

A level Physics: the rhetoric and reality of educational reform

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Abstract

This thesis examines the reform of A level qualifications in England that took place between 2012 and 2015. It examines how a complex, political, and contested reform process was carried out, and tracks the reform from its initial nucleation points to the first teaching of a reformed qualification.

Utilising concepts of power and power relations during this educational reform, this work examines the key figures and organisations that emerge and how they shape the discourse. The interplay between macro- and micro-scale policy reform processes and impacts are analysed in detail through steadily narrowing the focus to one subject, Physics, using it as a lens through which key tensions and discourses are examined.

Immersion within both the reform process and Physics results in a study that utilises multiple methods, from document and policy analyses, interviews with physicists and secondary school pupils, and an autoethnographic element to tell the story of this period of educational reform and the power of the Secretary of State for Education who initiated it.

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1. Introduction

In 2012 a period of education reform began that was focussed on A level education in England. This reform resulted in new A level qualifications being introduced, including Physics – the subject that this researcher teaches in an average, inner-city secondary school in the North of England.

This process was this researcher’s first experience of any educational reform and central to this thesis is that idea that an educational reform was seen simplistically as:

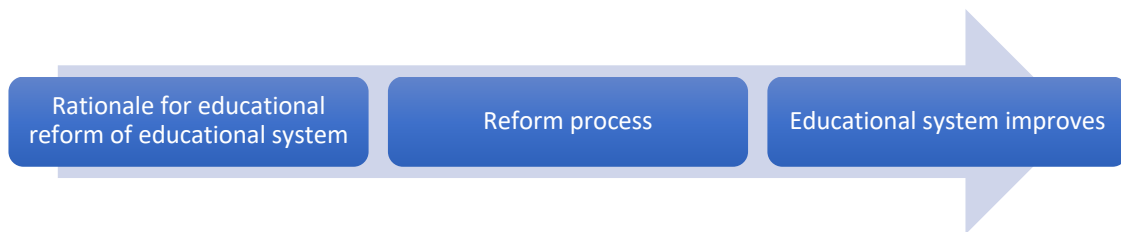


Figure 1: A model of educational reform

The reality of the educational reform was much more complex. Announcements regarding A level quality were made and then contradicted, policy announcements were made and subsequently corrected, dates of first teaching were announced and then postponed. Simultaneously, teachers such as myself were trying to keep abreast of these reform developments, begin the planning required to implement the reforms based on the information that I had, and carry out the work and teaching ordinarily required. In addition to this, the government spoke in terms that positioned the educational system as broken and in need of repair. From within this system this seemed like a highly subjective framing of A level education and not one that reflected my reality. Significant powers were at work, reframing public opinion and shaping educational discourses in order to rationalise a reform process that ultimately encompassed the entire state education system.

In laying out the reforms to A level education as clearly as possible through the use of multiple methods and perspectives it is the aim of this work to highlight the complexity of modern educational policy reform, from the government’s initial rationales for it, to its implementation in schools and classrooms.

In Black and Wiliam’s seminal (1998) paper they described classroom practice as a ‘black box’:

“In terms of systems engineering, present policy seems to treat the classroom as a **black box**. Certain *inputs* from the outside are fed in or make demands—pupils, teachers, other resources, management rules and requirements, parental anxieties, tests with pressures to score highly, and so on. Some *outputs* follow, hopefully pupils who are more knowledgeable and competent, better test results, teachers who are more or less satisfied, and more or less exhausted.

But what is happening inside? How can anyone be sure that a particular set of new inputs will produce better outputs if we don’t at least study what happens inside?”

(ibid. p2)

A ‘black box’ analogy has become something of a cliché in educational circles, however their description of several inputs and outputs translates well to the rationale and intended results of an educational reform process. There can be much that would form a rationale for educational reform, from aspects such as social-justice issues, a drive to raise exam results, or political ideologies. The reform process is multi-faceted, involves a great number of people with their own agendas, and will face many barriers; and the resultant ‘reformed’ educational system may, or may not, reflect the rationale that instigated it. Researching what happens inside this ‘black box’ can not only help to understand the qualifications that are ultimately taught, but also the mechanisms, tensions, levers, drivers, and other policy analogies that go into the creation of educational policy.

Emerging in the 1950s, policy studies involved governments looking to the social sciences to “develop public policies, replacing earlier approaches that were largely intuitive and ad hoc” (Rizvi & Lingard, 2010, p. 1). Primarily these were to support the wishes of the state “helping it to develop its priorities and programmes and determine ways of ensuring their efficiency and effectiveness.” (ibid):

“Governments believed that the intractable problems they faced could only be solved through the rigorous application of research knowledge and techniques developed by social sciences”

(ibid, p. 1)

During the 1980s the use of policy studies declined due to a number of factors, most notably 'ideological assault' by the Thatcher and Reagan governments; a fundamental shift in how policies are created, applied, and assessed (particularly concerned with increasing globalisation); and that an academic treatment of policy making "did not produce the reliable, generalizable and predictable policy knowledge it had promised" (ibid, p. 2)¹. While governments looked to 'policy scientists' so too did political lobbyists and groups who sought out research and analyses to support their own agendas and policy preferences "professing technical expertise that often masked their particular interests" (ibid, p. 2). While they were being increasingly shut out of the policy formation process directly, policy researchers at this time became increasingly interested in the process of policy formation:

"In addition to providing information helpful to policy makers, academic policy researchers were also interested in what governments did: how they negotiated various political interests, and more generally managed policy processes."

(ibid, p. 1)

In 'The Importance of Teaching: The Case for Change' (Department for Education, 2010a), an ancillary document to the new 2010 UK government's white paper on education, the Department for Education outlined its argument for a number of changes to English state education. Using almost ninety academic references, reports, and statistical analyses in support of its arguments it set out its agenda for schools to recognise what can be learned from nations that are rated higher in global rankings, to link student exam performance with a teacher's degree classification, and to suggest the fields of study that will lead to a secure global future for England (ibid). The Department for Education was led by the Secretary of State for Education Michael Gove who, during a subsequent educational reform, then painted educational academics as preventing English state education from being 'world-class', referred to them as "the blob" (The Independent, 2014), and infamously declared during an interview regarding the 2016 referendum regarding the UK's membership of the EU that "I think that the people of this country have had enough of experts..." (Gove, 2016).

