. (The interesting evolution of this report will be discussed in chapter 6) The report was commissioned to examine how the future supply of engineers and engineering technicians in Ireland would match the requirements

[7] The 'Points System' is administered by the Central Applications Office (CAO) on behalf of third level colleges. A fixed number of points is allocated per grade achieved in the examination. The CAO determines, each year, on the basis of supply and demand, the points required for any particular course and then allocates places on an order of merit basis, to students who have applied for them and who have achieved the requisite number of points.

of industry and public bodies (McIver Consulting/EGFSN 2003). The EGFSN commissioned McIver Consulting (Dublin) to draw up the report. This is a common practice, an example of expert groups, EGFSN, using a 'scientific' study to legitimise their conception of the problem. The two main issues arising from the analysis echoed the concerns of IEI: that a fall in numbers entering electronic engineering would have the potential to limit the growth of a range of ICT sectors, and that there was a threat of a general decline in numbers graduating in engineering (McIver Consulting/EGFSN 2003, vii). In response, the report recommendations focused on boosting the numbers graduating in engineering from Irish education institutions thus mirroring the aspirations of earlier IEI publications. It made projections of demand for engineers and engineering technicians in sectors as diverse as Software and IT Services; Electronic Systems and Hardware; Integrated Circuit Design; Telecommunications Services; Construction and Engineering Consultancy; Local Authorities; Medical Devices; and Pharmachem. The breadth of the list indicates the extent to which engineering skills have penetrated the economic landscape.

Because of the importance of mathematics for the engineering disciplines the report recommended that a 'range of measures should be taken to promote and improve the study of higher-level Mathematics…at second level' (McIver Consulting/EGFSN 2003, 25). In addition to the recommendations of the Task Force, it suggested that problems it believed were associated with *higher level* mathematics should also be addressed. It recommended:

- examining ways of increasing the numbers taking higher level maths;
- consideration of evidence mentioned in the Task Force report in relation to problems with marking on higher level papers and that those problems should be resolved;
- that the review should consider the possibility of recommending bonus CAO points for maths for all college courses and;
- that it should address factors at primary level and at junior certificate that affect the uptake of higher level maths at Leaving Certificate. (McIver Consulting/EGFSN 2003, 109)

The report warned against any lowering of standards at Leaving Certificate, quoting unnamed engineering academics who, it asserted, were consulted on this issue. Unsurprisingly, the anonymous academics were unanimously of the view 'that it would be counterproductive to lower the standard of the Higher Level mathematics course to make it more popular. The cost, in terms of reduced preparedness for the study of engineering, would outweigh any benefits' (McIver Consulting/EGFSN 2003, 109).

In summary it wanted an increased pool of students taking Higher Level maths throughout second level , no reduction in standards and the introduction of a system of bribery/incentivisation. They recommended achieving this by offering bonus CAO points, by reducing the level of difficulty attached to gaining higher grades while not reducing standards, and by creating a larger pool of possible candidates in lower secondary – and all without reducing the level of difficulty of the course – measures which in turn, they hoped, would increase the numbers entering college to study engineering. This paradox of increasing the numbers achieving higher grades without lowering the standard bedevils all the interventions, either explicitly or implicitly, and remains a serious consideration in relation to Project Maths.

The 2001 Chief Examiner's Report, had already addressed a similar question in relation to the 'suggestion to modify the standard required in the examination in order to give better grades to low-performing students' and concluded that:

> the examination must remain a valid instrument for measuring the achievement of candidates in relation to the course as laid down in the syllabus. In order to do this, it must continue to take the performance criteria envisaged in the syllabus as its primary point of reference, rather than attempting to distort the assessment instrument to perform a task for which it was not intended. (SEC 2001, 17)

An examination of the underlying reasons behind poor results was recommended by the Chief Examiner in 2001. It was incumbent upon the researchers to consider this point of view. They made their suggestions in 2003 when the Chief Examiner's Report was already available to them. However they chose not to engage with the existing debate. In fact there is no evidence in their report that they have read any of the Chief Examiners' reports – their single reference on page 89 is in fact a quotation from the report of the Task Force.

The concerns of the McIver Report were reiterated in the fourth report of the EGFSN when it was published the following October. From now on, the relationships between the multifarious forms of engineering and secondary school mathematics, and the identity of that relationship with economic prosperity become important presuppositions in the construction of the problem of mathematics at government and policy planning level.

3.6 Further Reports

The *Fourth Report of the Expert Group on Future Skills Needs* (EGFSN) reiterated problems at second level, which were perceived to lead to concerns about the reduction in numbers entering third level engineering courses and called for 'a review of mathematics and teaching methods' at second level . (EGFSN 2003, 6) The inclusion of 'teaching methods' in the 2003 call is significant and I will return to this subject later. The under-performance of male students (EGFSN 2003, 30) and particularly their under-performance in mathematics was a cause of concern to the EGFSN at this point, and this was construed as a factor that directly affected numbers entering ICT courses such as electronic engineering. This complex problem tends, wherever it appears in the reports, to be treated as a relatively simple one of encouraging or incentivising males.

Mary Harney, Tánaiste and Minister for Enterprise, Trade and Employment, in her forward to the 2003 EGFSN report (EGFSN 2003, iv), refers to Ireland's successful transition from an agrarian 'to a fully-fledged, first-world economy, operating at the leading edge of contemporary technology'. Here she acknowledges the 'considerable input' of the EGFSN into skills and education policy. In this version of the national narrative, the central problem is 'the provision of a highly skilled labour force'; as other sources of competitive advantage are being eroded, skills are assuming increasing importance for future economic development:

> Skills are now an instrument for industrial development; the *a priori* (sic) provision of an appropriate skill set is a key mechanism for stimulating a particular economic sector and attracting Foreign Direct Investment. In addition, with restrictions on direct aid to firms from 2006, anticipating and subsequently satisfying firms' requirements for a highly skilled work force will be a crucial support to enable them to get a foothold in global markets. (EGFSN 2003, iv)

The construction of the problem of mathematics must be considered against the background of Ms Harney's comments.

The language of this narrative and its implications for education are interesting. We should observe that the phrase 'an appropriate skill set' is a synonym for human capital. Educational outcomes are now classified as 'skill sets' and are essential for 'industrial development' and 'stimulating a particular economic sector' as well as making the country more attractive to multinational corporations – a typical neoliberal language and analysis. The reclassification of a young person's educational achievement as the acquisition of a 'skill set' appears to have slipped into the discourse here almost unnoticed. Globalisation, Ms Harney suggests, makes this inevitable. This new conceptualisation of education has the economy at its core, not the well-being and development of the young person or the common good – a significant shift in philosophical position and one that should not go unremarked.

The rhetorical assertion that the Irish economy 'operates at the leading edge of contemporary technology' is outside of the remit of this thesis, however a recent report in *The Irish Times* noted that 'Ireland rose to 18th from 26th place in a new index that measures the advancement of information and communication technologies (ICTs) in more than 150 countries worldwide, but dropped a place on ICT skill levels' (Campbell 2009, *The Irish Times*, 6 March, 7). Eighteenth place is hardly the leading edge. Nevertheless, her forward confirms that a central concern of policy makers supported by Government was that an appropriate skill set (human capital) should be made available for stimulating a particular economic sector and attracting Foreign Direct Investment.

3.7 A 'slip' or a 'major error'

The perception of the importance of engineering and, by implication, mathematics, was reiterated by the 2004 *Submission to the Minister for Education and Science on the YES Review*[8] prepared by the EGFSN. The document placed its 'emphasis on the economic role of the educational system' (EGFSN 2004, 1) and privileged the place of science and technology skills in the development of a knowledge economy. It asserted that '[a]n innovation-driven,

[8] The acronym YES stands for Your Education System.

knowledge economy is one in which science and technology form a key component of enterprise activity. Therefore Ireland's success in developing such an economy will be contingent on, inter alia, its ability to provide an adequate supply of science and technology skills in the years ahead' (EGFSN 2004, 6). However, the perceived poor performance of Irish 15 year-old students, in mathematical and scientific literacy in the new Programme for International Student Assessment (PISA), did not inspire confidence in the authors of the report 'in view of the paramount importance of both skills for a knowledge economy' (EGFSN 2004, 6). PISA, as we will see, would soon loom large in the landscape, but this early use of the league tables in the official narrative is significant. The implication here is that poor performance in PISA was an indicator of future problems for the supply of appropriate skills in the economy. The appropriateness or otherwise of PISA as an assessment of the achievements of Irish young people was not interrogated in any way. The PISA results were accepted by the EGFSN without question as an objective truth about our education system.

The EGFSN's fifth report, *Tomorrow's Skills, Towards a National Skills Strategy* (EGFSN 2007) once again emphasised the economy rather than the welfare or development of the student. Poor performance in mathematics, it observed could have severe economic consequences given Ireland's desire to become a 'knowledge economy' (EGFSN 2007, 19). Development of a knowledge economy depended on a 'strong supply' of scientists, engineers and technologists and also researchers in these three areas. The introduction of the need for 'researchers' and, consequently, high achievers, in this paper flags an increasing concern about the supply of mathematically and scientifically able students. Researchers were needed in order to fulfil commitments made under the Lisbon Agenda, commitments which referred to targets set when the EU heads of state established the European Research Area (ERA) project at the Lisbon Summit in 2000 as a contribution to making Europe the most competitive knowledge-based economy by 2010.

In this 2007 report, the 'stock of mathematical capacity' is discussed – an extraordinary formulation that owes much to the language of 'human capital'. This 'stock' was in 'sharp decline', the report asserted, as evidenced by the proportions of students taking Higher Level Leaving Certificate maths:

> A further cause for concern in relation to the future stock of mathematical capability is the sharp decline in the proportion of candidates taking higher level mathematics in the

> Leaving Certificate examination in recent years: this has dropped from 25 percent of the overall cohort in 2001 to 18 percent in 2005. (EGFSN 2007, 68)

This precipitous drop of 7% in four years is startling. If true it indicates a radical change in student perceptions in a very short time, and would indeed be cause for serious concern at every level of the education system. It is, however, an error, as will be seen from table 1.1 from the 2005 Chief Examiner's report (SEC 2005, 5).

		Number at each level			Percentage at each level		
Year	Total Maths Candidature	Foundation*	Ordinary	Higher	Foundation*	Ordinary	Higher
1993	*58922*	*6169*	*46158*	*6595*	*10.5*	*78.3*	*11.2*
1994	60524	*6419*	45442	8663	*10.6*	75.1	14.3
1995	63200	*5863*	46698	10639	*9.3*	73.9	16.8
1996	53246†	*5398*	38378	9470	*10.1*	72.1	17.8
1997	61035	6427	43566	11042	10.5	71.4	18.1
1998	61970	6056	45191	10723	9.8	72.9	17.3
1999	60637	5753	44188	10696	9.5	72.9	17.6
2000	58705	5846	42214	10645	10.0	71.9	18.1
2001	55149	5227	39984	9938	9.5	72.5	18.0
2002	53658	5296	38932	9430	9.9	72.6	17.6
2003	54256	5702	39101	9453	10.5	72.1	17.4
2004	53052	5832	37794	9426	11.0	71.2	17.8
2005	52178	5562	36773	9843	10.7	70.5	18.9

Table 1.1: Uptake of Leaving Certificate Mathematics at the three levels, 1993 – 2000.

The correct figures for the proportion of candidates taking Higher Level mathematics in the Leaving Certificate examination in 2001 is 18.0% and not the 25% as quoted above; In 2005 the figure had risen to 18.9%. During the period indicated there was, in fact, a modest percentage increase of 0.9%. Furthermore, the Chief Examiner's Report for 2005 evinces satisfaction with the overall growth-rate in the uptake at higher level. The proportion of students taking higher level had increased in 2005, the Examiner said, and was then the highest it had ever been. The Examiner notes, with some satisfaction, that 'the proportion of the candidature opting for Higher Level is now almost 70% greater than it was in 1993, the last year of the previous syllabus' (SEC 2005, 5).

It is difficult to understand where this error might have come from. It is possible that the EGFSN simply misunderstood the 2005 Chief Examiner's Report where the author notes that: 'The courses were designed in anticipation of the cohort dividing between the three levels in the ratio 25:50:25' (SEC 2005, 5). The 25%, it should be noted, was *never* achieved. It is tempting to speculate that the Expert Group took the aspiration as reality. However, the 25% figure is

un-attributed and there is no reference to the Chief Examiner's reports in the bibliography, a significant lacuna in assessing the quality of work of the EGFSN. It is remarkable that such a gross error could have found its way into the report of an expert group, that it could have been allowed to stand throughout the editing process and that it could have been repeated subsequently.

Such an error would be ironic in any case, especially in a document purporting to lament the decline in mathematical capacity in the state. However it is potentially catastrophic in one which helps to determine government policy in regard to mathematics and even more catastrophic when one realises that the 'statistic' was again used in evidence in the 2008 report on '*Future Requirement for High-Level ICT Skills in the ICT Sector*' (EGFSN 2008a, 106). The striking figure had the potential to shape the entire public discourse on mathematics.

A further inexplicable lacuna occurs in relation to existing educational research in Ireland. At this point the NCCA had already published its *Review of Post Primary Mathematics* (2005) and also *The Report on the Consultation* (2006) and so the NCCA findings were available to the EGFSN while the 5th report was being prepared. It is astonishing that the authors of the EGFSN report in 2007 did not consider the relevant NCCA work published in the two previous years. In fact, not a single NCCA document is referenced in its bibliography.

However, it appears that the intention of the 2007 report was to present only a negative construction of the state of mathematics at Leaving Certificate level in Ireland. Concern was expressed in 2007 about the *low percentage* of students achieving grade C3 or better at the Higher Level mathematics in the 2006 examination. The pool of eligible candidates for science, technology and engineering degree courses in that year was *just* 14% of the overall cohort (the cohort includes those students who did not sit mathematics at all). The report states that:

> The results from Leaving Certificate 2006 give cause for concern; out of a cohort of 54,110 students, just 14 percent secured an honours grade (grade C3 or higher) in higher level mathematics. (EGFSN 2007, 101)

This *low percentage*, however, represented 82.5% of those students who actually took the higher level maths paper in 2006, and when a comparable statistic occurred in 2008 it was described by a separate EGFSN report as *a positive achievement*.

> In 2008 some 8,500 students opted for Leaving Certificate Higher-Level Maths – comprising 17 percent of those who took Leaving Certificate Maths. Seventy-eight percent of candidates who sat Leaving Certificate Higher-Level Maths gained an honour in the subject – again a positive achievement. (EGFSN 2008b, 3)

It is unclear why a figure representing 82.5% or 7440 students from one cohort should be viewed negatively in 2007, while a lesser figure – the 78% of higher level candidates, representing 6,630 students – in 2008 was considered a positive achievement. The analysis is, at best, inconsistent. We are forced to conclude that it suited the narrative espoused by the EGFSN in 2007 to cast the figures in a negative light. In other words, the negative perspective helped to construct an appropriate 'problem' for that year.

The performance of Irish 15 year olds, in mathematics and science, in the international assessment PISA also worried the authors of the 2007 report. At this point in time the results of the first two assessments, PISA 2000 and PISA 2003, had been published by the OECD and Irish students, in 2003, were ranked 20th in a pool of 40 countries in mathematical literacy, a position which was considered 'particularly unsatisfactory' (EGFSN 2007, 68). In general, PISA results are construed by the legitimate voices in the discourse as good indicators of the health of mathematical learning in Ireland. As we will see, there is no public interrogation of the PISA aims or methodology until the disastrous PISA results of 2009. Public discussion of the results up to that year failed to consider that the students taking this international assessment come from a variety of mathematical backgrounds. The lower secondary maths curriculum of countries like Finland is in keeping with the PISA assessment while the Irish curriculum differs in very many areas. A detailed discussion of PISA will be entered into in chapter 5.

In summary, a false narrative of a substantial decline in the proportion of candidates taking Higher Level maths at Leaving Certificate was created and bolstered by statistical error or inconsistency. Ireland's current performance for scientific and mathematical literacy, in international assessment was considered 'inconsistent with our stated national objective of transitioning to a knowledge-based, innovation-driven economy' (EGFSN 2007, 68). Taken together the impression was created that the teaching and learning of mathematics were failing students and the economy. This construction took a firm hold in the press and was instrumental in preparing the ground for the radical changes in syllabus and pedagogy proposed under Project Maths.

3.8 An anecdotal decline

The 2008 report, *Future Requirement for High-level ICT Skills in the ICT Sector*, was yet another attempt to determine 'the future requirements for high-level skills in the sector and to identify the proactive actions required to ensure that the supply of these skills will support its growth potential' (EGFSN 2008a, 6). This report cites the importance of mathematics in the study of both computing and electronic engineering and the construction of the problem in this instance centres on the supply of high-performing candidates for third level ICT related courses. It makes selective use of evidence from Chief Examiners' Reports. It expresses a sense of unease about the attractiveness of the profession for prospective home-grown graduates. Interest among high-performing school leavers in the study of computing and electronic engineering was perceived as 'relatively weak because of factors such as continuing feelings of insecurity about the sector, slow growth in pay, competition from other sectors and changes in performance in mathematics at second-level' (EGFSN 2008a, 10). Feelings of insecurity and slow growth in pay are reasonable grounds for avoiding an occupation and their remedy lies within the industry itself which could attempt to provide greater job-security and quicker growth in pay, both of which would allow the ICT sector to compete more effectively with 'other sectors' – (see also Chapter 6.6). Following the logic of the IEI, more mathematics candidates would follow if the industry incentivised the jobs. However the claim regarding 'changes in performance in mathematics at second-level' needs to be interrogated further and an EGFSN reference to 'seeking to improve how science, technology, engineering, mathematics (STEM) subjects are taught and learned' (EGFSN 2008a, 10) must also be analysed.

In relation to changes in performance in mathematics at second level we see that the report is concerned with high-performing school leavers and thus its discussion of mathematics at second level is confined to higher level Leaving Certificate. According to the EGFSN:

> The main "new" issue that has arisen is that the Chief Examiners Report on the Leaving Certificate Higher-level mathematics paper of 2005 reported a significant fall in performance over a short period of time (EGFSN 2008a, 93).

We need to turn to the Chief Examiner's Report to interrogate this claim (SEC 2005, 54).

	A1	A2	B1	B2	B3	C1	C2	C3	D1	D2	D3	E	F	NG
2002	6.9	13.2	21.5	31.1	41.5	53.3	64.8	74.9	83.3	89.5	95.6	99.0	99.9	100
2003	6.1	13.3	22.4	32.1	43.4	54.4	65.4	76.2	84.5	90.3	95.7	99.2	99.9	100
2004	8.8	16.3	25.2	35.3	46.2	57.0	67.4	77.4	85.0	91.0	95.8	99.0	99.9	100
2005	**7.8**	**15.5**	**25.1**	**36.0**	**47.3**	**58.5**	**69.1**	**78.1**	**85.3**	**91.1**	**95.7**	**99.0**	**99.9**	**100**

Table 4.3: Percentage achieving at or above each grade – Higher Level, 2002 to 2005

An examination of the grades awarded to candidates, as displayed in the chart from the 2005 report, reveals that the percentage of students receiving high grades, say at or above B3, had increased continuously in the period examined. There is, therefore, no statistical evidence for this narrative. It is worth noting the Examiner's comment:

> The scripts of candidates achieving high scores were characterised by clear, accurate work that portrayed competence in all aspects of the syllabus. The solutions presented carried evidence of solid conceptual understanding and thorough revision. The candidates who produced work of such quality naturally received high grades, a just reward for the commitment and effort that they obviously invested in preparing for the examination. (SEC 2005, 71)

Given that there is no statistical evidence of decline and the Chief Examiner praised the work of high achieving candidates, where else might the EGFSN have found evidence for the 'the significant fall in performance'? In his/her concluding remarks, the Examiner stated that it would be remiss of her/him not to 'express the concerns of the examining teams that there has been a noticeable slippage over a relatively short period of time in the quality of work being presented' (SEC 2005, 72). Two problem areas were identified, first of all 'the examining team on paper 1 reports that the candidates *appear* (my emphasis) to be less comfortable than before with the basics of algebraic manipulation' (SEC 2005, 71) and secondly that there was a 'decline in the capacity of candidates to engage with problems that are not of a routine and well-rehearsed type' (SEC 2005, 72). The EGFSN translates these remarks as 'a significant fall in performance'. However an examination of the report reveals that the examiner is referring to anecdotal evidence, as perceived by the examiners, and limited to the study of algebra and problem-solving.

Problems with algebra represent issues of long standing and they are not confined to higher level candidates. In 1995 the Chief Examiner reported that 'there were noticeable weaknesses in algebra' (Department of Education 1995, 19) at Ordinary Level Leaving Certificate and in the same report weaknesses at higher level were also identified (Department of Education 1995,

7, 10). In 2000, the Chief Examiner again reported that 'Serious deficiencies were evident in algebra' (SEC 2000, 17). The Junior Certificate Reports tell the same story; the Chief Examiner's report in 1999 referred to weaknesses cited in 1996 and 1998 and concluded that '[a]ttention must be focused, in particular, on improving students' proficiency in algebra especially as basics of this area are essential for success in senior cycle mathematics' (SEC 1999, 13). Hence we see that students' lack of proficiency in algebra has a long history of being problematic and that it continues to cause problems. It is not a new development by any means and certainly is one that needed to be addressed.

The second problem dealt with in the Chief Examiner's discussion in 2005 was that of a 'decline in the capacity of candidates to engage with problems that are not of a routine and well-rehearsed type' (SEC 2005, 72). This problem had previously been addressed in the Chief Examiners Report in 2000 (SEC 2000, 17). In 2005 the complaint referred to a lack of perseverance among candidates where 'in the relatively recent past it was common to see two, three, or more attempts at a problem with which a candidate was struggling, it is now more common to see the work abandoned after the first attempt fails to yield rapid success' (SEC 2005, 72). The strategy criticised, not spending time attempting different approaches to a problem, does not appear to have affected the grades awarded to students. It is reasonable to suggest that this is an attempt, by students, at an efficient time-management strategy rather than a lack of 'willingness to struggle for success' (SEC 2005, 72), a charged description in itself. Clearly, since the grades awarded have not changed significantly, the students are achieving success by their new strategy. That being the case, two conclusions are possible: either (a) these reported strategies are effective or (b) the grades are inflated to maintain a bell curve. If the first is the case, then we may conclude that the mechanism of the examination has taught students and teachers a strategy that was not intended. Thus the new strategies become unintended consequences of the examination itself. In the second instance we should consider if a distortion of the assessment instrument has occurred thus causing it 'to perform a task for which it was not intended' (SEC 2001, 17).

Whatever conclusion we accept, an examination of the Chief Examiner's Report for 2005 and its statistical breakdown of grades indicates no such decline as measured by grades awarded and, to this reader, the 'noticeable slippage' in two specific areas of the course does not add up to a

'significant fall in performance' in mathematics in general. It is significant also that the EGFSN relies on the anecdotal elements of the report in contradistinction to the statistical evidence.

Given that the problems identified by the Examiner are of some standing and are now regarded as near fatal to the future of the economy, why is it that the Chief Examiners' reports had not previously provoked such a powerful response? It is difficult to escape the conclusion that this narrative of sudden decline is seized upon by the EGFSN because it belongs within the general economic discourse and the 'discourse of failure'.

A further example of a contribution to this discourse is the erroneous 25% figure (referred to in 3.7) which reappears here in this document referenced only to the EGFSN's own 2007 report. Despite the fact that the Chief Examiner's report from which the 'significant fall in performance' narrative is constructed actually discusses the 25% as a *target* that was never reached, as the chart below demonstrates (SEC 2005, 5-6), the EGFSN overlooked this detail. It is typical of the construction of discourses that some 'facts' are disregarded while others are privileged.

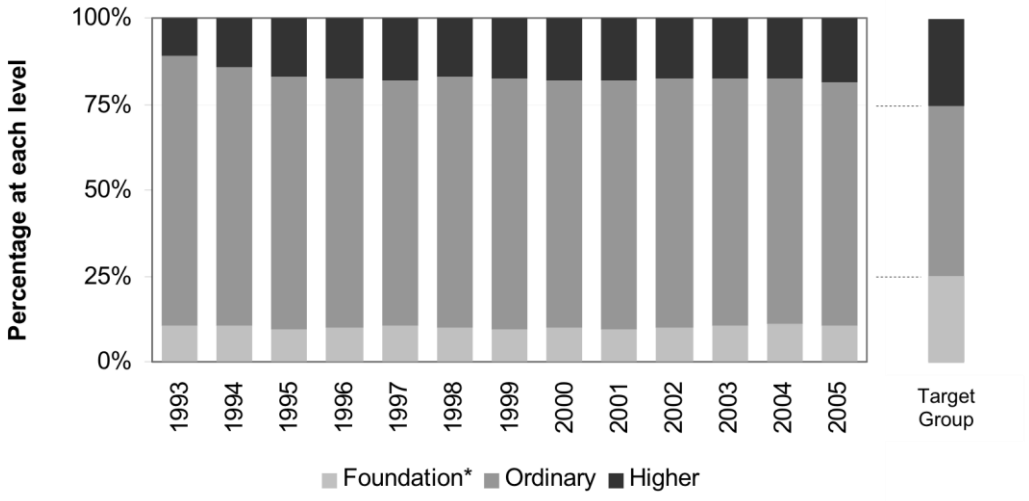


Figure 1.1: Percentage uptake at each level, 1993 – 2005.

The ICT report is concerned about a sharp decline in 'the future stock of mathematical capability', and claims that 'the proportion of candidates taking higher-level mathematics…[is] dropping from 25% of the overall cohort in 2001 to 18% in 2005 [footnote: EGFSN (2007), *Tomorrows Skills Towards a National Skills Strategy*, EGFSN, Dublin.]' (EGFSN 2008a, 106). In fact there was an increase in the percentage of students taking Higher Level mathematics in the

period concerned as evidenced in the Chief Examiners Report and it was noted that 'the proportion of the candidature opting for Higher Level [was]…almost 70% greater than it was in 1993.' (SEC 2005, 5). (Full details and figures are included in 3.7).

There is a sense of frustration and anger in this report untempered by any serious self-reflection on the part of an industry whose employment opportunities are not regarded as desirable by young people. The numbers entering electronic engineering and computing courses are falling and are now far below peak and the 'average qualifications prior to entry [have] disimproved significantly' (EGFSN 2008a, 83). This latter comment refers to the increasing percentage of students entering the courses with lower grades in mathematics a factor that results from high achieving candidates opting for careers other than engineering and technology. There is a presumption that students who like science, engineering and technology subjects and perform well in them in school, are more likely to choose to study those subjects at third level , and are more likely to perform well when they do so (EGFSN 2008a, 94). The real reasons behind the choices that students make would probably be more influenced by 'feelings of insecurity about the sector, slow growth in pay, competition from other sectors' (EGFSN 2008a, 10) than by their success in STM subjects at secondary school. Considerable personal experience as a teacher of mathematics shows that students and their parents give serious consideration to such problems as short-term contracts, low pay, poor possibilities of advancement, job satisfaction, social status and interpersonal interaction when considering their future careers. Student choice and the reasons behind it have been discussed elsewhere in the EGFSN reports and that element of choice is an essential component in the problems faced by those attempting to address the problems of supplying a highly skilled workforce to the ICT sector.

Another aspect of this report is its suggestion 'that there is scope for…seeking to improve how science, technology, engineering, mathematics (STEM) subjects are taught and learned' (EGFSN 2008a, 10). In particular, there are recommendations for improving the teaching and learning of mathematics through enhancing the professional development of teachers at both primary and secondary levels. The report acknowledges the work of the NCCA and the DES and 'agrees strongly that reforms to the teaching of mathematics at this level are necessary' (EGFSN 2008a, 107). However it warns that there is no scope to cut the content of Higher level Leaving Certificate mathematics without seriously undermining preparation for college. In this regard it acknowledges that much has been done in education to no avail: encouragement of

students, provision of information and pedagogical reforms. The one remaining area, upon which the group bases its last hope, is the provision of incentives to students. It recommends the introduction of a system of bonus college entry points and the introduction of bursaries for high-achieving students entering honours level computing and electronic engineering degree courses. These recommendations are intended to affect the teaching of higher level mathematics and to incentivise students into making the appropriate choice.

One other recurring issue is here and that is the grading penalty that appears to be suffered by students taking higher level mathematics in the Leaving Certificate. The authors of the report while requesting the State Examinations Commission to address the issue do not engage with the Examiner's refusal to distort the assessment instrument to perform a task for which it was not intended (SEC 2001, 17).

It is notable that the report calls for changes to teaching and learning and some technical adjustments to the marking of the examination, but stresses that the curriculum should not be reduced. This report presents a confused narrative. On the one hand, it is worried about a perceived fall in performance in mathematics and suggests that as 'mathematics is important in the study of both computing and electronic engineering, this may have contributed to undermining interest in these disciplines' (EGFSN 2008a, 86) while on the other hand, it considers that strategies such as 'improving teaching and learning, persuasion and provision of information to students' (EGFSN 2008a, 91) have failed to improve the numbers problem and thus it suggests that the only possible way to improve the numbers situation is by a programme of incentivisation. The declared object of the report is the provision of sufficient quantity, quality and diversity of skills. Thus mathematics appears as a necessary skill, a product of second level education.

3.9 Raising National Mathematical Achievement

The EGFSN *Statement on Raising National Mathematical Achievement*, is a short report, published in 2008 when the pilot scheme for Project Maths had already begun. Predictably now, the report focuses on a vision of mathematics as 'a fundamental requirement for the growth of the knowledge economy and the development of a world-class research and innovation system' (EGFSN 2008b, 1). Ireland's future social and economic development, it claims, would require

an adequate supply of people with mathematical skills and thus improving national mathematical achievement is seen as 'vital'.

The problem of mathematics as constructed by previous EGFSN reports is in evidence in the document. It is concerned with the relatively low number of students taking Leaving Certificate Higher Level mathematics; the high failure rates at Leaving Certificate Ordinary Level; and the falling quality in mathematics which needs to be addressed for a knowledge economy (EGFSN 2008b, 1). In light of these problems the development of a national strategic approach towards raising national mathematical achievement is deemed necessary.

The evidence used to support the problem is also familiar – the 2005 Chief Examiner's Report on Leaving Certificate Higher Level Mathematics paper and its concerns about a 'noticeable slippage' in the quality of students' work; data from the Report of the Task Force on the Physical Sciences on the grading penalty but no reference to the Chief Examiner's stance on this matter; the perceived difficulty among students on learning mathematics as identified by Forfás. It is notable that all of these issues are related to higher level mathematics.

As with other EGFSN reports the observation that at Ordinary Level 'failure rates over recent years have remained stubbornly high' (EGFSN 2008b, 5) is not interrogated. The issue of high failure rates at Leaving Certificate Ordinary Level had been addressed by the Chief Examiner in the 2001 report. In the examiner's assessment the problem relates to students making inappropriate course choices, as a large percentage of the cohort of students for whom the foundation level was designed take the Ordinary Level examination. Foundation level mathematics is not recognised by many third level institutions and employers. In the Examiner's report, it was stated that 'in any given year there are substantial numbers of candidates presenting for examination at Ordinary Level who are properly part of the envisaged target group of the Foundation Level' (SEC 2001, 16). Decisions, made by students are 'heavily influenced by the lack of appropriate recognition for achievement at Foundation Level by the providers of third level education and by employers' (SEC 2001, 17). Thus the failure rate at Ordinary level is 'stubbornly high', and is linked intractably with the lower than desired uptake at Foundation Level. This problem was never officially addressed.

The report argues that 'improving performance in mathematics at upper secondary level will boost the potential supply of graduate recruits for third level science, engineering, technology and business courses' (EGFSN 2008b, 3). Thus, for the EGFSN, the problem is, once again, one

of numbers. '[B]usiness,' the report says, 'is calling for radical measures to boost the numbers of students' (EGFSN 2008b, 5) and numbers will follow an increase in proficiency among students. OECD/PISA will play a significant role in validating such proficiency. The EGFSN seeks to set out:

> a challenging vision of what it would mean for Ireland to become one of the top OECD countries in terms of mathematics proficiency. This would mean moving upwards from our current position of 16th out of 30 OECD countries for mathematics proficiency among 15-year-old students in PISA tests. (EGFSN 2008b, 2)

There is no reference here to the fact that the OECD/PISA assessment involves a random sample of students the vast majority of whom are in 2nd, 3rd of 4th year and have not as yet embarked on the two-year Leaving Certificate programme.

The spectre of OECD haunts this report, providing some indication of the internationalisation of the policy process adopted by the EGFSN. Identifying the '*best practices*' for knowledge-based economies (OECD 1996, 3), it names Finland and the Netherlands from whom '[t]here are lessons that can be learnt from practice…to inform and enhance mathematics education development here in Ireland' (EGFSN 2008b, 7). It is the only EGFSN report which provides any definition of mathematics and it adopts mathematical literacy as defined by OECD/PISA – this, I contend, indicates a shift in the philosophical foundations of mathematics education with mathematical literacy being defined as:

> an individual's capacity to identify and understand the role that mathematics plays in the world, to make well founded judgements and to engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen. (EGFSN 2008b, 5; OECD 1999a, 41)

This definition and its implications are examined in more detail in Chapter 5. The report's focus on skill development and the acquisition of core skills is in line with OECD recommendations on upgrading human capital, which advocate the creation of policies to promote broad access to skills and competencies through the provision of, among other things, broad-based formal education and improving the matching of labour supply and demand in terms of skill requirements (OECD 1996, 19). For the EGFSN:

> [m]athematical and numeracy skills are essential for people living and working in a knowledge society and for accessing good quality employment opportunities. It imparts analytical and problem-solving skills which along with team-working, communication skills and creative thinking are core skills increasingly required across all jobs. (EGFSN 2008b, 4-5)

These are essential skills for the individual in neoliberal human capital theory, the skills from which she cannot be separated, they are the raw materials with which she can construct herself as a profitable entrepreneur.

The skilling of human capital in education circles is not solely directed at students; teachers too need to be up-skilled and within the neoliberal discourse their acquisition of new skills to enable the facilitation of 'more interactive approach to teaching mathematics' (EGFSN 2008b, 10) is part of the lifelong learning process. The interactive approach to teaching introduced in Project Maths represents a *learning-by-doing* (OECD 1996, 14) approach to mathematics with which many teachers would not be familiar. The model proposed by the EGFSN for the up-skilling of such teachers includes the 'provision' of professional development opportunities for mathematics teachers, in the form of a Professional Masters Degree and a part-time Higher Diploma in Mathematical Education (EGFSN 2008b, 10). The provision of such voluntary courses would enable 'the individualisation of responsibility for education or learning' (Olssen 2006, 21) for serving teachers while at the same time enabling the removal of the state's obligation to in-service training.

Ultimately the report identifies what it sees as the challenges and outlines a set of proposals aimed at ensuring that Ireland becomes one of the top OECD countries in terms of mathematical proficiency: to improve the quality and level of mathematical knowledge outcomes for all; to increase the number of students achieving at the highest proficiency level; and to reduce the numbers of students achieving at the lowest proficiency level (EGFSN 2008b, 8). It presents a number of policy proposals which will require the support of a broad range of partners' (p.9) with the aim of increasing the level of national mathematical achievement: provide professional development of teachers; develop a more interactive, imaginative approach to teaching mathematics; develop a more coherent progression of mathematics learning; support for parents role in their children's mathematics education; incentivise students to take mathematics at a higher-level; address the mathematics knowledge needs of adults in the

workplace; benchmark and evaluate national mathematical education performance (EGFSN 2008b, 10-13). A number of these proposals were, at that time, being implemented through the Project Maths programme.

3.10 Conclusion

What we see in this chapter is the application of neoliberal language and concepts to Irish education. The EGFSN, in this context, is the truth-sayer. Its reports constitute a statement of the neoliberal ethic for education and the transfer from knowledge to skills that it contains represents a declaration of the function of mathematics education as the creation of human capital. The skills that the reports declare to be the true purpose of education constitute the capital with which the young person becomes an entrepreneur of herself. As Minister for Education and Skills remarked:

> In today's society, entrepreneurial attitudes and skills are needed by everyone: entrepreneurship is the ability to turn ideas into action. Education for entrepreneurship is not necessarily a specific subject or a topic; it is a different way of teaching and learning based on project work and on experiential learning. The teacher becomes thus a facilitator, helping students to take the initiative in their education. (Quinn 2012b)

These organisations, EGFSN, IEI and the Task Force act within a context set by statements such as Mary Harney's (Tánaiste and Minister for Enterprise, Trade and Employment):

> Continued economic growth could put pressure on the availability of certain skills unless the appropriate policies are implemented. The reduced level of unemployment and the declining number of school-leavers are further factors. This has competitiveness implications for the economy and for our ability to grow indigenous firms and to attract international industries. (EGFSN 1998, 2)

Their reports and interventions create a picture of Irish mathematics education as failing the economy and therefore failing society. This image is predicated on a view of mathematics as a public policy instrument in a society where education has been accorded a new privileged status in relation to the economy.

The central problem was and remains how to persuade more students from a declining cohort to enter science and technology courses at third level to drive the knowledge economy strategy. It is this seemingly intractable problem that is addressed by the organisations examined in this chapter.