¹ In addition to the three points mentioned here, Rizvi and Lingard also highlight the emergence of new theoretical frameworks "such as critical theory, feminism, post-structuralism and post-colonialism", questions around the neutrality of those contributing to policy making, and how positivism became increasingly challenged within the social science community.

This thesis examines the ways in which an educational policy reform process was framed, how it was contextualised, and the discourses that resulted in the encapsulation of one policy into a single policy text. One goal of this analysis is the potential to improve reform outputs in the future by critically evaluating the process of one of the most recent educational reforms, but it is also aimed that by examining the production of a reformed qualification in detail we can reflect on the powerful role that specific organisations and people have in shaping a curriculum, and what reaches classrooms.

Accordingly, this thesis will examine the A level reform that took place from 2012 to 2015 in England from its initial proposals and the factors that led to it being instigated, to the final product – what was going to be taught to students in September 2015, with specific reference to Physics. To facilitate this, the focus of this thesis must be at times broad and consider the entire A level sector, but also narrow and examine the rich details and impacts of the reform process on individual elements and people.

The A level reform process was vast and contentious. In order to give a clear focus one voice subject was chosen – Physics. The subject contains its own challenges and tensions that may or may not be solved through educational reform, but considerations of how the A level reform process affected one specific subject provides a lens through which the reform process can be scrutinised. It can be seen what voices were listened to, what recommendations were accepted and which were rejected, and we can ultimately compare the reformed qualification with its unreformed counterpart to examine what the educational reform process has achieved.

This thesis does not aim to codify what educational reform is from a theoretical basis, nor is it a comparative study of theoretical reform frameworks laid out by educational theorists. Rather, it aims to provide a detailed analysis of the educational reform process at a specific point in time, in one subject, in order to highlight and then unravel the messiness of reform, the rhetoric behind it, and the ultimate reality of implementation.

As such, the thesis is concerned with truth and power, and how these operate in the reform process. It is with a discussion of these concepts and how we may identify them within the reform of A level Physics that we must begin.

2. Revealing truth and power in the reform process

Speaking on the subject of then Secretary of State Kenneth Clarke's review of Primary teaching methods in the early 1990s, Stephen Ball identifies significant aspects relating to the role of teachers within educational policy, and those in positions of authority over them:

"The Secretary's rights and obligations ... leave no legitimate discursive grounds from which 'the teacher' may speak. Indeed, there is little discursive space in all this for anything except acquiescence or silent dissent."

"What is achieved is a redistribution of significant voices. As always it is not just a matter of what is said, but who is entitled to speak. The teacher is an absent presence in the discourses of education policy."

(Ball, 1993b, p. 108)

In his critique of this review Ball notes how the Secretary of State positioned the review as a debate:

"The introduction of the notion of a debate, as an innovatory 'move' in the language game of educational politics is interesting. But this debate seems one-sided to say the least. The free and fair exchange of views normally suggested by the notion of a debate seems strangely absent; instead a platform is established, a discursive site for privileged critique and assertion."

(ibid)

Here there is a parallel to the Secretary of State, Michael Gove, during the initial stages of the reform process, and the language and framing of the educational reforms to A level Physics that this thesis explores. In considering the reforms, the tools and theoretical considerations of power and power relations that are used here by Ball became the starting point for this work – specifically language, reform discourses, and a Secretary of State for Education as a position of authority and power.

Bourdieu's work focused on the connected nature of power, authority and language; specifically how authority is instated in social settings and how social actors take positions of power over others (1991). Thompson (2010) applies such concepts in education by

viewing teachers as representatives of the state and society. She argues that while teachers may see themselves as representatives of their subject and field, the state has been present in their teacher training, their award of teacher status, and in judging them competent enough to judge student behaviour, carry out assessment, and all manner of expected functions. A teacher may see themselves as a thoughtful representative of their subject, but the state may view them simply as a tool, granted permission to teach according to the state's wishes. Bourdieu utilises the term 'performative magic' (1991, p. 219) to describe the aspects of superiority and subordination that play out here, and these themes are explored in this thesis through the contribution of subject organisations and teachers to the reform process and the extent to which their views are listened to, or ignored.

In subsequent chapters the role of numerous organisations and people within the reform process are described and analysed. While some of the interplay between such policy players may seem commonplace, oftentimes general points or illustrations of educational or pedagogic settings can demonstrate, through the application of educational theory, the dynamics of power (Thompson, 2010, p. 64-65). Sometimes, however, it is not simply enough to highlight a position such as a Headteacher or Secretary of State. A hierarchy or organisational map may demonstrate the structural positioning of power, but this does not necessarily capture the power dynamics between the participants (Wasser & Bresler, 1996). In this way, we must not take for granted a traditional hierarchical understanding of power, and instead focus on the "refined, invisible processes and relations" (Maeland, 2017, p. 96), in particular looking to Foucault and his suggestion that we attempt to understand a situation in light of the contextual and historical process (ibid, p. 98). In this aspect the thesis contextualises the key players and attempts to describe their situation and narratives within the educational reform process.

When examining the 'power of authority', concepts from Foucault, Bourdieu and Derrida's socio-political work are applied here in an educational context. As previously mentioned, Foucault offers useful considerations of educational settings and interactions (Thompson, 2010). Bourdieu suggests how social experiences shape our understanding of expectations, actions, and perceptions, thereby revealing the existing power relations that limit or subordinate social actors (Bourdieu, 1991, 1993). Derrida described the relationship

between language and authority, which is helpful when examining the language and vocabulary that is used by individuals in attempts to authorise themselves and their actions (Thompson, 2010). This thesis is not a study into the work of these philosophers, but takes their work as a starting point of how to critically analyse the A level education reforms and their impact; as Thompson believes, educational theory is useful “as something operative that allows us to disclose social reality. The quality of theory lies in the possibility of making our worlds comprehensible.” (2010, p. 64)

Bourdieu’s (1991) notion of the capital possessed by different social actors placing them in specific social contexts will be seen by looking to the interactions and exchanges between participants within the reform process (and those excluded), highlighting the power structures and the unequal power relations between them. These unequal relations feed into Derrida’s work on authority and its legitimacy (1991). These two intertwined concepts are of particular use when considering the politicised nature of education, particularly during this reform period. Those instating and directing reforms can be seen in positions of authority, yet the legitimacy of their position, according to Derrida (ibid), is essentially groundless and only comes into being when those with less authority accept the situation. In this thesis we will see how historical, political, and social structures are used to legitimise the power of certain individuals over the reform process. We also see how, during the reform process, those with power, in turn legitimise others to carry out their work, giving them authority over processes but without surrendering their power, thereby creating a complex network of power and power relations. Finally, Foucault’s concept of “difference” is a reminder of the ideal of multiple perspectives in qualitative educational studies (Maeland, 2017, p. 87).