Undoubtedly the Expert Group For Future Skills Needs had succeeded in constructing the perception of failure in mathematics teaching and learning. In this narrative, the system that, according to various commentaries, had created the boom years, was now failing the boom. A false assertion of declining proportions and percentages was used to reinforce this perception – assertions that went unchallenged by education academics, by the press or by the Chief Examiner. The group's reporting also reinforced the conclusion of the Task Force that competence in mathematics was at the heart of Ireland's continued prosperity. However, by 2008, most of the demands had not been met, no improvement had occurred in the proportion of students taking higher level mathematics; a large percentage of the overall cohort still failed to achieve a grade D or better in the exam; bonus points had been rejected by Minister for Education Batt O'Keeffe in favour of curriculum reform (Parliamentary Debates 2009); the SEC had not altered the marking system; no changes had been introduced in the rules governing the qualifications necessary to teach mathematics – all significant recommendations. No 'quick-fix' solutions had been adopted by the Department of Education and Skills. The Irish Universities Association (IUA) had rejected the reintroduction of 'bonus points' for mathematics (IUA 2008). On the other hand, the process of change had begun. A review of mathematics at Post-Primary level had been carried out by the NCCA and Project Maths, a new curriculum, was being piloted. One of the chief demands of the IEI and its satellites was that no dilution of standards should take place, it remains to be seen whether those demands will be adhered to in the new curriculum. There is no evidence in the reports themselves of any engagement with educational thinking, either at an academic level or from the relevant department or the NCCA. The use of the false statistic may be interpreted as either sloppy or sinister.

It is arguable, however, that the primary, and tightly circumscribed, purposes of the EGFSN group were the externalisation of risk to the government in proposing reform, insofar as their advice was the opinion of 'legitimate voices' 'experts' and therefore not 'political'; the reinforcement of neoliberal human capital theory as the orthodoxy for education; and, the

construction of a 'common sense' discourse to enable change. It is the contention of this thesis that such advice is always political. The achievement of the EGFSN was to construct a narrative of failure and to establish the discourse within which the transformation of mathematics education consistent with serving the neoliberal state could occur. The expert group, as we have seen, occupying as it does 'positions of considerable influence in education' (Harvey 2005, 3), plays an important part in neoliberal government and in the spread of the hegemonic discourse.

I contend that the organisations in question were effective in contributing to the construction of a philosophical position with economic expansion as the core function of education, establishing industry and the market in human capital at the heart of educational change. This contention is central to my thesis.

Chapter 4

Official Voices

Why a problem and why such a kind of problem, why a certain way of problematizing appears at a given point in time. (Foucault 2007b, 141)

4.1 Introduction

In Chapter 3 we saw how a number of special interest groups and expert groups constructed the problem of mathematics according to their own perspectives. But the interrogation of the reform of mathematics education as *text* must include a reading of the 'official voice' appointed by the Minister for Education and Science. The main voice here is that of the National Council for Curriculum and Assessment (NCCA) which represents a power network that includes the partners in education and other bodies including: the Department of Education and Science (DES); State Examinations Commission (SEC); Association of Secondary Teachers of Ireland (ASTI); Irish National Teachers Organisation (INTO) and Teachers Union of Ireland (TUI); school managerial bodies; parent organizations; subject associations; higher education interests; Irish Business and Employers Confederation (IBEC); Irish Congress of Trade Unions (ICTU); as well as two Ministerial appointees, one of whom is the appointed Chairman (ASTI 2012, webpage).

Together with those bodies discussed in Chapter 3 and their statements and reports they belong to the 'field of entangled and confused parchments' (Foucault 1991, 76) of this genealogy. At this point it is worth reiterating that it is impossible to sequence the analysis of a power network – as already discussed there can be no search for origins – and instead, we must attempt 'to isolate the different scenes where they engaged in different roles' (Foucault 1991, 76). But we must identify the network of power and influence, in Foucauldian terms the *apparatus*. I contend that we can observe at this point the establishment of a powerful network between a heterogeneous set of elements – discourses, institutions, regulatory decisions, administrative

measures, philosophical propositions – the set of elements assembled in response to the demands that the Knowledge Economy construct puts on education. The network itself is the 'apparatus' (Agamben 2009, 2) which has as its strategic function the reorientation of an education system, in this case, the reimagining of mathematics education policy within an economic framework. The apparatus is always located in a power relation – it appears at the intersection of power relations and relations of knowledge (Agamben 2009, 3). The elements of the network are interrelated, depend upon each other; the power of the whole relies upon the lines of force and the distribution of forces within the network. An element of this network the NCCA is one of the set of legitimate voices in the process of reform.

4.2 Agenda Setting

As we have already seen, calls to Government to review the teaching of mathematics had come from Engineers Ireland (IEI 2000b, 7) and from the Chief Examiner (SEC 2001, 18), and the Irish Mathematics Teachers Association (IMTA) had expressed its dissatisfaction with the lack of continuity that occurred between Junior and Senior Certificate mathematics following the Junior Certificate syllabus revision in 2000. In 2002 while acknowledging the publication of the Leaving Certificate results, the Minister for Education and Science, Mr Noel Dempsey, announced that he would ask 'the National Council for Curriculum and Assessment (NCCA) to review the Mathematics syllabi at all three levels (higher, ordinary, foundation) in order to address the ongoing concerns regarding the appropriateness and relevance of the content across the different levels as highlighted in previous Chief Examiners' Reports' (DES 2002, press release). Mr Dempsey's construction of the problem to be investigated is narrower than that described either by the Chief Examiner, the Task Force or Institution of Engineers Ireland and the perspective also differs. In the event, the review which took place did not consider the issues identified by the Minister or the Chief Examiner or IEI, rather it addressed the concerns of teachers, in particular the implications of the revised Junior Certificate Mathematics syllabus (first examined in 2003) for the Leaving Certificate programme. A brief document indicating the consequences of the revisions was sent to all schools in 2004.

As discussed in Chapter 3, calls for a review of mathematics at second level continued to come from a number of legitimate voices in the discourse. The Task Force on the Physical Sciences

(Task Force 2002, 19) identified the problem of mathematics in relation to the study of science and it called for a review. Subsequently the IEI/McIver (McIver Consulting/EGFSN 2003, 89) report and the fourth EGFSN (EGFSN 2003, 50) report added their voices and their demands to the calls. The EGFSN *Submission to the Minister for Education and Science on the YES Review* reiterated many of the criticisms that had already been voiced and, in view of what it saw as the paramount importance of mathematics skills for a knowledge economy, expressed the view that the position of Irish students in PISA mathematics assessments was cause for serious concern (EGFSN 2004, 6). In chapter 7 we will see how the media, another voice in the discourse although not an official one, campaigned for change in second level mathematics and also called on the DES for a review (Editorial 2004, *The Irish Times*, 7 December, 19). We cannot say for certain that the NCCA review that led to the remodelling of the mathematics curriculum came about on foot of the demands of the EGFSN, The Task Force, Forfás, the IEI, the Chief Examiner, the media or other forces but it must certainly be true that they were influential in creating the imperatives. In this matter they helped to create the common sense. In the event a review was initiated in 2005 by the NCCA Council and Executive on foot of a request from the DES. Mary Hanafin was Minister for Education and Science when the review began.

Before we begin our reading of the NCCA it is worth setting out some differences between the 'problem' as constructed by legitimate voices (EGFSN, Forfás, IEI, Task Force) and that of the Chief Examiner. Two different philosophical positions were driving the construction of the problem – mathematics education as a factor of Ireland's economic future on one hand, and on the other an approach centred on identifying and correcting student weaknesses in specific areas of the mathematics curriculum and in drawing attention to situations where students were being unfairly treated by third level institutions and employers. We could call this second position the 'student-centred' approach.

Take the State Examination Commission's 2001 special report into that year's high failure rate at Leaving Certificate Ordinary Level, for example. It prioritised the duty of the education system to ensure that courses provided for Leaving Certificate students receive appropriate recognition from third level institutions and from employers. The high failure rate at Ordinary Level arises as 'in any given year there are substantial numbers of candidates presenting for examination at Ordinary Level who are properly part of the envisaged target group of the Foundation Level' (SEC 2001, 16). Decisions, made by students are 'heavily influenced by the

lack of appropriate recognition for achievement at Foundation Level by the providers of third level education and by employers' (SEC 2001, 17). The Examiner suggests that the Department of Education and Science should establish 'a system of proper equivalences between the different subject levels at Leaving Certificate to assist third level institutions and employers' (SEC 2001, 18), a solution that would help to solve the problem and prevent future students from making inappropriate decisions and in turn allow students to receive appropriate recognition for their efforts. It should be noted that the concerns expressed here are always about justice for the student, rewarding student effort and carefully considered decisions.

On the other hand, a different discourse prevails among the EGFSN, Forfás, IEI and the Task Force where the concerns are economic in nature, with the demands of the labour market and of a 'knowledge economy' directing their focus on education. At the launch of the report *The Demand and Supply of Engineers and Engineering Technicians* the EGFSN in association with the Institution of Engineers of Ireland announced the 'need to plan now so that we will be in a position to provide the intellectual capital needed to succeed in moving to the next stage of economic development – becoming a knowledge economy' (EGFSN/IEI 2003, press release). Minister Michael Woods at the launch of the *Third Skills Report by the Expert Group on Future Skills Needs* remarked that 'our education provision must strive to ensure that the measures are put in place to meet the rapidly changing demands of the labour market' (EGFSN 2001, press release).

Further evidence of the new economic imperatives for education appear in a 'note to editors' in Mary Harney's, (Tánaiste and Minister for Enterprise, Trade and Employment) press release at the launch of the Fourth Report of the EGFSN. This identified specific recommendations for action for the principal stakeholders in the transition to a knowledge economy and, for the education sector it summarized the Report's recommendations as follows: 'the need to increase the participation rate and levels of attainment; to review curricula on an on-going basis, to ensure that they reflect the changing needs of the enterprise sector; and to place greater emphasis on management skills, sales and marketing expertise and generic skills' (Department of Jobs Enterprise and Innovation 2003, press release). The focus of the Task Force was on 'Ireland's economic future [which] depends critically on the supply of an increasing number of people qualified in science and engineering' (Task Force 2002, Foreward) These issues, reflect the neoliberal discourse in relation to an education system and 'the concern among nations to

develop human capital' (OECD 1999a, 11) to ensure that the needs of the economy are satisfied.

The NCCA, whose task is to advise the Minister for Education and Skills on curriculum and assessment for early childhood education and for primary and post-primary schools, (NCCA 2012a) in its published literature does not identify any problem with mathematics prior to the 2005 *Review*, and therefore it was not publicly involved in the preliminary process of agenda setting or in the positioning of maths in contemporary education. In its 2002 *Draft Plan of Action*, based on the paper *Developing Senior Cycle Education*, a review of Applied Mathematics was proposed for 2003 (NCCA 2002a, 65). In the event, in 2005, the NCCA on foot of a request from the inspectorate, initiated a root-and-branch review of post-primary mathematics in an effort to address 'a range of issues surrounding mathematics at post-primary level in Ireland' (NCCA 2005b, 2).

In passing it is worth observing that this thesis assumes a high level of principled debate within bodies like the NCCA, during which the emerging trends are contested from various perspectives, including that which we have already characterised as the 'student-centred' approach. Indeed, the NCCA regards its policies in general as 'student-centred'. However, the thesis deliberately concerns itself with the published documents, within which are archived these contestations, and therefore with the compromise reached between the contesting views. Thus, in this chapter we will consider a number of official documents which were produced or commissioned by the NCCA as part of the review process: *Review of Mathematics in Post-Primary Education – a discussion paper*, *International Trends in Post-Primary Mathematics – perspectives on learning, teaching and assessment*, *Consultation Questionnaire* and the *Report on the Consultation*. Together these documents provide a comprehensive account of the official construction of the problem of mathematics. They include a comprehensive review of the relevant international literature which supports the construction of the problem and the proposed solution. However there is 'scant reference' in the documentation to the bitter international debate on the introduction of the various kinds of reform mathematics (Grannell *et al.* 2011, 10). The documents contribute to the creation of an appropriate form of 'public opinion' within the education community, and they provide proposals for change within a defined framework. In short they set out their own agenda. 'Agenda setting', where the manner of problem construction provides a legitimate platform for the proposed solutions, is part of the policy

process (Rizvi and Lingard 2010, 5).

4.3 The Problem of the Problem

Emanating from a legitimate voice in the policy process, The *Review of Mathematics in Post-Primary Education* (NCCA 2005b) constructs its own version of the mathematics problem – in fact McLaughlin's felicitous phrase 'the problem of the problem' (see 3.1) seems appropriate here. I contend that the NCCA had, from the outset, a very clear view of the preferred direction of mathematics education at second level . This view may have been shaped, at least in part, by the state's involvement with the development of the OECD/PISA assessment. I will return to this involvement in Chapter 5. In any case, it was conscious of the problem as constructed by other legitimate voices in the discourse and it constructed the *Review* in such a way as to provide for a solution that would, at least in part, satisfy the demands of the power-nexus.

The NCCA *Review* discussion paper marks the official beginning of the first root-and-branch reform of mathematics education in Ireland since the introduction of the 'new mathematics' in the early 1960s and as such, it was long overdue. Its discussion of mathematics education in Ireland and the related problems are set within a defined context.

It focuses on skills, the acquisition of which, it asserts, impinge on an individual's opportunities for development. In a society increasingly dependent on science and technology, it suggests, mathematical skills have economic implications (NCCA 2005b, 2). Here the young person is seen, firstly as an individual and then as a functioning unit within a society which is equated with an economy. Her study of mathematics is confined to the acquisition of skills. Interestingly the *Review* does not refer to the development of a framework of key skills influenced by the Lisbon strategy and the OECD DeSeCo (Defining and Selecting Key Competencies) initiative, which was to be integrated with the curriculum, teaching and learning, for senior cycle (NCCA 2009, 20). Nevertheless this skills framework is present in the senior cycle syllabus of Project Maths illustrated by a wheel of skills and competencies but it is noticeably absent from the junior cycle syllabus.

The Review is aware of the international narrative of falling standards in mathematics and how these are said to impact on third level, and it adduces much anecdotal evidence to support the suggestion that the same problems apply in Ireland.

It regards recent developments at Primary and Junior Certificate levels here as parameters that must be adhered to. In effect, this means that the Realistic Mathematics Education (RME) approach to teaching and learning, introduced to Primary level in 2002 and Junior Certificate 2000, is the inevitable outcome of any review process. To this end it emphasises international trends towards *realistic mathematics education* (RME), *problem-solving,* and *modelling.* It gives primacy to mathematics as the servant of science and technology.

Inscribed in the document is a further, unstated context – that of the 'discourse of failure'. The elements of this discourse contain a multiplicity of perceived system weaknesses and failures including those asserted by various EGFSN reports: poor standards in state exams; poor performance in international assessments; poor uptake at higher levels; system not in line with developing international trends; low levels of mathematical knowledge and skill among students proceeding to third level; dissatisfaction with the 'traditional' teaching and learning culture of mathematics; (NCCA 2005b). The authors of the Review do not subscribe to 'the no-crisis argument that the existing mathematics education system has provided a sufficient pool of mathematically competent people to support the Celtic Tiger economy' (Conway and Sloane 2005, 212). As previously argued (see Chapter 2), the discourse of the failure of mathematics education has already been well-established in the USA, Europe and elsewhere, where 'the scale of current economic and social change…demands a fundamentally new approach to education and training' (Commission of the European Communities 2000, 4). It was intended that the *Review* should act as a stimulus for discussion 'on the nature and role of mathematics education' (NCCA 2005b, 2) in schools, while at the same time 'keeping in mind developments that [were] currently under consideration at both junior and senior cycle' (NCCA 2005b, 2). In passing it is worth remarking that, by selecting a different set of analyses, a different narrative emerges – had the review valued the TIMSS achievement tests which appear to have played to strengths in the Irish system rather than the very different philosophy behind PISA which served to highlight weaknesses (Oldham 2001, 276) for example, then a different narrative would may emerged. The *Review* chooses not to identify the strengths of the system.

The *Review* was initiated in 2005 in the context of an Irish economy still booming, at a time when Pat O'Sullivan, Senior Economist with Bank of Ireland Private Banking, with remarkable hubris, could state that Irish wealth ranked second amongst leading developed countries (O'Sullivan 2006b, BoI website) and it was also the time when Irish politicians were attempting

to build a Knowledge Economy. In the event, in keeping with Ireland's traditional low spend on education (*The Irish Times* online 2010, 9 September), the process that ensued from the review would eschew those solutions that were likely to cost more and the economic collapse that preceded the introduction of Project Maths would ensure that the low-cost option would always hold sway.

Mathematicians, especially those involved in pure mathematics, tend to talk of mathematics in both a practical and an aesthetic sense. Very often a solution is described as 'beautiful' or 'elegant'. Traditionally, the Irish curriculum has recognised both aspects and the authors of the *Review* acknowledge the *'dual role'*. Mathematics, they say, has both a practical and a theoretical importance, 'providing basic language and techniques for handling many aspects of everyday and scientific life' while also dealing with 'abstractions, logical arguments, and fundamental ideas of truth and beauty – an intellectual discipline and a source of aesthetic satisfaction' (NCCA 2005b, 2). The language and ideals in this introduction are familiar and reflect the aspirations of the Junior and Senior cycle syllabi of the time. In fact this description of the dual role is taken almost verbatim from the introduction to the 1992 Leaving Certificate syllabus and is also to be found in the Junior Certificate syllabus published in 2000. The only omission is C.F. Gauss' metaphor of mathematics as 'the queen and the servant of the sciences' (Department of Education 1992b; Department of Education and Science 2000) which appears in both syllabi but is dropped from the discussion paper's definition – an interesting omission when one considers the importance of mathematics in a society that is 'increasingly reliant on and influenced by advances in science and technology' (NCCA 2005b, 2). Why omit this seemingly innocuous trope?

A further paragraph in the introduction to the *Review*, which contains the germ of things to come, may help to explain the omission. It refers to a 2002 UK report on *Mathematical Skills in the Workplace*, in which the authors, Hoyles et al., conclude that 'mathematical literacy can contribute to business success in an increasingly competitive and technologically based world-wide economy and that there is an inter-dependency of mathematical literacy and the use of information technology in the workplace' (NCCA 2005b, 2). This concept of *mathematical literacy* is defined by the OECD in the Programme for International Student Assessment (PISA) as 'an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded mathematical judgements and to engage in mathematics in ways

that meet the needs of that individual's current and future life as a constructive, concerned and reflective citizen' (NCCA 2005b, 2; OECD 1999a, 41). There is a concentration here on the practical functions of mathematics. According to De Lange (chair of PISA's Expert Group for Mathematics which developed the definition of mathematical literacy, and in which Irish academic Seán Close was one of five members), PISA primarily addresses the goals of preparing students for society and for future schooling and work. It is not concerned with showing students 'the beauty of the discipline' (de Lange 2006, 21). Perhaps, here, we may be said to be looking at the place of mathematics as the '*servant*' of the sciences and not the '*queen*'. As the review was not intended to be merely an exercise in syllabus revision, but an evaluation of 'the appropriateness of the mathematics that students engage with…and its relevance to their needs' (NCCA 2005b, 3), the inclusion of *mathematical literacy* in the introduction and its association with technology and business success rather than with intellectual discipline (NCCA 2005b, 2) , taken together with the exclusion of the aesthetic claims, indicates, I contend, the intention of this document to narrow the focus of mathematical education in a fundamental way.

It is a given of the document that developments in technology require new skills. That the technology has been invented, developed and used successfully by people with existing skills is not adverted to. The necessary 'new mathematics skills' are not specified, nor is there any argument or evidence to suggest that they are, in fact, new. Nevertheless, the 'changed nature' of mathematical skills required for use in information and communications technology must, the authors assert, have implications for the education system; the development of mathematical skills will have an impact on the individual's opportunities for development and this, in turn, will have economic implications in a society which is affected by advances in science and technology. Thus the scene is set for 'the fundamental evaluation of the appropriateness of the mathematics that students engage with in school and its relevance to their needs' (NCCA 2005b, 3). However, I contend, the real change implied by the *Review's* construction of the problem is a philosophical 'shift from education being seen as a public good that serves the whole community, to education being seen as a private good that serves the interest of the educated individual, the employer and the economy' (Ball and Youdell 2008, 15-16). It represents a concentration on education for the individual functioning to serve the economy 'as a constructive, concerned and reflective citizen' (OECD 1999a, 41).

4.4 Constructing the Problem

This official NCCA narrative sets out a particular critique of the state of mathematics education in Ireland that firmly places the existing curriculum in the *modern maths* tradition of the 1960s. Through the syllabus revisions that have taken place since then, the authors contend, the 'modern' emphasis in the curriculum has been 'diluted' and 'a more eclectic philosophy has taken its place' (NCCA 2005b, 11). What form this dilution took or what the 'eclectic philosophy' is, is not specified. The lack of a root-and-branch revision in mathematics education, the authors contend, may be the reason why 'more recent trends in mathematics education did not permeate discussions in Ireland' (NCCA 2005b, 11). The trends may not have permeated 'official' education policy discussions and there may not have been any 'genuinely radical critique of the aims of mathematics education in the junior cycle or of the style of content, pedagogy and assessment that is appropriate for the cohort served by the programme' (NCCA 2005b, 11), but the influence of recent trends in mathematics education had permeated recent curricular developments.

One such trend the Realistic Maths Education (RME) philosophy and practice are very much in evidence in the revised Primary School Curriculum[9]. The NCCA review itself tells us that, 'the revised Primary School Curriculum is more in line with the RME philosophy and, in particular, with the problem-solving approaches to mathematics education' (NCCA 2005b, 6). This philosophy together with the changed approach to teaching and learning advocated by the Junior Certificate syllabus revisions implemented in 2000, we are told:

> may eventually permeate second level education 'from the bottom up' as students transferring to post-primary schools have had longer experience of such approaches at primary school and teaching and learning in mathematics at junior cycle adopt the changed approach advocated by the syllabus revisions implemented in 2000. (NCCA 2005b, 6)

Thus, although 'post-primary mathematics syllabuses in Ireland do not currently make reference to the modelling or RME approaches' (NCCA 2005b, 6) the philosophy has indeed infiltrated recent syllabus changes and as already indicated, it is anticipated that it will eventually permeate the post-primary system 'from the bottom up'. It appears therefore, as

[9] The revised mathematics curriculum was introduced in Primary Schools in 2002.

though at least one of the directions of any syllabus remodelling that might result from this NCCA review process, had already been defined.

Apparently the *Review*'s brief discussion of trends such as problem-solving, modelling and Realistic Mathematics Education (RME) is the 'official' introduction into the debate of some of the 'more recent trends in mathematics education' (NCCA 2005b, 11). The 'some' is significant. The authors of the report do not refer to the 'conflict-ridden' academic debate on whether mathematics should be taught as a closed deductive system as opposed to 'realistic' mathematics (Dolin 2007, 101). There is no discussion of the more diverse range of perspectives on the teaching of mathematics such as constructivist and competency-based approaches which have been developed by mathematics educators (Lyons *et al.* 2003, 4) and Critical Maths Education is not mentioned. RME, however, is the mathematical approach on which the OECD/PISA mathematical literacy is based (Shiel *et al.* 2001b, 8) and success at PISA is an important consideration for the authors of the *Review*. PISA will be examined in greater detail in Chapter 5.

The PISA assessment was dominant in educational and economic discourse at that time and success in PISA was associated with a country's attractiveness for inward economic investment. The givenness of PISA means that the priorities of the PISA assessment are not interrogated by the authors and PISA results (among those of other international assessments) are accepted as 'evidence' of perceived problems in secondary schools. This, in spite of the fact that PISA does not examine the content of the school curriculum (OECD 1999a, 9) and unfamiliar question formats are present in the assessment; 'the situating of mathematics problems in a context (e.g. embedded in a real-life setting) was recognised as unfamiliar for the majority of items at all three syllabus levels' (NCCA 2005b, 15) at Junior Certificate level. Neither are the standards of students at upper secondary level in 'PISA successful' countries examined. The authors say that concerns exist in many countries about the standard of mathematics among students leaving second level education (NCCA 2005b, 3), and in particular the standards of those entering third level. Whether these concerns exist in countries which prioritise 'PISA standards' and *mathematical literacy* as the basis of their curriculum, is not adverted to. PISA, it must be remembered, is an assessment of fifteen year-olds, who are completing their lower secondary level compulsory education. Consider Finland, a country which has been very successful in the PISA assessments: in 1985, problem-solving was introduced to the Finnish curriculum in

response to an increasing interest in problem-solving around the world at the time, and since 1990 'everyday life mathematics' and related problems are taught. There appears to be a direct causal link between recent curriculum changes and the PISA performance. A syllabus review was introduced in 2004 at Grade 7, Grade 8 in 2005 and Grade 9 in 2006 (Paasonen 2004, 19), and it is this latter cohort which took part in Finland's triumphant 2006 assessment. However, Finnish academics have been cautious in their welcome for the PISA results; the success has been described as a 'pyrrhic victory' (Tarvainen and Kivela 2005, n.p.) and in the view of many 'the mathematical knowledge of new students has declined dramatically' (Solmu 2005, n.p.) The argument put forward is that the PISA study gives valuable information about the skills needed in life to solve simple problems, but that these skills are not enough in a world where a mathematical basis is needed in technical and scientific areas (Solmu 2005, n.p.). Thus, concerns arise about the standards of mathematics among students entering third level in Finland and it remains an open question whether adherence to PISA values will have any positive effect on university intake standards. The opposite may well be the case, if evidence from Finland is shown to hold elsewhere. The question then arises, who, if not the universities, are the likely beneficiaries of the swing to PISA values. Despite Ireland's precipitate move in the direction of PISA-friendly curriculum and pedagogy, there is no evidence that we are likely to solve the problems that pertain here according to the acknowledged narrative. The move is a leap into the twilight, if not the dark. It is the contention of this thesis that other agents wait in the wings to take advantage of the move. The PISA-swing may well solve problems other than those acknowledged or understood in the public discussion, in particular, the problem of human capital.

4.5 Constructing the Evidence

The concerns, mentioned above, about the standard of mathematics among students leaving second level education, and in particular the standards of those entering third level are identified, by the authors of the NCCA *Review*, in the Irish context. The *Review* claims that students proceeding to higher education have a 'low level of mathematical knowledge and skills' (NCCA 2005b, 3) and are unable to 'cope with the basic concepts and skill requirements' of their courses. This is most probably true in relation to students who achieve the lower grades of the Ordinary Level Leaving Certificate. This is not surprising when one considers that the Chief

Examiner considered that '[t]he strengths of Ordinary Level candidates are seen to lie in the area of competent execution of routine procedures in familiar contexts' (SEC 2000, 31), hence the objective of instrumental understanding is being achieved quite well and is deemed appropriate for young people with this level of competence. Perhaps it is more appropriate to say that these students *can* apply mathematics in the 'simplest and most practiced way' and that this ability is one learned from the routine nature of questions in the Leaving Certificate examination. The authors of the Review admit that the decontextualised nature of the examination questions contributes to the emphasis on routine procedures (NCCA 2005b, 11). It may not be out of place here to suggest that Ordinary Level students, achieving grade D (40%-54%) are, by definition, those whose interest and hence application extends only to routine procedures. These outcomes may differ from those that third level institutions would like to find in their new cohort of students but grade D in Ordinary Level mathematics is the minimum mathematics qualification for many maths related courses, particularly in Institutes of Technology. The problem is in effect an intractable dilemma, since it can only be solved by reducing the number of successful applicants – Institutes of Technology would attract a higher standard of applicant if they raised their minimum requirement, but in turn this would reduce the number of qualifying candidates.

I contend that this perceived problem of falling standards and concern about low level of mathematical knowledge and skill are, in part, connected with the qualifications of students being accepted onto STM courses (as discussed in 3.8) and with the international discourse on mathematics education. The demand for Engineering, Science and ICT courses has been falling for a number of years (Keena 2002, DCU website) and consequently students with fewer CAO points were being accepted onto courses. However, it is beyond the remit of this thesis to fully engage with the question as to whether standards are in fact falling and if so to what extent. Suffice it to say that the NCCA accepted the existence of the problem, based, it seems, almost entirely on anecdotal evidence. In fact the matter of anecdotal evidence and 'anonymous attribution' bedevils the entire debate. A proper study of this question would be very beneficial in concentrating the debate.

The *Review* considers the numbers problem and clearly identifies the role of Higher Level mathematics in terms of entry to third level – the 'relatively poor take-up of Higher Level mathematics rightly gives cause for concern, since it has implications for the follow-on study of

mathematics to degree level' (NCCA 2005b, 10). In its discussion of the uptake of Higher, Ordinary and Foundation levels at Junior Certificate it notes that in most subjects Higher Level is intended for the majority of students whereas for mathematics, the Higher Level mathematics syllabus is targeted at students of above average mathematical ability (NCCA 2005b, 8). The result is that the cohort of students who study Higher Level mathematics is smaller than for other subjects. Thus one of the possible causes of the numbers problem becomes apparent – the course is designed for a smaller target cohort. By contrast, the *Review* attributes the relatively poor up-take of Higher Level at Leaving Certificate in part to the perceived difficulty of mathematics and also to an 'elitist' status which, it claims, is attributed to the subject in some schools. No mention is made here of the 'above average' cohort although the syllabus states that 'the Higher course is aimed at the more able students' (Department of Education 1992b, 5).

In keeping with the concerns of business and industry the *Review* constructs its version of the problem of Ordinary Level at Leaving Certificate. The authors concentrate on the poor performance candidates and construct the problem at this level with what they repeatedly call 'evidence'. This section reads like a fault-finding exercise rather than a review. Nowhere are the strengths of the system explored. The concentration is entirely on constructing the image of a failed system. Achievements of students are overlooked. The 'evidence', predictably now, is selected from international assessments, the Chief Examiner's Reports, and a healthy dose of anonymous attribution and anecdote from third level institutions. As elsewhere, the role of 'international studies of achievement' (NCCA 2005b, 15) in identifying problems with mathematics education in Ireland is accepted and unchallenged. Although the authors caution that the results of such studies must be treated with care as they do not always compare like with like, they still claim that such assessments can provide 'helpful' information about strengths and weaknesses in student achievement. They accept the results of international assessments, in which Irish students participated, as evidence that the performance of *some* students at junior cycle 'gives cause for concern' (NCCA 2005b, 16) and that 'the seeds of at least part of the problem at senior cycle may be sown during the junior cycle or earlier' (NCCA 2005b, 16). The studies cited are: IAEP I (1998) where the Irish performance was 'decidedly moderate'; IAEP II (1999) whose results showed 'a worrying tail'; TIMSS (1994) where the performance of Irish second-year students was 'better than that of the comparable cohort in a number of countries with similar cultural and developmental level'; and PISA (2000, 2003)

where the Irish achieved a score in *mathematical literacy* not significantly different from the OECD average but where, in 2003, it was considered that this OECD average performance of Irish students was below that of several countries that might be deemed comparable (NCCA 2005b, 15). This reading of the results already archives the 'discourse of failure'. The TIMMS 1994, for example, ('better than that of the comparable cohort') could have encouraged the authors but they choose to counterbalance the positive message with evidence from the 1996 Chief Examiner's report for the Junior Certificate which discussed basic weaknesses particularly among students taking Ordinary and Foundation Level papers. In fact, the authors remark that the Chief Examiner's report 'helped to counteract any undue optimism from the comparatively good results from TIMMS' (NCCA 2005b, 16). Equally, the fact that OECD/PISA found the results of Irish students to be 'not significantly different to the average' could be read as quite an achievement as the school curriculum is not examined by the assessment and the mismatches are too numerous to mention. In summary, the international assessments and studies, the authors contend, provide 'evidence that the problems observed at Leaving Certificate level start further down' (NCCA 2005b, 16). We will return to the subject of international assessment in the chapter 5.

Another 'evidence' producing site is in the Chief Examiner's Report. The 'evidence' chosen here points again to trouble with the Ordinary Level Leaving Certificate and also with Ordinary and Foundation levels at Junior Certificate. The authors refer to the reports of the Chief Examiner as valuable documents, which highlight areas of strength and weakness related to the objectives of the syllabus. Predictably the *Review* concentrates on the weaknesses identified, particularly in 2001 when the 'extraordinary' report was produced in response to 'poor Ordinary Level results' (NCCA 2005b, 16). A glaring omission in the *Review's* consideration of the Chief Examiner's report (section 5), is its failure to draw attention to the Chief Examiner's contention that the high failure rate at Ordinary Level is attributable in large part to the failure of third level institutions to accept Foundation Level, a fact that forces students who might otherwise sit that level to take the Ordinary Level paper instead (SEC 2001, 15-16). The issue is briefly dealt with elsewhere in the *Review*, but at this point the impression of failure is allowed to stand as a general observation.

This *Review* is an insight into the preferred 'official view' of mathematics teaching and learning in this country. It provides an interesting, if limited, overview of certain aspects of mathematics

education in Ireland and contrasts it with some aspects of current international thinking. More significantly, it constructs a discourse of failure surrounding the provision of second level mathematics education, in particular at Ordinary Level Leaving Certificate that would shape its own strategy and that of other actors in the field. The underlying assumptions are clear: that the agenda for the education of young people must be set by international standards and priorities, by international assessments – PISA in particular – by economic considerations and by third level demands; that change is both inevitable and essential. Equally clear is the fact that the agenda for change is already predetermined, that, in fact, the *Review* is not so much an even-handed analysis of an existing system with all its strengths and failings – the strengths of the present system are ignored – but an unsubtle attempt to construct a problem for which the solution is already known.

The *Review* discussion document was completed and passed by the NCCA Council in March 2005. At that stage the NCCA commissioned a review of the literature on current international trends in mathematics education as a companion paper to its own document, and to inform the discussion and debate. In the next section we examine the choreography of these reviews, which is interesting in its own right.

4.6 The Choreography

International Trends in Post-Primary Mathematics Education, the companion document to the *Review*, is an impressive assessment of the literature on mathematics education, albeit with some blind spots which I will return to shortly. The report provides information on current policy concerns, current trends in mathematics curricula and assessment reform initiatives in a number of countries. In the process it highlights a range of individual projects, developments and special interests: Australia's focus on the value added by the use of computed algebra systems (CAS) in the learning of algebra in the school system (Conway and Sloane 2005, 42); Singapore's focus on 'how to develop more of America's strength: getting Singaporean students and teachers to be more innovative and creative' (Conway and Sloane 2005, 49); Lesson study in Japan (Conway and Sloane 2005, 69-75); the role of assessment in standards-based reform in the USA (Conway and Sloane 2005, 51-53); in the UK it considered the lack of suitably qualified maths teachers at a time when mathematics appeared 'to count more and more in economic and

scientific progress' (Conway and Sloane 2005, 53); the Mathematics in Context (MiC) programme in the USA (Conway and Sloane 2005, 161-66); the 'math wars' in China, which occurred in 2005, a decade after the USA National Council of Teachers of Mathematics (NCTM) modelled reform of mathematics curricula was introduced (Conway and Sloane 2005, 12). However, a noticeable omission is any reference to the American Math wars, a controversy relating to the introduction of new mathematics programme in the United States (Grannell *et al.* 2011, 10). The report also considers theories of cognition and learning, in particular, it focuses on the Realistic Mathematics Education (RME) movement and situated cognition, both of which underpin PISA's mathematical literacy framework (Conway and Sloane 2005, 87). It provides a comprehensive analysis of assessment and the need to alter modes of assessment in line with contemporary theories of learning. Limited by its terms of reference, it attempts to provide a snapshot of how mathematics education looks in the present day. It accepts certain elements of the discourse of failure without interrogation: that students do not understand what they learn; that students are 'failing'; the knowledge economy and the human capital argument that education must serve the economy; and the idea that a new century and globalisation require a new kind of education. It looks at the ways in which teaching, learning and assessment are moving in the drive to create knowledge economies in a world where mathematics is seen 'as a high-yield subject in preparing workers and citizens for the knowledge society' (Conway and Sloane 2005, 56).

In effect, *International Trends in Post-Primary Mathematics Education* provides post-factum logistical support to the NCCA *Review of Mathematics.* As already said, it was commissioned by the NCCA in April 2005 and as such it is the product of another 'legitimate voice' in the curriculum development process. *International Trends* is not a critical appraisal of current trends in mathematical education; rather it is a review of appropriate literature which sets out 'to highlight the *most significant* trends in mathematics education internationally' (my emphasis) (Conway and Sloane 2005, 5) that might inform the review of mathematics at post-primary level in Ireland. Clearly the term 'most significant' is crucial here, and may perhaps account for the significant lapse with regard to the American 'Math Wars'.

It is reasonable to assume that such an international survey of trends would precede and provide a foundation for the local analysis. However, in this case the survey of the international literature post-dates the local analysis, the problem's bureaucratic construction, and the choice

of a preferred solution. As we have seen the NCCA and the DES had constructed the problem of mathematics education in Ireland and set their hearts on success in PISA, and the apparent road to this success was the adoption of a version of Realistic Maths Education (RME). The choreography is therefore interesting.

The report is intended to function 'as a companion paper to its own (the NCCA's) discussion document, to inform the discussion and debate' (NCCA 2005a, 2). I would argue, however, that it is instead intended to provide convincing 'evidence' that will support the NCCA's construction of the problem in mathematics education and its preferred solution. This current desire for evidence and evidence-based discussion is akin to the preoccupation with the need for evidence-based policy in the public sector referred to by Rizvi and Lingard who draw attention to the focus, of policy makers, on 'what works' as the basis for public policy (Rizvi and Lingard 2010, 49). They link this preoccupation to new public management and pressures for efficiency and effectiveness in public policy delivery. But the document as a whole is permeated by a post-dated feeling, the suggestion that their findings must fit within a predetermined rubric. It is easy to test whether the commissioning of the document was open-ended: we only need to ask ourselves the question: What if the authors had returned a contrary opinion? I contend that had the authors rejected RME and PISA it would not have altered the path of the reforms by one degree.

The expression 'companion document' suggests a mutual relationship, a pair of documents intended to complement each other. Thus the two documents must be seen as interrelated and intended to be read together. We are told by the authors that the focus and content of the commissioned report reflect 'the outcome of consultation between the researchers and the NCCA' (Conway and Sloane 2005, 6) and thus I contend, that the general content and direction of the report was predetermined both by these discussions, by the content of the 'Invitation to Tender' document and by the problem's own bureaucratic construction. A version of the NCCA review was available to the researchers during the preparation of their report. The NCCA review had been completed and passed by the NCCA Council – prior to the advertising and commissioning of *International Trends* – and thus makes no reference to the later Sloane and Conway work. However, a casual glance at the NCCA website would suggest that both documents were in preparation at the same time since they are both officially published in October 2005. There is more than a suggestion of choreography about this apparent synchrony.

The review, which, due to the imminent publication of the NCCA's own *Review*, had to be completed within three months, was to present 'recent and contemporary' literature that focused on 'frameworks and philosophies' that underpin mathematics education. It was to include consideration of curriculum and assessment provision; periods of compulsory mathematics education; time allocated to the subject; various forms of assessment; the place of ICT in teaching, learning and assessment; teacher qualifications and professional development; and mathematics as an entry requirement for (some) third level courses (NCCA 2005a, 4). A draft of the review was to be made available to the NCCA, 'for comment and feedback' (NCCA 2005a, 3) three weeks prior to completion. In short, the authors had two and a half months to complete a worldwide survey of the literature on mathematics education. They were fortunate to have considerable experience to bring to bear. In addition to this extraordinary timescale, the invitation to tender itself imposed constraints. The review should focus on 'frameworks and philosophies that underpin mathematics education internationally' (NCCA 2005a, 2-3) while drawing attention to the 'realistic mathematics education movement and the concept of "mathematical literacy" for all' (NCCA 2005a, 3). RME and mathematical literacy, it should be remembered, underlie the OECD/PISA process and represent favoured themes in the discourse of the business/engineering/politics/media nexus.

The authors are further constrained by the requirement to 'take into account the mathematics curriculum in Primary Schools' (NCCA 2005a, 1) with its RME-based philosophy and the aspiration, expressed in the *Review of Mathematics in Post-Primary Education*, that this philosophy 'may eventually permeate second level education from the bottom up' (NCCA 2005b, 6). Students' experience of mathematics education in post-primary school at the time, the tender document claims, focused primarily on 'learning and practising techniques and routines…this experience [was] at variance with the philosophy underpinning the revised primary mathematics curriculum' (NCCA 2005a, 1-2); neither was it in keeping with the 'thrust of the methodology' (NCCA 2005a, 2) introduced during the teacher training programme for the revised 2000 Junior Certificate mathematics syllabus. The new Junior Certificate methodology was consistent with that associated with the RME framework while the syllabus, grounded in the 'new maths' tradition, was composed of a reduced version of the 1987 revision of the syllabus introduced for the Intermediate Certificate programme in the 1960's. The 2000 revision of the Junior Certificate mathematics syllabus 'did not entail a fundamental reappraisal of mathematics

education or its underpinning philosophy' (NCCA 2005a, 1), however the aims of the new Junior Certificate syllabus were revised and are, according to the tender document, 'broadly similar' (NCCA 2005a, 1) to those of PISA – though substantial differences are acknowledged in the underlying philosophies, in mathematical content, in the nature of assessment and in implications for teaching and learning. The interest in and attention to PISA are further emphasised with the reference to the performance of Irish students in OECD/PISA in 2000 and 2003, where they 'achieved scores that were not significantly different from the OECD average' (NCCA 2005a, 1). These statistics are cited without further comment. It would have been astonishing, with the weight of these constraints bearing on them, had the authors of *International Trends* been in a position to utter more than cautions in relation to the course set by the department. The authors are acutely aware, on the one hand, that the RME-turn has already been made and the future direction set, and, on the other hand, that certain elements of the system may remain negotiable, in particular teacher training and assessment, and consequently they make a strong case for a radical overhaul of both structures.

4.7 Ireland and the 'International Conjuncture'

In their work the authors identify a worldwide 'powerful international movement' (Conway and Sloane 2005, 201) with its focus on 'redefining and reforming' mathematics education in many countries. They describe this movement as 'a *conjuncture*…which sweeps around the world, knowing no respect for national boundaries' (Conway and Sloane 2005, 201). They depict the proposed redefinition and remodelling of mathematics education as a set of 'significant challenges' which have 'emerged as urgent issues and are an illuminating barometer of the changing relationship between school and society in an era of globalisation, with its calls for a move toward a knowledge-based society' (Conway and Sloane 2005, 201). The '*conjuncture*' and its movement create an image of a great wave of educational reform, arising spontaneously and sweeping round the world. This is typical of hegemonic discourses, whereby the historical necessity of the hegemony is presented as self-evident. But a wave is never spontaneous and requires an initial and continuous energy source. The source of this energy comes from outside education. For the authors, the energy source – the wind to the worldwide wave – is 'cultural pressure' (Conway and Sloane 2005, 201). In support of their 'cultural pressure' assertion, Sloane and Conway list the now familiar arguments used by businessmen,

politicians and expert groups in discussions relating to the redefinition of mathematics education: 'disenchantment with the overly abstract focus of the now longstanding 'new' or 'modern' mathematics curricular culture, alarm among the business community (and some educators) at students' limited capacity to apply knowledge in new contexts, pressure from the learning sciences to revise our deeply held ideas and assumptions about both learning and mathematical understanding, the unprecedented elevation of international comparative test results onto government and cabinet tables,' (Conway and Sloane 2005, 202) and finally a catch-all complaint that deeply undervalues its constituent elements by grouping them all together as though they were a minor domain of interest – 'deep concern about perceived and/or actual gender, socioeconomic status (SES) and ethnicity gaps on mathematics achievement tests'. Cultural pressure, we are told, 'has led or is leading to significant educational reform agendas in a number of countries' (Conway and Sloane 2005, 202). On the other hand, from a very different perspective Hursh captures this so-called 'cultural pressure' very adroitly:

> The neo-liberal states, through the use of standards, assessments, and accountability, aims (sic) to restrict educators to particular kinds of thinking, thinking that conceptualizes education in terms of producing individuals who are economically productive. Education is no longer valued for its role in developing political, ethical, and aesthetic citizens. Instead, the goal has become promoting knowledge that contributes to economic productivity and producing students who are compliant and productive. (Hursh 2000, online journal)

The authors of *International Trends* do not question the term 'cultural'. For them the pressures exerted by interested groups of industry and their political allies are sufficient to merit its usage. Such circular logic in the economic sphere is often called 'faith-based economics'. I prefer to call it 'leap-in-the-dark thinking'.

In this case, the authors outline the official narrative and accept it as an argument in the case for change. The unquestioned acceptance of the 'significant challenges' which have emerged as 'urgent issues' belongs to the 'seemingly commonsense assumptions' (Apple 2004, 12) that form the foundations of many curricular innovations. A critical appraisal of these pressures requires that we identify the political, social and economic interests that underlie these 'taken for granted' (Rizvi and Lingard 2010, 64) assumptions and to question how and why the

ambitious 'social and economic goals being set in the fast-growing economy' are 'ambitious' rather than nebulous, and why, in particular they require 'a more concerted effort to address perceived weaknesses in mathematics education' (Conway and Sloane 2005, 55). As we have seen in Chapter 3, it is difficult to separate this 'cultural pressure' for change from the demands for an economy-centred education as expressed in the reports of expert groups, business organisations and politicians friendly to corporate interests and their 'neoliberal theories of human capital' (Peters 2001, 1). The idea of shifting the emphasis in educational policy from the well-being of the child to the well-being of the economy is a long-held neoliberal ambition intended to produce young people amenable to the new work order. In Ireland this process has been underway since at least the late1960s (O'Sullivan 2005, 135). David Hursh writes that '[t]he hegemony of globalized neo-liberal economic policies has contributed to refining education in terms of its contribution to the economy' (Hursh 2000, n.p.), and he quotes Blackmore to the effect that, at the international level, education 'has, in most instances, been reshaped to become the arm of a national economic policy, defined both as the problem (in failing to provide a multi-skilled flexible workforce) and the solution (by upgrading skills and creating a source of national export earnings)' (Blackmore 2000, 134). This strategy, as outlined in previous chapters, has been underway in Ireland for some time.

Sloane and Conway align themselves with this economic approach. For them, mathematics is 'foundational in that in its absence the economy and society would suffer in not having mathematically skilled workers and citizens ready to deploy and advance on these basic skills' (Conway and Sloane 2005, 13). Notable here is the fact that mathematics is foundational not to the young person's understanding of the world and society, rather the subject is foundational to 'the economy and society' – and in that order. The student is not central.

In fact this study is, among other things, a thoroughgoing explication of why the economy, as defined in the official narrative, requires educational change. In this 'era of globalisation' (Conway and Sloane 2005, 35), the authors argue, a new relationship between the economy and education is developing. They argue that it is no longer an official belief that students can learn all they need to know for life and work in school (although it is reasonable to suggest that this was never the case). However this change of attitude has led to a new focus on learning and 'learning to learn'. The authors suggest that the shift in emphasis from school subject content to the importance of learning to learn is due to the 'accelerating pace of social change, economic

development and…knowledge production' (Conway and Sloane 2005, 149) which demands that in the course of 'learners' lives 'it is crucial that they have the capacity to continue engaging with new knowledge and ideas' (Conway and Sloane 2005, 149). The authors see globalisation as presenting challenges that will require 'deep disciplinary knowledge, and the capacity for interdisciplinary knowledge construction, and competence in dealing with non-routine problems' (Conway and Sloane 2005, 149). Finally 'in an era of lifelong learning, school graduates are expected to enter the workforce, higher education, or further education with the capacity for promoting their own learning' (Conway and Sloane 2005, 149). The focus on learning to learn in the context of promoting lifelong learning is, we are told one of the 'most distinctive features of contemporary educational and economic policy-making at national and international levels' (Conway and Sloane 2005, 148). It has become a key educational policy priority around the world calling into question the purpose of schooling, the content and the pedagogy. No attempt is made here to gloss terms like 'lifelong learning', which, as argued in chapter 2, is often a synonym for 'precarious labour', where continuous retraining of the worker is required, in particular during periods of enforced unemployment.

The purpose of mathematics, in this scheme is quite clear. According to the authors, 'the fruits of high-quality mathematics education…ensure a rich harvest for the economy and society' (Conway and Sloane 2005, 4). It is not clear what the authors mean by 'society' in this context, unless they mean that the downstream effects of economic wealth will benefit people's personal lives, a version of the neoliberal 'trickle down' theory. Ireland's economic goals – the knowledge economy and its most recent incarnation, the smart economy – are seen to present particular problems in relation to mathematics. These problems, according to the authors, are highlighted by the 'moderate' performance of Irish students in international assessments. Here they specify the mid-ranking placement in both PISA 2000 and 2003 in mathematics literacy (Conway and Sloane 2005, 55). They speculate on what they call 'the slow emergence of concerns about mathematics education' on foot of the PISA results and manage to sit neatly atop the fence as to the wisdom of 'the less dramatic reaction in Ireland' to the urgency of the need for reform:

> Given that curriculum reforms, if undertaken, are best done in a considered rather than reactionary manner, less immediate concern may be justified. On the other hand, bearing in mind the ambitious social and economic goals being set in the fast-growing

> economy, it could be argued that a more concerted effort to address perceived weaknesses in mathematics education is merited. (Conway and Sloane 2005, 55)

They acknowledge that the existing system has been very successful for Ireland citing 'the no-crisis argument that the existing mathematics education system has provided a sufficient pool of mathematically competent people to support the Celtic Tiger economy' (Conway and Sloane 2005, 212) – again an economic assessment of the value of education – but 'while the curriculum and examination system has served society well it may not be providing students with the necessary learning experiences for the 21st century, especially in an emerging knowledge society' (Conway and Sloane 2005, 220). With this factor in mind the authors (come off the fence) acknowledge 'the need for some moderate - if not significant - mathematics education reform given Ireland's ranking in international comparative studies vis-à-vis the country's ambitious economic, educational, social and research goals' (Conway and Sloane 2005, 203).

The presence of the PISA assessment in this document is consistent with its appearance in the NCCA discussion paper the *Review of Mathematics in Post-Primary Education*. For the NCCA, as discussed above, PISA has the status of a given. The dominance of this relatively new assessment (at the time of the Review only PISA 2000 and 2003 had taken place) in educational and economic discourse has resulted in the acceptance without interrogation of educational priorities originating in the Organisation for Economic Cooperation and Development (OECD). Through PISA the OECD has established itself as 'a policy actor and mediator of knowledge, with an increasing capacity to shape policy priorities in education' (Rizvi and Lingard 2010, 133), throughout most of the OECD region as well as in other non member countries. PISA will be examined in detail in Chapter 5, but the following remarks are apposite here.

International Trends accepts OECD/PISA, with very few caveats, as a detector of what is right or wrong in a national education system. 'This does not necessarily mean that PISA results alone should be used, for example, as a reason for curriculum change in mathematics, but that a careful consideration of the relative merits of adopting a PISA-like approach to mathematics education may have considerable value' (Conway and Sloane 2005, 203).

Success at OECD/PISA is regarded as an indicator that a national system has the right ingredients for future economic success. No studies are adduced to make this link between

PISA-like education systems and economic consequences. It is not sufficient to point to successful economies that use the system, since the success of the economy is in itself a possible causative factor, and arguably the principal causative factor, in the good educational results of its students. Finland, for example, provides its students with free education, free school meals, free medical and psychological care, highly qualified teachers and many other benefits of the social state (Sahlberg 2012, n.p.). Whether its success in the PISA assessment is caused by or causative of these societal priorities is a moot point. Equally, nobody has chosen Ireland's education system as an exemplary model despite the fact that it was credited with having helped create the so-called Celtic Tiger economy – still apparently thriving at the time of the publication of this report.

PISA is, in fact, a leap in the dark, a fact acknowledged by the authors in their musings on the imagined representation of a competent mathematical learner of 2010 and 2020, the possibilities they admit are 'based on…incomplete knowledge of how society will evolve in the next few decades and what that will mean for mathematical ways of knowing' (Conway and Sloane 2005, 213). In fact, they – and we – stand in much the same position as an educationalist in 1905, attempting to predict what the 20th century would require by way of education.

In another example of leap-in-the-dark thinking, the authors suggest that success at PISA is a possible passport to the 21st century, a passport which will provide students with the 'new skills' necessary for economic and personal success and create a 'a pool of researchers and other professionals for a range of fields' (Conway and Sloane 2005, 211) the underlying assumption here is that PISA is a good predictor of whether Ireland has such a pool. The authors admit that the course they propose is unpredictable, that it would take many years for a change to a PISA/RME based curriculum to produce results and that, even then, there is no certainty that the PISA turn will provide the desired results. However, there is no independent analysis of the PISA 'effect' offered. Despite their warnings that such success is not guaranteed, it is the only passport which the authors choose to present to the policy makers who commissioned their report.

As discussed earlier the authors accept that the cultural pressure to redefine mathematics education has led or is leading to significant educational reform agendas in a number of countries. They cite China, Australia, Singapore, USA and the UK as examples (Conway and Sloane 2005, 202). These countries together with Japan are the sources of the projects,

developments and special interests referred to by the authors as examples of best practice that might be considered during the process of mathematics education remodelling in Ireland. The connection between all of these countries seems to be economic: each has a highly liberalised economy like Ireland's. The unmentioned elephant in the room is Finland, also highly successful in PISA, with an admirable education system, but very much a social democracy and a very high spender on education. It is difficult to see any connection between China, Japan and Singapore, with, among many other factors, their culture of deference to authority and the status of teachers, and the USA, the UK and Ireland where no such deference or status exists in any degree. What is the value of comparing educational projects in a technocratic way without reference to the cultures with which they are intimately entwined?

In essence the argument for change outlined in this document is founded on the belief that a new century with its economic imperatives must perforce require a new kind of education, and this belief directs the authors to those countries where the economic argument runs along similar lines to that in Ireland. This argument is supported by reference to the demands made by the new work order – corporations require more flexible (should we read 'compliant'?) workers therefore education must respond by producing such workers. The OECD/PISA assessments are then adduced to prove that Irish education is failing to produce suitable young people. In adopting the views summarised in this section, the authors accept the argument of capital which seeks to impose its needs on labour. They might, as easily, have taken the side of labour and argued the case for change on the basis of the needs of working people for the critical tools to understand their situation. This latter strategy, however, would not have been popular with the organisation that commissioned the study.

4.8 The problem of consultation

Following the publication of the *Review of Post-Primary Mathematics* and *International Trends in Post-Primary Mathematics Education*, the NCCA initiated a consultation process 'to allow those with an interest in the issues raised to respond to these and to raise any other concerns which they considered should be addressed under the review' (NCCA 2006, 2). For this purpose a consultation questionnaire was developed and distributed to the partners in education. Contributions were received from interested parties and discussions were held between a small

number of groups and the NCCA (Irish Mathematics Teachers Association, Junior Certificate Mathematics Support Service Team, two parents' representatives groups and also with a representative of the Union of Students of Ireland) (NCCA 2006, 2). Subsequently a report on the consultation was produced and, perhaps significantly, the authors of the *Report on the Consultation* draw attention to the fact that no individual business or employer completed a questionnaire even though, they claim, this sector had repeatedly voiced concerns in recent years about standards and achievement in mathematics (NCCA 2006, 5). This begs the question: for which economy or for which sector of the economy is an inability to use or apply mathematics except in the simplest and most practiced way an important issue? Does the problem apply to indigenous business and industry or is it of interest only in the case of Foreign Direct Investment (FDI)?

The questionnaire, through its language and content, constructs the problem of mathematics in a way favourable to the NCCA plan and it disciplines the respondent to return answers relating to the chosen path. In many ways, the questionnaire is, in its own right, an exercise in shaping public opinion. One question, for example, (Q.2) constructs the problem of mathematics for the respondent by indicating international concerns about the type and quality of mathematics education that students experience at school which, according to the *Review* are echoed in Ireland. These concerns also reflect the 'cultural pressures' of Conway and Sloane. That mathematics teaching emphasises procedural skills rather than understanding; that it has poor application to real-world contexts; there is a low uptake of Higher Level mathematics and poor results in Ordinary Level; there are gender differences in uptake and achievement; and difficulties for students at third level. The questionnaire then invites the respondent to remark on these problems and to suggest other problems that might occur. Clearly, at the very outset, the respondent has been presented with a negative construction. It is not in any sense, an open question. This construction is consistent with the NCCA's own *Review*. In its April 2006 *Report on the Consultation* the reported responses to this question, as expected, confirmed the presence of the 'problem'. Apart from a number of respondents who believed in the benefits of developing a reasonable level of procedural skill or those who were dissatisfied with the effects of early introduction of calculators (NCCA 2006, 8) (an issue also identified by the engineers group) the reported voices of the respondents were in agreement with the NCCA. However the problem of teachers of mathematics who are 'non specialist mathematicians' (NCCA 2006, 11)

identified by the IMTA and some lecturers and was, I contend, the basis for many of the problems experienced at second level in the preceding years, was given scant attention by the NCCA. It is worth remarking here that although teacher qualifications are outside the remit of the NCCA, nevertheless it is significant that no public recommendations to the effect of correcting the deficit in fully qualified mathematics teachers would issue as part of this consultation process despite concerns being expressed and recorded. Interestingly the question with the highest level of non-response was that which asked about the relative merits of 'modern maths' and RME approaches for Junior Certificate and Leaving Certificate mathematics. This question was mainly answered by lecturers in mathematics (NCCA 2006, 13) and many second level teachers indicated a lack of familiarity with current trends. This is remarkable because RME was the underlying philosophy of the new Junior Certificate programme introduced in 2000 and the revised Primary School Curriculum is in line with the RME philosophy (NCCA 2005b, 6; 2006, 35). However, in both cases, the syllabus documents make no reference to the RME approach. I contend that this 'lack of familiarity' arises in part from the reluctance of the NCCA to officially locate its curricula within an identifiable tradition or philosophy and also, from my experience as a participant, I observed that the in-service programme provided for teachers of the new Junior Certificate concentrated on the 'how' of the methodology and not the philosophical background. The presumption that teachers are resistant to theory translates into a determined suppression of theoretical discussion. This is above all an educational failure, perilously close to the strategies condemned by the NCCA – teaching for reproduction and not for understanding. Indeed, as we will see in chapter 7, the department's own 'theoretical' production on problem-solving does not inspire confidence. This same pattern would be followed with the introduction of Project Maths – the fully scripted teacher in-service presentations for the project would ruthlessly exclude theorising or theoretical questions.

The issue of the non-recognition of the Foundation Level Leaving Certificate mathematics for entry to third level courses was a recurring theme in the responses. It had appeared in the *NCCA Review,* the Chief Examiner's Reports and again in this document it is a cause for concern among many of the respondents. In the event, Project Maths was developed with examinations at three levels, higher, ordinary and foundation at both Leaving and Junior Certificate. The proviso that 'the issue of the status of the Foundation Level course and the examination grades achieved by

candidates in terms of acceptability for some courses at third level will be explored', was announced by the NCCA while the project was in development (NCCA 2008b, website).The statement is still on the Project Maths website in 2012 (NCCA 2012b, website). To date it has not been publicly 'explored'.

It is important to remember that the *Report of the Consultation* is a complex document with manifold purposes, including possibly an attempt to persuade the NCCA's masters in the DES and Department of Finance of the necessity for change. But most of all it is a highly selective document, the result of a long editorial process that began, intentionally or otherwise, with the people who took the minutes of public meetings and ended with the NCCA's own editorial team. Thus, expressions like 'many respondents', 'a number of respondents', 'some respondents', 'in some responses', 'reference was made to', must be read as archiving the priorities of the NCCA itself.

4.9 Conclusion

This chapter interrogates the official publicly acknowledged narrative of the development of second level mathematics education in Ireland with its attendant publications. It identifies a process whereby the NCCA constructed a problem in a particular way in order to validate a predetermined solution. It argues that only certain statements were permitted in the discourse of mathematics education, and shows how these statements related to each other in a single formation. I contend that the NCCA process chose not to privilege a number of issues which if investigated might have led to alternative solutions to the problems associated with the teaching of mathematics. For example, in relation to the problem of exam candidates receiving low grades, it chose to overlook the effect on students of teachers of mathematics who did not have a third level qualification in the subject; it ignored the findings of an Education Research Centre (ERC) survey which found that 28% of teachers of mathematics surveyed in 2003 had studied degree courses which did not include mathematics as a major component (Cosgrove *et al.* 2004a, 20); the problem identified by Engineers Ireland of the low numbers of mathematics graduates pursuing a career in teaching; and the literature relating to the success of mathematics education in countries (like Finland) where teachers are highly qualified and a high-spending social state supports educational aims. Statements on these issues were not permitted in spite of

the fact that problems with the supply and demand of qualified teachers of mathematics were evident in Ireland and internationally at the time.

The ostensible aim of the process was to investigate through an internal review, an international review by an academic team and a public consultation the available options for solving a problem defined by the NCCA. The chapter argues that, in essence, the solution – Realistic Maths Education with a teaching for understanding approach – had already been decided by the NCCA and the problem was constructed by them in such a way as to legitimise their choice. It is important to note here that this thesis makes no objection to RME, rather it is focused on the apparatus of power as it applies to education and attempts to form a genealogical understanding of how such power is brought to bear on educational change.

Chapter 5

The Leaning Power of PISA

Power produces knowledge…there is no power relation without the correlative constitution of a field of knowledge, nor any knowledge that does not presuppose and constitute at the same time power relations. (Foucault 1977, 27)

5.1 Introduction

In the preceding chapters I have examined the official, publicly available narrative of policy change in its own terms. Such an analysis reveals powerful agencies attempting to shape and control the discourse and represents, to some extent at least, the self-aggrandising of agencies and people in pursuit of greater power and control. Because of the limit of *in its own terms* we can discern only the shadows of even larger international movements and the march of history; we detect them in their effects, as it were, rather than in their presence. This chapter will look at one of the forces behind the international movements, one which is not an agent of the official narrative in Ireland, but whose influence is present in that narrative and whose aim it is to inform education policy decisions (OECD 1999a, 7) on a global scale. I am referring here to the OECD. Through the influence of PISA it has become a powerful force in the development of education policy in the global field (Bieber and Martens 2011; Grek 2009; Rizvi and Lingard 2010).

It is important at this point to reiterate the distinction between the terms 'neoliberal' and 'globalisation', while at the same time acknowledging that what we have is 'neoliberal globalisation'. This thesis does not form an objection to globalisation *per se*: such an objection brings King Canute to mind. Rather it seeks to interrogate the particular form of globalisation instantiated in the Irish educational reform process and which, I will argue, is dominated by a local understanding of the requirements of the PISA assessment. There may well be advantages in international studies of education, and comparisons between different education systems have been underway for a very long time, and certainly precede 'globalisation' as we know it. In this

regard it is worth observing that there are several international assessments not conducted by the OECD. The UNESCO 'Education for All' study, for example, seeks to connect the educational policy debate with 'employment, health, finance and family, among others' (UNESCO 2012, website). The study seeks to 'promote the right to education of all children, youth and adults and to place education at the top of the political agenda'. Another such study is the Trends in International Mathematics and Science Study (TIMSS) carried by the International Association for the Evaluation of Educational Achievement (IEA). IEA studies examine the education process and its effects in an effort to understand the links between the 'intended curriculum' (as intended by policy-makers), the 'implemented curriculum' as taught in schools and the 'achieved curriculum', what the students actually learn (IEA 2012, website). TIMSS specifically 'measures trends in maths and science achievement at fourth and eighth grade' (IEA/TIMSS 2011, website). The study is based on achievements within national curricula and effectively studies the value of education systems in their own terms. The IEA recognises the diversity among participating countries:

> Fundamental to IEA's vision is the notion that the diversity of educational philosophies, models, and approaches that characterizes the world's education systems constitutes a natural laboratory in which each country can learn from the experiences of others. (IEA/TIMSS 2011, website)

PIRLS (Progress in International Reading Literacy Study) (IEA/PIRLS 2012, website), yet another such study, monitors trends in reading comprehension at fourth grade. Significantly, Ireland's performance in these assessments can vary considerably from those in the dominant PISA assessment, and surprising correlations can be thrown up, such as the fact that in the UNESCO study, for example, Ireland trails far behind Cuba (O'Shaughnessy 2012, *The Irish Times* online, 23 August), while in the Third International Mathematics and Science Study (TIMSS), Irish student achievement scores were high enough to prompt some outside interest in the Irish curriculum and teaching methods (Oldham 2001, 266).

On the other hand, this chapter argues that OECD/PISA is directed at exercising discipline over international education systems through the mechanism of the PISA assessment and that this discipline is used internationally, nationally and at a local level to introduce and implement policy decisions that impact on curriculum development. In particular I will examine its influence in Ireland on the development of new mathematics curricula.

5.2 Power of the global education policy field

The discourse of neoliberalism and neoliberal globalisation has brought with it changes in the formation of national policy, and, as a result of these changes, 'policy can no longer be 'thought' or 'thought about' within the limits of the nation state and national boundaries' (Ball 2009, 537). Education policies are now framed within the global education policy field. The policy created is directed by the priorities of the globalised economy and by the need to refer to the 'global process' because national educational policymakers must consider the imperatives of globalisation and align these with values negotiated at local or national level (Rizvi and Lingard 2010, 42). Thus policy production is located locally, nationally and also within a global framework, giving rise to an evolving landscape in which comparative data and performance are so prominent (Istance 2011, 99). The effect of these data manifests itself in the production of internationally agreed objectives, norms and standards which are intended to influence education policies in a form of 'soft power' (Bieber and Martens 2011, 101). One major influence in this 'internationalisation' of education policy is the Organization for Economic Cooperation and Development (OECD) which in recent years has strengthened its role as a policy actor in the field of education through the development of international comparative indicators of school performance. Indicators are produced by the OECD's International Programme for Student Assessment (PISA), and, according to the OECD, 'the primary reason for developing and conducting this large-scale international assessment is to provide empirically grounded information which will inform policy decisions' (OECD 1999a, 7). The scale of the assessment is astonishing and the potential impact of the OECD on informing policy decisions, on a near global scale, is apparent. Angel Gurría, Secretary General of the OECD, at the launch of the PISA 2009 results, boasted that PISA had tested 'around half a million high school students from over 70 countries, which account[ed] for nine-tenths of the world economy' (Gurría 2010, OECD website).

The OECD, established in 1961, developed out of the Organisation for European Economic Cooperation (OEEC) which was set up under the Marshall Plan to aid the post-war European economic recovery. The OECD itself is an economic organisation aiming to achieve the highest

sustainable economic growth and employment in its member countries, while maintaining financial stability, and thus contributing to the development of the world economy (OECD 2011, web page). It has limited formal powers; its influence depends on the data, statistics and analysis it produces and its capacity to use those to inform the decisions and practice of the different users (Istance 2011, 88). There is no explicit reference to education in the OECD Convention, nor is it listed among the concerns or purposes of the organisation (Papadopoulos 1994, 11). However, Papadopoulos, who was deputy director responsible for education in the Directorate for Social Affairs, Manpower and Education at the OECD, claims that education has an 'inferred' role both in terms of its contributions to economic growth and to social progress and that, at least in the early days of the OECD, these twin concerns forming the educational philosophy of the organisation, could not be achieved independently (Papadopoulos 1994, 33). The main motivation for OECD involvement in education in the early 1960s was that education could contribute to economic growth, and hence the OECD derives its education mandate from its economic one, a significant derivation when one considers the position of power in the global education field achieved by the organisation's brainchild, PISA.

During the last decade of the 20th century the OECD developed the International Programme for Student Assessment (PISA). Officially the programme is formulated to produce policy-orientated and internationally comparable indicators of student achievement (OECD 1999a, 7) together with quantifiable measures of human capital (OECD 1999a, 11). PISA conducts a 'three-yearly survey…of knowledge, skills and other characteristics of 15-year-olds' (OECD 2004, 4) which it argues is an assessment of reading, mathematical and scientific 'literacies'. The three literacies, as constructed by the OECD/PISA panel of experts, are examined in each assessment with one literacy being investigated in depth on each occasion. A nine year cycle is created with each literacy receiving one thorough analysis and two check-ups in the period (OECD 1999a, 10) thus allowing for the creation of longer term trend indicators for each participating country. In the process PISA objectivises the subject, the country's student population (in this case 15-year-olds) whose labour at school produces the human capital that is associated with prospective national economic growth. The results of the PISA assessment, as used in calculating this stock of human capital, replace the previous measure used i.e. the level of education completed (OECD 1999a, 11; 2006, 11). Human capital is defined by the OECD as '[t]he knowledge, skills, competencies and other attributes embodied in individuals that are

relevant to personal, social and economic well-being' (OECD 1999a, 11; 2006, 11) where the knowledge, skills and competencies in question are constructed by the OECD. In the 2009 PISA framework document the definition of human capital is refined to the sum of what the individuals in an economy know and can do (OECD 2009c, 3) and its place in economic prosperity is emphasised. An interesting annotation by Jallade to excerpts from Papadopoulos's book equates 'human capital' and 'knowledge society'. The note suggests that the concept of 'human capital' was new in the early days of the OECD but now it is called 'knowledge society': 'the semantic has changed, but the basic idea remains' (Papadopoulos 2011, 85).

The OECD considers that for countries near the 'technology frontier' the share of highly educated workers in the labour force is an important determinant of economic growth and socio-economic development. A consequence of this is that PISA devotes significant attention to the assessment of students at the high end of the skill distribution (OECD 2007b, 19). The connection between education, human capital and economic growth is an accepted element of the neoliberal discourse and in the OECD's *2009 Education At A Glance,* for example, the monetary value of education as human capital is quantified (OECD 2009b, 166-67).

Through its compilation and publication of stratified league tables which rank countries according to their scores in the examination, OECD/PISA has the effect of objectivising the subject in a process of 'dividing practices' (Foucault 2002a, 326) where 'good' systems are distinguished from 'bad'. The candidates – the participating countries – are differentiated by their position in relation to complex, PISA-defined OECD averages, categorised and, in the process, given an educational and economic identity. Through this practice, countries are motivated and policy decisions informed. Consider here the argument made by Sjøberg that the OECD 'is not an impartial group of independent educational researchers' but that its politics and economics are neoliberal, and that its advice has to be interpreted accordingly (Sjøberg 2007, 208-09). He reminds us that PISA is concerned with skills and competencies that can promote the economic goals of the OECD and not about 'Bildung' or liberal education. The expert advice of OECD/PISA, presented in its apparently 'scientific and neutral' language serves to obscure the fact that there are other possibilities, other political choices that could be made, based on a different set of social, cultural and educational values.

However, the OECD/PISA strategy has proved successful and PISA has become known as 'a decision support instrument' (Mangez and Cattonar 2009, 23) with participating countries

interpreting their performance in a manner which best suits their own agenda. In Portugal, for example, the 17th Constitutional Government used the OECD/PISA survey to justify several educational reforms (Naterico and Costa 2009, 54), while in Hungary PISA has become a substantial point of reference for domestic education policy (Berenyi and Neumann 2009, 50). In Germany, the results of PISA 2000 produced a 'PISA-shock' which brought about a new consensus regarding the need for reform, which has in turn resulted in a 'frantic' reform agenda (Ertl 2006, 624). However, the influence of PISA on countries is not uniform and is related to a variety of internal and external issues. A country's own PISA rating will influence its attitude: in Scotland, for example, whose system according to PISA is doing well, the OECD is viewed as a 'trustworthy partner', the gold standard for conducting comparative studies (Grek *et al.* 2009b, 73). In non-OECD countries, it has been noted that 'participating in PISA sets a modernisation agenda and enables countries to place themselves in a relationship with the 'best'' (Grek *et al.* 2009a, 17). For countries in transition from socialism to capitalism PISA is also 'embedded in the wider modernization narrative' (Berenyi and Neumann 2009, 46) and an 'eagerness to join the "civilised West" clears the obstacles from PISA's way to enter the national educational discourse' in Hungary (Berenyi and Neumann 2009, 43). In the Irish case the influence of OECD/PISA is officially acknowledged by the NCCA (NCCA 2002b) and I contend that the development of the new mathematics curriculum, is shaped by specific PISA values. (We will examine the details of this influence in chapter 8). For now, suffice it to note that a report in *The Irish Times* from 'a major OECD conference' stated that 'the Minister for Education, Mr Dempsey, paid tribute to the work of the OECD in acting as a catalyst for change in Irish education policy' (Flynn 2003, *The Irish Times*, 8 February, 5). In this chapter I will argue that a powerful PISA effect is very much in evidence in Ireland, in particular, in the development of Project Maths.

OECD/PISA has, in a short period of time, achieved a hegemonic position in the world of education. It has established a discourse of power centred on the construction and monitoring of an international field of education. It is 'dominant globally (at least in the global north) as the key international comparative measure of the effectiveness of schooling systems' (Grek *et al.* 2009a, 8). In its 1999 *Framework for Assessment*, when the OECD positioned itself as the producer of policy-oriented and internationally comparable indicators of student achievement, it constructed the need and the audience for its analyses. It claimed that 'parents, students, the

public and those who run education systems need to know' (OECD 1999a, 7), and it constructed what this group 'needed to know' by listing the questions that it (the OECD) should be asking: How well are young adults prepared to meet the challenges of the future? Are they able to analyse, reason and communicate their ideas effectively? Do they have the capacity to continue learning throughout life? (OECD 1999a, 7) It offered a conduit to the answers through comparative international analysis, which it claimed, would enrich the national picture by providing a larger context within which to interpret national results. The international analysis was intended to provide the tools with which central authorities could monitor achievement as governments and the general public 'need[ed] solid and internationally comparable evidence' (OECD 1999a, 7). No evidence is adduced to show that the 'general public' in any country had expressed this need prior to the intervention of OECD/PISA. The PISA structure, in practice and effect, established a multinational network of surveillance to monitor the throughput of education systems and to maintain quality control over their products. This effort to achieve quality control was to involve all of the actors in the network, nationally, internationally and locally, and the PISA process, an intricate hierarchical network of observation, was constructed and incentivised by the PISA Consortium and its publicity machine. A new discourse was established in which OECD/PISA achieved the status of 'a policy actor and mediator of knowledge with an increasing capacity to shape policy priorities' (Rizvi and Lingard 2010, 133). This status was arrived at by establishing itself as the premier observatory of national educational performance levels. The first PISA 2000 involved 43 countries; by 2009 it involved 65 (OECD 2010b, website), or over 70 according to the OECD Secretary General Gurría (Gurría 2010, OECD website) and PISA 2006 covered representative samples of around 20 million 15-year-olds in 57 countries (OECD 2010a, website). This representative sample was composed of more than 400,000 students (OECD 2007a, 10), approximately one in every fifty of the population of 15-year-olds in the sampled countries. In this way the OECD developed a niche for itself as a repository of international expertise in respect of comparative measures of the quality of educational systems (Rizvi and Lingard 2010, 133). Through PISA it carries out benchmarking exercises, identifies best practices and recommends specific policies. In this way the organization has positioned itself as a participant in national policy making, influencing areas such as agenda setting, policy formulation and implementation (Martens and Jakobi 2010b, 175). Considered in the light of disciplinary

power, it is possible to conceptualise the strategy by which OECD/PISA achieved dominance over education policy decisions on a global scale.