Following his framing of power as fluid and dynamic rather than a stable entity, such power must be considered in light of the actions that are taken; equally important is questioning who the participants and players are, what is the ‘truth’, and describing and interpreting the power agents present in the research (Maeland, 2017, p. 89). As mentioned previously, this is done through a thorough telling of the reform process in a chronological way, ‘beginning’ to ‘end’, while exploring the key players and organisations that become part of it (and when).

Further applying broader concepts of power to the aspects of education and educational research that this thesis considers, Hannus and Simola (2010) see policy technologies and techniques as a form of power mechanism. Such techniques originate at a national level, but the power relation is formulated at a local level when they are implemented or considered for implementation (Simola, 2009). This description falls into Weber's (1968) view that:

“Power is the probability that one actor within a social relationship will be in a position to carry out his own will despite resistance, regardless of the basis on which this probability rests.”

(Weber, 1968, p. 15)

This is considered during the thesis when looking to aspects of resistance to educational reforms, how those may attempt to 'push back' on certain ideas and the success, or otherwise, of such actions. The power of a Secretary of State to instate reform therefore relies on whether or not their reforms are implemented by those in the classroom, and on the methods through which they attempt to ensure that this occurs. Such methods exemplify Foucault's (2000) conception of power shifting from the poles to the relation that connects them – a power mechanism formed from visible and hidden factors and actions. Through this work the visible factors are highlighted and the hidden factors elicited from some of those affected by the reform process (either by result or implementation), but not necessarily in positions to shape it.

The different positions of those affected by the reform (teachers, schools, students, universities, etc.) and those shaping it (the Department for Education, Ofqual, learned organisations, etc.) broadly follow Heiskala's (2001, pp. 251-258) posit that different amalgamations of power considerations are present at different levels. Within those levels multiple relations and multiple actors are either working in conjunction with each other as a form of collective power or reduce the power of others through a form of distributive power. Heiskala concludes that distributive power is predominantly found at local micro-levels and that collective power, as a more complex structure, is found at macro-levels. Hannus and Simola believe this to be too dichotomous (2010, p. 3) and this thesis will

examine how even macro-level policy players, such as exam boards, are still subject to reductions in power, attacks on their legitimacy by others, and shifting power relations.

As such, a study of power mechanisms and how they play out at multiple levels and in multiple structures is important in the examination of this educational reform, and why this thesis takes a broad focus, considering as many macro- and micro-environments and relations as possible. In doing so it is guided, as exemplified by the start of this chapter, by the previous work and considerations of Stephen Ball, in particular his description of first- and second-order policy effects (1993b) - those that are evident in practices or structures in specific sites and across the system as a whole, and those that are seen in social changes, respectively. Here we additionally see the effect of Foucault in the former and Bourdieu in the latter. As Ball states, when considering the power and power relations in educational management:

“It is such power relations at the micro-level of society that make possible certain global effects of domination. This is a microphysics of oppression – not the long and coercive arm of the state at work, but a bottom-up capillary process of local and unstable relations. This is a set of power relations which are produced ‘from one moment to the next, at every point’.”

(Ball, 1993b, p. 112)

This thesis attempts to explore the reform process through narrowing the focus of this study from macro-level positioning and debates related to broad educational reform, down through the mid-level considerations of a particular field and to a single subject, and ultimately to the micro-level of a single school and the views of individuals. It is not a thesis related to power per se, but power is a clear thread throughout all aspects of the reform, raising questions about the nature of this reform, and future ones. Foucault’s words are relevant here when considering the ultimate generally intended product of educational reform, a change to what happens in a classroom:

“While the logic is perfectly clear, the aims decipherable...there is none there to have invented them.”

(Foucault, 1984, p. 95)

The implementation of education policy is, in this case, ultimately achieved by classroom teachers. While figures of importance in delivering the reformed curriculum, and facing serious consequences were they not to, they are not involved with the creation of it. This dynamic is not isolated to teaching but:

“It is here that we can begin to construct the problem of the history of the modern school and the history of contemporary education policy as a set of relations among games of truth and practices of power.”

(Ball, 2013, p. 44)

Just as A level Physics is part of a much wider ensemble of qualifications and subjects, the creation of an A level Physics specification² is situated in a broad ‘policy ensemble’ (Ball, 2006, p. 48), related and similar policies that are shaped by these concepts of ‘truth’ and ‘power’. Ball notes that power is not always harmful, nor does it have to be a “mode of subjugation, or a general system of dominance” but that it is an “arrangement of social forces that are exercised” (2013, p. 30). He cites Foucault’s belief that “relations of power are among the best things hidden in the social body” (Foucault, 1998, p.119 cited in Ball, 2013, p.31) but that policy texts use certain forms of language that signify their meaning. This language, formalised in both official (and occasionally unofficial) policy texts are framed by the wider discourses that took place during their consideration and, through careful consideration of these discourses, we can reveal the policy that lies beyond the text (Rizvi & Lingard, 2010).

“Discourses are about what can be said, and thought, but also about who can speak, when, where, and with what authority”

(Ball, 2006, p. 48)

Ball’s use of the term ‘authority’ echoes the definition of policy used by Easton (1953) as an “authoritative allocation of values”. This authority, in this case the Department for Education, led by the Secretary of State for Education and the government in which he

² A specification is the document from which A level courses are taught and examined. There is no A level National Curriculum in England, however the specification can be considered the ultimate policy text of a reformed qualification, as will be explained later.

served, is characterised by Easton as distinct from more general ideas of power. Here it is a situation where a policy is created and enacted through legitimate power afforded to a government through elections. Ball (1994) however suggests that the power that creates a policy is an assumption of authority, not only because policies are “contested, value laden and dynamic” but also because they are often a product of compromises (Rizvi & Lingard, 2010, p. 12). To carry out policy analysis one must decode the text, but also the context in which they take place, the environment that they create, and their effect on their outcomes.

If education policy follows the interplays of concepts of truth and power, then reforms to education policy show these the most visibly. While reports of educational achievements and failings circulate widely in the media, the process of reforms to education shine a spotlight on what those with power regard as education, and how they exercise their political will in order to shape and control it. Unbalances to these ‘games and practices’ during policy reforms create “jolts and surprises” through which techniques of power and the deployment of knowledge can be revealed (Foucault, *Security, territory, population: lectures at the College de France 1977-78*, 2009, p. 79).

Apple highlights how considerations of power and policy are of specific importance in education as they allow us to examine the origins and effects of how curriculum knowledge is selected, organised, and transmitted (2013). Further building on the work of Young (1971), Bernstein (1977), and Mouffe (1979), Apple and Weis describe the process of curriculum production as a non-neutral process; one that is stridently ideological, and reflective of how the cultural capital of specific groups “re-create relations of domination and subordination by ‘positioning’ subjects within larger ideological discourses and relations” (2013, p. 80).

Ball’s separation of policy research into three distinct yet intertwined areas; texts, discourses and effects (1994); allows each to be simultaneously used as frames to consider the A level reform - as both the curriculum and policy documents that were produced because of the reform, and the discourses behind their creation. When examined together they can allow us to not just consider the reform as a comment on specific changes to what

is taught in a classroom, but as an example of the knowledge that has been approved by persons as yet unknown and changed from the previous established system for motives similarly unknown.

If power and authority are central to the creation of policy, this raises the question of where the authority that underpins a policy come from, and how is it exercised or allocated. As the state uses its authority in order to enact its policies, it can then in turn use these policies to legitimise its authority. With many individuals and organisations involved in a policy reform discourse, as we will later see, which of these has the authority to create, shape, and enact educational policy; ensure that it is understood and followed; or to steer educational practice? Ball (1994) suggests that it is in the 'structures of nations' where texts and discourses find this anchorage and that we must consider both national and sub-national forms of government, and their multiple agencies, to examine it fully. However, texts and discourses do not exist in material vacuums "rather they are located in specific material realities and cultural formations" (Rizvi & Lingard, 2010, p. 15):

Even when considering how a national policy is implemented at a school level we can see the effects of those involved in the production of the policy, their positioning, and their competing interests (ibid). All of the policy players are located in different logics of practice (Bourdieu, *Practical Reason: On the Theory of Action*, 1998) and power relations, and a "confusing interplay of trust/distrust" (Ball, 2007, p. 3) that inhabits the processes attempting to reform educational practices. The processes of the production and implementation are also significant as, through them, we can see the chronology of an issue coming onto the initial policy agenda, its construction and translation into policies and policy texts, and its subsequent implementation and evaluation of its consequences (both intended and unintended) (Rizvi & Lingard, 2010).

Through the examination of the reform it is also important to consider that policy documents and newly produced curricula do not represent the whole picture. Elmore describes how policy can be considered as "layered and additive" (Elmore, 1996; cited by Ball, 1997, p.16) whereby the previous policies continue in some form, perhaps reflected in

teaching materials or recalcitrant members of staff. Elmore also suggests that the instigators of educational reforms typically, but erroneously, assume that:

- “a) the newest set of reform policies automatically take precedence over all previous policies under which the system has operated
- b) reform policies emanate from a single level of the education system and embody a single message about what schools should do differently
- c) reform policies should operate in more or less the same way in whatever setting they are implemented”

(ibid, p. 16)

Debates presented by Nespors and Ball suggest that analyses of policy and reform only tend to consider “the interactions of politicians, administrators, teachers, and researchers” with parents and students “formulated as commodities and consumers” (Nespors, 1996, p. 380). To see reforms in their entirety we must also consider “what sort of people and voices inhabit the texts of policy analysis” and “how we engage with the social and collective identities of our research subjects” (Ball, 1997, p. 22). In doing so we may be more able to reveal “the complex interplay of identities and interests and coalitions and conflicts with the processes and enactments of policy” (ibid).

Ozga (1990) suggests that analyses of policy-sociology must “bring together structural, macro-level analysis of education systems and education policies and micro level investigation, especially that which takes account of people’s perception and experiences” (p.359) and, while she cautions against “a view of policy making which stresses ad hoc-ery, serendipity, muddle and negotiation” (p.360), Ball believes that relating together analyses of the macro and the micro can allow us “to look for the iterations [of social actions] embedded within the chaos (Ball, 1993a, p. 10). To synthesise these ideas and assist the analysis throughout the thesis I have organised these concepts into a theoretical framework to consider policy reform.

2.1 Theoretical Framework

“The idea of policy as edict from on high was always a crude measure to achieve effective change. This is particularly so when more effort is put into the production of the actual policy text than to a thought-out implementation strategy.”

(Rizvi & Lingard, 2010, p. 19)

In this thesis the creation of a specific educational policy is analysed, however this policy does not exist in a policy vacuum. It draws on other policies and policy texts, ideas and ideologies, debates and discourses, and together these form a complex reform process. The policy reform under analysis, however, does not follow a clear path. The concepts discussed in this chapter are interwoven throughout it and they shape both what the policy produced is, and how the reform unfolds.

The educational theorists drawn on in this chapter have conceptualised the features of educational policy and, by extension, the tensions and discourses that they reveal. In recognising that policy production will likely also contain these features, tensions, and discourses then considerations of policy can also be applied to analyse the educational reform. In order to provide a constant reference point, a framework outlining the key considerations in the previous part of this chapter is given below. This framework consists of twelve aspects that will be used to frame analyses of the reform process that produces the policy features that they describe.