When we come to consider the influence of PISA, there is a tool in Michel Foucault's toolbox which may be useful – his interrogation of disciplinary power. Considering PISA as a 'technology of power' (Foucault 1977, 194) in Foucault's sense enables us to interrogate the OECD/PISA exercise of power in disciplining education systems.

5.3 Foucault, PISA and the Examination

In Foucault's thesis '[t]he exercise of discipline presupposes a mechanism that coerces by means of observation' (Foucault 1977, 171). I contend that PISA is such a mechanism. PISA 'observes' the performances of countries and through its observation and ranking of countries it produces scientific evidence with all the force that 'science' entails, which acts as a form of coercion, resulting in countries adopting new policies in order to maintain or achieve competitiveness in the market. In his speech at the launch of the results of PISA 2006, Angel Gurría, OECD Secretary-General, spoke of the success of the system, stating that 'the discipline provided by subjecting schools to external assessment with publicly visible results produces strong effects' (Gurría 2007, OECD website). It is this discipline, which successfully produces strong effects, that subscribes to OECD power in the field of education. PISA can thus be described as 'an apparatus in which the techniques that make it possible to see induce the effects of power, and in which, conversely, the means of coercion make those on whom they are applied clearly visible' (Foucault 1977, 170-71). Although this disciplinary power is exercised within a biopolitical context – countries voluntarily subscribe to PISA – nevertheless PISA operates on them as a disciplinary power to produce 'bodies both docile and productive' (Wall 2012, 119). Although it is ultimately felt as a form of biopower, the peculiar relationship between the State and the OECD panopticon is that of discipline operating at least in part through the regulatory power of the norm.

I contend that in the PISA mechanism the 'technique that makes it possible to see' is the examination, and 'the means of coercion' is the publication of PISA country rankings and the attendant mediazation ensuring visibility.

OECD/PISA uses the technique of the examination in order to gather information and evidence on participating countries which it then uses to prepare and produce its 'most widely known and cited research products' (Gurría 2007, OECD website), the PISA reports. The data gathered, the means of production, the establishment of educational norms and the international visibility of the results induce for the OECD the effects of power. In the PISA assessment

> students have their abilities assessed by being required to perform a set of pencil and paper tasks within a given period of time. The term "test" has varying connotations in different countries, in some cases implying that the results have implications for individual students. PISA's purpose is to survey characteristics of each country's students collectively, rather than to examine individuals. Therefore the term "assessment" is used to describe PISA, even though the conditions experienced by students will be similar to those of a school test. (OECD 1999a, 16)

Thus the preferred instrument of PISA, is the long-established pencil-and-paper examination traditionally used in education as an 'exchanger of knowledge' (Foucault 1977, 187). In Foucauldian terms 'it guaranteed the movement of knowledge from teacher to the pupil, but it extracted from the pupil a knowledge destined and reserved for the teacher' (Foucault 1977, 187). Likewise, this instrument, in the hands of the OECD, is the mechanism through which the perceived knowledge and skills necessary for active participation in what the OECD envisages as a globalised economy are established and made known to participating countries. In turn, the knowledge that OECD extracts allows it to establish the levels of performance being achieved by 'students collectively' in participating countries, thus enabling the publication of stratified league tables and the provision of 'scientific evidence' and critical comment that can act as 'leverage for further reform' (Grek *et al.* 2009b, 82).

In passing it is worth observing that this OECD 'ceremony of power' (Foucault 1977, 185), despite all its talk of education for the 21st century, observes all of the rituals of the traditional examination: a high level of secrecy surrounds the contents of the examination; certain institutions are empowered to act as intermediaries between the upper levels of the hierarchy and the subjects; the test takes place on a carefully devised timescale; the results, establish over countries a visibility through which they are differentiated and judged; the 'normalising judgement' is presented to the public on a timetable of the hierarchy's choosing.

According to Foucault, '[t]he success of disciplinary power derives…from the use of simple instruments; hierarchical observation, normalizing judgment and their combination in a product that is specific to it, the examination' (Foucault 1977, 170). The examination thus combines the techniques of an observing hierarchy and those of normalizing judgment.

In the context of OECD/PISA the observing hierarchy is a complex entity. In the first instance it is the OECD itself, in particular that element of the OECD where education is seen as the producer of human capital and the passport to future economic success and expansion. Another layer of the structure is provided by the Project Consortium[10], a consortium of experts contracted to construct the tests. This consortium, led by ACER, a company that employs 350 people in Australia, constructs, runs and controls the workings of the PISA mechanism in association with the OECD. The OECD also acts in consort with national governments, expert groups, national and international media, industrial and business organisations, educationalists and educational institutions, students and the general public. The mechanism of observation is distributed throughout these disparate groups forming them into a more or less cohesive gaze focused on the PISA-defined educational performance of all the participating countries together and the individual countries severally. This mechanism of surveillance proffers an apparently simple justification for its activities: it monitors 'the extent to which students near the end of compulsory education have acquired some of the knowledge and skills that they will need in later life' (OECD 2004, 4). But the instruments with which it operates – the design of the experiment, the examination, the structure of scientific analysis (and claims to objectivity) and the authority that it conveys, the involvement of expert groups, the elaborate publicity apparatus, the volume of its publications reinterpreting every facet of the data, the use of local coordinating bodies, the scope of the study and its determination to involve countries on the global stage – effectively ensure that the ends it seeks to produce are maintained in the forefront of public discourse on education in the participating countries. These ends include the desire of the OECD to exert influence through the process of 'mutual examination by governments, mutual surveillance and peer pressure to conform or reform' (Martens et al. 2004:15, quoted

[10] In 2005 the consortium was composed of: the Australian Council for Educational Research (ACER); the Netherlands National Institute for Educational Measurement (CITO); the Educational Testing Service (ETS); the National Institute for Educational Policy Research (NIER, Japan); and Westat, OECD/Pisa. 2005. *Main Study National Project Manager's Manual*: OECD, http://www.pisa.oecd.org/dataoecd/55/61/39829353.pdf.

in Rizvi and Lingard 2010, 129). This is the functioning of what Foucault calls an 'observing hierarchy'.

The PISA operation, therefore, is a form of 'hierarchized, continuous and functional surveillance' (Foucault 1977, 176). This surveillance, with the examination at its core, creates a form of disciplinary power which 'functions like a piece of machinery' (Foucault 1977, 177). Though the power of PISA is distributed over many domains and agencies 'it is the apparatus as a whole that produces power' (Foucault 1977, 177). The supranational OECD, although technically a creature of governments, in fact exercises considerable sway in generating policy and affects change at the level of the nation state.

The discipline exercised by OECD/PISA has at its core some form of correction or penalty, 'a small penal mechanism' in Foucault's felicitous phrase (Foucault 1977, 177), which has the effect of 'normalizing' – itself an instrument of power. In the 21st century it is not desirable for a country in the developed world to be determined by its difference, its individuality, its self-determined expertise, its self-regulated education system; rather it is required to fit the new norm. 'By "normalization", we mean a system of finely gradated and measurable intervals in which individuals can be distributed around a norm – a norm which both organizes and is the result of this controlled distribution' (Rabinow 1984, 20). In educational terms, this norm is established through the standardisation of educational outcomes. I contend that OECD/PISA is attempting to establish a new set of educational outcomes, a new norm, which concentrates on the 'knowledge and skills needed in adult life' rather than on the 'mastery of the school curriculum' (OECD 1999a, 8) and in the process it is influencing the form and content of changing school curricula. It is through iterations of the PISA cycle that the norm becomes established and the development of a new discourse through the mediasization of PISA ensures its absorption into the common sense of society.

PISA results are published in hierarchical tabular forms, which order countries by rank. This instrument provides the scientific evidence with which an education system is judged by governments, business, the media and in turn by the general public. It is used by governments to drive change. The results are regularly interpreted by the media as evidence of the success or failure of a system without reference to the fact that it is not the aims and objectives of that system that are being assessed but a set of objectives developed by the OECD in collaboration with governments of OECD countries – the new norm – examined through surveys designed

and implemented by an international consortium (OECD 1999a, 3). In passing it is worth noting that the discourse around 'education for the 21st century' activates in fits and starts around publications. For example, the EGFSN reports and the McIver Report discussed in Chapter 3, and the various NCCA reports discussed in Chapter 4 all created media events to a greater or lesser extent. The publication of the PISA league tables always occasions a flurry of interest in the media and ministerial pronouncements. We will examine this phenomenon in Chapter 6.

Thus the PISA results, initially encountered in the form of stratified tables but also glossed and interpreted by local participants, function to provide participating countries and others with 'empirically grounded information which will inform policy decisions' (OECD 1999a, 7). In turn they become the statistical backing for the kind of changes sought by the OECD. The publication of this data receives much attention from politicians, businesses and business organisations, teachers unions, school management organisations and the general public, many of whom absorb the data in the simplest possible form as being something akin to the FIFA soccer rankings while others utilize the data for their own purposes. PISA, rather archly, recognises that 'many individuals, in participating countries, including professionals and lay-persons, will use the survey results for a variety of purposes' (OECD 1999a, 7), but what these purposes might be is not alluded to. In general, the commentary provided in OECD/PISA briefings is finely tuned to the discourse in each individual country – the PISA machine produces an analysis which is individualised and localised, employing a local educational entity to carry out the calibration and to defend it where necessary in public discourse. It is widely publicised in the media where most of the public discussion takes place. Once the initial results of a PISA examination have been published further detailed results and comment are published intermittently by the OECD and the local PISA research centres. PISA evaluations, and comments appear on a regular basis in the form of chance or otherwise remarks by ministers or journalists and papers at educational conferences (and sometimes the reporting thereon in the national media). Statistics derived from PISA are used to underpin a wide range of arguments in places as diverse as answers to parliamentary questions and letters to the editor, in one case, for example, being used to justify larger class sizes (*The Irish Times* 2005, April, 17) and this continuous appropriation of the truth-telling power of PISA maintains the mechanism in public view and reinforces the awareness that we are being watched over. Thus OECD/PISA, is rarely

far from the consciousness of educationalists, politicians, business organisations and the general public, 'provid[ing] a "spectacle" of recognition that comes with high levels of visibility and reputation' (Grek *et al.* 2009b, 82) and functioning like a watchdog over the chosen field of education. Much of the commentary that occurs between PISA publications is ill-informed and simplistic but, as we will see in chapter 6, functional in forming public opinion. As we have seen this instrument of public opinion is used to effect throughout the cohort of participating countries, and section 5.4 below will examine this effect in Ireland.

The OECD hierarchical tables, by distributing countries according to grade and publishing the outcomes, serve to both punish and reward. Foucault identifies the dual function of such a distribution:

> The distribution according to rank or grade has a double role: it marks the gaps, hierarchizes qualities, skills and aptitudes; but it punishes and rewards. It is the penal functioning of setting in order and the ordinal character of judging. Discipline rewards simply by the play of awards, thus making it possible to attain higher ranks and places; it punishes by reversing this process. Rank in itself serves as a reward or punishment. (Foucault 1977, 181)

The hierarchizing league tables exercise this double role, they rank countries according to the quality of their human capital and in so doing reward those at the top. They exert pressure on countries which are not at the top to compare themselves with successful countries which 'may provide useful points of reference and offer best practice' (Gurría 2007, OECD website).

A further exercise in reward and punishment occurs in the production of trend indicators. These indicators, showing how results change over time (OECD 1999a, 8), serve as an incentive to ensure that countries, once they have committed themselves to the PISA mechanism, continue in their efforts to implement PISA policy objectives.

At a national level a detailed report is produced which compares the data internationally and at an international level details of all participating countries and their national reports are available either freely on the OECD website or they can be purchased from the OECD bookshop. At a local level the school authorities can acquire their own schools performance data which

compares the school means with the national norm.[11] There is nothing to prevent schools from publishing these data, thus setting up a further iteration of the league.

In this way the PISA examination derives its disciplinary power from its techniques of surveillance and normalization combined in the instrument of the examination.

5.4 PISA Power in Ireland – An analysis of the NCCA Response

It is important to remember here that states, through their governments, commit themselves to the PISA system voluntarily, which is to say that they knowingly enter the process and subject themselves to its discipline. Ireland is both collaborative in – having been involved from the outset – and subject to the disciplinary system. One of the questions that therefore arises is: to what purpose does a country like Ireland subject itself to the analysis and criticism of the OECD? There must be a perceived gain from entering into international comparisons that the comparison alone does not satisfy. It is a contention of this thesis that the Irish state uses PISA as a mechanism for change, exactly as the OECD intended, and that this change favours long-

[11] The school's data are compared to the national data for Ireland. I present here an example of the kind of data which was available to a teacher in a participating school in 2003:

Below is a summary of how students in your school performed on the PISA 2003 mathematics assessment. Apologies if any of the statistical terminology are unfamiliar or unclear. As you are a mathematics teacher, I'm assuming a level of knowledge beyond that of the general population. If anything remains unclear, please feel free to ask me.
The table below shows national data for Ireland and data for your students. You'll see means and standard deviations for the overall mathematics scale and for the four subscales. Also included are the scores for each scale at the Irish 10th, 25th, 75th and 90th percentiles. I haven't shown the data for the OECD as a whole, but for each scale you can consider it as more-or-less equal to a mean of 500 and SD of 100. If you want more information about the scales and what they measure, please read http://www.erc.ie/documents/p03summaryreport.pdf .

	School mean	**School**</st1:**City**> SD</st1:**State**></st1:place>	**National mean**	**National SD**	**National 10th percentile**	**National 25th percentile**	**National 75th percentile**	**National 90th percentile**
Overall mathematics	593.3	68.0	502.8	90.4	393.1	445.0	561.9	613.9
Space & shape	559.9	76.8	476.2	94.5	354.0	412.3	541.9	599.0
Change & relationships	592.3	59.5	506.0	87.5	393.2	448.2	567.5	617.5
Quantity	591.5	62.6	501.7	88.2	387.6	442.0	563.9	614.9
Uncertainty	614.1	65.0	517.2	88.8	402.5	455.9	579.8	632.5

standing Irish economic policy, part of which concerns the need for innovation and foreign direct investment.

We have already seen that PISA results permeate the discourse of failure in Ireland, and in chapter 6 we will see how it manifests itself in the media. In fact, Ireland was represented on the initial group that drew up the definition of mathematical literacy upon which PISA mathematics is dependent. From the mid-nineties, Seán Close of St Patrick's College of Education, Dublin was a member of the Expert Groups for Mathematics (OECD 1999a, 78; 2003, 199) under the chairmanship of Jan de Lange (de Lange 2006, n.p.). He was also a member of the curriculum committee for mathematics (Government of Ireland 1999, 126) during the development of the new Primary School mathematics curriculum which in turn, as we have seen, had a controlling effect on the development of Project Maths. The PISA project is managed in Ireland by the Educational Research Centre in collaboration with the Department of Education and Skills.

Remarkably, considering how recent results are interpreted, when the results of PISA 2000 were published the Irish media gave them a predominantly positive response, with comments like 'all involved in the Irish education…can deservedly feel proud of the results in PISA' (White 2002, *The Irish Times*, 15 January, 7) and reference was made to the Republic's 'very good education system characterised by outstanding teachers and hugely committed parents' (Editorial 2001, *The Irish Times*, 5 December, 15). The prevailing discourse at that time was that the Irish education system was among the best, having played its part in the production of the Celtic Tiger. There was no public discussion of what PISA was or was not examining and there was no response to PISA from official sources in education. Shortly after the publication of the results however the NCCA published a response to PISA on its website.

The *NCCA Response to PISA 2000* is a remarkable and, to date, unique document. Although it extends to a mere two pages it is a microcosm of most of the major themes that arise in relation to PISA in Ireland and, as such, it will be useful to examine some of these themes in miniature here in order to establish them as topics of contention. Furthermore, the response is, I contend, a point of inflection in the history of Irish education, easily overlooked because of its slightness.

Through its acceptance of the normalising and hierarchizing process and the mechanism of disciplinary power in the first International Programme for Student Assessment (PISA) 2000, it confirmed the place of PISA in the discourse of Irish education. It provided an endorsement of

OECD/PISA as a valid mode of international assessment and policy making, officially confirming the presence of the Organisation for Economic Co-operation and Development (OECD) as a powerful influence on the education of young Irish citizens and on future trends in Irish educational policy, and providing a foundation for the 'discourse of failure' which subsequently enveloped many aspects of Irish education, and in particular mathematics education.

The response begins by establishing the authority of the NCCA and its mandate to declare the state's fealty to the process. The NCCA has the 'responsibility under the Education Act for advising the Minister for Education and Science' (NCCA 2002b, 2) on issues of curriculum and assessment. This declaration of authority bestows on the NCCA what Foucault calls 'the status of those who are charged with saying what counts as true' (Rabinow 1984, 73). It establishes the legitimate voice of the NCCA in the discourse of Irish education. Each society, has its own 'regime of truth' that is to be found in 'the types of discourse which it accepts and makes function as true' (Rabinow 1984, 73) and, in this slender document, with its unequivocal welcome of 'the OECD initiative to undertake an international assessment' (NCCA 2002b, 2), can only be interpreted as an acceptance of this external mechanism, an endorsement of the stated OECD objectives and an acknowledgement of the arrival of a new 'catalyst for change in Irish education policy' (Flynn 2003, *The Irish Times*, 8 February, 5).

The *Response* chooses to interpret the PISA mechanism as entirely benign, a neutral scientific aid which will help to calibrate education policy with ever greater exactitude, a mere 'decision support instrument' (Mangez and Cattonar 2009, 23). The 'availability of comparative international data' (NCCA 2002b, 2), was to help the NCCA to carry out its functions in relation to curriculum and assessment by providing useful 'information on school and student characteristics' (NCCA 2002b, 2). In carrying out its 'responsibility' as advisor to the Minister, the NCCA advice, based on this new 'empirically grounded information' will help to 'inform' education policy decisions at the most senior level. In fact the 'policy-orientated' (OECD 1999a, 7) indicators derived from OECD/PISA publications and assessments will, in due course, underpin much of the thinking of subsequent curriculum reform in mathematics in Ireland; in particular it would influence the syllabus changes of Project Maths – an argument I will return to in chapter 8. The *Response* makes no acknowledgment of the likely effect of PISA's normalizing judgment and penal mechanism and it is difficult to know whether the NCCA could

foresee, much less welcome, the effect that the simple hierarchizing of countries in tabular form would have on public perception of education in Ireland. However, the debut of the PISA mechanism is also the debut of the 'discourse of failure' which will gradually come to dominate the public discourse.

5.5 The Discourse of Failure and the NCCA Response

The 'discourse of failure', as I have already suggested (chapter 1), concerns the argument put forward by contemporary cognitive science that 'even when a school appears to be successful, even when it elicits the performances for which it has apparently been designed' (Gardner 1993, 3), when the school produces students with 'good grades and high test scores' (Gardner 1993, 3) it still can be considered a failure since it produces students 'who do not display an adequate understanding of the materials and concepts with which they have been working' (Gardner 1993, 3). The definition of 'an adequate understanding' is open to interpretation. We can detect the foundations of this argument in the OECD/PISA international assessment.

The assessment, is not concerned with how successful, on its own terms, an education system is. As I have noted (in 5.2 above), OECD/PISA does not set out to 'examine how well students have mastered the specific curriculum content' rather it aims to assess 'the extent to which young people have acquired…wider knowledge and skills' (OECD 1999a, 11). The 'knowledge', 'skills' and 'competencies' in question were selected and defined by an OECD programme launched in 1997 – *The Definition and Selection of Competencies* (DeSeCo). The outcomes of DeSeCo form the theoretical underpinnings of OECD/PISA (DeSeCo Project 2005, 3; OECD 2009a, 7). Thus the knowledge, skills and competencies examined are not necessarily a prerequisite of the objective outcomes of a country's curriculum and 'OECD/PISA is not constrained by the common denominator of what has been specifically taught in the schools of participating countries' (OECD 1999a, 11), neither does it exclude all school curriculum content. Hence, the PISA assessment contributes to the discourse of failure since it is deliberately assessing outcomes which are not necessarily part of a country's curriculum. The end result is an assessment of 'knowledge and skills' which will be familiar in part or in total to the students of certain countries and unfamiliar to others. For example, PISA mathematical literacy 'is thought to be closer in spirit to the practices of elementary and lower-

secondary education in the Nordic countries' (Stedøy 2004, 96). On the other hand, in Ireland, where students sit the international assessment at Junior Certificate level 'there is a substantial mismatch between the material examined in the PISA tests and the material in the Junior Certificate syllabus' (Oldham 2006, 34) and the 'fact that junior cycle syllabuses are a greater distance than the syllabuses of many other countries from the PISA mathematics framework and assessment items may be considered a matter for concern' (Close 2006, 65). Situations like these are repeated, in varying degrees, throughout the participating countries putting Irish students and others at a distinct disadvantage in the assessment. As a result, the 'PISA league tables' (Prais 2003), in ranking countries according to PISA-defined merit, help to create a 'culture of evaluation' (Niemann 2009, n.p.) which is regularly interpreted by the public and by the media as a true evaluation of school systems, and, by evaluating countries in the same normalizing process using identical (or near-identical) criteria no matter what the relationship to their own curricula, OECD/PISA is attempting to direct national policy towards its definition of the 'knowledge and skills' that it determines students should have at the end of compulsory education. Countries that lie at the disreputable end of the normal scale suffer the punitive effect of ranking but are also made aware that their economies are not worthy of foreign direct investment. Wherever such a mismatch occurs a discourse of failure is generated, with the OECD/PISA rankings as the dominant 'regime of truth' (Rabinow 1984, 74).

This change of emphasis from mastery of content to command of skills is the stock-in-trade of cognitive science, and, in particular the work of academics like Howard Gardner. Gardner defines the '*disciplinary expert*' or '*skilled person*' as one whose knowledge is not limited to course content but one who has 'mastered the concepts and skills of a discipline or domain and can apply such knowledge appropriately in new situations' (Gardner 1993, 7) – in other words the exception in Gardner's failed school! This '*disciplinary expert*' belongs to that much sought after group in the new work order (Gee *et al.* 1996) – those who 'really' understand (Gardner 1993; Gee *et al.* 1996). It is this evaluation of what are deemed to be the skills of the '*disciplinary expert*', as ranked in PISA's vertical league tables, which 'represents one of the most influential mechanisms for the global conversion of educational practice, discourse, and policy' (Takayama 2008, 387). It is to this mechanism that the NCCA *Response* subscribes.

The PISA mechanism is regarded as declaring truth about the Irish system in relation to the education systems of other countries. Again truth is to be interpreted here in the Foucauldian

sense as 'the ensemble of rules according to which the true and the false are separated and specific effects of power attached to the true' (Faubion 2002, 132). This ensemble of rules contains statements that derive their power from state authority but also from extra-national structures that are both contained within the state discourse and foundational to it. The truth of any such statement is founded, not on any theoretical justification but on the force that it can bring to bear to enforce its authority. In this context, the NCCA, wielding the weight of the Education Act, its expertise and its requirement to advise the State, establishes the authoritative truth about the three examined domains in PISA, and grants sanction to the reading literacy programme alone.

The normalizing effects of the PISA league tables internationally has been widely acknowledged (Dahlström 2008; Niemann 2009; Takayama 2008). It was the publication of the first PISA tables that prompted the 2002 NCCA short response in which they congratulated the participating students and their teachers on 'a highly creditable performance' (NCCA 2002b, 2). The choice of words is interesting, a 'creditable performance', in its American usage, is one which is 'deserving [of] public acknowledgment and praise but not necessarily outstanding or successful'. The Oxford English Dictionary (OED) makes it an even less-congratulatory 'believable'.

The NCCA accords a particular value to the 'world-class performance' of Irish students. In reading literacy they performed at a mean score a of 527, (OECD 2004, 2) which was statistically significantly above the OECD average, and ranked fifth on the table overall among 27 OECD countries (NCCA 2002b, 2). Reading literacy was the major domain of that first assessment. This result was greeted by the NCCA as a 'noteworthy achievement' and it was compared with other international literacy reading studies, where Irish students had performed at or below the OECD country average. Whether or not the other international assessment tests conformed to the same set of criteria as that of PISA or whether they were closer to the stated aims of the school curriculum is not mentioned, and no such comparison with previous forms of assessment is advanced in the document in relation to the 'less-successful' Science and Mathematics domains. The NCCA is content to observe that, in literacy, we performed better in PISA at the upper level and that the proportion of students that achieved scores at or below the lowest level was consistent 'with that found in a reading literacy study conducted by the

International Association for the Evaluation of Educational Achievement (IEA/RLS) in 1991' (NCCA 2002b, 3). No plan for change was proposed here.

The reaction to the performance of Irish students on the scientific literacy scale was interesting and, in the NCCA's difficulties we can see the seeds of how the results would be constructed for the future so as to generate a perception of failure. Scientific literacy was a minor domain in the 2000 assessment and the Irish performance in this domain ranked ninth overall with a mean score (513) that was significantly higher than the OECD average. This relatively high ranking provided the NCCA with a peculiar difficulty because it had already initiated changes to the science curriculum which were intended to be more PISA compliant – although, unfortunately, the new curriculum would have little or no effect on subsequent rankings. In fact that first year's ranking was the highest and subsequent years would see a 'statistically insignificant' decline in performance. (Ireland' ranking in 2003 dropped to thirteenth with a mean score of 505 (Cosgrove *et al.* 2004c, 19), and in both 2006 and 2009 the rank was fourteenth with mean score 508 on both occasions (Eivers *et al.* 2007, 30; Perkins *et al.* 2010, 23)). Because plans for curriculum changes were already under way, it was necessary for the NCCA to construct the original result as unsatisfactory. Two statements are made that would be appropriate to a much poorer performance: we are told that many students do not study science at junior cycle and that these students performed poorly in the assessment; we are also cautioned that as this was a minor domain and was based on a reduced set of content areas (NCCA 2002b, 3). Proposals for curriculum change that 'will better facilitate the development' of skills that 'feature strongly in the PISA assessment of scientific literacy' (NCCA 2002b, 3) are to be included in the new science component of the revised Primary School Curriculum and in the revision of the Junior Certificate Syllabus that was underway at the time. It is reasonable to speculate that this introduction of PISA skills to the new curriculum is in line with the aspirations of OECD in their production of 'policy-orientated' (OECD 1999a, 7) indicators to encourage education systems to 'focus on modern challenges' (OECD 1999a, 11). Given that Ireland was a contributory state to the PISA mechanism and that the DES and NCCA must have had sight of the PISA *Framework Document* during the preparation stage, it is reasonable to speculate that a closer alignment with PISA was an *intended* outcome of the proposed new science curriculum.

The performance in mathematical literacy, another minor domain, 'did not differ significantly from the OECD country average' (NCCA 2002b, 3). At fifteenth in the league, Ireland's

performance at mathematics was significantly weaker than in either Science or Literacy. However, no discussion ensues. The silence is significant. No defence of mathematics teaching or curriculum is advanced. No comparison is made between the Junior Certificate curriculum and the mathematical literacy of the PISA assessment. The failure of the mathematics education system implied by the relative positioning of reading literacy and maths literacy on the league table is allowed to stand unexamined. However, we are told that the revised Junior Certificate mathematics syllabus will include 'increased emphasis on mathematical understanding and the ability to apply this in realistic contexts, which is a strong feature of mathematical literacy' (NCCA 2002b, 3). Again, it is reasonable to speculate that a closer alignment with PISA was an *intended* outcome of the preferred approach to teaching advocated by the new Junior Certificate curriculum.

We can see from the allusions to curriculum development that success in the PISA assessment is an important consideration for the NCCA. The changes mentioned are all compliant with the new norm, with objectives that 'feature strongly in the PISA assessment of scientific literacy' (NCCA 2002b, 3) or are 'strong feature[s] of mathematical literacy' (NCCA 2002b, 3). This reaction on the part of the NCCA establishes the PISA mechanism as what Foucault termed one of 'the techniques and procedures accorded value in the acquisition of truth' (Rabinow 1984, 73).

Slight as it is, it raises questions and introduces themes that will need to be unpacked at much greater length as my thesis progresses. It is significant that the NCCA, has not published another official response to PISA and consequently, this document stands alone as a point of inflection in Irish education, introducing and affirming the new mechanism as a power in the state, accepting the gaze from the observatory, the approval or disapproval of the hierarchy, the necessity for discipline and the presence of discipline's 'small penal mechanism'; it establishes the normalising process and accepts the OECD-defined norms and content as desirable outcomes in Irish education; and it enters into the discourse of failure that has come to dominate thinking on mathematics education in particular. It is clear from the NCCA response that a PISA-ward journey was already well underway in 2002.

5.6 Conclusion

OECD/PISA has achieved a dominant role in the internationalisation of educational policy. This role, with its emphasis on a state's ability to produce suitable human capital for the market, resonates effectively with the demands of multi-national corporations which can use the PISA league tables as a way to assess the kind of educational standards they can expect to find in a country. They therefore rank alongside other indicators, such as a state's GDP, labour laws, social protection, environmental restrictions, corporation tax laws and friendliness towards foreign direct investment. The voice of OECD/PISA was legitimated within Irish educational discourse by the NCCA's official welcome of the publication of the first PISA league tables. The disciplinary function of the tables encourages states towards a homogenised education and values shared across borders. It tends towards shifting power over education systems away from people, away even from representative democracy, and towards a technocratic administration whose objectives are primarily economic. This trend belongs within the same mathematics discourse that caused a shift in Ireland towards the economic role of education and this discourse will be interrogated in the next chapter. Though I do not contend that it was causative of this shift, PISA is used within the discourse as a mechanism for change. It functions to condemn existing educational practice as 'failed', with the terms of the failure defined by the OECD and not by the State or its people.

However, as Foucault himself observes, the 'existence [of power relationships] depends on a multiplicity of points of resistance' (Foucault 2003, 280) and equally the actions of macro-economic powers are mediated at national and local level. In the educational context, teachers have always mediated the demands of the state. This mediation or resistance is often characterised as conservatism. However, the teacher encounters the student and her family at close range as individuals and members of social and personal groups. It is also possible to interpret teacher resistance to change as a response to this personal familiarity with the conditions of people's lives. It is difficult to imagine the new language of 'self-interested individuals' replacing society and caring with a heartless profit-driven world taking hold in secondary schools, especially considering that the majority of secondary schools in Ireland boast of a religious ethos. In this regard, perhaps we should look to the teachers themselves for the source of future resistance.

Chapter 6

The Mathematics Discourse

> *[D]iscourse…appears as an asset – finite, limited, desirable, useful – that has its own rules of appearance, but also its own conditions of appropriation and operation; an asset that consequently, from the moment of its existence (and not only in its 'practical applications'), poses the question of power; an asset that is, by nature, the object of a struggle, a political struggle. (Foucault 2008a, 136)*

6.1 Introduction

In previous chapters we have seen how the narrative of legitimate and official voices and institutions worked to shape the discourse surrounding mathematics education. Neoliberalism works by creating a kind of 'common sense' that permeates all aspects of society, becoming 'public opinion' – a highly suspect term the interrogation of which is outside the scope of this thesis – and enables the introduction of policies without effective dissent. That is not to say that dissent does not exist, merely that it is not regarded as a legitimate voice in the discourse. Where it is included it comes under the general heading of 'balance' in journalistic practice. Thus, a dissenting voice may be quoted as one among many assenting voices, or an occasional article from a trade union economist may be sought as 'balance' to a continuous diet of right-wing economists. We will see this pattern in operation throughout this chapter. Gramsci observes that '"good sense" is the healthy nucleus that exists in "common sense"' (Gramsci 1971, 328). This stems, by and large, from the agency of ordinary people who are acted upon by the agents of the common sense. Thus, a state may wish to treat its citizens as self-interested individuals, but the citizens persist in behaving as, for example, loving, caring, self-sacrificing family-members, club members, trade unionists, supporters of charities or protestors. Thus 'common sense' is a complex construct, but one which power and the state constantly seek to simplify down to certain salient characteristics that deny personal, local and collective agency except where such agency synchronises with their demands.

In this chapter, we will consider the role of the media in the construction of this common sense and in the spread of the hegemony, and within this context the intervention of Prof. Kathleen Lynch will serve as an example of how resistance is neutralised. In the context of the Irish government's curriculum remodelling project, we turn our attention to the extension of the discourse of these powerful agents into the sphere of public opinion through the creation of a common sense specifically orientated towards mathematics. As Foucault observed, only certain statements have legitimacy within a discourse. Because of the complexity of the relationships and the limitations on time, this chapter will choose one organisation – The Institution of Engineers of Ireland (IEI) – for a detailed analysis as a case study, primarily because it has been the most persistent in inserting itself into the discourse, and in addition it will make a general survey of the other main actors in the field.

The education discourse, within which the new maths curriculum of the 2000s was constructed, occupied a space within the fields of politics, economics and education. This discourse contextualised educational change as occurring within a rapidly changing economic environment where developments in science, technology and communications were reshaping both the focus of business and the way in which business was carried out. This changing environment, it was argued, called for radical changes in education. Whether or not business was undergoing a new and radical change is outside the scope of this thesis but it is worth remarking that turmoil in international capital has a long history.

6.2 Seán Flynn and Journalistic Objectivity

According to Foucault, discourses should not be treated as 'groups of signs (signifying elements referring to contents or representations) but as practices that systematically form the objects of which they speak.' (Foucault 2008a, 54). Interestingly, a rare statement of practice which includes an intent to 'form the objects' exists in the context of Irish media discourse; it came from Seán Flynn, education editor of *The Irish Times*. In 1997 Flynn, then Opinion Page editor of *The Irish Times*, wrote a short article about the media activism of that newspaper for Sigma, a little-known OECD newsletter for public administration practitioners in central and eastern Europe (Flynn 1997, 14). In his article Flynn identifies the arrival of Albert Reynolds as Taoiseach in 1992 as the beginning of a new era of 'openness, accountability and transparency'

in Irish politics. Within this context he claims that the public service was seen by the general public as 'poorly organised and not responsive to change'. Flynn describes the active campaign carried out by his newspaper, through commissioned articles which were 'augmented' by editorials, to bring about change in the public service, and claims that ultimately many of the changes favoured by *The Irish Times* were implemented. Although he concedes that such change might have occurred anyway, and here he does not address the circular relationship between public opinion and the press, he sees the role of the newspaper as 'an important catalyst for change'. A consciousness of the power of the press in forming public opinion and influencing policy makers permeates the piece. Thus it is reasonable to suppose that editorial policy in *The Irish Times* is consciously orientated towards activism at least from time to time. In Foucault's terms, the newspaper is conscious of the power of the media to 'systematically form the objects of which they speak'. It is probable that this attitude to media activism prevails to a greater or lesser extent in all of the serious newspapers in the state. It is open to speculation whether such an orchestrated campaign was again instituted by the press in an effort to influence the direction of mathematics education in the new millennium, but suffice it to say that the print media, in particular *The Irish Times*, became active agents in the development of a new discourse concerning the state of mathematics in Ireland and the need for change.

6.3 A case history: The agency of IEI in Maths education discourse

As discussed in chapter 2, the ambition to develop Ireland as a knowledge-based economy provided the space for Forfás to privilege renewed interest and new approaches to STM education, but not all parties interested in economic success and its links to education used the same language. The Institution of Engineers Ireland (IEI), for example, the professional body which represents engineers from all disciplines in all industry sectors and in the public service was conscious of its role in, what it called, the 'modern 'high-tech' economy' (IEI 2000b, website) and made no reference to knowledge-based economies or societies at that time. It is possible that the engineers faced what they perceived as the realities of the developing economy as opposed to Forfás who were working with the knowledge economy trope. However IEI was very sure of the 'challenges' facing the developing economy and conscious of its own role in the development. It claimed that the success of Government policies throughout the eighties (aimed at making Ireland an attractive location for high technology international companies) in

'growing' the Celtic Tiger was due largely to the availability of a pool of highly skilled engineering and technological personnel, but it maintained that continued economic growth and development was being threatened by a severe skills shortage in the engineering and technological labour force (IEI 2000a, website). It was through its determination to attempt to solve the problem of the shortage of engineers that IEI positioned itself as a pressure group intent on influencing the future direction of mathematics education in second level schools. In fact, John Power Director General of Engineers Ireland (EI), at the outset of Ireland's economic crash, flatly declared that 'engineering was the cornerstone of the Celtic Tiger and must be given priority to reinvigorate our economy again' (Donnelly and Walshe 2008, *Irish Independent* online, 18 August).

In an interview with *The Irish Times*, Gerry Byrne (IEI president in 2000), identified engineering as having a key role in the country's 'radical shift along the value chain – away from pure production with little or no intellectual input and towards high value-added input in areas such as research, development, design and logistics' (McCall 2001, *The Irish Times*, 13 November, 1). Byrne also indicated a new and different mix of skills that would be required in the workforce, in particular people at higher levels in scientific and technical competencies would be required. Clearly, since this is a *new* kind of worker with *new* skills and competencies, the education system was not yet producing it. The production of this new worker would involve changing education, although Byrne did not feel the need to state this explicitly, relying instead on the rhetoric of newness and competency to suggest the need for such changes to his readers. To this end he identified the need for a high level of interaction between the universities and institutes of technology, the Industrial Development Authority (IDA) Ireland and Enterprise Ireland, and IBEC and industry in general to ensure the transformation.