1. Curriculum production is non-neutral and stridently ideological (Apple & Weis, 2013)
2. Policy is more than a set of policy documents or legislation; how policy is produced and implemented are also significant (Rizvi & Lingard, 2010)
3. Policy is “multidimensional, multilayered, and occurs at multiple sites” (Rizvi & Lingard, 2010, p. 14)
4. Policy “exists in context” (Rizvi & Lingard, 2010, p. 15)
5. Policy is value-laden, contested, and dynamic (Ball, 1993a)
6. Policy “remains a state activity” (Rizvi & Lingard, 2010, p. 16)
7. Policy is “a set of relations among games of truth and power” (Ball, 2013, p. 44)
8. Policy “interacts with policies in other fields and can be a product of compromise” (Rizvi & Lingard, 2010, p. 18)

9. Policy involves discourses governed by “what can be said and thought, who can speak, when, where and with what authority” (Maguire & Ball, 1994, p. 6)
10. Policy “is never straightforward when implemented” (Rizvi & Lingard, 2010, p. 19)
11. Policy making “has been mediatised” (Rizvi & Lingard, 2010, p. 19)
12. Policy is chaotic, but combinations of sector-wide and small-scale level policy analyses can help to unravel this (Ball, 1993a)

2.2 Applying the Framework

Where some single-focus studies attempt to reduce the task of unpicking policy chaos by focusing on specific aspects of educational reform processes only, this “neglect of the general” has a tendency to conflate specific and general effects (Ball, 1993a, p. 16). If we are to fully examine the reform process we must therefore consider how aspects of this framework are revealed in both the macro-environment of the A level landscape and its reform, as well as the micro-environment of Physics education and the impact the reform process has on the teaching of A level Physics and on students.

Considering these recommendations as broad guidelines this thesis is organised into specific areas:

1. Why reform A levels? – a consideration of what A levels are and why it was proposed that they be reformed. Following this, a consideration of the Physics A level, and the issues affecting Physics education.
2. The reforms to A levels – what direction the reform process took following its announcement and the interplay between the organisations responsible for it and its delivery.
3. The reforms to A level Physics – how the reform process on a general, sector-wide level resulted in the production in a Physics curriculum, what it contained, and what it did not.
4. Considering the reforms in practice – three perspectives on the reforms and the reform process representing those who did not have a voice in the reform but are the ultimate users and experiencers of it.

These areas are arranged in a generally chronological structure by virtue of the reform having a broadly identifiable start and end point. There is, however, some overlap between sections because, as we will see, many pieces of work take place simultaneously.

The theoretical framework is used as both a guide to the direction of the research and a tool with which to consider education reform. With many documents, policy players, and viewpoints, the twelve aspects of education policy to be sought out in each of the four reform areas mentioned above act as waypoints that, taken together, trace a journey through the research.

These twelve features of policy reform may not all be found in conjunction with each other, but it is suggested here that for an educational policy to demonstrate them, the creation and reformation of policy would establish them. When examining such a large and complex reform and reform process the framework is used as a guide to critically consider the importance and relevance of the findings, and areas to be sought out and investigated. That is not to say that the research excludes that which does not fit into the framework, but that the framework is used to suggest areas of investigation and reveal key events, documents, decisions, and happenings.

For example, Point 11 states that policy making has been mediated (Rizvi & Lingard, 2010, p. 19) and this thesis accordingly examines where and how the A level reforms were discussed in the media, how key policy players presented their actions publicly, and in what ways the A level reforms altered due to public and media scrutiny of the process. As such considerations take place at significantly different periods and contexts Point 11 feeds into the analysis of the reform at multiple stages in order to preserve the chronological narrative and the narrowing focusing of the thesis.

In a similar way, the thesis is not explicitly presented using the framework. It is proposed that the twelve aspects are a useful tool, but the focus of the work is not to suggest that they are a definitive framework through which educational policy reform could or should be considered. The twelve aspects are used here as a framework for tracing and conceptualising how one particular educational policy reform was conceived and enacted. In

this capacity the twelve aspects can be seen ebbing and flowing throughout the research and discussions, but are identified in the final chapter of the thesis as part of the study's final reflection and evaluation. Appendix One is used to provide an example of how this was done practically – when and where each of the twelve aspects were identified and how they formed the flow through each thesis section and chapters.

3. Research Methods

As an educational reform process is temporal in nature and structure, a methodological approach that affords the ability to investigate emergent issues, or pertinent documents is required, especially as they will not always be known at the outset.

Similarly, in order to analyse the nature of educational reform, how it is discussed, and the motivations of those involved, the approach must enable work across multiple discourses, and be flexible enough to react to the entrance of new ideas, people or organisations, and the new considerations that they may bring.

Finally, considerations of the reform rationales, the process of the reform, and the outcomes will require seeking the views of various groups; for the wider perspective on Physics and Physics education this will be HE Physicists, and regarding the result of the reform process, students. In addition to this as a teacher of Physics and leader of a school Physics department, my own relationship with the reform process leads to an auto-biographical element to my research. The ultimate result of the reforms will be interpreted by me in the writing of teaching plans, disseminated by me to members of my department, and enacted by me in a classroom. This means that my methodology needs to carefully manage my own positionality throughout the thesis, however the lived experience of someone who the reform process affected is a useful contribution to analysis of the reform. As such a short autoethnographic element is incorporated into the consideration of the reforms.

This research takes a mixed-methods approach that includes the following elements:

- Analysing documents, reports, and other research pertaining to issues and debates around Physics education
- Statistical analysis of data where this is not covered above
- Flexible and reactive analyses of the reform process from its announcement through to the policies and legislation that are created
- Analysing documents pertaining to a reformed A level Physics specification
- An autoethnographic element

- Seeking views of HE Physicists about their experiences and views of Physics education
- Seeking views of those involved in Physics education about the reform process and the reformed qualification

3.1 Researcher Positionality and an Insider Perspective

While a researcher who is embedded within a reform process may be a potential source of conflict, my own positionality forms the basis of the work and the reason for identifying Physics as one subject through which to view the reforms. Researcher positionality here helps to link the aspects together by setting a structural narrative as someone with experience of educational research processes, a background in physics and in education, a professional interest in the reform process, as someone who contributes to the resultant specification via consultations with the teaching profession, and then as someone who implements the reforms. It is my own experiences of Physics and, as a teacher in an everyday inner-city school in the North of England, that afford me a personal connection to this research, but one that must be clear from the outset.

Gair (2012) considers that an intimate knowledge of the context being studied is one of several advantages to being an insider researcher. As much of the literature relating to insider research and insider perspectives pertains to researching environments of which the researcher is a part (such as research within one's institution), I take a slightly hybrid 'outside-within' position.

The interplay of the levels that are examined within this study creates a situation where I consider myself an insider researcher, but one with limitations. My perspective shifts throughout the research, in some areas akin to an archaeologist – piecing together the chronology of decisions, documents, and communication that went on, in some akin to a diarist – describing how the local environment was affected during this period of time. I am a Head of Physics – implementing the reforms and tracking the unfolding reform process; I am a Physics teacher – teaching students what will be on the reformed A level courses; and I am a teacher-researcher – asking questions of my students about their perceptions of the subject that I have taught them. Each of these afford me an 'intimate knowledge' of the

context, as per Gair's (2012) suggestion of an 'insider researcher', however Coghlan and Brydon-Miller (2014) describe an insider researcher as "a researcher or participant who works for or is a member of the participant community". I am 'outside' the larger reform discourses, not present in many situations and contexts (such as the reviews and meetings regarding what should be taught on a Physics course) and am, in a way, marginalised by the reforms (having them 'done' to me and my institution, with little or consideration by those in power).

I do not consider myself or my perspective to be easily disentangled, nor do I attempt to do so. Instead I argue that this perspective is used (and is useful) to draw the research together, ascribing to St. Louis and Barton's view that knowledge claims are richer and more complex if there is a bridge between the personal experience of the participant and academic discourse (2002). Collins (1991) describes this variation as 'the outsider-within', suggesting that one's location within a system creates different lenses of reality, where the researcher is an expert observer of situations in which they may be excluded, but have a common stake in the outcomes. Here I feel that my perspective as a Physics teacher, Head of Department, and doctoral student in an education discipline affords me the perspective of an 'outsider-within' researcher in the wider environments that this study considers.

Where some interpretivist researchers seek to immerse themselves in the field that they are researching, I am already located within the field and cannot be removed from it.

Objectivity is the wish of many scientists, however Habermas (1972) argues that a pursuit of scientism in social science research neglects important considerations such as the values and moral beliefs of those being studied and the differences that may arise between equally informed opinions. In this way "positivism is unable to answer many interesting or important areas of life" (ibid, p. 300).

In this thesis, the underlying motivations behind a controversial, politically driven process are considered and evaluated through the documents that are produced, and the effect that this has on students and on my teaching. Considerations of motivations are inherently important when considering their result, and difficult to identify through a purely positivist approach when one does not have access to those involved. A similar problem with

positivism is the tension between a person's agency and structures in which they may be required to operate (Layder, 1994); people exercise agency and, whether a result of circumstances of their own choosing or not, they "do not behave simply, or deterministically like puppets" (Cohen, Manion, & Morrison, 2011, p. 15). With respect to this, the nature of a researcher deeply embedded within the environment and structures that they are researching can bring a strength to a piece of research that others lack. A highly structured environment can only be truly understood if it is considered from the standpoint of the individuals who are operating within the structures and confines of this world (ibid); in analysing a reform to A level Physics education, the impact is arguably most comprehensively assessed and evaluated by someone who teaches A level Physics.

However, if the researcher is no longer a detached and truly objective researcher then post-positivism may argue that they can only be understood by the researcher sharing their own frames of reference. While subjective undertakings are potentially more open to multiple interpretations than objective research, "reality is multi-layered and complex" and "many are not reducible to simple interpretation" (ibid, p. 17). An understanding of individuals' interpretations of the world can be a positive aspect when trying to explain specific contexts (Beck, 1979) and an ability to provide 'thick descriptions' is essential in order to represent complexity rather than reducing it (Geertz, 1973).

While there is a belief that social environments should be studied in their most natural state, limiting the intervention of, or potential manipulation by, the researcher (Hammersley & Atkinson, 1983) this work is concerned with a reform process that I was part of, but did not shape above my own location within the process. My voice and experiences are present in this research, however they are useful to provide a context and to link together documents and impacts of policy decisions in ways that may not be apparent to one with only a chronology or document publication dates at their disposal.

Wellington considers it a 'mystery' why many educational researchers subscribe to the ideals of objectivity, validity and reliability exemplified by scientific research, suggesting that those researching education aspire to be "systematic, credible, verifiable, justifiable, useful, valuable and trustworthy" (Wellington, 2000, p. 14). My experiences and background

within Physics makes it difficult to shake off the ideals of pure scientific research, however I do not consider objectivity and reliability a fundamental aspect of all research, but this does present a small element of tension with my work. I accept the argument that it is never truly possible to be objective in subjective situations like educational research (St. Louis & Calabrese Barton, 2002), particularly given the contested area of education reform, but I do not believe that my place within the research outlined above removes my ability to be impartial or to step back and look at a situation from multiple angles, while still maintaining Wellington's aspirations. In this study of the reform process, using the methods subsequently outlined, it is my aim to do so in a clear, methodical, and justifiable way, such that the narrative is constructed using my knowledge and perspective as a guide to the research, but not to present or select (or exclude) material in order to only present a subjective interpretation.

Maher and Tetreault (1994) bound subjectivity with considerations of positionality, and Foley (2001) further ties positionality with reflexivity. Taking these ideas together I consider two of Foley's three conceptions of reflexivity particularly useful to me as a researcher: 'Confessional reflexivity' – "a serious effort to convey how subjectivity may be affecting interpretations (ibid, p.5) and 'Theoretical reflexivity' – how a researcher produces "as objective and authoritative account as possible" (p.7). The triangulated nature of the research design and the way in which the research is presented in the thesis aim to balance these areas, and to take an approach that I cannot avoid my position within the research. Instead I use my own experience, location and knowledge as valid tools to probe and reveal the reform process not just from my perspective, but from an angle that may be considered relatable to the wider literature on education reform processes.