Around the same time Paddy Purcell, the director general of the Institution of Engineers, described IEI as a key player in the 'Republic's economic miracle' and claimed that Irish economic success was built on the foundations set by investment in engineering and technology graduates in the previous two decades (Purcell 2001, *The Irish Times*, 21 September, 6). Purcell, writing in *The Irish Times*, said that Ireland's unprecedented levels of inward investment throughout the 1990s were due to the presence of more than 50,000 engineers working in the Republic together with the Government's competitive tax regime. In the 1980s, more than 15% of all graduates were from an engineering background and this provided a skills pool that

was successfully marketed by IDA Ireland and 'into which foreign nationals were only too happy to tap' (Purcell 2001, *The Irish Times*, 21 September, 6). However, paradoxically, throughout the 1990s as the demand for engineers grew the proportion of second level students entering engineering related courses at third level decreased (Keena 2002, DCU webite). The IEI maintained that an adequate competence in mathematics and science subjects is necessary in order to undertake a third level engineering programme. These subjects were increasingly perceived by students at second level as being more difficult and less attractive than other subjects and were not being taken as Leaving Certificate subjects by sufficient numbers (IEI 2000b, website). Thus many students did not have the required qualifications for entry to engineering courses. The Institution of Engineers of Ireland (IEI) 'targeted the downward trend in participation and pass rates in the physical sciences (maths, physics, chemistry) at Leaving Certificate level as one of the places to begin to redress the balance and make sure that our future skills needs are met' (McGuigan 2002, *The Irish Times*, 15 August, 14).

This public manoeuvring was designed to position IEI as a legitimate voice in the discourse. The conditions under which the concerns of IEI would enter the discourse belong to the same group as those of ICSTI and Forfás. Although IEI is not a State-appointed body, its account of the role played by its members in the development of the Celtic Tiger, the 'Republic's economic miracle', remained uncontested, thus giving weight to its considered opinion in political and economic circles. Its doctrine of education as an economic instrument helped to position its legitimate voice and its opinions were rarely contested publicly. In essence, IEI constructed a very simple problem – if the industry is to continue to grow in Ireland, more engineers are needed than the education system is producing and 'reaching the supply targets will pose major challenges for the educational institutions at second and third level, for research bodies, for public authorities and for industry' (IEI 2005, 2). That the fault lay with the education system as opposed to the industry went largely without question, such was their dominance in the argument, but Byrne's recognition of the need for a 'new and different mix of skills' and the fact that education systems all over the world are having difficulties attracting students to engineering related courses (Begley 2002, *New York Times*, 7 June, 1) (see 3.6) suggests that the problem is a deeper one than appears at first glance. The question of how the industry itself might remedy the situation is examined in section 6.5 below. In any case, IEI, representing as it does blue-chip technology multinationals and 'big pharma', as well as small engineering firms,

seeks to treat education as an instrument for the creation of human capital which it hopes to exploit. Being focused on such a narrow target has allowed it to position itself very effectively in the discourse and to achieve a high status. However 'the numbers problem' which was fundamental to the engineers' concerns, it seems, was much more complex than the engineers thought.

6.3.1 The engineers and the numbers problem: achieving legitimate voice status

The numbers problem was the catalyst which encouraged IEI in 2000 to produce a discussion paper entitled *A Review of our Engineering Manpower Shortages at Degree and Technician Levels* (See 3.5). The *Review* was circulated among politicians, policy makers and industry related vested interests, the agents and agencies mentioned by Byrne in his Irish Times article – The Minister for Education & Science, Forfás, HEA, IDA Ireland, IBEC and the media among others. The review identified a decline in the proportion of students pursuing a career in engineering and also a severe skills shortage in the engineering and technological labour force. It attributed many of these problems to what it saw as the unresolved imbalances in the education system identified in the *Culliton Report on Industrial Policy for the 1990's,* mainly the non-vocational orientation of an education system which had become progressively more academic in nature since the 1970s (IEI 2000a, website).

It is a measure of the high 'legitimate voice' status accorded the IEI in public discourse at this early stage that the *Review* was promptly read and evaluated at official level. In reply to a Dáil question on the review, (in early October) Mr Michael Woods TD, Minister for Education & Science, commented that the paper had at that time been considered by the EGFSN which had concluded that the concerns of the IEI in relation to engineering manpower, other than in the area of civil engineering, had been addressed through that group's work. Furthermore, the EGFSN had established a specialist sub-group to address the skills needs in the construction sector and civil engineering would be considered in that context (Woods 2000, Dáil debate). It is probable that the Dáil question to which the Minister was replying was prompted by IEI, and the scope and detail of the minister's response, together with the information that the IEI report had already been considered indicates the level of legitimacy afforded the organisation. In any

event, the Minister's response did not satisfy IEI who felt that the work of the EGFSN 'was inherently limited in scope, and did not comprehensively analyse requirements across the full spectrum of engineering disciplines' (IEI 2000b, website). IEI wanted to be actively involved in any review and they called for a more comprehensive analysis to be carried out by the EGFSN with IEI input. The IEI had discussed such an analysis with Forfás earlier that year and following those discussions IEI had obtained quotations for the cost of carrying out such analyses (IEI 2000b, website). This demand would shortly be met. By April 2001, Minister Michael Woods, having consulted with EGFSN indicated that '[t]he Expert Skills Group has agreed to work with the Institution in undertaking an analysis of current and likely future demand for engineers and engineering technicians' (DES 2001, press release). An analysis was carried out and the report, '*The Demand and Supply of Engineers and Engineering Technicians*', was presented by the EGFSN in 2003 (See 4.6). The report was produced by McIver Consulting (Dublin) under the guidance of a steering group made up as follows: Dr. Catherine Kavanagh (Chairperson) Forfás, Prof. Gerard Byrne (UCD), Roger Fox (FÁS), Jack Golden (Cement Roadstone Holdings/IEI), Paddy Purcell (IEI). (Notable here is the appearance of former IEI chairman and past president Gerry Byrne wearing his second hat as Professor Gerard Byrne of UCD, and Paddy Purcell, the director general of the Institution of Engineers). Three of the five were engineers and members of IEI. The extent to which the IEI demands were met may not be immediately obvious: they got their involvement, the analysis was carried out, it was carried out by an independent consultancy and engineers dominated the steering group.

The attention given to IEI was again in evidence in relation to its STEPS project. Subsequent to the publication of the *Review* a meeting was held between the Minister for Education and IEI where a proposal for a cooperative venture between IEI and the DES on a schools' based initiative to promote engineering as a career was discussed (Woods 2000, Dáil debate). The resultant project STEPS (Science, Technology and Engineering Programme for Schools), was funded by industry and the Department of Education and Science and by October 2000 a steering committee which included a Forfás/DES representative had been set up, and the project had commenced (IEI 2000b, website).

Although the IEI report was produced and circulated in March 2000, it does not appear to have found its way into the media until September, (back-to-school time) when two well placed, student/parent focused articles appeared, one publicising the STEPS project (Foley 2000b, *The*

Irish Times, 19 September, 69) and the other, under the headline, *Engineers are in Short Supply* directed at second level 'would-be' engineers who at that time of year would be making both career and subject choices (Foley 2000, *The Irish Times*, 19 September, 14). The engineers campaign to increase the number of students entering the engineering profession was under way.

The IEI has no formal role in education but its belief that 'sound industrial development and allied education policies' (IEI 2000a, website) were key factors in successful economic development were very much in evidence in October 2000 when IEI saw fit to submit a series of proposals to government entitled *Solving the Shortage of Engineers Problem.* These proposals arose from an IEI national conference which followed the *Review* consultations, and attracted speakers from the public service, Forfás and HEA, and from industry, Abbott Ireland and Hewlett-Packard among others (IEI 2000b, website) – it included an interesting confluence of policy-makers and would-be policy-makers. One set of proposals that emerged from the conference contained a series of recommendations to review aspects of second level science and maths education.

At this point it is worth recalling that the decline in numbers that was so worrying the engineers was not a simple one. In addition to the decline in the proportion of young people choosing engineering courses at third level, changes in the demographic meant that the size of the Leaving Certificate cohort was itself declining. In a further complication of the problem, this decline took place against a backdrop of an *increase* in both the proportion of and actual numbers of students taking Higher Level mathematics at Leaving Certificate (See 3.7). We have already remarked that the introduction of the new Leaving Certificate syllabus in the early 1990s had resulted in an increase in the percentage of students taking Higher Level mathematics from 11.19% in 1993 (the last exam in the old syllabus) to 18.13% in 2000. These percentages represented 6595 students in 1993 and 10,646 in 2000. This increase had been welcomed by the Chief Examiner (SEC 2000, 1) but, crucially, it did not translate into an increase in the percentage of students taking engineering courses at third level. Thus one of the premises of the IEI campaign that an increase in the number of students taking Higher Level mathematics must necessarily translate into an increase in those opting for engineering-related courses was not borne out by the facts. Clearly, as ICSTI pointed out in their 1999 study, young people were not choosing STM subjects in the required numbers (Forfás/ICSTI 1999b, n.p.). At the very

least, these complications should have prompted the engineers to consider what aspects of working life within the industry itself were causing students to reject engineering as a career.

The IEI had assessed what it saw as the situation in relation to the shortage of engineers and the falling number of students interested in entering the profession. It defined its own numbers problem and then identified the education system as part of that problem. It situated itself as a self-interested pressure group working for change, lobbying the government on behalf of its members (Shanahan 2000, *The Irish Times*, 6 October, 32) and informing public opinion through its regular media contributions. Though it had no official role in education, it orchestrated its campaign and was relentless in its execution. Successive reviews, reports, submissions and responses reiterated and refined the construction of the problems and repeated the solutions. These in turn insinuated themselves into public opinion, official governmental reports, such as, the Report of the Task Force on the Physical Sciences 2002 and various EGFSN reports.

6.3.2 Issues targeted by the engineers

The engineers' campaign to effect a favourable change in the educational discourse focused on a small number of issues which were taken up by the media and which concentrated over time into a narrow range: the numbers problem – the shortage of engineers and the shortfall of numbers entering engineering-related courses (Donnelly 2001; Editorial 2007, *The Irish Times*; Flynn 2002; Flynn and Oliver 2001; McGowan 2006; McGuigan 2002; Mooney 2009) etc.; the necessity to raise standards in maths teachers and teaching and in the kind of student emerging from schools (Brennan 2002; Carbery 2010; Dyson 2010; Engineers Ireland 2009; Flynn 2009a; Flynn and Oliver 2001) etc.; and the need for bonus points for Mathematics to incentivise students to enter engineering and science related courses at third level (Donnelly 2001; Hunt 2010; IEI 2010; Mooney 2009; Power and Mooney 2008) etc. This culminated in a demand by John Power, director general of Engineers Ireland for a 'bias' in the education system towards maths and technology (Carbery 2010, *The Irish Times*, 17 February, 3). Set against a backdrop of the drive towards a knowledge economy, each of these demands obeyed the rules of the discourse and would in due course become influential statements.

The IEI believed that having qualified maths teachers in the classroom affected how the subject was taught. It argued that the 'numbers problem' was exacerbated by the shortage of candidates

of a suitable standard wishing to enter the teaching profession (IEI 2000b, website), quoting, at one point, 'a startling statistic' which showed that only six honours graduates in the country pursued teaching as a career choice in one particular year (Seán Flynn and Oliver 2001, *The Irish Times*, 12 September, 4; Purcell 2003, *The Irish Times*, 8 April, 8). The problem was reported (Brennan 2002, *The Irish Times*, 7 June, 54; Seán Flynn and Oliver 2001, *The Irish Times*, 12 September, 4), but it had no impact on department policy and the IEI solution of 'hello money' for teachers of mathematics was rejected by Minister Woods and opposed by ASTI (Flynn 2001, *The Irish Times*, 25 September, 3). The problem was allowed to continue and by 2010 a survey of maths teachers and principals in Ireland revealed that 48% of maths teachers were without 'a specific qualification' (Carbery 2010, *The Irish Times*, 7 February, 3) . By this time the Irish economy had collapsed and teachers leaving the profession were not being replaced. It was now accepted that the problem was significant for economic development but the department was debarred from solving it because 'teacher recruitment is at a standstill' (Carbery 2010, *The Irish Times*, 7 February, 3). In the same article it was reported that a 2010 University of Limerick Study linked the lack of suitably qualified mathematics teachers with the very problems that worry the engineers – poor performance in maths and the low uptake of Higher Level. Had the policy-makers heeded IEI concerns when they first raised them, much of the subsequent problem with under-qualified teachers might have been obviated. This throws the real influence, on a year by year basis, of the IEI's interventions into question. Just how much influence do they have if what they regarded as the fundamental problem was not addressed by policy-makers? We may be in a better position to answer this question in the next chapter in which we will examine Project Maths itself.

6.4 Other opinion-makers

The engineers were not alone in shaping public opinion. In articles, opinion pieces, press-releases, conferences, submissions to government organisations, interviews groups as varied as the American Chamber of Commerce (ACC) in Ireland, Fine Gael party and the employers group IBEC brought all the pressure of organisations used to moulding public opinion to bear on the system. Their aim was to achieve hegemonic status in the discourse, in order to shift both the public perception of the purposes of mathematics education, in particular at second level, and the reality. That these organisations should expend so much energy in shifting the

discourse towards the economic instrumentalisation of second level and that the process was so laborious, is indicative of the extent to which the idea of second level education as centred on the young person rather than on the economy was embedded in the public mind.

It must be remembered that the discourse has not only 'its own rules of appearance, but also its own conditions of appropriation and operation' (Foucault 2008b, 136). An array of agents and voices was admitted as fulfilling the necessary conditions and their arguments were appropriated to the discourse. Together they represented extraordinary economic power – The American Chamber of Commerce in Ireland, representing over 600 companies, the employers group IBEC and in particular their PharmaChem and ICT groups, the Institution of Engineers representing engineers of all kinds from civil engineers to CEOs of multinationals. The utterances of these groups reflected and refracted off each other. Threatening, cajoling, pandering to national pride and ambition, stoking near-xenophobic fears of the flight of capital to the East or the necessity to import labour, the effect was to amplify their importance in the discourse and to flood the policy-making structures of government. The utterances and demands of such groups were reported in the media and freely used in the construction of the common sense relating to the position of mathematics in the economic ambitions of the State and its investors.

Thus the economic discourse came to dominate. Ita McGuigan's argument in her 2002 Irish Times article (McGuigan 2002, *The Irish Times*, 15 August, 14) is similar to that of Forfás and ICSTI which argued that the education system needed to express the official national aspiration for scientific and technological innovation (Forfás/ICSTI 1999a). For IBEC the computer sector contains Ireland's 'top employers' and 'our greatest assets are our minds' (Flynn 2006a, *The Irish Times*, 13 June, 6) and mathematics and science are to underpin our economic development (Editorial 2007, *The Irish Times*, 15 August, 15). Anne Heraty, then chairperson of the EGFSN, suggested that 'boosting our maths skills levels [was] essential to realising opportunities for employment'. Mathematics, for her, is a 'fundamental requirement for Ireland's development as a modern economy' (Flynn 2008, *The Irish Times*, 16 December, 9). The American Chamber of Commerce, representing US firms in Ireland, declared the situation regarding higher level mathematics and science as 'a barrier to Ireland fulfilling its potential as a knowledge economy' (Flynn 2009b, *The Irish Times*, 13 August 2009, 6) and by 2010, according to the *Irish Independent*, it was issuing 'a damning indictment of the education system' and calling for

curriculum change and the introduction of measures to promote problem-solving (Donnelly 2010b, *Irish Independent* online, 5 January). In a similar vein, John McGowan (president of IEI 2006) threatened a gloomy future and unless we increased the output of engineers, IT and science graduates, 'the concept of a knowledge economy for Ireland will simply be just that - a concept' (McGowan 2006, *The Irish Times*, 16 June, 4). IBEC, the employers group, in a comment after the publication of 2007 Leaving Certificate results, again saw the development of the knowledge economy as being dependent on a strong supply of scientists, engineers and technologists but, they said, 'the results raised doubts about the ability to deliver on this agenda' (Flynn 2007a, *The Irish Times*, 15 August, 1). For Turlough O'Suillivan, director general of IBEC, 'our transition to the knowledge economy will depend on how well our education system transmits mathematical skills to our young people' (O'Sullivan 2008, *The Irish Times*, 27 March, 13). His opinion piece moves without hesitation from the 'monumental economic transformation to become a knowledge-based economy' to the necessity for a transformation of mathematics education without any intermediate argument. By this time the two are linked infallibly in the minds of opinion-makers. For them, education is for the economy.

Many of the utterances of these organisations contain a veiled threat – that capital will move elsewhere, specifically to developing economies which may overtake us in the production of qualified engineers. Brian Carney of IEI suggested that 'the state's ability to maintain its attractiveness as a location for multi-national investment is at risk' (Brennan 2002, *The Irish Times*, 7 June, 54). Employers are 'increasingly worried' about the attitudes of young Irish workers as well as their 'ability to learn fast ' and this is somehow related to the fact that the numbers of students sitting Higher Level Maths fell by 8% in that year (Kerr 2006, *The Irish Times*, 17 August, 8). Fine Gael's Brian Hayes flatly declared that 'Ireland will suffer' unless the participation rate in science at Junior Certificate level is increased to 100% (Flynn 2009b, *The Irish Times*, 13 August, 6). In the same article Seán Flynn quoted 'US multinationals' as warning that 'US investment could now be at risk'. Ita McGuigan suggested that the 'high tech boom [was] in danger of being starved of its most vital component – technically qualified workers' (McGuigan 2002, *The Irish Times*, 15 August, 14). 'Without an increase in the throughput of graduates [from engineering courses] Ireland will struggle, if not fail, to build on the economic success of the past decade' (McGowan 2006, *The Irish Times*, 16 June, 4). An editorial writer in the *Irish Examiner* in 2010 seemed to be completely unaware of the kind of crisis being

constructed in *The Irish Times*. In the belief that our education system would lead us into the Promised Land of the knowledge economy we were 'being delusional…it is disheartening that there seems to be no sense of urgency, no crusade or understanding that we are barely standing still, and unless we up our game very considerably we will be left very far behind' (Editorial 2010, *Irish Examiner*, 9 July).

That the system had failed was a given. DCU professor of computing Michael Scott complained that the current CAO points system was delivering many 'poorly educated and poorly motivated' (Flynn 2009b, *The Irish Times*, 13 August, 6; Scott 2009, *The Irish Times*, 12 August, 17) students to the university sector. Ireland's 'relatively poor performance' – in OECD/PISA 2003 – came as little surprise to Seán Flynn considering that 'high failure rates at Junior and Leaving Certificate have been evident in recent years' (Flynn 2004, *The Irish Times*, 12 July, 8) and IBEC described poor maths performance in Ireland as a 'hammer-blow to the economy' (Editorial 2004a, *The Irish Times*, 12 July, 19). Áine Kerr reported that IBEC had identified the failure rate in Leaving Certificate mathematics as an area of 'grave concern' (Kerr 2006, *The Irish Times*, 17 August, 8) while 'industry and guidance councillors' would have their work 'cut out for them' (Monaghan 2006, *The Irish Times*, 27 October, 12) in building a knowledge economy considering high failure rates at maths and science. In an uncharacteristic moment of reflexivity, an Irish Times editorial writer noted that '[c]oncern about maths and science has become an embedded part of our education system' (Editorial 2007, *The Irish Times*, 15 August, 15).

This failure added up to a crisis which the reigning Fianna Fáil administration was 'unwilling or unable' to address, according to Fine Gael's Olwyn Enright (Flynn 2007a, *The Irish Times*, 15 August, 1). The rhetoric of crisis took hold from 2006 onwards – Seán Flynn may have been the first to use it in an article about Leaving Certificate results (Flynn 2006b, *The Irish Times*, 28 April, 7). In the same article Minister Mary Hanafin was reported as having expressed her 'alarm' at the situation. The Royal Irish Academy (RIA) demanded a return of bonus points in response to 'what is seen in education circles as the "crisis in maths" (Flynn 2006c, *The Irish Times*, 16 August, 1). The Labour Party and Fine Gael (then the opposition parties in Government) combined to produce a 'joint initiative on the crisis in maths' in 2006 (Opinion 2006, *The Irish Times*, 14 November, 13). An editorial in *The Irish Times* attempted to shift the introduction of the rhetoric of crisis from business people and journalists to the government.

According to the article, 'government ministers have been pointing to the "crisis in Maths and Science"' for 'close to a decade' (Editorial 2007, *The Irish Times*, 15 August, 15). The editorial writer asserted that the 'road shows and exhibitions' that 'have been rolled out' were, in fact, initiatives of government not industry. In this sense, the crisis had inflated and the agreement of all parties that the term was an appropriate description could be safely assumed. Project Maths was developed as a solution to the crisis, according to Dick Ahlstrom, but 'commentators' expressed 'disquiet' at an early stage (Ahlstrom 2009, *The Irish Times*, 4 September, 102). Maeve Dineen, in an *Irish Independent* article argued that problems in maths were well signalled by the chief executives of companies such as Intel and Google and her solution was for 'new ways of teaching, new subject matter and less emphasis on outdated maths, which computers have made obsolete' (Dineen 2010, *Irish Independent*, 30 August). A voice from the field of education in this argument came from Ted Hurley, Professor of Mathematics at National University of Ireland in Galway, who argued that there was nothing basically wrong with the mathematical syllabi and examinations in secondary schools but that it was the implementation of syllabi by unqualified people that represented the problem (Hurley 2010, *The Irish Times*, 24 May, 13). The problem was not new and had been brought to the attention of decision makers in both the political and academic communities over many years, but to no avail. Some days later this view of 'out of field' teachers was supported by a prominent member of the IMTA (Tiernan 2010, *The Irish Times*, 26 May, 15). Then in 2011, *The Irish Times* reported that the DES was to introduce a scheme to help 'unqualified' maths teachers in the classroom. This scheme would provide 'unqualified maths teachers or those without full qualifications with the opportunity to upskill their knowledge of maths' (Flynn 2011, *The Irish Times*, 12 September, 3). The article draws a clear link between these 'unqualified' teachers and the fact that 'more than 4,000 students failed Leaving Certificate maths' in 2011. The training of the 'unqualified' is to be outsourced and in the process a new market is being created, with the department developing 'a competitive process to select providers to run the training programme. Tenders will be invited…' (Flynn 2011, *The Irish Times*, 12 September, 3). In the event, approximately €2 million was made available by the DES for development of a course for 'out of field' teachers who were already teaching mathematics (Quinn 2012a, Dáil Debate) at a time when the embargo on recruitment prevented schools from replacing retiring teachers of mathematics. The contract was awarded to The National Centre for Excellence in Mathematics and Science Teaching and Learning (NCE-MSTL) at the University of Limerick (University of Limerick

2012, website). This institution has already run a number of summer courses for teachers of Project Maths.

In this discourse, *The Irish Times* Education correspondent is a significant agent. In this regard one set of articles and responses is instructive. In a pre-results piece in 2009 *Focus on maths failure rate as Leaving results due out tomorrow* (Flynn 2009a, *The Irish Times*, 11 August, 1), Flynn presented the spectacle of government and business leaders 'bracing themselves' for high failure rates in maths. The article is permeated with the rhetoric of crisis and failure: 'last year almost 5,000 students failed maths' and there were 'high failure rates' in all the STEM subjects, as well as a 'security breach' in English; students had 'deserted' construction and property related courses. In a nice metaphor, he asserted that building-related courses had 'virtually collapsed'. He also reported here that the Minister for Education was 'rolling out' the new Project Maths programme in response to the 'maths crisis' and that according to O'Keeffe the new programme was 'designed to encourage greater take-up at Higher Level and provide a solid foundation for careers…as we seek to build the knowledge economy and society'. This was followed (next day – results day) by the familiar round-up of opinions in relation to the 'crisis' in maths from a number of significant agents in the discourse. The accumulated opinions, presented under the 'crisis' heading *Low uptake may put US investment 'at risk',* (Flynn 2009b, *The Irish Times*, 13 August, 6) were intended to increase the pressure on Government to address the 'crisis', and were mainly a recycling of well-established clichés. The American Chamber of Commerce, for example, was quoted as saying that 'the continuing decline in numbers taking Higher Level Leaving Certificate papers in maths and science represents a barrier to Ireland fulfilling its potential as a knowledge economy' and it pointed to what it saw as a 'fundamental problem in the teaching of these key areas in schools'. It demanded 'fundamental reform of curriculum with a new stress on innovation and problem-solving in maths and science'. The article gives no indication whatsoever that the spokesperson for The American Chamber of Commerce had the slightest notion of what was already in train in terms of curricular and pedagogical reform in mathematics. Nevertheless, Seán Flynn relies upon the power of the Chamber as representing American FDI in Ireland to reinforce the newspaper's long-standing line on the discourse of failure. Flynn attempts to give further weight to these opinions by including the views of the Higher Education Authority and the Royal Irish Academy, which he claimed had recently expressed concern about declining academic standards. Whether these

organisations had spoken specifically about maths and science at that time is not made clear. The comments may well have been the kind of generalised complaints about intake that the universities indulge in from time to time. Engineers Ireland were represented by their line that 'the training of maths and science teachers must be improved to boost the standard of teaching in these subjects', as were the complaints of the IBEC group PharmaChemical Ireland. Opposition politician Brian Hayes, while complaining that the government had failed to tackle the crisis in maths and science called for 'root and branch reform of maths teaching and learning'. It is not clear whether Mr Hayes was aware that a 'root and branch' reform was underway with Project Maths. Nor is it immediately obvious why Flynn saw fit to include this quotation without comment unless he felt that, whatever its validity, it lent support to the general set of uninformed truisms that emerged in the article. A *similar* round-up of high powered opinion was carried out by the *Irish Independent* and included a senior vice president of Cisco, the director general of Engineers Ireland, the director of Discover Science and Engineering and Dr Danny O'Hare (former Chairperson of EGFSN) under the heading *Adding up the numbers of Irelands worsening tech and science deficit* (*Irish Independent* 2009, 13 August).

The publication of OECD/PISA assessment results plays a curious role in this discourse of failure reminiscent of the way Leaving Certificate results are *anticipated as bad*, and made the subject of a sort of vox pop of corporate and political luminaries *post hoc*. The chart below shows the trend in relation to *The Irish Times*, the pattern, which grows slightly more elaborate with each iteration, tells the story of a remarkable awakening:

Irish Times Comment	**PISA Ranking for Mathematics**
'High marks in education' (2001)	Not significantly different to the OECD average
'Low Irish maths standards' (2004)	Not significantly different to the OECD average
'Poor performance in maths continued unabated for almost a decade' (2007)	Not significantly different to the OECD average
'The year that Irish Education fell to earth' 'Shattering the myth of a world-class education system' (2010)	Below the OECD average

In Ireland PISA has a limited footprint in the media but I contend that the Irish media contribution to the PISA publicity mechanism, limited as it is, exerted considerable influence on the shaping of a discourse which contributed to the hegemony of a particular analysis (Foucault 2003, 7), in effect equating success in PISA with a successful mathematics education system. The media, in particular *The Irish Times*, accepted PISA as a measure of the 'mediocrity' (Oliver 2001, *The Irish Times*, 5 December, 7) of mathematics education in Ireland and proposed success in the PISA assessment as a ticket to the development of a successful 'knowledge economy'. What was absent from the discussion was any form of analysis of the PISA assessment, its origins, its *raison d'etre*, its objectives. John White, Deputy General Secretary of the Association of Secondary Teachers of Ireland (ASTI), was alone in cautioning that

> we must never allow a narrow, quantitative league-table syndrome to dominate our thinking in relation to the education service. In any consideration of quality in education, it is important to guard against allowing quantitative data to overwhelm the central core of a grounded philosophy of education. Such a philosophy must be founded upon respect for the dignity of each pupil who attends our schools; academic attainment is not synonymous with human value and, however precariously, the tradition of Irish education has respected this. (White 2002, *The Irish Times*, 15 January, 7)

White's contribution failed to penetrate the discourse. The PISA assessment was accepted as a given, it carried the OECD brand-name and it was construed as a scientific discourse producing 'truth'. The businesses contracted to create the assessments and produce the data remained invisible. Economically and politically PISA was presented as an independent evidence-producing instrument that indicated the existence of a major problem in mathematics education in Ireland which if not addressed urgently would hinder inward investment and the development of a successful knowledge economy.

The Irish media accepted the OECD as an organisation which through its international assessment was capable of evaluating the standard of education in a country without reference to that country's curriculum. Successive iterations of the assessment produced media reports which compared and contrasted performances and drew conclusions from the evidence. This is not unique to Ireland. Sjøberg, writing from Sweden, remarks that PISA provides the media with 'convincing images and perceptions' about the quality of the education system and the

nature of young people (Sjøberg 2007)(204). In many cases these images feed into or help to create national self-stereotypes.

In 2001, Irish people (to judge by their media) were quite content with their placing in PISA, even in mathematics, and confident of their education system's strengths. Three PISA related pieces were published in *The Irish Times* on December 5th 2001, the day following the publication of the first results of PISA 2000, and all were approving, concentrating on the results which put Irish students 'close to the top of the world league table in Science and English' (IT Editorial 5-12-2001, p.15) and paying scant attention to the underwhelming position of mathematics. There was one sign of future trends in the discourse, a single sentence in the editorial where the result in mathematics was taken as confirmation of 'the recent trend of poor results – especially at Ordinary Level – in the State examinations'. Specious comparisons such as this have a way of embedding themselves in the discourse and can be very difficult to dislodge. However, by the second iteration of the cycle, these same rankings in mathematics had become a problem. By the third iteration the mathematics rankings had become a catastrophe and an indictor of Ireland's failing prestige as a desirable site for foreign direct investment. The fourth iteration produced Ireland's PISA shock and with it a ripple of activity from the DES. At that point, the *Irish Independent* announced that 'The report for the National Competitiveness Council makes a direct link between the maths performance of 15-year-olds, as measured by the international Programme for International Student Assessment (Pisa) study, and national economic progress' and 'that Ireland has no hope of competing with the best economies in the world unless it cracks the country's "average" ranking in maths' (Donnelly 2012a, *Irish Independent* online, 4 July). Elsewhere it was reported that '[t]he Programme for International Student Assessment (PISA) report will puncture our hard-won image of having one of the best education systems in the world' (Walshe 2010, *Irish Independent* online, 8 December). What narrative had been shattered by these results? What new narrative is taking its place? These are significant questions. An examination of the commentary itself, however, provides very little guidance as to why this narrative has taken hold.

6.5 The bonus points controversy

The Project Maths response to the 'crisis in maths' was not universally seen as providing an appropriate solution to the 'numbers' problem and pressure was continuously being exerted on the Minister for Education to introduce a more immediate resolution in the form of bonus points. This controversy was played out in public largely through the media. Mr Batt O'Keeffe, Minister for Education and Science when the pilot phase of Project Maths was initiated, opposed the introduction of extra points for maths on the grounds that 'curriculum reform has more impact than points' (Flynn 2008, *The Irish Times*, 16 December, 9; Parliamentary Debates 2009). He cited the Irish experience which was that participation in Higher Level maths increased in 1994 on foot of curricular reform at the time when bonus points were removed. However business and industry interests disagreed with the Minister and were determined to have their way.

In 2008 two EGFSN reports (EGFSN 2008a, 94; 2008b, 12) called for the introduction of bonus points for Higher Level mathematics in Leaving Certificate and around the same time Mr O'Keeffe's department asked the Higher Education Authority (HEA) to investigate the desirability or otherwise of awarding extra points. The overall view emerging from the HEA, according to Minister O'Keeffe, was 'that the introduction of bonus points was unlikely to dramatically increase uptake of Higher Level Maths' (Parliamentary Debates 2009) and furthermore, that the Report of the Points Commission in 1999 had also recommended against such an approach. Minister O'Keefe appeared to be adhering to the policy of research-based policy decision-making. The conflict between Minister O'Keeffe and the EGFSN had previously been reported in *The Irish Times* (Flynn 2008, *The Irish Times*, 16 December, 9) where, for the EGFSN bonus points were a key instrument in reviving maths; the universities and institutes of technology believed they would not achieve a revival; and the Minister put his faith in curriculum reform.

The bonus points motif was not a new one. In their submission to government, *Solving the Shortage of Engineers Problem (2000),* IEI had recommended that greater take-up of 'honours maths' should be encouraged through the awarding of 'extra points', and it did so again in its recommendations to the Task Force on the Physical Sciences (2001) however it took another five years before this recommendation became a feature of public discourse. In June 2006, during the Leaving Certificate exam, Seán Flynn reported that the Royal Irish Academy (RIA) –

'the group of renowned scholars' (Flynn 2006a, *The Irish Times*, 13 June, 6) had called for the introduction of bonus points for students taking maths and science. This incentive, they said, was required to address the 'crisis'. The call was immediately backed by the employers group IBEC for whom the 'low numbers…taking Higher Level maths and science is a major concern' (Flynn 2006a, *The Irish Times*, 13 June, 6). Later that year in his post-leaving certificate results column Seán Flynn again reported that '[w]hat is seen in education circles as the 'crisis' facing maths and science has prompted the Royal Irish Academy (RIA) to demand the return of bonus CAO points for maths and a similar incentive for science subjects' (Flynn 2006c, *The Irish Times*, 16 August, 1). The RIA, that group of 'venerable academics' as Flynn called them, saw the awarding of bonus points as a way of increasing the supply of 'quality graduates'.

The Minister for Education, then Mary Hanafin, was sympathetic to some kind of incentive scheme and in August 2007 she proposed that third level colleges should award extra points to students taking 'honours' (sic) maths provided they proceed to take science, engineering and technology courses. She addressed her demand to college registrars who were responsible for setting entry requirements to courses (Flynn 2007b, *The Irish Times*, 16 August, 1). The proposal was intended to make it more attractive for students to take Higher Level maths in the Leaving Certificate and to then go on to study science, technology and engineering. However during Ms Hanafin's remaining months in office no further progress was made on the issue and as we saw her successor Batt O'Keeffe opposed the awarding of bonus points.

There was no agreement on the proposal to introduce bonus points. An Irish Times editorial in 2008 argued that as points for entry to science courses were already historically low it was hard to see how bonus points would act as a real incentive (Editorial 2008, *The Irish Times*, 8 January, 15). Minister O'Keeffe continued to argue that the bonus could be 'counterproductive and reinforce the perception that mathematics is a difficult subject' (Flynn 2009c, *The Irish Times*, 28 February, 8) and there was continued albeit uneven opposition from the third level institutions. The Irish Universities Association (IUA) had in 2008 reported its considered opinion that the introduction of bonus points was unlikely to increase uptake of Higher Level mathematics significantly and they also expressed concern that such a measure would mask the underlying challenges facing the teaching and learning of mathematics throughout the education system (IUA 2008, 1). Brian Mooney, guidance counsellor and Irish Times columnist, maintained that the argument widely promoted by Engineering Ireland, the ICT industry, IBEC and others, was

based on the false premise that there is a competitive process among second level students to secure places in programmes requiring Higher Level maths (Mooney 2009, *The Irish Times*, 20 January, 16). Mooney pointed out that students were avoiding taking places in science, engineering and technology programmes because they lacked interest in these disciplines and not because they lacked points.

The 2010 *Report of the Project Maths Implementation Support Group* considered at length the question of bonus points for Higher Level Mathematics but failed to reach a consensus on the matter (DES 2010b, 23). Both the Department of Education and Skills and the State Examinations Commission considered it would be inappropriate to award bonus points for Higher Level mathematics through the mechanism of the Leaving Certificate examination, the IUA as we have already seen opposed their introduction through the CAO mechanism. However, both IBEC and EGFSN considered it 'an imperative to introduce bonus points in order to make an immediate impact on Higher Level take up of mathematics in schools' (DES 2010b, 26). In August 2010 the first attempt at a statistical study found that 'extra points won't entice Leaving Certificate students to take Higher Level maths'. The study was conducted online by IEI and completed by only 122 students who sat Leaving Certificate in 2010. The conclusion was that 'bonus points on their own are not the solution' (Hunt 2010, *The Irish Times*, 12 August, 3). Understandably, given the small sample, the survey had little or no impact on the debate.

Nevertheless, with a new Minister for Education in the Spring of 2010 the official position of government changed once again. Speaking at the Teachers Union of Ireland (TUI) Conference in April 2010 Minister Mary Coughlan 'signalled the return of bonus points' (Holden 2010, *The Irish Times*, 8 April, 9), on the grounds that 'our young adults are smart people. They know the time and effort versus reward matrix associated with taking honours maths in the context of the CAO points system'. On the same day an *Irish Independent* headline managed to suggest that the announcement of bonus points had instantaneous results: 'Hi-tech jobs boost after U-turn on maths bonus' (Donnelly and Walshe 2010, *Irish Independent* online, 8 April). However the TUI education and research officer questioned the proposed measure and expressed the concern of the TUI at 'this potentially rash move', indicating the TUI preference for a more appropriate way to address the problem, such as Project Maths. There were other issues of importance to be discussed at the conference. The TUI president 'described as "stupid" the rhetoric of the

smart economy in the context of the 'systematic dismantling and destruction of public education in the last eighteen months' (Holden 2010, *The Irish Times*, 8 April, 9).