Within the more localised environments, specifically those related to the experiences of myself, my students and the lecturers I selected to interview, my position and perspective of a physics educator can be of benefit and does more resemble that of an 'insider'. Blackledge and Creese (2010) note that 'inside researchers' have sufficient knowledge of participants and the region being studied to pick up on cues (during interactions) and areas of interest (during other analyses) that outsider researchers may not notice. While I am situationally and professionally linked to the students and lecturers that I have chosen to interview I am

not carrying out research about our relations or the nature of our intertwined environments. Instead I am seeking their views on Physics and Physics education, but in a capacity where I experienced (and was responsible for) this for the students involved. Accordingly, this thesis incorporates an autoethnographic element.

The ethical considerations of the study and the participants are outlined in the second of the methodology chapters, but first the methodological approaches for the primary phase of the thesis are now described.

3.2 Proposed Methodological approaches

The chosen approaches, and their application across the thesis, are shown below.

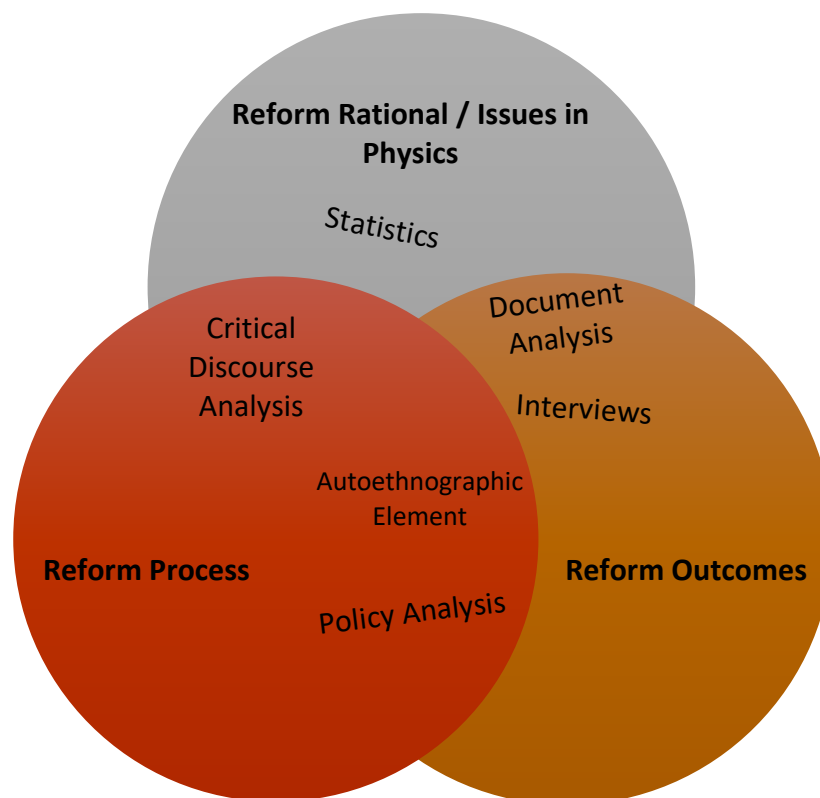


Figure 2: Methodological Approaches

3.2.1 Mixed methods

A pragmatic approach suggests that attempting ‘what works’ in order to answer questions posed by research would be the most useful approach to an investigation (Cohen, Manion, & Morrison, 2011), with some researchers arguing that utilising mixed methods approach is impossible to avoid if one wishes to discover ‘what works’ (Chatterji, 2004). However, a mixed methods approach does not mean that ‘anything goes’ – such an approach must have its own rigour, and it is through application of these standards that the research must deliver useful answers to the questions that are put by the researcher (Denscombe, 2008). A pluralistic approach rather than a single methodological approach enables any errors in single approaches to be identified but can also lead to richer data, new avenues to investigate and corroboration and triangulation between different methods (Johnson, Onwuegbuzie, & Turner, 2007). The consequence is that this research is driven by the nature of the research, such that researchers mix methods in response to the task at hand rather than their own preferences (Cohen, Manion, & Morrison, 2011).

Greene (2008, pp. 8-10) organises mixed methods research into four areas: ontology and epistemology³; enquiry logics⁴; guidelines for practice⁵; and sociopolitical commitment⁶. Making multiple domains implicit in all stages of a research methodology strengthens a mixed methods approach (Yin, 2006), and while the approach may be practical rather than realistic, it is practice-driven (Denscombe, 2008), and ensures that the researcher is not “a slave to methodological loyalty” (Oakley, 1999, p. 251) and enhances the quality of the research (Suter, 2005). The following sections set out each of the methods chosen, and justifies them in relation to the research aims.

3.2.2 Document Analysis

With a temporal nature to this research examining a process of educational reform that has now concluded, any form of analysis would be historical in nature. While this is certainly the recent past (with nothing relating to the reforms existing prior to 2010), an approach is suggested involving the materials produced in three key stages: those that frame the reforms, presenting a rationale for them or suggest what elements may need to be considered by them; those that are generated by the reform process or because of the reform process taking place; and those that are produced by the conclusion of the reform process

While most of the materials that can be used to examine the reform process specifically relate to education, the nature of the process (and at times the controversial aspects of it) suggests that historical framing of the documents is required, a framing that is not usually part of wider analytical frameworks pertaining to discourse.

While one of the aims of this research is the analysis of the discourses relating to educational reform, an evaluation and analysis of the historical aspects of the reform process can also be used to consider the process. For example,

³ Assumptions about the nature of the world, philosophical assumptions and stances, how we understand the world, the warrants we use, etc.

⁴ Data collection and analyses, reporting, methodologies of research, etc.