The Labour spokesman (soon to be Minister for Education), Ruairí Quinn, welcomed the announcement (Holden 2010, *The Irish Times*, 8 April, 9). Engineers Ireland and the American Chamber of Commerce lined up with the Labour Party to welcome the move, though the engineers warned that 'the method of teaching the subject must change' (Gartland 2010, *The Irish Times*, 9 April, 6). The IBEC group, ICT Ireland, believed the reintroduction of bonus points 'will send a clear signal to national and international industry leaders that Ireland is serious about developing a smart economy' (Holden 2010, *The Irish Times*, 8 April, 9) but Jim O'Hara of Intel described it as a 'just one little sliver of the right incentive' (Kennedy 2010, *Irish Independent*, 3 June). In August 2010, on results day, the Minister announced that she would press ahead with her plan to award bonus CAO points for maths, despite concerns raised by UCD and other colleges (Flynn 2010a, *The Irish Times*, 18 August, 1) and about a month later the universities agreed although university academics, especially in UCD, UCC and NUI Galway appeared less than fully convinced of the merits of the scheme (Carroll 2010, *The Irish Times*, 20 August, 4; Donnelly 2010b, *Irish Independent*, 6 October; Editorial 2010a, *The Irish Times*, 11 October, 15; Flynn 2010a, *The Irish Times*, 7 October, 7).

The bonus CAO points were to be awarded to *all* students who achieved grade D or better in Leaving Certificate higher maths *regardless* of the course they wished to pursue, maybe this was the compromise!

The bonus points issue was one element of the discourse where disagreement among the 'legitimate voices' came to the fore in public. The opposition of the IUA and third level academics, particularly in the field of education, stood in direct conflict with the heavy guns of industry and commerce, particularly IBEC, EGFSN and the IEI. In effect, two discourses clashed on the issue: on the one hand the seemingly intuitive economic discourse, which advocated the instrumentalisation of education for 'the good of the economy', together with the unstated parity of the terms 'economy' and 'country'; on the other the complexity of traditional educational argument centred on the child or the traditional academic disciplines, on social justice or equity and gender balance, often backed by complex studies and dependent on complex arguments. In a sense, the debate had already been lost and won. Every intervention into the discourse is governed by rules which decide their validity. By the time the academics

entered the fray three rules had become firmly established: Education is for the economy; Maths is in crisis; and Something immediate must be done to increase the numbers entering engineering, science and technology courses. No intervention that did not accept these conditions could succeed.

This discourse is, of course, primarily political, but it attempts to evacuate the political content and replace it with a supposedly neutral term – the economy. Everyone of every political persuasion wants the economy to do well. Nevertheless the political re-emerges in the question of what kind of an economy is desirable. Very occasionally voices of dissent or resistance are heard through the hegemonic noise. One such voice is that of Kathleen Lynch, Professor of Equality Studies at UCD. She continually seeks to re-inscribe the political in the debate. She accepts that education has an economic function, but that function is to provide young people with the best start in life. In this approach, education is at the service of social justice and equality and the education system should as far as possible avoid doing anything that will increase inequality and injustice.

In a 2010 opinion piece for *The Irish Times*, Professor Lynch deconstructed the bonus points issue from a very different perspective to that of most other agents in the discourse. She questions the merits of the decision 'to award bonus points for success in Higher Level mathematics *for entry to all fields*' (Lynch 2010, *The Irish Times*, 24 September, 16) on the grounds of social justice, education and policy. Speaking as an academic in the field and one of the authors of a study based on analysis of national data on the teaching and learning of mathematics, *Inside Classrooms: The Teaching and Learning of Mathematics in Social Context, 2002,* she identifies serious social justice issues associated with changing access routes to higher education. She argues that there are students who do not have the opportunity to study mathematics at higher level. In particular she cites statistics relating to the proportion of schools that do not teach Higher Level maths at Junior Certificate or where less than 20 percent of students take Higher Level – amounting to 200 schools. A large proportion of these schools are designated disadvantaged and thus these are the students 'who will be further pushed down the ladder in terms of accessing higher education in a competitive entry system'. She concludes that the decision to award bonus points in Higher Level mathematics 'is a profoundly unjust and socially excluding mechanism for prioritising students for entry to the entire university'. This

despite the fact that she accepts that bonus points may be justified for some courses for particular reasons.

She also considers the decision to be a gender issue although she regarded this as less significant and she also addresses many urgent issues that need to be confronted in the teaching of mathematics in Irish schools including: the content and scope of the Higher Level; negative attitudes; the number of teachers without a specialist maths degree; the lack of in-service education provision; the shortage of mathematics education specialists in teacher training courses; and the lack of investment in the teaching and learning of mathematics

She suggests that the argument that bonus points would 'motivate' more students to take Higher Level mathematics disregards important research evidence and was contrary to the growing recognition in Ireland of the importance of research-based policy. She concluded that the '[p]roblems faced by mathematics are infrastructural; they will not be solved by a quick-fix solution that is overtly socially exclusionary.'

Reaction to this piece was published in the letters pages beginning some days later. A number of the letters published dealt with the gender issue while ignoring the social justice and educational problems. One letter from Dr James Cruickshank, President, Irish Mathematical Society, (most of whose members work in Irish third level institutions), attacks the argument that awarding 'bonus points would be unfair because it would disadvantage certain students based on their social background and gender' (Cruickshank 2010). Bizarrely, he accuses Prof Lynch of misunderstanding the intention behind the introduction of bonus points which he explains 'are intended to incentivise students towards taking Higher Level maths' and thus he claims all the percentages that she referred to would change if bonus points were introduced. Dr Cruickshank, in his analysis, ignores the fact that in 2009 some 79 schools in Ireland had no Higher Level mathematics class at Leaving Certificate and hence students in these schools would automatically be excluded from all bonus points. In addition he argues that the 'biggest inequality that our students face' is not that of social disadvantage but the fact that mathematics requires 'more hours of study and more effort that (sic) most other subjects'. This faces students of mathematics with 'an unfair disadvantage'. The two sides of the argument express incompatible world-views: for Professor Lynch the social disadvantage is overwhelming, whereas for Dr Cruikshank the self-imposed choice of mathematics is of far greater importance. It is difficult to avoid the conclusion that Professor Lynch's considered opinion was admitted to

the discourse as a token, an indicator that in a democracy the voices of dissent are welcome. That her central thesis was immediately ignored is indicative that her role is that of token bleeding-heart. There is no place for the discourse of social justice in this hard-edged business language.

The introduction of bonus points is, in effect, a policy change in that it prioritises one subject, not on educational but on economic grounds, as a desperate attempt to increase numbers in the interest of the economy, but without the backing of favourable research evidence and contrary to existing research and the considered opinion of a wide range of educationalists. How would this balance of forces be reflected in the new curriculum of Project Maths? We will explore this question in the next chapter.

6.6 Should Industry put its own house in order?

There are always alternative discourses which are not admitted to the hegemony. One of those discourses involves a critique of the current state of capitalism – in particular, employment conditions, the precariousness of employment, career opportunities, alienation and job satisfaction. This critique does not fulfil the requirements for acceptance within the economic discourse in Ireland. The question simply does not belong to that group of relations between statements which form the mathematics education discourse here. At the most fundamental, we could ask why students don't want to enter the engineering, technology and science professions in suitable numbers? Let us, as Minister Mary Coughlan does (Holden 2010, *The Irish Times*, 8 April, 9), credit our students with intelligence and assume that they are capable of rendering a sensible answer to this question.

For example, as previously noted, guidance councillor, Brian Mooney, argues that Irish students simply lack interest in the engineering, science, technology disciplines (Mooney 2009, *The Irish Times*, 20 January, 16). It is worth considering whether the 'fault' rests with the education system or, as has been suggested elsewhere in this thesis, rests substantially with the industry itself. What *are* the career prospects for a young person considering entering the STEM related disciplines? What kind of factors contribute to a young person's decision to avoid them?

An Australian study examining the adaptability of ICT students identifies the ideal characteristics of the ICT professional:

> The 'new' ICT professional should be an articulate problem-solver who understands business and technology, in particular how technology can solve business problems. Furthermore, the ideal ICT student should be adaptable. The adaptable student embraces change, learns quickly, under-stands the job market, thrives on variety, is autonomous, predicts change, and acts as a change agent in the organization. (Van Der Vyver 2009, 19)

However it also recognises the reality of those ICT professionals who find themselves under persistent pressure, exposed to constant change and uncertainty in highly unstable, changing environments and contrasts this with the aspirations of the young students in the survey who 'prefer a degree of stability, a relatively defined career path, job security, and a career that is relatively stable' (Van Der Vyver 2009, 19). The author suggests many students (in his study) who choose ICT courses are not equipped to deal with the 'constant change and uncertainty' of the industry and that many 'less adaptable' students chose their course of study with 'limited knowledge about the realities of work in ICT'. Maybe 'our young adults are smart people' (Holden 2010, *The Irish Times*, 8 April, 9) as Minister Coughlan said and inform themselves of the realities of the industry and then follow their own aspirations in choosing a secure and rewarding career for themselves.

Another Australian study of attitudes to ICT Careers and Study among 14-19 year old students drew up a list of student aspirations; students 'are seeking a career' that provides them with 'interaction with interesting people', 'new challenges', 'avoids high levels of stress', 'does not involve being "stuck" in an office or in front of a computer all day', 'has a high income' and is glamorous (DIIRD 2007, 8). A list of the most positive aspects of the industry, as perceived by the study's cohort, coincided on only one point – 'ICT is well paid'. Even that perception does not necessarily apply to the sector in Ireland, especially for the higher achievers who compare incomes with the stable professions such as Accountancy, Law and Medicine (O'Sullivan 2006a, *The Irish Times*, 19 August, 15).

An interesting joint British/Irish study examined the role of Human Resources systems in the ICT sector in Ireland and concluded, inter alia, that 'despite the rhetoric of the knowledge economy…many of the jobs undertaken in the ICT sector do not conform to the distinctive features of knowledge work' (Monks *et al.* 2010, n.p.). Having studied four major ICT firms in Ireland they found mainly high-stress occupations in which employee's performance is closely

monitored by employer designed metrics, a low priority for innovation, very little room for creativity, repetitive work in which the 'principles of teamwork are leveraged to increase the pace of work rather than…to enhance the exchange of knowledge', and

> instances where the expensive investment by these Governments in graduate skills-sets in computing and IT are squandered as these graduates are forced into customer-facing roles, denied access to technical training and deterred from the risk-taking core to innovation by reward systems designed to promote idea reuse and cost-saving. (Monks *et al.* 2010, n.p.)

Their findings confirmed 'prior research that provides a rather gloomy picture of the working lives of graduates and those with technical skills who might once have been regarded as the epitome of knowledge workers'.

A business consultant put it in a nutshell when he said that young people's perception of IT is 'long hours, repetitive work, little recognition and no fun. It's hard to counter their perception, because, in many organizations, the reality of life in IT is long hours, repetitive work, little recognition and no fun' (Skaistis 2008, website). Or as a 2009 Ipsos MORI study found Irish students believe that ICT work is 'an environment for 'geeks and 'nerds', and it is a stressful, boring and an isolated work environment' (Murray 2009, *Irish Examiner*, 7 May). Surprisingly, the recommendation of this report was not to change working conditions but that 'the message needs to be conveyed by male and female 'heroes' to counteract the 'geeks' and 'nerds' stereotype'.

Young people have sisters, brothers, parents, uncles, aunts and cousins as well as friends. In many cases they can see clearly the kind of work being undertaken in the system and, at least while jobs are plentiful, are simply not attracted. During a recession, on the other hand, the prospect of unemployment changes their focus.

A letter to *The Irish Times*, presenting the same 'gloomy picture', in this case of the general engineering field, is worth quoting it in full (O'Duffy 2006, *The Irish Times*, 19 August, 15)

> Madam, - There has been much comment on the low numbers of students sitting Higher Level science and maths, and the poor results achieved. Business leaders warn of likely damage to the country's economy and claim that we need more qualified engineers and scientists. However, the explanation is right on their doorstep. These

> same business leaders offer minimal career growth to engineers and scientists. Most engineering jobs are basically dead-end jobs, where the best prospect for significant salary growth is to do an MBA and move away from technical work.
>
> Until recently, engineering was at least regarded as a stable career, but not any more. Technical jobs, especially in high-end work such as research and development, are often the first to be cut in leaner times and many large companies have a policy of outsourcing technical work to contractors in developing markets.
>
> So any student who is bright enough to be a successful engineer or scientist is probably also bright enough to realise that in today's environment this is not an attractive career choice. The starting salary may be good, but after 10 years an engineer may be earning up to three times less than comparable students who studied accountancy, medicine or business.
>
> For perspective, this has been a topic of debate in the US for some years now. There have been two recent articles in the Wall Street Journal from business leaders bemoaning the low level of interest among the brightest students in studying science and engineering.
>
> In each case, they were met with a barrage of replies from engineers saying that, in the current business climate, they could not in good faith recommend careers in science and engineering to anyone. If business leaders truly needed more engineers and scientists, then they needed to put their money where their mouths were, and offer better salaries, better careers and better job security.
>
> Exactly the same is true in Ireland. - Yours, etc,

This comment, which has the feel of an insider's view, is borne out by recent studies into career opportunities in the sector. There is a growing body of work that challenges the optimistic portrayal of the job opportunities offered within these new industries:

> The research indicates that many workers within ICT firms are not engaged in the innovation associated with knowledge work but rather are employed in the sales and marketing activities that have been associated more with the routines and restrictions of call centres. (Monks *et al.* 2010)

So, given that the work is not necessarily rewarding or exciting, is it at least plentiful? A study by Professor Emma Smith, presented at the 2011 BERA conference in London, examined the statistics regarding employment opportunities in the engineering sector in the UK. As in Ireland

> the UK government's proposals to develop the nation's scientific skills base largely lie in increasing the supply of young people into the STEM professions either through attracting well qualified people into teaching, increasing the science content of the National Curriculum in schools or reforming the curriculum so as to encourage able young people to remain in the 'science stream' and subsequently study the subject at university. (Smith and Gorard 2011, 173)

Yet the study found that less than half of the engineering graduates are in employment which directly relates to their degree six months after graduation, and a sizable proportion of graduates, it is reported, find work in what are termed 'non-graduate jobs' such as cashiers and waiters. Of those who found employment in fields related to their degree, 38% were in engineering itself and a further 8.4% in various Science and ICT related professions (Smith and Gorard 2011, 172).

The main agents involved in the discourse treat this as a problem of 'young people's perceptions of the industry'. For them it is, in essence, an image problem. Young people can be incentivised into committing their lives to an unattractive industry by bonus points and a determined effort to make engineers seem glamorous. The mathematics curriculum – in need of reform anyway – can be reformed in a way that will be business-friendly and this too will lead more students into engineering. These strategies are firmly embedded in the discourse and match the requirements. On the other hand, to suggest that the sector involves non-unionised multinationals with a reputation for driving their workers hard, herding them into call centres or in front of computers, and abandoning them in favour of cheaper labour in the Far East, is external to the discourse. It involves a critique of neoliberal capitalism itself. It is rarely mentioned in Ireland.

6.7 Conclusion

It is difficult to overestimate the overwhelming nature of the 'crisis' discourse. Anyone with an interest in education who reads the newspapers could hardly fail to absorb it in part or in whole.

After ten years of concerted opinion shaping, what is the state of public opinion on mathematics education in Ireland? The majority of members of the public have direct experience of the Irish education system and many of them will have children or friends in direct contact with mathematics teachers and the mathematics curriculum. It is unreasonable, therefore, to talk about an actual 'public opinion' as a unified discourse, as opposed to the narrative of 'public opinion' presented in the media. Certainly members of the public will have disparate experiences and opinions in relation to all the issues raised here. However, there is a sense also in which the historical/cultural 'bloc', as Antonio Gramsci termed it, is determined by the available common sense, and this common sense is determined by privileged experts and opinion-makers. It is therefore reasonable to assume that individual people within the state, coming to it through a variety of experiences and thought processes, share some or all of the views expressed in the media. In this sense, the 'public' may be said to have a 'public opinion' which relates to mathematics education in general without prejudice to whatever good or bad experiences they themselves or their friends and relations have had.

In this chapter we have seen the concerted shaping of this public educational discourse around certain 'truths'. Underpinning them all is the 'truth' that education is for the economy. In fact, the economic discourse has permeated most, if not all, aspects of education and culture and forms the bedrock of the Gramscian 'common sense' here. Economic forces are at work reshaping the Irish work force in line with Human Capital Theory, and it follows from this that the education system as we have known it in recent years does not work in the new context. Failure thus enters as a primary statement in the discourse. That mathematics is crucial to the development of scientific and technological development is another 'truth'. And within this 'truth' it is self-evident that present mathematics education is failing the economy because we are not producing scientists in sufficient numbers or a sufficient quality of engineering student according to the definitions inherent in the new economic discourse. Solutions to this failure must themselves obey the rules of the discourse. Therefore, a solution that suggests social disadvantage as a significant inhibitor will, at best, be relegated to secondary status. On the other hand, the business-friendly incentivisation solution has tremendous power.

We have seen this discourse undertaken by a variety of bodies throughout the thesis, and in this chapter we examined a case history of one particular agent, the IEI, as well as taking a glancing look at other actors in the field. We have seen that such agents, with greater or less

determination, tenacity and success, have come to dominate public opinion and have established the discourse of failure and the economic role of schooling as central to all education questions.

Finally we acknowledged that there are always multiple discourses, some privileged, some ignored or relegated. We briefly examined one such discourse and discovered that to acknowledge its validity is to question the nature of modern capitalism and its employment practices. Clearly, this discourse carries very little weight in Ireland. The right-wing or centre-right politics that prevail here are indeed 'closer to Boston than Berlin' (Harney 2000). Only since the collapse of 2008 has any attention been given to these alternative voices, and very little of that attention has come the way of the education debate.

One question remains. What effect has all this effort had on the development of Project Maths, and how is it reflected in the curriculum and the form of pedagogy advocated by the department? The next two chapters will attempt to answer this question.

Chapter 7

Everything in its Place

…mathematical learning is cumulative, with work at each level building on and deepening what students have learned at the previous level. (DES/NCCA 2010; 2011b; 2012)

7.1 Introduction

As already demonstrated, within the apparatus certain kinds of power are fetishised – political, corporate, entrepreneurial, technological and technical power. Expert groups tend to contain a mix of people representing these subgroups. While these elements are designated 'legitimate voices' and 'experts' in the discourse of policy-making, the corollary is that other agents are devalued. This legitimisation process is predicated upon a political assessment and the expert groups invoked by government rarely if ever adopt a critical stance. I argued (in 3.3, for example) that they are, in essence, called upon to validate existing government policy – policy-based evidence gathering as opposed to evidence-based policy-making.

In this chapter I will consider the place of one group whose expert status is acknowledged but strictly delimited – the Irish Mathematics Teachers Association (IMTA). I will argue that in the legitimating and de-legitimating process, as elsewhere, economic pressures, as defined by the business and industry experts of the groups discussed in Chapters 3 and 4, were given precedence over the educational experience of teachers in the roll out of Project Maths.

It is unusual for the educational establishment to reveal its philosophical position in plain language. Ireland, as John Coolahan remarked, is famously legislation-shy where education is concerned (Coolahan 2012, UCC Lecture). Typically the educational establishment reveals itself in passing, in circulars, letters, ministerial speeches, terms of reference and other such documents. In Chapter 5 we examined one such document – the NCCA's formal welcome of the PISA assessment. This chapter considers another – a letter from the Department of Education and Skills responding to an intervention by the Irish Mathematics Teachers

Association (IMTA). However before proceeding to these communications it is necessary to consider a brief outline of Project Maths itself.

7.2 IMTA

As I have already argued (see 3.2), the European Union and The Irish Government make extensive use of expert groups, regarding 'the collection of expert knowledge' as 'crucial to secure a sound knowledge base for better policies' (European Commission 2010, EC website). In the formation of its thinking on the mathematics problem, prior to the initiation of the NCCA *Review of Post Primary Mathematics,* we have seen that the Irish Government drew heavily on the expertise of groups such as the EGFSN, The Task Force on The Physical Sciences and Forfás. I have argued, following Donegan, that such groups established by governments are not in any sense objective, but rather they:

> make their judgements and prescriptions on the basis of conceptualisations of the space, subjects and objects with which they are concerned, which they take to be universally-accepted as 'reality' but which are in fact contingent, local, and specific. (Donegan 2006, 43)

Furthermore, the decision to defer to such a group presupposes a measure of agreement between the group's opinions and those of government. In other words, governments have a tendency to seek the advice of people who support pre-determined policies. In this sense, exclusions can be as significant as inclusions. In the policy process policy-players have disparate and often conflicting interests, we will observe such 'different and competing interests' (Rizvi and Lingard 2010, 15) when we read the IMTA submission to the DES (IMTA 2010) before the official roll out of Project Maths to all schools and the DES response (DES 2010a).

In chapter 2 I discussed Ball's view that the development of curriculum and curriculum reform is a product of compromises (see 2.2), a process of negotiation between the accepted approved contributors, where '[o]nly certain influences and agendas are recognised as legitimate, only certain voices are heard at any point in time' (Ball 2006, 45). The voice representing the Irish maths teachers was not recognised as legitimate at the point of mathematics policy development, the IMTA was not represented on the NCCA Mathematics Board of Studies, for example. Later, the voice was legitimated, within specific parameters, during the process of

syllabus development, refinement and implementation with its attendant methodologies. Nevertheless, a subtle differentiation meant that there remained contexts where the voice was excluded.

One such context involved the rationale behind the introduction of Project Maths at senior cycle. In part at least the controversy arose because the Project Maths programme emphasises the importance of the continuity of mathematics education from early childhood education onwards. The intention was to change all aspects of mathematics education at second level – 'its nature and content, the methods adopted in teaching and learning, how mathematics is assessed, and the attitudes and perceptions associated with mathematics inside and outside the education system' (NCCA 2008a, 5). A radical change in curriculum and pedagogy was envisaged, but this change would be incremental, having already taken place at primary level it should now begin its progress through secondary 'from the bottom up' (NCCA 2005b, 6).

Project Maths prioritised continuity in learning through all stages of schooling and beyond:

> The way in which mathematics learnt at different stages links together is very important to the overall development of understanding. The study of Leaving Certificate mathematics encourages learners to use the numeracy and problem solving skills developed in early childhood education, primary mathematics and Junior Certificate mathematics. (DES/NCCA 2008, 3; 2009, 6; 2010b, 3; 2010c, 7; 2011b, 7)

And emphasising this continuity from one level to the next, beginning at early childhood education:

> The emphasis is on building connected and integrated mathematical understanding. As learners progress through their education, mathematical skills, concepts and knowledge are developed when they work in more demanding contexts and develop more sophisticated approaches to problem solving. In this way mathematical learning is cumulative, with work at each level building on and deepening what students have learned at the previous level. (DES/NCCA 2009, 6; 2010b, 3; 2010c, 7; 2011b, 7)

Therefore, from its inception, Project Maths was designed as a programme of cumulative learning which was to move students seamlessly from the primary school mathematics curriculum, through the junior cycle and on to senior cycle, and the DES/NCCA adhered steadfastly to the principle in its published material. Furthermore, the Leaving Certificate

mathematics syllabus of 2008 introduces senior cycle education as 'learner-centred' (DES/NCCA 2008, 2) and thus in senior cycle mathematics education '[t]he learner is the main focus of the educational experience' (DES/NCCA 2008, 2). However a 'learner-centred' approach to 'building connected and integrated mathematical understanding' was not evident in the decision by the DES to introduce Project Maths to students at fifth year[12] at the time when the programme was introduced to the pilot schools in 2008 and rolled out to all schools in 2010, nor was it evident in their defence of the decision. In point of fact the effects of this decision could best be described as a *rupture* in the educational experience of students. The high ground of pedagogical and pastoral care was held by the objectors, and the DES, despite its professions of 'learner-centredness' and cumulative learning, was simply defending on the grounds of economic pressure.

From the beginning of the project there was some disquiet among members of the IMTA regarding the simultaneous introduction of the new programme at first and fifth year. Concerns about this issue were communicated to the NCCA and DES through feedback from the pilot schools and also through meetings with IMTA officials. The introduction of the junior cycle programme was widely welcomed and early reports from pilot schools suggested that the new course was popular with both teachers and students (IMTA 2010; Irish Mathematics Teachers' Association – Dublin Branch – IMTA 2009). However the introduction of the programme at fifth year was more problematic.

At an early stage in the project, teachers in pilot schools reported problems with the implementation of the senior cycle programme to their Regional Development Officers (RDO) and there was a belief among participants that the Project Maths Team accepted the validity of the problem and brought it to the attention of the NCCA. In March 2009, just seven months into the project, the only critical teachers' forum entry to feature publicly on the official Project Maths website appeared. It was from an exasperated teacher who posted his school's many frustrations with the project's implementation and he asked why 'the programme [did] not concentrate on first year students ?' (Kenna 2009, Project Maths website). This post was the only voice of dissent to appear on the site. The NCCA did not respond and the post was quickly

[12] The Leaving Certificate is a two year programme taking places in the 5th and 6th year of secondary schooling. Students are generally between 17 and 19 years old by the time they sit the terminal examination of their secondary schooling.

removed. This can only be read as a closing down of critical discussion. The forum was rapidly closed to participants from outside the pilot schools.

A letter from the Dublin Branch of the IMTA (Irish Mathematics Teachers' Association – Dublin Branch – IMTA 2009) welcomed the new programme at junior cycle but expressed considerable concern regarding its planned introduction at senior cycle. It detailed a number of issues which would disadvantage students commencing Project Maths at fifth year. For example, it considered Leaving Certificate mathematics as a build up of 'ideas, connections, skills and understanding over a five year period' as reflected in the Project Maths documentation and suggested that students entering this programme at fifth year would not have had the experience of the shift in techniques and approaches that is central to the new programme. Students entering fifth year would be ill-prepared for the changes and much time would be spent 'gap-filling' before the new course could be commenced, thus increasing the time taken to cover the course. It also addressed concerns in relation to the actual syllabus (Strand 1, statistics and probability). Hitherto the study of probability commenced at senior cycle and was not covered at junior cycle. Furthermore, only 2-3% of students attempted the optional statistics and probability unit in Leaving Certificate as 'students and teachers see it as very onerous (Irish Mathematics Teachers' Association – Dublin Branch – IMTA 2009) and the new Strand 1 module is described as taking the old Leaving Certificate option and adding to it. This issue, it was envisaged, would cause problems for both teachers and pupils. The abrupt introduction of the new programme at fifth year would condense a proposed five year development of knowledge, skill and expertise in this difficult area into two years. These and other issues were discussed in the letter and the main recommendation it made was that the introduction of Project Maths to senior cycle should be delayed so as to arise naturally as students progressed.

The concerns were discussed at a meeting in April 2010 between the IMTA and the DES. At that meeting the IMTA, on behalf of its members, submitted a policy statement on Project Maths which clearly outlined its official position. Although teaching organisations are typically characterised in the media and academic research as 'conservative', there is no evidence that the IMTA was resistant to curriculum change and much that suggests the association sought change and welcomed it. In its statement the IMTA outlined the association's official position on Project Maths and indicated the concerns of IMTA members:

> The Irish Mathematics Teachers Association fully supports the development of Mathematics Education in Ireland through Project Maths.
>
> The Association believes that, because the very nature of Project Maths involves a different approach and mindset from the cohort of students and teachers, the new syllabus should be introduced in first year only in September 2010, and its introduction to Senior cycle should be delayed until the students involved have completed the programme at Junior Cycle. (IMTA 2010)

Here the IMTA is merely adhering to the stated aims of Project Maths itself where 'as learners progress through their education, mathematical skills, concepts and knowledge are developed' (see 7.2 above). Steady and continuous progress would not be the experience of students for whom the new strands were introduced at fifth year. The problem-solving approach to mathematics would require a *mathematical attitude* among students which belongs to the Realistic Maths Education (RME) philosophy while the students at senior cycle had been trained according to the Bouraki modern maths philosophy. The philosophies are mutually incompatible, and, in fact, Hans Freudenthal developed RME *in opposition* to the Bourakian system then sweeping the mathematics education world. Freudenthal considered that '14 years is much too late to shape a mathematical attitude' (Freudenthal 1991, 122) and maintained that the mathematical attitude, which he described as the mastery of big strategies, should be developed at an early age and thus form the initial condition for developing attitudes at higher ages. Had the project been introduced to first year and allowed to move through the entire secondary system the students would have experienced the subject as a 'connected and integrated mathematical understanding' (see 7.2 above), a continuum from junior infants through primary school and on to second level, and therefore stood a better chance of developing Freudenthal's mastery of big strategies.

The IMTA was also concerned that 'problems, adjustments and clarifications' would be required to the project and that these should be dealt with before the introduction of the programme to the highly sensitive final years programme. At this point in time, five months before national roll out of the programme, the syllabus and its assessment was still in a state of flux and the first Leaving Certificate examination of the pilot group had not yet taken place.

> The Association strongly believes that this policy [introduction in first year only] is the most educationally sound way to rollout Project Maths and will work to this end in the coming months. (IMTA 2010)

That the voices of teachers were not legitimate in this instance, and that they belonged to the area of policy implementation rather than that of policy production (Rizvi and Lingard 2010, 15) is clearly seen in the Department of Education and Science response to the April meeting with IMTA officials and to the policy statement.

7.3 DES Response

The letter from the DES is an important one, representing the most complete available formulation of the Department's rationale for introducing Project Maths – the syllabi themselves provide a more guarded construction, but the powerful agents behind the reform come into focus in the letter. It is tempting to suggest that the DES here lets down its guard and commits itself precisely because it does not consider its interlocutors to be important. It may be examined in three sections. In the first section the letter sets out the rationale for the development of a new curriculum. As will be seen, this rationale has its genetic code in industry. The second section advances the 'reasons' for the simultaneous introduction of the programme at both junior and senior levels. This is a direct response to the IMTA's objection. The letter suggests that industry is, once again, a significant driver of this strategy. The third section places the teacher firmly in the area of policy implementation, decisively excluding the IMTA and its members from policy production, while simultaneously inviting them to provide feedback to inform the review and evaluation of the pilot phase.

The letter is as remarkable for its summary of the economic rationale which led to Project Maths as it is for its complete disregard for the teachers opinion of what is best for the student (the 'learner') who is supposedly 'the main focus of the educational experience' (DES/NCCA 2008, 2). The language of the industry-education partnership, *The Project Maths Implementation Support Group*, established to oversee the implementation of Project Maths is very much in evidence here. The letter came from the Principal Officer at the Qualifications Curriculum and Assessment Policy Unit of the Department of Education and Science, Ms Kelly, the Principle Officer, was also a member of the industry-education partnership. There is a remarkable

concurrence between the language of the letter and the report of the industry-education partnership's Implementation Support Group – to the extent that whole phrases and one whole paragraph are virtually identical. In the following quotation the words in square brackets represent the variation:

> A high level of mathematical achievement is vital for Ireland's future competitiveness in the knowledge economy. Mathematics [letter: Maths] is an essential skill for disciplines such as science, technology, engineering and finance, but it also promotes the ability to think rationally, analyse and solve problems, and process data effectively [letter: clearly and accurately]. Proficiency in mathematics is a strong asset in any employment. (DES 2010a, 1; 2010b, 30)

Given this concurrence we may safely assume that the letter to the IMTA explaining the department's rationale for implementing Project Maths at both first and fifth year represents the views of the industry-education support group. Put another way, the Department of Education appears at best to concur with industry in the matter and at worst to be acting merely as a channel for the industry-education group.

In its own right, the letter could serve as a summary of one track of my thesis – that curriculum development in mathematics education in Ireland has been driven by economic forces. We see in the response what Apple called the 'seemingly commonsense assumptions' (Apple 2004, 12) that form the foundations of many curricular innovations. The decision is upheld, according to the DES, '*[i]n view of the circumstances and the need for urgent reform in mathematics*' (DES 2010a, 3). (Note: For the purposes of this chapter, I am placing quotations from the letter in italics in order to distinguish them clearly.) When we interrogate these circumstances and the need for urgent reform we see confirmation of pressure from 'legitimate' voices of the discourse – with all of whom we are already well-acquainted in this thesis: from advocates of the Smart and Knowledge economies, from OECD/PISA, from higher education personnel, from the Expert Group on Future Skills Needs, the National Competitiveness Council, the Innovation Task Force, Engineers Ireland, and from employers and the employers' organisation IBEC – all cited in the letter. We become aware of the attention paid by the DES to the demand for near instant results and how this resulted in the sidelining of what the IMTA proposed as the best interests of the student. The voices of students, teachers, schools and parents are conspicuous by their absence in the department's understanding of why there is a '*need for urgent reform*'.

In passing it is worth noting that the word 'urgent' appears five times in the three page document – suggesting that the department implicitly accepts the 'crisis' discourse. If we track the word throughout the letter we can construct the following narrative: according to the EGFSN, IEI, and the Innovation Task Force, urgent action is needed to improve attainment and increase numbers; students are urgently required in the labour market; the urgency has been impressed on us by the EGFSN, the National Competitiveness Council, and The Innovation Task Force; the DES has accepted this urgency and that is why 'the planned model of implementation…should proceed simultaneously' (DES 2010a).

In explaining why the model of implementation was adopted, the author[s] state that *'[f]or a considerable time there have been concerns regarding the low participation of students in Higher Level maths in the Leaving Certificate'* (DES 2010a) and that reports from EGFSN, Engineers Ireland and the Innovation Task Force '*all stressed the importance of urgent action to improve attainment levels in mathematics and to increase the proportion of students sitting Higher Level mathematics*' (DES 2010a). I have argued in my thesis that these concerns were economic in nature rather than student centred, and that they emanate from the perceived prerequisites of the developing Knowledge Economy and the perceived needs of Engineers Ireland (among others) who played a prominent role in their construction. While interrogating the engineers' 'numbers problem' (6.4 and again in 3.5) I analysed the role of Engineers Ireland in problematising the uptake of Higher Level maths at Leaving Certificate. Their action, together with the Forfás/ICSTI aspiration to develop 'a national science and technology infrastructure' (Forfás/ICSTI 1999a, 9) contributed to a refocusing of the purpose of maths education and a powerful shift in educational policy discourse. The engineers argued that Ireland's future economic growth and competitiveness depended on an adequate supply of students skilled in the field of mathematics that could support the high-value knowledge-based industries of the proposed Knowledge Society/Economy and later the Smart Economy (Carbery 2010; DES 2010b, 8; EGFSN 2003, iv; McCall 2001; Purcell 2001). While Forfás/ICSTI argued that the development of 'effective, modern and meaningful STM provision in schools' was essential for the country to develop 'a world-class capability to innovate' (Forfás/ICSTI 1999a, 9). Such a transformation of education policies and practices is inherently political. It is affected by many interested parties; in particular, in this case the IEI and the ICSTI, whose early attempts to influence the definition

and social purposes of education (Bowe et al. 1992) triggered the creation and construction of the initial discourses. (see 2.2)

The economic discourse is clearly visible in the explanations given by the DES for its decision to implement their chosen model of reform. In language redolent of the documents we have examined in previous chapters emanating from industry and business sources, the letter to the IMTA, asserts that the production of human capital to meet the '*ever rising skill levels in the move to higher value jobs in the Smart Economy*' (DES 2010a) is a priority. Increasing the number of students taking Higher Level maths at Leaving Certificate is seen as '*vital for Ireland's future competitiveness in the knowledge economy*' (DES 2010a) but these students need to have a '*high level of mathematical achievement*' (DES 2010a). The belief that '*[m]aths is an essential skill for disciplines such as science, technology, engineering and finance*' (DES 2010a) and an acceptance, based on the OECD/PISA assessment, that the present mathematics syllabus was failing to provide the necessary skills put pressure on policy makers to affect change and to implement Project Maths '*at optimum speed as planned*' (DES 2010b, 16). The coincidence of this discourse with that of industry and business commentaries is remarkable.

One of the key issues in the 1999 ICSTI/Forfás Benchmarking report was that 'the pace of and procedures for consultation should not prevent timely policy decisions and implementation' (Forfás/ICSTI 1999a, 3). I believe that this stricture, a tacit delegitimation of consultation with teachers, is reflected in the determination shown by the DES not to alter its Project Maths implementation timetable and in the haste with which the programme was rolled out to all schools allowing little or no time for the pilot phase to be fully assessed. The DES claimed that '*the model of development sought to balance the need for urgent reform with the need to ensure that changes would be made in a manner commensurate with the system's capacity to cope with change*' (DES 2010a). It does not discuss its measurement of such capacity.

The second section of the letter presents the reasons for the simultaneous introduction of the programme at both junior and senior levels. It does not engage with the IMTA's arguments regarding 'the most educationally sound way to rollout Project Maths' which would allow '[a]ll problems, adjustments and clarifications in relation to the Senior Cycle syllabus' (IMTA 2010) to be dealt with before it is introduced in fifth year. What it does is to attempt to justify the decision on the basis of advice from its partners in industry whose expertise in education research is not in evidence, and also on grounds of consistency within the system. Introducing

Project Maths at fifth year would satisfy '*the urgent need for reform which would impact quickly on the outflow of students into higher education and ultimately the labour market*' *(DES 2010a).* It also defended its decision on the basis of the welcome it had received from '*the Expert Group on Future Skills Needs, the National Competitiveness Council, and the Innovation Task Force*' (DES 2010a) all of whom had advised that '*urgent reform in Mathematics is essential to support a competitive economy in the knowledge society*' (DES 2010a). The NCCA decision-making structures – representing both industry and education – had also approved the decision. The disciplinary deployment of these groups as simple authorities with which to overrule the IMTA's objections effectively consigns that organisation to a relatively subordinate position in the discourse.

It is necessary to understand that, at this time, the syllabus was still in a state of flux. What was clear was that Project Maths would remain a terminal-exam-orientated programme with the Junior Certificate examination at the end of junior cycle and the 'high stakes' Leaving Certificate as the terminal exam of senior cycle. However, the syllabus for Strands 1 and 2 had not yet been finalised for the national rollout. Neither had these strands been tested at Leaving Certificate. The trialling of strands 3 and 4 had just begun and Strand 5 was still in its initial construction phase. Strand 5 would not be introduced to the pilot schools until September 2010 at the same time as the national rollout of Strands 1 and 2. So it was still possible to make changes.

'*The key aim of the new approaches is to enhance student's* (sic) *understanding*' (DES 2010a), the letter argues, and it is therefore necessary to provide this enhanced method of teaching at both junior and senior levels. The argument here seems to be one of fairness: one cannot in fairness deprive the seniors of this opportunity to learn in the new methodology. However, it disregards the very real problems faced by students and teachers in relation to the vast amount of background learning in Strand 1 (Probability) – three or four years of classes – that is taken as read for Project Maths at senior cycle. It also ignores the problems associated with combining a newly-encountered 'mathematical attitude' (we recall Freudenthal's remark that '14 years is much too late…' (Freudenthal 1991, 122)') with the quite different approach that students have hitherto known during their secondary schooling. It is important to remember that those fifth year students who are given the '*opportunity to engage in the new approaches*', must also continue to engage in the old approaches. Problem solving and discursive questions will be in for Paper 2 and out for Paper 1 etc. The methodologies, style and marking systems of the two methods are

mutually exclusive. As a teacher in the field at the time I can attest to the confusion and hostility that the interface between these two quite different systems provoked, as students with three or four years of standard curriculum learning and practice not only changed gears but changed vehicles for part (only part) of their mathematics learning. This confusion and hostility is more likely to disadvantage them rather than help them, and is unlikely to leave them with a positive attitude to mathematics. This is the central argument made by the IMTA and is not addressed in the letter.

Finally, this section of the letter argues for the creation of in-school teams, led by the more 'expert' teachers, the purpose of which is to change teaching practice throughout the school. This is a standard neoliberal industrial practice couched in the language of 'leadership' and 'expertise': '*[T]he more highly qualified and "expert" teachers in the school, who are generally deployed to teach the senior classes, should be in a position to lead change within the school*' (DES 2010a). This argument tacitly acknowledges the problem of under-qualified maths teachers, especially at junior level, which should have been addressed when the problem was first raised in the late nineties. The department's solution, is a kind of apprenticeship system where in-school teams of good practice take the place of a proper centrally-funded advanced education for teachers who have inadequate knowledge of the mathematics they are about to teach or the new methodology. In this context, it effectively outsources part of teacher training to schools and the 'more expert' teachers, though no argument is advanced to suggest that these teachers, whose careers will have taken place entirely within the 'new maths' ethos, will be more flexible, more open or more expert in the new methodologies. Furthermore, it seems to be balanced against the needs of the student as advanced in the previous argument. In this case, the development of school teams of good practice and the danger of '*dilution of the project*' (DES 2010a) outweigh the objections that the simultaneous introduction will make life harder, not easier or better, for senior students.

The final section of the letter clearly limits the function of the teacher to the implementation of the policy. Having placed the IMTA in opposition to the EGFSN, IEI and the Task Force on Future Skills Needs, having dismissed the IMTA's concerns without properly engaging with them, the letter then proceeds, without a trace of irony, to ask for the IMTA's '*view on the extent to which (a) teachers and (b) students are adequately prepared for the new content and methodologies at senior cycle without having undertaken them at junior cycle*' (DES 2010a). Which brings the wheel

full circle. The IMTA might well have resubmitted their statement at this point and reminded the DES of their belief that:

> because the very nature of Project Maths involves a different approach and mindset from the cohort of students and teachers, the new syllabus should be introduced in first year only in September 2010, and its introduction to Senior cycle should be delayed until the students involved have completed the programme at Junior Cycle. (IMTA 2010)

Notable in this letter is the fact that the DES counterbalances the approval of organisations such as Engineers Ireland, EGFSN and Forfás as part of their argument for introducing Project Maths simultaneously at both levels against that of the professional opinion of mathematics teachers.

The DES letter accepts the judgement of OECD/PISA as an indicator of the preparedness of the Irish student population to serve the needs of the economy. It regards as true '*that being "average" at Mathematics in OECD PISA studies will not enable Ireland to keep pace with changing needs*' (DES 2010a, 1). Those needs include the '*ever rising skill levels in the move to higher value jobs in the Smart Economy*' (DES 2010a, 1). The OECD is thus an extra-national source of policy pressure. The DES position can be summarised as the belief that in order to be confident that we have human capital with the skills necessary for the development of a Smart Economy we must be above average at PISA mathematics. In this case PISA mathematics will not only be the assessor of the mid-cycle second level mathematics skills deemed necessary to achieve future economic success, but, as discussed in Chapter 6, it both determines and measures those skills. This is Foucault's examination as a disciplinary mechanism *par excellence*.

The introduction of PISA is risible in the context of a discussion about introducing Project Maths at fifth year since the students concerned will have already passed the age limit for the assessment. Why should concerns about being 'average' in the OECD/PISA assessment be of interest here unless the revised syllabus at that level is in some way connected to OECD/PISA? When we consider that PISA is an assessment of 15-year-olds at the end of compulsory schooling (OECD 1999a, 8) it becomes clear that introducing the new syllabus at senior cycle will not significantly improve the country's placement at the next PISA assessment. However PISA was constructed as a change support instrument which would provide 'a new basis for policy dialogue' (OECD 1999b, 3) and by supporting 'a shift in policy focus from the inputs used in education systems and institutions to learning outcomes' (OECD 1999b, 3) the OECD

believes that PISA assists countries to 'bring about improvements in schooling and better preparation for young people as they enter…adult life' (OECD 1999b, 4). Hence, in Ireland, the PISA assessment can be viewed both as an evaluation of the outputs of compulsory schooling and as a mid-cycle indicator. It passes judgement on how well the education system is equipping its students with 'the set of skills and competencies which are suited to the knowledge economies' (OECD 2009a, 5) and for the 'ever rising skill levels in the move to higher value jobs in the Smart Economy' (DES 2010a, 1). Thus, by providing 'insights into curriculum strengths and weaknesses' (OECD 1999b, 3), the assessment will also provide 'direction for schools' instructional efforts' (OECD 1999b, 3) which can subsequently be addressed at senior cycle. I contend that OECD/PISA exercises power over the construction and enactment of mathematics education policy at all levels of secondary education in Ireland to the extent of substantially determining the outcomes, the skills and the competencies.

7.4 Conclusion

The DES response involved a manipulation of relations of forces within the apparatus intended to define the IMTA's position relative to that of others. That position is one of implementation and practice rather than policy-making. In the process the letter revealed significant elements of the department's thinking in a way that is not available through more conventional published sources such as the department's website or its circulars. In particular, the reference to OECD/PISA is particularly revealing, and that reference will be interrogated further in the next chapter.

In this chapter I have attempted to unpack some of the segments of discourse at work in the enactment of Project Maths, and in the process to elucidate the relative policy function of expert groups, the tendency to accept certain groups as legitimate, the dominant educational role accorded to economic forces and the concomitant value placed on economic rather than educational advice – themes that have already surfaced in various forms throughout my thesis.

In the next chapter we examine the extent to which PISA has leaned on the Project Maths concept.

Chapter 8

PISA in Project Maths

Target setting can have unexpected consequences. These may include teaching to the test, at a potential risk of limiting both breath and depth of learning. (Le Métais 2003, 76)

8.1 Introduction

If, as I argue, success at PISA is a fundamental objective of Project Maths, it should be possible to find the genetic imprint of OECD/PISA in the documentation. This chapter sets out to trace that genetic imprint. In doing so it will bring into focus the work of the Educational Research Centre and related academics, it will examine the Project Maths syllabus using the PISA framework as a lens, and finally it will consider some recent critical work which, I will argue, serves to support many of my findings. I have argued in Chapter 5 that the NCCA and the DES were profoundly oriented towards the PISA objectives and in chapter 7 we saw that in its letter to the IMTA the DES accepted, without question, the judgment of OECD/PISA. This chapter traces the imprint of OECD/PISA on the new curriculum and demonstrates how Project Maths is directed in a highly significant way towards PISA. We will begin by turning our attention to the development of the Project Maths syllabus in order to trace the extent to which it has absorbed the PISA model.

8.2 The PISA-Ward Journey

As we have already seen OECD/PISA claims to measure mathematical literacy and not the content of school curricula (OECD 2002, 82), taking, in the process, an instrumental view of mathematics (Close 2006, 54) as opposed to the subject-centred approach which has traditionally dominated school mathematics. However, Eivers (see 8.5 below) disputes the curricular content claim arguing that the OECD/PISA assessment is implicitly informed by the curricula of some participating countries and thus 'PISA reflects the curricula (and 'world view') of some countries better than others' (Eivers 2010, 98). Close cites debate among

mathematics educators and measurement specialists during the development of PISA on this issue. The argument was that although in some countries mathematics curriculum was close to the PISA framework in terms of mathematics taught, (Netherlands and Australia were mentioned) it was felt that in many countries outdated mathematics curricula needed to be revised and so problem solving tasks in unfamiliar situations which would be outside the experience of school curricula could be included in the assessment (Close 2006, 55). This strategy, in effect, subjects the 15-year-old student population of some countries to the experience of failure in order to construct evidence of the need for policy reform. It is in this way that the OECD constructs the discourse, creates the problem and thus provides a space for its solution. In particular, for countries whose curricula are not already PISA-friendly, PISA is a provider of policy-based evidence, thus fulfilling the aspiration that results are expected to yield information relevant to policy makers which will influence practice (OECD 1999a, 38). We mentioned in chapter 5 that PISA mathematical literacy is considered to be closer in spirit to the practices of elementary and lower-secondary education in the Nordic countries (Stedøy 2004, 96) than it is to Irish school mathematics. In the same chapter we saw how many countries have adopted PISA as a catalyst for educational change. However, we did not analyse specific local circumstances, (political, economic, social factors) which may have animated a state's desire for change. In Ireland's case the spectre of PISA has loomed large in the field of mathematics education since its inception in the late 1990s. Among legitimate voices in the discourse, as we have seen, it has been treated variously as an evaluation of the system, as a catalyst for discussion, as an instrument of change, as a reason for change and as a curriculum model. It has been invoked in arguments which advocated a PISA-shift in educational policy, a shift which reflects 'a neoliberally oriented understanding of the relation between the state, market and education' (Uljens 2007, 1). However, there was no publicly available, official, critical evaluation of OECD/PISA undertaken in Ireland before the nationwide roll-out of Project Maths; there was no evaluation of the values that underlie the program, and more importantly, in the light of Project Maths and its adoption of the real life problem solving method, there was no critical debate or analysis of the real life or 'authentic' (OECD 2002, 16) problem solving approach to teaching and learning promoted by OECD/PISA.

In the field of academic writing a body of work has been produced – for the most part – by researchers at the Educational Research Centre, Seán Close of the Education Department, St

Patrick's College, Dublin and (later) a researcher with the Education Research Centre and Elizabeth Oldham of the School of Mathematics, Trinity College Dublin[13]. These authors have written both individually and collectively on OECD/PISA mathematics and in particular they have carried out detailed analyses which compares and contrasts the PISA framework and the Junior Certificate curriculum from a number of perspectives (Close 2006; Close and Oldham 2005; Cosgrove *et al.* 2005; Cosgrove *et al.* 2004b; Oldham 2002; 2003; 2006a; Shiel *et al.* 2007). Close has also written as an insider from his perspective as a member of the Expert Group for Mathematics (Close 2006) and Oldham from her position as Ireland's representative on the PISA Mathematics Forum (Oldham 2002). The work of all of these agents has been influential in the process of remodelling mathematics education in Ireland. Of even greater significance for Project Maths than their ERC work (in the case of Oldham and Close) may be their influence at committee level in the NCCA at both Primary and Secondary levels, but this material is not publicly available and therefore outside the remit of this thesis. Elizabeth Oldham, was a member of the PISA Forum and the PISA Implementation Group, and former NCCA Education Officer, and as already mentioned has published extensively on PISA. It would be fair to say that she is a forceful advocate of international assessment, problem-solving and curriculum reform based on OECD/PISA values. As an indicator of the extent of her influence, phrases from her early papers and many of her key ideas are to be found in documents like the *Review of Post Primary Mathematics*. Notably, she is not critical of external assessment and has not publicly questioned the underlying values; as such she may be assumed to be in agreement with those purposes and in step with the various official organisations to which she belongs – although in a rare moment, in a 2002 article written from the perspective of Ireland's representative on the PISA Forum she observes that the PISA tests are not 'value free' and 'hence the choice of content and skills assessed in PISA is open to critique' (Oldham 2002, 45). However, she has not, as yet, published such a critique. Therefore, as an influential lecturer in mathematics education, as a committee person, as someone who published regularly on mathematics education, her role as an insider intellectual in the propagation of the

[13] It is important to recall here that in Ireland the OECD/PISA assessment is implemented jointly by the Educational Research Centre and the Department of Education and Science. Seán Close was a member of the Mathematics Expert Group involved in developing the PISA assessment framework and tests for mathematics which commenced in 1998 and served with this group for the PISA 2000 and PISA 2003 assessments and is currently a researcher with the ERC; and Elizabeth Oldham has served as a member of PISA Mathematics Forum and is a longstanding member of the National Advisory Committee for PISA, was education officer with the NCCA and was involved in the production of the *Review of Mathematics in Post-Primary Education*.

educational common sense, cannot be underestimated. Seán Close, with whom she often collaborated, was Ireland's representative on the PISA Mathematics Expert Group, as previously mentioned and served as an NCCA education officer, on the curriculum committee for mathematics, during the revision of the Primary School curriculum (Government of Ireland 1999, 125) – Oldham was also a committee member here. Close has also published informatively and uncritically on PISA.

What is striking about the contributions of the institutions, such as the ERC, and academics is the extent to which they are both critics of the existing system and insiders of the system. Their analysis of OECD/PISA, therefore, tends towards detail and comparisons rather than fundamental criticisms of the idea of international assessment itself. Remarkably it is not until 2010, (subsequent to Ireland's shocking performance in PISA 2009), when Eemer Eivers publishes her critique of the method of analysis of PISA that we can see an ERC academic become properly critical. It is tempting to report the apocryphal story about Albert Einstein's first words. When his parents asked him why he had not spoken until then he replied: *Bisher war Alles in Ordnung* (Until now everything was in order)!

This charge may well be levelled at other academics in the field of mathematics education: they have failed to provide a critique of the PISA mechanism and its values. We have already noted this tendency in *International Trends in Post-Primary Mathematics Education*, for example (see 4.6). The National Centre for Excellence in Mathematics and Science Teaching and Learning (NCE-MSTL) in the University of Limerick concentrates on pedagogy and educating the educators. It does not provide a critical perspective. However, the influence of ERC is unparalleled among the other institutions.

The ERC, on behalf of the Irish State, acts for PISA in Ireland; it fine-tunes the PISA assessment, runs the assessment, grades it, provides commentary on it and is commissioned to prepare all the reports on the assessment. Following each PISA assessment the ERC prepares and publishes a series of reports which provide statistical data and comment on the performance of Irish students. It is not surprising therefore, that while everything was in order and Irish students were placed at the OECD/PISA average (Cosgrove *et al.* 2004b, 48; Eivers *et al.* 2008, 60; Shiel *et al.* 2001b, 44) the ERC, as sub-contractor of the state, was never critical of the PISA process or its underlying assumptions.

In 2001, in its first PISA report, the ERC attributed the average performance of Irish students in mathematics[14] in part to the 'substantial differences between what students at Junior Cycle are taught and what PISA mathematics assesses' (Shiel *et al.* 2001b, 158) and proposed, for further consideration, the question of whether the Junior Cycle should be assessing mathematical skills that are similar to the PISA mathematics assessment. Whether this was merely a rhetorical question, or whether the subject was ever debated or discussed is not clear but by the time PISA 2003 was administered the cohort of participating students had progressed through the 'new' Junior Certificate syllabus. In chapter 4 we discussed the apparent PISA bias in this syllabus. And, unsurprisingly, in the second report of the ERC (based on PISA 2003 where mathematical literacy was the main focus) we find a detailed analysis of the 'new' Junior Certificate syllabus in which comparisons are again made between curriculum coverage and the performance, and between the PISA framework and assessment and the Junior Certificate syllabus and examination. The report, for example, deliberates on one of the aims of the new syllabus which it claims 'may be interpreted to be consistent, to some extent, with the PISA 2003 definition of mathematics (Cosgrove *et al.* 2004b, 162), which emphasises, it says, mathematical understanding and its application in real-world contexts. It also observes that a number of the objectives of the syllabus could be compared 'in a general way' with the PISA mathematics framework, a comparison which depicts the new Junior Certificate mathematics syllabuses as being 'somewhat similar to the PISA approach to mathematics' (Cosgrove *et al.* 2004b, 163). Another move in the PISA direction observed in the report concerns the teaching methodologies introduced through the in-service programme. Referring here to Oldham, we are told that the new methodology was an attempt to 'move away from mechanistic approaches towards teaching for understanding, a change that is consonant with the philosophy underlying PISA mathematics' (Cosgrove *et al.* 2004b, 164). In spite of all this there was no improvement in the PISA mathematical literacy score attained by the 2003 cohort a factor which the ERC attributed, in part, to the fact that these students had not experienced the new mathematics component of the revised Primary curriculum (the maths component was introduced in 2002) and also to the perception that the impact of change on student achievements is a slow process (Cosgrove *et al.* 2004b, 164-65). However, in PISA 2006 there was again no improvement in the score attained by the Irish cohort of students and while acknowledging the apparent lack of

[14] Students in this cohort had studied the 'older' pre-2000 mathematics syllabus.

effect of the revised syllabus in the PISA scores a new aspiration was expressed by the ERC team – 'that new developments, such as Project Maths, may be diverse enough in content and focus to raise the achievement of high performers in mathematics as well as catering to the needs of students at other performance levels' (Eivers *et al.* 2008, 138) – thus Project Maths became, for the ERC team, the apparent route to future success at PISA.

Let us now look at why the ERC may have put their faith in Project Maths.

PISA's Expert Group for Mathematics developed the definition of 'mathematical literacy' in PISA as:

> Mathematical literacy is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded mathematical judgements and to engage in mathematics, in ways that meet the needs of that individual's current and future life as a constructive, concerned and reflective citizen. (OECD 1999a, 41)

This definition focuses on the individual and her involvement with mathematics and how her engagement with mathematics is perceived to permeate all aspects of her life. We are told that aspects of the definition have specific meaning in the PISA context and that the term 'literacy' indicates 'the ability to put mathematical knowledge and skill to functional use rather than just to master it within a school curriculum…[and]…the ability to pose and solve mathematical problems in a variety of contexts' (OECD 2002, 82). According to de Lange the definition addresses the goal of preparing students for society and for future schooling and work (de Lange 2006, 21). I contend that the Project Maths programme adopts the PISA concept of mathematical literacy in all but name, aiming to introduce to the school curriculum mathematical knowledge and skill in a more applied format:

> Project Maths is designed to ensure that current and future students of mathematics at post-primary level will have the opportunity to engage in their studies in a manner which will enhance their understanding of the subject, provide contexts and applications of mathematics that are meaningful and relevant, and enable them to develop problem-solving skills and strategies that will serve them not only in their future study of mathematics but also in their daily lives. (NCCA 2008a, 5)

The aspirations of Project Maths do not reflect the ideal of former syllabi ('the queen and the servant of the sciences' in Carl Friedrich Gauss' phrase quoted in the old syllabus). But rather in

the new programme 'mathematics is seen as the key to job opportunity. No longer simply the language of science, mathematics contributes in direct and fundamental ways to business…For nations it provides knowledge to compete in a technological community' (DES/NCCA 2010, 6; 2011b, 6). Project Maths emphasises its usefulness, the role it is seen to play in 'the development of the knowledge society and the culture of enterprise and innovation associated with it' (DES/NCCA 2010c, 6; 2011a; b, 6). De Lange identifies PISA's emphasis on the element of 'functionality' in mathematics and, in discussing countries who take the outcomes of PISA seriously, he claims that 'they embrace the idea that the output of an educational process should include a certain amount of 'functionality', but it is up to the countries to decide how important this aspect is' (de Lange 2006, n.p.). In literature surrounding the development of Project Maths, it is argued, that much of what students learn in the new Project Maths programme will be about putting mathematical knowledge and skill to functional use rather than the application of procedures in 'a purely mathematical and abstract context' (Cosgrove *et al.* 2005, 210). At all levels it is envisaged that mathematics will be taught 'in contexts that allow learners to see connections within mathematics, between mathematics and other subjects, and between mathematics and its applications to real life' (DES/NCCA 2010, 6; 2011b, 6) and thus mathematics teaching and learning is being directed away from the 'modern' maths method which was 'a formal and abstraction-focused approach' (Conway and Sloane 2005, 23) towards the more instrumental approach to the subject.

There are many other features of the Project Maths programme that reflect characteristics of the PISA framework for mathematics while at the same time many of the traditional (non-PISA) components of Irish mathematics curricula, particularly in the area of content, have been maintained and in some cases enhanced. A PISA-like 'authentic' problem solving approach to teaching and learning has been adopted and there has been a shift in policy focus from educational inputs to learning outcomes, which according to OECD/PISA 'can assist countries in seeking to bring about improvements in schooling and better preparation for young people as they enter an adult life of rapid change and deepening global interdependence' (OECD 2002, 3). The State Examinations Commission (SEC) tells us that 'even with respect to subject content that is similar to before, Project Maths involves a significant shift in emphasis regarding the skill set being developed' (SEC 2010, 107). The provenance of this skill set is PISA via the OECD DeSeCo (Defining and Selecting Key Competencies) initiative (NCCA 2009, 20)

therefore, let us now consider the OECD/PISA concept of mathematical literacy and its associated skill sets and compare it with the learning outcomes and skills being developed and assessed by Project Maths. The framework for this analysis will mirror that used by OECD/PISA in its own analysis of mathematical literacy and its assessment.

8.3 Three dimensions of mathematical literacy

In order to transform the definition of mathematical literacy into an assessment, the PISA mathematics Expert Group identified three broad dimensions which they called *processes, content* and *context*. (OECD 2002, 82).

Processes: This dimension deals with the skills needed for mathematics and such skills are divided by PISA into three 'competency clusters', *reproduction, connections* and *reflection*. *Reproduction* concerns simple computations or definitions; *connections* involves bringing together mathematical ideas and procedures to solve problems in familiar contexts and; *reflection* comprises of mathematical thinking, generalisation and insight, and requires students to engage in analysis, to identify the mathematical elements in a situation, and to pose their own problems (OECD 2002, 82). Some but not all of these competency clusters were to be found in the old Leaving Certificate (1992) and the Junior Certificate (2000) programmes and in the state examination questions. However, as will be seen, all three have been introduced with the Project Maths curriculum.

In the early 2000s such was the interest in PISA mathematics that a PISA/Junior Certificate mapping exercise was carried out by Close and Oldham. The findings of this research identified mismatches between skills examined by the Junior Certificate examination and those of the PISA assessment. The research arose out of the mathematical performance in PISA 2003 of Irish 15-year-olds, where mathematics was the major domain, which was considered to be 'of some concern' (Close and Oldham 2005, 185). The mean score of Irish 15-year-olds in mathematical literacy in both the 2000 and 2003 PISA assessments was not significantly different from the OECD mean (Cosgrove *et al.* 2004b, 7; Shiel *et al.* 2001a, 7) and this had occasioned discussion about the contrast between the type of questions in PISA and those of the Irish Junior Certificate (Close and Oldham 2005, 185). The authors, Close, drawing on his experiences as a member of the Mathematics Expert Group for PISA, (Close and Oldham 2005, 186), and

Oldham, drawing on her experience as former Education Officer with the NCCA and a member of the PISA Mathematics Forum (Close and Oldham 2005, 186), presented an analysis of their mapping exercise at the First National Conference of Research in Mathematics Education. Questions from the Junior Certificate paper of 2003 were mapped onto the PISA mathematics framework. The results were compared and contrasted. It was intended that the research would 'promote discussion and reflection on the Irish curriculum' (Close and Oldham 2005, 186) in the period leading up to the review of post-primary mathematics. The analysis identified many 'mismatches' between the PISA framework and assessment and the Junior Certificate. In particular the Junior Certificate examinations contained no items on *reflection*, very few on *connections* and over 90% on *reproduction* (Close and Oldham 2005, 198). Thus the process of mathematicisation, mathematical thinking, generalisation and insight involved in the *reflection* competency cluster was absent from the examination and the making of connections between the different strands and domains in mathematics and the integration of information while solving simple problems as required in the *connections* cluster was poorly represented.

The 'mismatches' identified by Close and Oldham were addressed in the development of Project Maths, and all the 'competency clusters' are now represented in the new syllabi and in the assessment. The format of the syllabi has moved away from the familiar input/content focused structure and concentrates instead on 'learning outcomes' associated with each topic. This too is in line with OECD/PISA recommendations (OECD 1999b, 3). Some learning outcomes can be categorised according to the 'competency cluster' they represent and they in turn reflect the requirements of the assessment. Thus we can 'map' the learning outcomes onto the competency clusters and vice versa. The learning outcomes related to *reproduction* deal with 'knowledge of facts, representing, recognising equivalents, recalling mathematical objects and properties, performing routine procedures, applying standard algorithms and developing technical skills' (OECD 2002, 84). These competencies are identified in syllabus course tasks where students are expected to be able to recall axioms, solve first degree equations in one or two variables, use and apply the rules for indices, construct a variety of geometric shapes (DES/NCCA 2011a), perform arithmetic operations, factorise expressions, use trigonometry to calculate the area of a triangle, perform constructions (DES/NCCA 2011b). The second competency cluster – *connections* – expects students to make 'connections between the different strands and domains in mathematics, and integrate information in order to solve simple

problems…The problems are often placed within a context, and engage students in mathematical decision making' (OECD 2002, 84). While the third competency – *reflection* – asks students 'to mathematise situations…to recognise and extract the mathematics…use mathematics to solve the problem, analyse, interpret, develop…models and strategies,…' (OECD 2002, 84). Both of these clusters, as we can see, are concerned with problem-solving, and returning to the Project Maths syllabi we find these competencies reflected in each content strand where students learn about 'synthesis and problem-solving skills' and to explore patterns and formulate conjectures; explain findings; justify conclusions; communicate mathematics verbally and in written form; apply their knowledge and skills to solve problems in familiar and unfamiliar contexts; analyse information presented verbally and translate it into mathematical form; devise, select and use appropriate mathematical models, formulae or techniques to process information and to draw relevant conclusions (DES/NCCA 2010a, 16, 20; 2010c, 20, 23; 2011a, 16, 20, 25, 29; 2011b, 20, 23, 27,31; 2012a; b)

These skills will enable students to bring together the 'mathematical ideas and procedures to solve straightforward and somewhat familiar problems' (OECD 2002, 82) of the *connections* competency and also to 'engage in analysis, to identify the mathematical elements in a situation, and to pose their own problems' (OECD 2002, 82) as demanded by the *reflection* cluster.

Thus, I contend, the PISA framework was used as a template in the development of the Project Maths syllabus and its learning outcomes.

8.4 The Examination

In turn, it is intended that each of these three competency clusters – *reproduction*, *connections* and *reflection* – will be assessed in the Junior Certificate and Leaving Certificate examinations. As we saw in Chapter 2.6 the 1999 ICSTI benchmarking study examined the issue of assessment and found that when the purpose of assessment is summative, for national certification, as is the case at Leaving Certificate, then the approach to teaching and learning is constructed and determined by the terminal exam rather than by the curriculum. This point is reflected in the mathematics discourse in the form of criticisms of teachers at second level teaching to the test (NCCA 2005b). On the other hand, the terminal examination is highly valued. In Ireland 'the Leaving Certificate (established) has a high profile, and in the context of its selection function for Higher

Education, a high stakes educational programme…[i]t enjoys public confidence in its standards, status and currency' (NCCA 2003, 14). In such situations 'extensive debate about and developments in assessment are few and far between' (NCCA 2003, 20) and Project Maths retains unchanged the traditional mode of assessment, Foucault's *examination* (Foucault 1977, 184). The ICSTI findings which indicate that assessment in a 'high-stakes' environment, like that of competition for CAO points, often discourages the development of the teaching and learning process were disregarded. That the state examinations for Project Maths, like OECD/PISA, retain the pencil-and-paper test format and the length of the examinations and the number of papers taken by students at all levels remains unchanged is striking. It seems inherently contradictory that a course directed towards so-called real life problems should be assessed in such an artificial environment.

By contrast the structure of the mathematics examination papers has been altered and the question type and marking schemes have been radically altered. The SEC has provided us with a useful indicator of its intentions regarding the new assessment in the form of a set of draft Leaving Certificate sample papers for phase 1 of Project Maths. These were issued to the pilot schools in October 2009, together with a set of proposed solutions and a report on the trial assessment was published the following January. Officially the trialling process was intended to measure the effectiveness of the draft sample papers and the marking schemes (SEC 2010) but the outcomes of the trialling were also to 'assist with the implementation of the syllabus itself…[and help]…to clarify the objectives and learning outcomes of the syllabus for teachers, candidates and other interested parties.' (SEC 2010, 8). Given in the report are the sample questions together with model solutions and it is accepted that the detail of the questions was drafted so as to achieve the general aims of Project Maths (Grannell *et al.* 2011, 12). Marking notes for examiners are set out which demonstrate how the relevant marking scale was to be applied to candidates' work. The new schemes are different in structure from those previously used by the SEC and they reflect the changed emphasis in Project Maths: 'No examination paper can be considered properly in isolation from its marking scheme. It is the combination of the two that determines what competencies are measured and in what proportion.' (SEC 2010, 105). In turn, the examination determines what is taught: 'You get what you assess; you don't get what you don't assess; you should build assessment towards what you want…to teach' (Resnick and Resnick 1992, 59 quoted inTorrance 2009, 218). Thus, in the Project Maths

programme, testing is used overtly as a tool to implement the new policy. In this regard it is worth remarking that the methodological changes introduced in the earlier reform of the Junior Certificate were never examined and it appears that they were rarely implemented, consequently they did not lead to the expected improvement in the performance of Irish 15-year-olds in the OECD/PISA assessment. Thus the examination is the 'lever', in Torrance's word, (Torrance 2009, 219) to affect system-change; in Foucauldian terms it is the disciplinary mechanism that ensures implementation of the examined methodology. This is somewhat ironic considering that 'teaching to the test' was a frequent complaint about the pedagogy associated with the older Leaving and Junior certificate courses.

We can map the Project Maths examinations onto the PISA assessment. The learning outcomes examined by the SEC in the draft Leaving Certificate sample papers reflect the 'competency clusters' of the OECD/PISA framework for assessment. The examination papers are divided into two sections with section 1, entitled *concepts and skills,* dealing mainly with items of *reproduction* with some elements of the *connections* dimension while section 2, *contexts and applications,* concerns itself with items of *connections* and *reflection.* In the trialling report the content area and assessment objectives of each examination question are stated explicitly. The *reproduction* cluster presents itself through assessment objectives such as: Execute routine procedures in a mathematical context; Demonstrate knowledge of notation and terminology; Apply routine procedures; Demonstrate use of geometrical instruments; Demonstrate knowledge of terminology and facts (SEC 2010). We see the assessment of the *connections* cluster in questions that require the student to: Apply routine procedures (in non-mathematical context); In a non-mathematical context, apply routine procedures (viz. execute trigonometric calculations); In a non-mathematical context, apply routine procedures, interpreting the solutions in the original context; (SEC 2010). And the *reflection* cluster, which was absent from the previous syllabi, is present: In a mathematical context, apply understanding of concepts and connections, including relevant conditions, implications, etc.; Demonstrate understanding of concepts, connections, conditions and implications; In a non-mathematical context, apply understanding of concepts and connections, interpreting solutions, conditions and implications in the original context (viz. 'mathematise' the presented problem and show how to solve it) (SEC 2010).

Thus the omissions and mismatches identified by Oldham and Close in their 2005 PISA/Junior Certificate mapping exercise are being addressed at Leaving Certificate level and an examination of the 2011 Junior Certificate Project Maths (pilot phase) paper reveals a similar move. (2011 was the first year for the examination of Project Maths strands 1 and 2 at Junior Certificate. No trialling examination or trialling report were carried out for this examination.)

Following the Leaving Certificate trialling process the SEC, DES and NCCA approved the sample assessment questions and agreed that they were 'appropriate both in style and standard, and that radical alterations…[were] not required' (SEC 2010, 103). Apart from a number of refinements these sample papers set the pattern that will persist in the state examinations for the foreseeable future. The marking schemes used in the trialling exercise were structurally different to those used previously. This was:

> appropriate in light of the significant broadening of the nature and style of questions that may arise in the examination, and also serves to create a more direct and explicit link between the marks awarded and the qualitative characteristics of student responses….it is hoped that these schemes will assist all interested parties in having a clearer picture of what constitutes a response of a specified level of quality, and a clearer understanding of how the examiners evaluate the relevant evidence when making their assessment judgments (SEC 2010, 105).

Content: The content of the Junior and Leaving Certificate syllabi is not formatted in the image of PISA, there are significant differences between the two. Although Project Maths has been influenced by the concept of mathematical literacy, as we have seen, it has incorporated the PISA defined competency clusters in its learning outcomes and assessment objectives. Under the influence of PISA it has given priority to interpreting and solving mathematics problems embedded in realistic contexts and this in turn has affected the teaching and learning process where teaching *via* problems is advocated (Anon. 2011, Project Maths website). But Project Maths is not a mini-PISA. In a country where school maths has traditionally been both feared and revered, where 'honours' maths students had the status of the elite, and foundation level struggled for recognition (and failed in many instances), where politicians, business and parents had, until the advent of PISA, boasted that the education system was responsible for the success of the Celtic Tiger, many of those involved in mathematics education believed that our system had much to offer and that it should not be altered beyond recognition. An ERC test curriculum

rating project carried out in conjunction with an analysis of PISA 2003 highlighted important mathematical content in the Junior Certificate syllabus which is not examined by PISA (sets, geometry and trigonometry) and content, namely probability, that is present in PISA but not in the Junior Certificate (Cosgrove *et al.* 2005; Cosgrove *et al.* 2004c). Oldham, on the other hand, concluded that should a curriculum which gave greater emphasis to RME be considered, the content of the syllabus would need to be reduced to allow for the 'relevant process skills', unless extra time was to be allocated to mathematics (Oldham 2006, 48). In the event, the time allocation for mathematics was stipulated (but not lengthened) and many courses were shortened: the study of vectors and groups was removed; individual topics were removed from the core material of the earlier syllabi; the study of geometry was completely overhauled; and the emphasis on probability and statistics was increased (Grannell *et al.* 2011, 33). In the event, this strategy would lead to conflict between third level academics and the NCCA (see 8.5). Subject areas not assessed by PISA were retained. Structurally the course content was introduced in a series of defined strands. According to the DES (the letter again) 'the changes other than in probability and statistics are methodological rather than content based' (DES 2010a). In introducing the new syllabi, probability and statistics were prioritised. Previously not studied until Leaving Certificate, probability was to begin in first year, and as we have already seen, together with statistics it comprised the first strand to be introduced at all levels.

The five content strands of Project Maths can be linked broadly to the main strands of the revised primary school curriculum (NCCA 2008a, 2). The practice of classifying mathematics curriculum in content strands is rejected by PISA on the grounds that it compartmentalises mathematics and does not allow for the complexity of problems, nor does it reflect the complex patterns of the world around us (OECD 2002, 84). OECD/PISA argues that it encourages students to view mathematics as a 'collection of fragmented pieces of factual knowledge' (de Lange 2006, 7). The mathematical content of PISA itself is organised around a phenomenological approach, 'describing content in relation to a phenomenon and the kinds of problems for which it was created' (OECD 2002, 84). The phenomena are referred to as 'overarching concepts' and they were selected in order to 'encompass sufficient variety and depth to reveal the essentials of mathematics and…at the same time represent or include the conventional mathematical curricular strands' (OECD 2002, 84). The PISA 'overarching concepts' are: change and relationships, space and shape, quantity and uncertainty.

The Project Maths adoption of the content strand structure at second level, however, is a continuation of the primary school curriculum. It is intended that the strands selected will provide continuity along the 'pathways' which the different topics of mathematics follow as the learner progresses from primary to secondary school (DES/NCCA 2011a, 8). In an effort to address the problem of fragmentation at primary level the NCCA suggests that the strands 'although presented in separate sections, are not isolated areas. They should be seen and taught as interrelated units in which understanding in one area is dependent on, and supportive of, ideas and concepts in other strands' (DES 1999, 3). There is an echo of this aspiration in an early Project Maths document which acknowledges that 'the various strands of mathematics are inter-related, and therefore can be taught in a more integrated manner' (NCCA 2008a, 2). However the ideal succumbs to practicality as the authors of the trial report attempt to justify the proposed sequential introduction of the Project Maths strands being presented as 'stand-alone component[s] of the course' (Grannell *et al.* 2011, 5). We see, for example, that the phase 1 strands which had traditionally been examined on Paper 2, in Leaving Certificate, will remain as individually defined units on this paper (SEC 2010, 4). The decision was influenced by factors such as 'the need to balance an increase in syllabus elements in one strand with a decrease elsewhere, and confining the impact of change at the examinations to one paper in any given year' (NCCA 2008a, 2). The effect of the mode of introduction and of the subsequent examination limited the extent of inter-relation in the assessment and hence in the classroom. As Resnick and Resnick suggest, 'you get what you assess'.

In conclusion, the content range of Project Maths at both Junior and Senior Cycle is broader than that of the PISA assessment, providing for the student a wide ranging mathematics course which aims 'to develop the mathematical knowledge, skills and understanding needed for continuing education, for life and for work (DES/NCCA 2010a, 6; 2010b, 6; 2011a, 6; 2011b, 6). However, under the influence of PISA, content based changes in probability and statistics occurred and these were introduced in strand 1 of the project. The approach taken to teaching and learning in all strands is influenced by the PISA philosophy of RME and problem-solving.

Context: The third dimension of PISA mathematical literacy deals with the context within which mathematics is applied. PISA tasks are designed to include a variety of situations such as 'personal life, work and leisure, the local community, and society' (OECD 2002, 82). In the

Project Maths programme these context areas are reflected in lesson plans and sample questions. State examination questions, produced by the SEC, are set within similar 'realistic' situations and lesson plans developed by the Project Maths implementation group also reflect this characteristic. However the range of contexts within which problems will be set is not specified in the official documentation but it would appear that the range of 'real life' situations is wider than those proposed in the OECD/PISA assessment. It is difficult to assess how authentic the chosen contexts can be however. Commenting on one question from the 2010 Leaving Certificate paper, for example, the UCC interim report (see 8.5 below) remarks that '"[r]eal-world" problems should be formulated so that they are not silly' (Grannell *et al.* 2011, 29) and it then proceeds to discuss the [un]realistic nature of the question. Many 'real-world' problems are outside of the experiences of students and thus the interpretation of questions can cause greater problems than the mathematics required for the solution. Another aspect of setting problems in context concerns the reading content. Eivers discusses this problem in relation to PISA and she concludes that setting problems in context hampers the validity of the assessment because of the heavy reading load involved (Eivers 2010, 99). She argues that PISA mathematics assessments 'require reading skills beyond a level that we can presume to be shared by most or all of the target population. Thus the test format employed in PISA means that many students' reading skills have an unnecessarily large effect on how well (or poorly) they perform on the science and mathematics assessments' (Eivers 2010, 100). This is also a problem for Project Maths, particularly in the case of students with reading difficulties or possibly those for whom English or Irish is not their first language; the 'reading' content of the questions can be a source of disadvantage. All of this is despite the fundamental category error of assigning a term like 'realistic' to an entirely artificial construct which is only found in the 'real' world in its singular form – namely, the paper and pencil, timed examination in an invigilated examination hall. In literature this kind of artificial construct of 'realism' is generally known as 'the realistic convention', and in terms of these word-based problems, the term is apt.

8.5 Critics

Despite the need for a 'reform which would impact quickly on the outflow of students into higher education' (DES 2010a), Project Maths has failed to attract the approval of third level teachers of STEM subjects. We need not rely on anecdotal evidence here, as we have two

published reports to hand, both of which raise serious concerns about the number and nature of topics which have been removed from the core material of the new syllabi. One paper reports that Project Maths has dispensed with 'much of the mathematics that is regarded as being of key technological and scientific worth (calculus, linear algebra, vectors)' (Stack and Other Maths Professionals 2012, 5), while the other cites the removal of all references to vectors in the Higher Level Leaving Certificate syllabus and argues that it will impact on the teaching of Applied Mathematics at both second and third level (Grannell *et al.* 2011, 14). Engineers Ireland have also raised objections to the syllabus. As members of the *Project Maths Implementation Support Group* the engineers were well placed to voice their objections. The report records that 'strong concerns were expressed by the Engineers Ireland representative about the dropping of vectors, matrices and reduction in integral calculus in the Leaving Certificate syllabus and that the matter was being treated as a "closed issue"' (DES 2010b, 37). This must be understood in the context of the government's continuous appropriation of the concerns of third level and the engineers to bolster their arguments for the new course, as well as Minister Mary Hanafin's 2008 declaration that 'I am confident that [Project Maths] will…better prepare students for careers in the science, technology, and engineering areas in particular' (Hanafin 2008). The NCCA response to EI was recorded in the report

> The NCCA had made decisions about syllabus content through its representative structures…Consideration was given to the breadth of syllabus content, depth of treatment and work load required to deliver on the Project Maths objectives…It was agreed that the EI concerns would be mentioned in this report, and would be revisited in the course of any such review (DES 2010b, 37).

Ironically, it was noted by the authors of the UCC *Interim Report* that the introduction, to Project Maths, of new material in the area of probability and statistics may present new opportunities for the designers and instructors of third level *business* orientated programmes (Grannell *et al.* 2011, 14)!

The *Interim Report on Project Maths* prepared by mathematicians of the School of Mathematics and Sciences of University College Cork raises concerns about the influence of the PISA philosophy on Project Maths and argues that Project Maths has been heavily influenced by PISA in its approach to mathematics and in the content of its programme. But the members of the UCC School 'are not convinced of the merits of PISA-type material' (Grannell *et al.* 2011, 34). In

particular they express concerns about the PISA approach to problem solving which emphases 'authentic real-world problem solving' from which they claim 'very ambitious, untested benefits are predicted to follow' (Grannell *et al.* 2011, 15). It contrasts the study of mathematical problems which have traditionally been part of the mathematics curriculum with the comparatively recent developments where problem solving is regarded as an important and prominent medium for teaching and learning mathematics. Whereas the report indicates that it is not opposed to the introduction of new approaches to teaching and learning in schools, it is concerned that the method being introduced in Project Maths is of a controversial nature and not one that receives 'general acceptance internationally' (Grannell *et al.* 2011, 34).

In Project Maths there is a shift in emphasis from teaching problem solving to teaching *via* problems (Project Maths website 2011), however, as already indicated, there is no evidence from the NCCA of any engagement with a critical analysis of the new approach in the development of the project, despite the fact that it is a keenly contested method. Neither does the NCCA literature, as we saw in chapter 4, mention any major studies on the effectiveness of the approach perhaps because, as Sweller et al remark '[t]here is no body of research based on randomized, controlled experiments indicating that such teaching leads to better problem solving' (Sweller *et al.* 2010, 1303).

In fact, it is disheartening to note that when I first sought out the Project Maths approach to problem solving on the website (November 2011), I found that the Department's thinking on the matter was presented in a single-page document. The article appeared rather dated as the incomplete citations were found to refer to articles and books published between 1980 and 1994. Repeated enquiries to the named contact on the Project Maths website failed to elicit a satisfactory response regarding the sources cited in the piece. Then, by entering key phrases from the document, a Google search unearthed the paper from which the references had come (Taplin mid 90s), together with the bibliography I had requested from the author, a post-primary Inspector. The document posted on the Project Maths website, as it happens, is a compilation of two short, unedited and unattributed extracts from Taplin. Given that the citations contained within the Project Maths document are incomplete (there is no bibliography) it can only be assumed that they existed because they existed in the original article from which it appears to have been 'copied and pasted' and/or they existed to lend the authority of scholarship to the chosen approach. The references in this document date from the

1980 National Council of Teachers of Mathematics drive to shift the US mathematics education to one of problem solving. Many of them predate the fierce controversy that followed in the American 'Math Wars', which involved among other issues, a dispute over the efficacy of the problem-solving approach. A teacher approaching this document for a rationale would be diverted to outmoded sources – even supposing that a teacher had access to them (most teachers have no access to university libraries and journals). If this 'document' is to be treated at face value – as the NCCA/DES description of why it has opted for problem solving – it would appear that it has ignored, disregarded or been unaware of the controversy surrounding its introduction around the world, particularly in the USA.

On the current Project Maths website (Project Maths Development Team 2012, website) there is a short five line statement which comes directly from the earlier document and which declares that the 'focus is on teaching mathematical topics through problem-solving contexts and enquiry-oriented environments which are characterised by the teacher "helping"[15] students construct a deep understanding of mathematical ideas and processes by engaging them in doing mathematics' (Project Maths Development Team 2012, website; Taplin mid 90s, 1). The theoretical foundations which underpin the problem solving approach of Project Maths appear to come from the 'minimally guided approach' (Kirschner *et al.* 2006, 75). Underlying this approach to teaching is the assumption that students are challenged 'to solve "authentic" problems or acquire complex knowledge in information-rich settings based on the assumption that having learners construct their own solutions leads to the most effective learning experience' and also that 'knowledge can best be acquired through experience based on the procedures of the discipline' (Kirschner *et al.* 2006, 76). Kirschner *et al.* claim that there is no body of research supporting the technique and that evidence from controlled studies, almost uniformly supports direct, strong instructional guidance rather than constructivist-based minimal guidance particularly during the instruction of novice to intermediate learners (Kirschner *et al.* 2006, 76). Research suggests that students can be taught to be effective problem solvers only by providing them with a large store of domain-specific schemas and that mathematical problem-solving skill is acquired through the use of specific mathematical problem-solving strategies which are relevant to particular problems (Sweller *et al.* 2010, 1304).

[15] The latter part of this quotation 'helping…mathematics' is from Lester et al., 1994, p.154 as quoted in Taplin.

A paper entitled '*Major Flaws in Project Maths*' prepared by a number of third level mathematics lecturers considers problems with Project Maths methodologies. The academics claim that in the programme too much emphasis is placed on applications to the detriment of the theoretical foundations of the subject (Stack and Other Maths Professionals 2012, 2). Students, they say, are placed under the unrealistic expectation that they can carefully analyse realistic applications without first acquiring the necessary background knowledge and mathematical ability. The UCC report also addresses this problem of method, in particular the failure of Project Maths to introduce teachers and students to a methodology which will enable them to effectively solve authentic problems. Real world problems, they say, require that students apply 'methods of idealization' in order to get a manageable mathematical problem and thus 'properly trained teachers' are required. They suggest that students need to learn the skills involved in solving word problems which may or may not be realistic and, having mastered these skills, that they should move to real world problems. The report observes that in Project Maths there is an apparent expectation that 'teachers can invent or discover real world applications of Mathematics, and implicitly, can develop the idealization methodologies themselves' (Grannell *et al.* 2011, 39), an expectation that the mathematicians suggest is unrealistic. In light of this problem, the report concludes that exhortations to teachers, found in the 2007 Teachers Guide (Shiel *et al.* 2007), produced by members of the ERC together with Oldham and Close, to place more emphasis on PISA type context based problems are 'misplaced'.

We have already seen that the official voice of the ERC raised no fundamental critique of PISA during the period 2000 to 2010. What then are we to make of a 2010 article by Eemer Eivers, one of the team of authors of previous ERC reports on PISA, published in The Journal of Irish Education, the official journal of the ERC itself, which offers a critique, not just of PISA and its methodology, but also of the tendency of academics to write as insiders rather than critics? Eivers approaches the problem from the perspective of a statistician who believes that the complexity of the statistical techniques used in PISA limits the number of people capable of engaging in any debate about what PISA does. However, she considers that the response to PISA in Ireland has been mainly uncritical as a result of the hitherto 'reasonable' performance of Irish students. Academic and media scrutiny, she remarks, have not been as intense as in some other countries. Are we to understand then, that Eivers is writing here because of the 'shocking fall in the performance of Irish 15-year-olds' (Donnelly 2010a, *Irish Independent*, 10 December,

online) in the OECD/PISA 2009 assessment? Would this analysis of PISA have remained unwritten or perhaps unpublished if Irish students had returned another 'reasonable' result? In her conclusion Eivers considers an observation by Rochex and notes that there is 'a shift in the relationship between research and politics, whereby researchers have changed from adopting a critical stance to becoming politicised "experts" (although they may view themselves as apolitical, neutral authorities)' (Eivers 2010, 114). She writes as a psychometrist and argues that the complexity of the statistical methodology and analysis makes PISA opaque to the non-statistician, and seems to imply that this excuses herself and her colleagues from failing to present a proper critique of PISA. Nevertheless a good deal of her article is devoted to observations on the economic nature of the OECD and the corollary of an economic rather than purely educational purpose to PISA; on the relationship between the curricula of some countries with the implied curriculum of PISA; on the fact that where the Irish curriculum crosses over with the PISA curriculum our students do well; on the cultural bias of the assessment; on the difficulties posed by translation and the relative lengths of time needed to read the tests as against the strict equality of time allowed; on the political interest in cross-national studies which is derived from economic rather than educational interest; on the 'one size fits all' definition of key competencies needed in widely differing societies; on the question of whether a pencil and paper test can really measure 'real life skills'. She argues that even in the mathematics and science tests, PISA measures literacy skills rather than mathematical or scientific skills, as a consequence of which she suggests that PISA overestimates the mathematical and scientific skills of English-speaking students with good reading ability. She notes that the UK was excluded from the 2003 PISA because its response rate fell below the threshold, but the USA, which has never achieved the threshold has never been excluded, wryly observing that the USA contributes 25% of the OECD's budget. All of these theoretical and practical issues are readily understood by the non-psychometrist, but they have not hitherto formed part of the Education Research Centre's published analysis. In that context her reference to Rochex's observation about the 'shift in the relationship between research and politics' may be interpreted as a belated and much-needed self-criticism. What is disappointing here is that even this partial analysis of the PISA assessment reveals considerable ideological and practical problems that have not formed part of the public understanding of the process and that have not, hitherto, informed the debate on Project Maths. As a consequence there has been no

debate about PISA and it has entered the public domain as a neutral judge and jury without theoretical, practical or ideological baggage.

8.6 Conclusion

In a mini-mapping exercise, this chapter has traced the genetic imprint of OECD/PISA in the curriculum, and argued that the methodology, aims and objectives, and some of the content of Project Maths reflect this influence. However, this thesis is not arguing that PISA is the sole purpose of the curriculum remodelling represented by Project Maths. Clearly, the official voices in Ireland identified OECD/PISA as a useful tool for remodelling mathematics education, recognising the potency of the change mechanism as a means of disciplining a teaching profession and a general public who might believe that education was more about the development of young people than the development of the economy. That some university mathematics teachers are not enthusiastic about the changes, that they in fact fear that the changes will not prepare students for the depth and breath of mathematics that is demanded of students entering third level (Grannell *et al.* 2011, 3), coupled with the belated entry of the ERC as critic of the methodology and purpose of PISA, the tracing of the OECD's hidden curriculum assumes considerable importance.

The university teachers and Eivers concur on a number of points, but one is particularly worrying – that PISA and consequently Project Maths is mainly a test of literacy skills through word problems. That there is a distinction between mathematical skills and so called problem solving skills (real life problems or authentic problems) is material for a thesis in itself, but suffice it to say here that the introduction of Project Maths has been problematised from these two unexpected quarters, and that it is likely that further interventions will expose other weaknesses.

The EGFSN has stated its target to put Ireland at the top of the PISA league tables (EGFSN 2008b, 2), and there is little doubt that that this is an underlying objective of the Project Maths remodelling exercise, part of the [un]hidden curriculum. In this respect it is instructive to remind ourselves of the NCCA's statement, quoted as the epigraph to this chapter that '[t]arget setting can have unexpected consequences'.

Chapter 9

The Present

It is therefore history of actuality in the process of taking place. (Foucault 2007b, 137)

The genealogy speaks for itself. As I write it is the [non]summer of 2012, a climactic upheaval is occurring in the discourse of mathematics education in Ireland. The state examinations begin. At Junior Certificate, with the exception of the pilot schools, students sit two traditional 'old' course papers. Students sitting mathematics at Leaving Certificate must contend with a traditional Paper 1 where the 'old' course is examined and a Paper 2 where the first phase of Project Maths is tested. It is the year when 25 bonus CAO points will be awarded to all students who achieve at least a D3 grade at Leaving Certificate Higher Level mathematics. The bonus points are much hyped by the media; it is reported that as a result of the extra points the numbers taking Higher Level maths have 'surged to a near record level', that 'the decision…is paying dividends' and that we are seeing a 'dramatic turnaround' (Flynn 2012f, *The Irish Times* online, 30 May). However fear is in the air. Minister Ruairí Quinn has urged students to 'keep their courage, hold their nerve and stick with higher level' (Donnelly 2012c, *Irish Independent* online, 30 May). That the success of the new policy is important to the Minister is reflected in another intervention, published on the first day of the examinations, where Quinn pleaded with students not to drop back to pass level on the day of the exam: 'I know that students might be nervous about the higher level paper, but if they have worked hard they should stay the course' (Faller and Holden 2012, *The Irish Times* online, 6 June; Irish Government News Service 2012; Stack 2012, *Irish Independent* online, 6 June). In all these reports we learn that the bonus points have succeeded in producing a near 25% increase in the numbers applying to take Higher Level mathematics at Leaving Certificate. A casual reading of the media reports suggests that the 'numbers problem' is well on its way to being solved, that the 'quick-fix' has worked. Project Maths alone had not had this affect as only16% of Leaving Certificate students from the 24 pilot

schools took Higher Level in 2011, approximately the same percentage as that in non-pilot schools (Irish Times Reporters 2011, *The Irish Times* online, 17 August).

Because this is happening *now* we must all rely primarily on media reports and press releases for information on events as they unfold. Thus, the media creates the common sense. Although each person brings their own personal agency to interpret what is projected by the media, nevertheless there is no other public discourse available at the present moment, and even personal agency is forced to enact itself within or against this common sense.

In June, newspapers reports on paper 1 maths present a round-up of comments from teachers, union representatives, grind school tutors and text book writers, students and the suitability of the paper at all levels is confirmed. This is the traditional annual Leaving Certificate opera, repeated in one way or another in all education systems that fetishise a terminal examination. There are no reported comments on Project Maths paper 1 from the pilot schools. However a different story emerges some days later when media reports are dominated by an adverse reaction to paper 2, Higher Level, Leaving Certificate, the new Project Maths paper. An online Irish Times discussion on the afternoon of the examination gives evidence of a difficult paper. One comment claims that many students may have been 'traumatised' on their initial reading of the paper while another says that at first glance it looked difficult, but that once you got working it was 'more manageable'. Complaints centre on the poor wording of the questions, while the alignment of the exam with the syllabus content is also questioned. Comments are quoted from the usual sources (teachers, grind school tutors, text book authors, union representatives, etc.) (Holden 2012, *The Irish Times* online, 12 June). The ghost of the discourse of failure still hovers behind the commentary. The following day *The Irish Times* leads 'Higher level paper called disastrous, traumatic' and follows with a version of the online report. A call from a Sinn Féin party education spokesman for an enquiry into the paper is reported together with a description of the paper as: 'one of the worst in the history of the State' (Flynn 2012b, *The Irish Times* online, 13 June). The State Examinations Commission defence of the content of the paper is also here. Further articles appear, the *Irish Examiner* carries a report from the national secretary of the IMTA, under the headline 'The first Leaving Certificate papers to test Project Maths failed to make the grade' (O'Sullivan 2012, *Irish Examiner* online, 14 June). He is critical of many aspects of both the higher and ordinary level papers – he cites issues of language and time, the structure of the paper and marking scheme, and in particular he identifies a

question based on a 'robotic arm' which, he says, seemed biased towards those who study Physics or Applied Maths.

Some weeks later in a Dáil debate the Minister for Education and Skills is questioned on the efficacy of Project Maths by a Fine Gael TD. In her question (O'Connor 2012), Deputy O'Connor pinpoints the Leaving Certificate 'robotic arm' question and refers to comments made to her by an examination corrector who claimed that the marking scheme for this question has been changed drastically because the results were so dismal. In spite of this, she argues that the August results would show the 'usual bell curve form' and would 'not show the fundamental weaknesses in the system'. She expresses concerns that pupils were not being taught basic mathematical concepts in Project Maths and she refers to the reports by third level 'maths professionals' who had expressed the view that Project Maths will have 'a negative impact on maths education'.

The Minister's response (Quinn 2012a) does not address the issues presented by Deputy O'Connor, rather it presents a brief overview of Project Maths and related data and concludes with the usual round-up of declared supporters for the project from industry and expert groups:

> I emphasise that the skills that are promoted through Project Maths are sought after by employers and the introduction of the revised syllabus has been welcomed by Forfás, the Expert Group on Future Skills Needs, Engineers Ireland and industry interests.

One again the absence of education interests in the list of adherents is remarkable.

In response to a further question Quinn declares that:

> Some concern has been highlighted in regard to this year's leaving certificate papers, which is normal. As I said, the chief examiner and the college of examiners in the State Examinations Commission look at these matters. The Government is fully aware of the importance of maths and other STEM subjects. We will continue to ensure the initiatives I have outlined are prioritised in order that a quality maths education is available for young people both at junior and senior cycle

This exchange of views is not reported in the media until the publication of the Leaving Certificate results though it is available on the official Dáil website.

The publication of the Leaving Certificate results in August is accompanied by a press release on the DES website (DES Press Release 2012) under the banner '35% rise in the number of students sitting Higher Level Maths'. A reading of this official congratulation leaves one in no doubt as to the priorities of this year's Leaving Certificate. The statement reads:

> The highest number of students ever sat Higher Level Maths this year. 22.1% of all Maths students took the higher level paper, compared to 15.8% last year. The Minister has welcomed this dramatic increase. "I am particularly heartened to see the large jump of 35% in the number of students taking Higher Level Maths. There is no doubt that the 25 bonus points for all those who achieve a D3 or higher in the subject has made a significant impact as has the continued roll-out of Project Maths."…The number of students receiving an A at higher level has remained broadly the same as recent years; however, the overall percentage of A students is down due to the higher numbers of candidates.

A magical transformation in the discourse ensues. Suddenly the narrative is all about success. Do these responses represent a rupture in the discourse of failure that has provided so many column inches over the past decade? An Irish Times online report quotes the Minister as saying that incentivising Leaving Certificate mathematics students with extra points had succeeded 'beyond anybody's expectation' (Flynn 2012d). The print headlines are reporting that the numbers problem has been largely redressed. The front page of the *Irish Examiner* cites the statistic that '22.1% take higher-level papers' and that standards have improved, '83% get honours grades' (Murray 2012a, 1) while inside it carries comments from the American Chamber of Commerce and the Institute of Chartered Accountants under the heading 'Results in maths add up to joy for business' (Murray 2012b, 7). *The Irish Times* editorial announces that 'Numbers failing maths have dropped significantly…This suggests that two initiatives designed to address the "maths crisis" are working' (Editorial 2012, 13) The Ordinary Level failure rate is not so bad according to Seán Flynn on Page 1 under the headline 'Dramatic fall in number failing maths in Leaving Certificate' (Flynn 2012a, 1). Best of all, according to the front page of the *Irish Independent*, the solution to the problem of mathematics has brought with it 'Jobs hope as record numbers get bonus in maths' (Donnelly 2012b, 1). Interestingly, this particularly fatuous headline survived in the online edition for only a few hours! The first paragraph of this

latter report states that the results put 'students on track for careers in the jobs-rich areas of science and technology'. Hope indeed for a country reeling under austerity measures.

Flynn in *The Irish Times* reports on a 'lengthy' statement issued by the SEC in response to claims that 'examiners were "pressurised" to deliver better grades' (Flynn 2012c, 5). The response explains the process whereby standards for new syllabi are established in advance of examining by a group 'deemed to have an expert knowledge of what the students…ought to be able to achieve'. This group is 'representative of teachers and other subject experts including third level and industry'.

One interesting aspect of the Higher Level results is that there is a noticeable drop in the number of students achieving A grades this year but unusually this is couched in positive language by the media. The *Irish Independent* reports that 'even though the number of A1s in higher maths dropped slightly, the Government and industry chiefs heralded the roll-out of a new syllabus and the huge rise in students aiming for the toughest exams' (Carty 2012). (I have just checked the figures on SEC website for 2011; 5.9% of 8235 or 485 students achieved an A1; while this year 2012 the figure is down to 345, according to the *Irish Independent*). This drop, representing a fall in A1s from 5.9% to 3.1%, would, I suggest, have attracted serious criticism in previous years.

Remarkable in all of this is the fact that no education journalist questions how an examination that was, according to *The Irish Times* 'one of the worst in the history of the State' could produce such desirable results.

Some days later the CAO allocation of college places is announced and we read another story of success. *The Irish Times* online declares that 'Science joins the top tier as points see dramatic rise' (Faller 2012); 'New jobs focus in CAO options' (Flynn 2012e) where 'Students are opting for college courses which offer the best employment prospects, pushing science and technology to the fore'. Under the banner 'IBEC welcomes college demand' (*The Irish Times* online 2012, no author) we read that IBEC believes that 'We are beginning to attract more high calibre students into subjects for which we are likely to see a demand from industry into the foreseeable future,' and where they reject the suggestion that the 25 additional bonus points for Higher Level maths has distorted the CAO points system. There is a noticeable absence of comment from Engineers Ireland, but points for engineering are described as a 'mixed bag'. At UCC, for example, engineering courses are down with the exception of electrical and electronic, elsewhere points

are low at 370 out of a maximum of 600 in DCU and 430 in Galway. CAO points across the board for many college courses unrelated to STEM subjects have risen to their 'highest level for decades' (Flynn 2012g) raising concerns that 'the new bonus points for maths may be distorting third level admissions'.

I have argued throughout my thesis that the 'problem of mathematics' was constructed in such a way as to contribute to a set of predetermined solutions. From August 15th onwards we observe those aspects of the problem privileged by business and industry being solved in the terms in which they were constructed. The numbers taking Higher Level maths increased by 2869 students (reported in media as almost 3,000), the points for science, technology and some engineering courses increased and the demand for such courses grew. The changes resulted from a simple ministerial directive – bonus points. Other issues that bothered business, industry and media interests in previous years included the failure rate at Ordinary Level. This failure rate was reduced by 20% in 2012. In the euphoria of the solution nobody has complained that this still leaves around 4,000 students failing this year. Nor is the magical reduction interrogated. The unspoken belief seems to be that Project Maths has done it. Then there is the problem of the grading penalty at higher level – it is difficult to say if it has been addressed – the overall percentage of A, B and C grades rose slightly to 83% this year (in 2011 it was 80.9%). One cannot speculate about the effect on the results of the new marking schemes. It will take a number of iterations of the full Project Maths examination before a judgment can be made on whether or not the grading penalty is being addressed, and if so, in what way?

In one of her result's day article (Donnelly 2012d, *Irish Independent* online, 15 August) Katherine Donnelly raises a number of key points. She remarks that 'it was crucial that the bonus points initiative got off to a good start – and it couldn't have been better'. She continues 'Sceptics may doubt whether it really means that Irish students have suddenly improved their game, or whether examiners took, perhaps, a more sympathetic view and ensured that they recognised candidates' every effort.' And she concludes…'Maybe now, for the first time, there is some hope of solving the maths question, but it doesn't end there. Employers last night pointed to the need to tackle the abysmal participation by Irish students in foreign language learning. We're currently ranked the worst in Europe. That's simply not good enough in a global economy where English is not enough.' And then in September *The Irish Times* report on the publication

of Junior Certificate results begins with 'High failure rates in languages are a striking feature of the Junior Certificate results released today' (Faller and Flynn 2012, *The Irish Times* online, 12 September).

It is as if the time has arrived for the apparatus of the remodelling of mathematics education to be 'partly (and only partly) dismantled…soon to be reactivated, rearranged, developed in certain directions' (Foucault 1977, 297).

Chapter 10

Conclusion

> *…interrogate it first from within, find out how it came about, how it was established and justified and only then, deduce what it was. (Foucault 2007b, 133)*

The ideal of a knowledge economy holds many attractions even granting the expropriation of 'knowledge' by corporations and other seats of power. It is good that people of all ages should have access to sources of information and means of communication; that young people should emerge from school with skills as well as knowledge; that learning should not end at school or college; that the learner should possess critical and creative thinking skills; that citizens should be personally effective. However, this thesis contends that the changes underway in education are not for the welfare and development of young people; for the development of a critically aware citizenry; for the protection of equal access to knowledge and skills; for the development of civil society or for the strengthening of democracy. What is clear from the discourse is that the apparatus assembled in response to an urgency of capitalism. This urgency is complex, but includes the falling rate of profit and the necessity to invent new ways of generating profit – the knowledge economy as constructed by business, industry and government. This is masked by the jobs argument that the technology arena is jobs-rich and directing students towards it will maximise their chances of employment. Thus, the human capital argument, with all its attendant euphemisms of creativity, innovation, personal development, entrepreneurship, etc. is essentially an attempt by capital to create a fit-for-purpose product using the mainly state-owned education system.

To close this thesis let us consider the effect of the complex and shifting network of power relations that established itself between the elements of the apparatus that the thesis has described. In examining the nature of the apparatus, we observed that, an apparatus assembles

in response to an urgency and has a dominant strategic function. The urgency, in this case, is the demand for a knowledge economy. The apparatus under consideration in this thesis has as its strategic function the reorientation of an education system in order to bring about a reconfiguring of the subjectivity of the young person around the demands of human capital. In the thesis the discussion of the apparatus arises naturally from the examination of the remodelling of mathematics education policy in Ireland.

The urgency may be defined as the constructed problem + time. The 'problem' as construed by the apparatus as a whole is a composite of the problems constructed by the elements of the apparatus. It is not constructed in the same way by all elements. Thus, the problem for the education system can be seen as one of transition. The problem for the EGFSN, dominated by corporate interests, is the need for quantities of suitable human capital. On the other hand, for the IMTA, representing teachers of mathematics, the problem is constructed in terms of the welfare of the student. For the NCCA it is the revision of syllabi consistent with the perceived needs of the economy and in accordance with the education policy of OECD/PISA. The problem for higher education is the consequence of the application of counting practices to the academy and the perception of the academy as a key driver in the knowledge economy (Olssen and Peters 2005, 313). But time is also a source of conflict. Each of the elements has its own differential time. For the corporate interests time tends to be annual; for the IMTA the problem relates to a cohort and is therefore calibrated in five or six year intervals; who knows how long the timescale for the NCCA is, but to judge by the pace of reform it is probably counted in decades. While all of the elements are broadly agreed on the construction of the urgency, the nature of the problem and the differential timescales cause considerable difficulties. Thus we have the conflict of interest represented by the simultaneous introduction of Project Maths at First and Fifth years: here the IMTA is operating on its 5-6 year calendar, while the corporate interests want to see annual results. The NCCA views the successful implementation of Project Maths as a long term project while the third level institutions want immediate improvements in the knowledge and skills of its applicants.

What we have observed is the assembling of an apparatus of governance. The elements of this system include institutions like the OECD and the Government, the bureaucracy, expert groups and special interest groups, the media, the school, state assessment and international assessment, the neoliberal discourse of education. A network exists between each of these

elements but it is the apparatus as a whole that produces power (Foucault 1977, 177). Not all elements exercise the same level of power. Engineers Ireland, for example, were legitimated as a pressure group and their influence was wielded as an instrument by other elements such as the Minister. However, in the final analysis, their objections to the ultimate product were overruled. Third level academics were useful for anecdotal evidence and their complaints were privileged in the discourse of failure. However, their objections, in turn, were relegated, and anecdotal evidence suggests that their subsequent reports have been studiously ignored! The IMTA, never granted much significance, was firmly placed in the realm of implementation of what others created. On the other hand, non-education groups like the EGFSN and IBEC have their views prioritised and their demands hold sway in the proposed curriculum and pedagogy. Throughout all of this, the student, the parent and the school are largely absent from the debate. In essence the young person is a worker in training.

In the present case, this system of governance is directed at education and its contribution to the economy. The mechanisms of the system are: agenda-setting; framing the issues in a particular context; the selection and provision of data; the calling forth of further elements; the dissemination of the agenda and its accompanying data through the network including the media; the development of policy based on the problems constructed in the agenda. Although, because of my own particular interest, I have analysed this system of governance in relation to mathematics education, it must be remarked that the system is directed at the education system in general and is likely to move on to other areas – the construction of the problem of science was undertaken in parallel with that of mathematics, and that of language teaching, as we saw in the media report above, is now in hand. But neoliberalism fetishises mathematics as the key to innovation and hence the system has directed considerable attention to mathematics during the period under consideration.

Further conclusions, outside the scope of this thesis, might be drawn on the actions of this or other systems in relation to the governance of other aspects of Irish society. The effect of this system has been to focus mathematics education on the needs of the economy as constructed by the system. This construction is expressed in the term 'knowledge economy' with its attendant demands for a certain kind of human capital. These two terms, knowledge economy and human capital, archive the valorisation of education by neoliberalism, and the subsequent explosion of the discourse of failed curricula and schooling and the necessity for new skills. Further study is

required into the process of reshaping of subjectivity that is at work here. It may well be argued that education policy as a whole in Ireland is attempting to engineer a new kind of subjectivity in which the young person becomes an entrepreneur of herself, undertaking for herself self-training for the permanently precarious workplace, not an independent thinker but an individualist who nevertheless is innovative rather than different, who is a team player for selfish reasons, for whom community is the work-place, a community of competition and profit. In other words, the new purpose of education is to reshape the young person as a rational self-interested individual. In this regard we recall Minister Quinn's call for an '[e]ducation for entrepreneurship…a different way of teaching and learning…helping students to take the initiative in their education' (Quinn 2012b). All of this implies the closing off of other conceptions of the self. Young people are not to understand themselves as wage-labourers, as trade union members capable of communal action on pay and conditions, as candidates for secure employment; they are not to expect the company to train them, to provide them with a pension or health benefits, incremental salaries, job security or promotional prospects. Neither can they expect the state of which they are citizens to do more than the bare minimum to preserve life and limb and guarantee their rights as individuals. In this new world, it is literally every woman for herself. We are really moving into the realm of biopolitics here, for as Roberto Esposito remarks, *a propos de* Foucault's use of the term: 'Not only is biopolitics other than sovereignty, but between the two a clear and irreversible caesura passes' (Esposito 2008, 34). However, as a concept, biopolitics, though clearly also at work here, is better reserved for the interrogation of the education system as a whole, and therefore should provide a useful matrix with which to conduct further analysis.

The choice of context in which the issues are framed is highly significant. This thesis has consistently argued that the development of national policies is firmly set within the context of global policy. Thus, for education, a considerable part of the agenda is set by the OECD which exercises discipline over its members through perpetual surveillance and ranking. The OECD is itself a system of global governance which exercises its governance through idea-generation and diffusion, policy evaluation and data production (Martens and Jakobi 2010a, 7).

Throughout the thesis we have attempted to identify and describe the apparatus of power. What it reveals is the network between business, industry and the State and institutions of the State, and between these and global economic structures which have powerfully influenced the

direction and strategic values of the reform. We have brought into contention the common sense terms that otherwise pass as unremarkable – knowledge, knowledge economy, human capital, problem solving, skills, expert groups, the problem of mathematics – and identified in them the trace of the political. Therefore, where these terms occur in this thesis they must always be read as expressions of power and as political choices – they help to constitute the neoliberal common sense which this thesis has sought to problematise.

Five major themes in educational reform emerge: the arrival of neoliberal governance in Ireland; the triumph of human capital theory as the hegemonic educational philosophy here; the dominant role of OECD/PISA and its values in educational discourse in Ireland; the fetishisation of western scientific knowledge and knowledge as commodity; and the formation of a new kind of subjectivity, namely the subjectivity of the young person as a form of human-capital-to-be.

Further work is required on the implementation of Project Maths, particularly in the light of the low government spend. Policies provoke resistance, as Foucault observed, even where a discourse has achieved hegemony, and teachers have always been characterised as resistant, though this is usually treated as conservativism by the forces of change. The new methodology and values will be mediated at school and classroom level and will undergo changes. It will be interesting to observe the implementation of these policy changes at the human level. The shift in focus to 'better teachers' and new methods of teacher training will also need to be interrogated. To what extent will the emphasis on teachers as human capital themselves lead to investment and new kinds of courses? How effective will these new courses be in achieving the desired changes? And how will this process proceed against a backdrop of what Olssen calls 'deprofessionalisation' (Olssen 2009, 445). How effective will the new pedagogy be in achieving the aims of the curriculum and will it be reflected in the desired improved results in PISA? On a wider level, the educational and philosophical foundations of PISA itself, its structure and methodologies would provide grounds for several theses. Work has been undertaken in other countries on this matter but very little here. The present shift of emphasis to the 'more able student' is a product of social and educational constructs; a study of such students would be a valuable contribution to research and one in which I am particularly interested.

As I conclude my work on mathematics education policy in Ireland the ghost of another discourse has found its way into the media at a time when, traditionally, journalists are short of material. *The Irish Times* reports, (O'Shaughnessy 2012, *The Irish Times* online, 23 August) under the headline 'Literacy system fashioned during revolution adopted by many countries' that Cuba is far above Ireland in the UNESCO 'Education for All' table, but that Ireland, in turn, is well-placed at 21st above the USA at 33rd. The article, not written by any of *The Irish Times* education writers, lays particular emphasis on the success of Cuba's revolutionary education strategies and variations thereof in Venezuela and Nicaragua. With its language of education quality and equality, the elimination of educationally induced poverty and the mobilisation of young people as agents of revolutionary change the article contrasts sharply with the discourse to which we have become accustomed. Nevertheless, as a sign that another way is possible in European society, the article remarks that last year the Spanish city of Seville was the first EU authority to adopt the system.

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