⁵ How to mix the methods chosen

⁶ What and whose interests, purposes, and political stances are being served

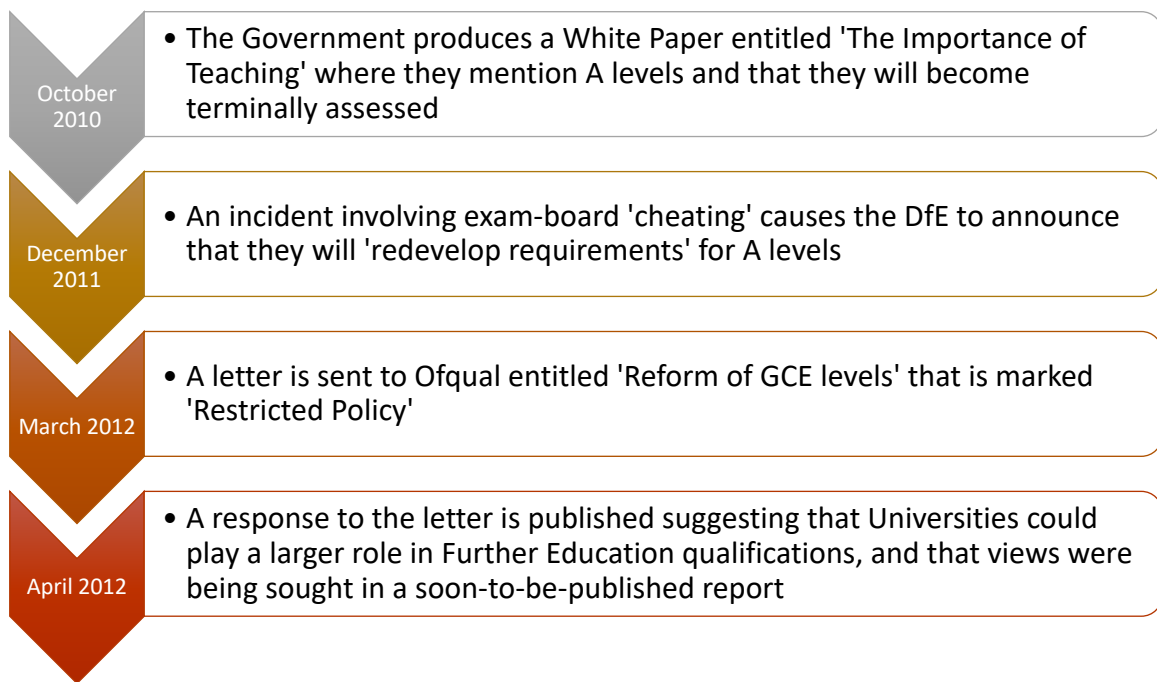


Figure 3: A document chronology

A chronology such as this, resulting in a 'document' timeline, can not only demonstrate the process of various reform stages but also allow the temporality of the reform to be considered as a factor in of itself. For example, the March 2012 letter marked 'Restricted Policy' was published publicly by Ofqual only four days later. In April 2014, a letter from Ofqual to the DfE suggested that the planned reforms should be delayed from the originally planned, "ambitious", September 2014 accreditation and commencement of study proposed for six months' time⁷.

The analysis of documents and texts has been the most characteristic and traditional method by which modern historical research has been separated from social research (Cohen, Manion, & Morrison, 2011), but with a drive towards the transparency of decision-making processes and accountability in politics, more documents than ever are in the public domain, either through Freedom of Information requests, press releases, uploaded statements, and letters sent between individuals.

While this is not a new avenue of analysis in educational research, the use of documents and texts has tended to appear less significant in social research than interviews, questionnaires, and techniques of direct observation (Burton, 2000). Here, the benefit of a

⁷ The document timeline that was produced during the thesis can be found in Appendix two.

documentary analysis (in conjunction with other analytical methods) affords a level of insight into some of the decision-making processes that would not previously have been possible, and allows a fuller picture of the reform process to be built⁸.

Some of the documents highlighted above form part of the analysis. However, for the purposes of the research, a document is defined using Cohen's description as "a record of an event or process, produced by an individual or a group, though not always following rigid typologies" (Cohen, Manion, & Morrison, 2011). For example, some of the key individuals involved in the reform process are public figures who, as well as contributing to written documents, would be interviewed in the print media and on television. While reports produced by official organisations have an element of assumed authenticity, in education such sources tend to record the approaches adopted or held by policy makers (Timutimu, Simon, & Matthews, 1998). As such Cohen (1999) suggests that documents should be analysed and understood in relation to:

"the semiotics of text production, how meaning is made in text, the status of authorial intention versus the reader's interpretation, the role of the community of discourse in the reception of the text."

(ibid, p. 81)

This feeds into further justification for a mixed methods approach given the analytical techniques that are suggested for use in the thesis.

Jupp and Norris (1993) suggest that there are three types of documentary analysis – positivist, interpretive, and critical. Positivist approaches assert an objective, systematic, rational, or quantitative nature of a study; interpretive approaches, as discussed previously, consider that documents have an element of social construction; while critical approaches involve considerations of social conflict, power, control and ideology. Codd's (1988)

⁸ This is, however, not without its own potential challenges. For example, in communiqués between the Secretary of State for Education and the Chief Regulator of Ofqual, the dates on the letters nor their recorded dates on their respective websites are not possible, as the Secretary of State thanks the Chief Regulator for a letter he received two days before it was sent. While a simple error, such quick turnarounds during the reform process make building a full chronology of who knew what, and when, both important and challenging.

discussion of educational policy documents includes interpretive and critical elements, arguing in favour of theories of discourse relating the use of language to the exercise of power, and seeking to deconstruct the official discourse of policy documents accordingly. In treating the outcome of the educational reform process as 'policy' it is my intention to combine such methods of analysis, as well as using Critical Discourse Analysis when considering the reform process itself.

3.2.3 Critical Discourse Analysis

Critical discourse analysis has mainly been associated with the ideas of Norman Fairclough, Ruth Wodak, and Teun van Dijk, although there is no single, homogenous version of CDA (Machin & Mayr, 2012). Rather there is a host of analytical and critical approaches that can be classified as CDA with many authors sharing the commonality of view of language as a means of social construction: language both shapes and is shaped by society (ibid). The use of a CDA approach is appropriate to this analysis, along with other analytical perspectives and data collection techniques. This is to counter potential criticisms about the objectivity of the researcher – making it preferable to support the conclusions from different sources of data.

CDA typically analyses, for example, news texts, political speeches, advertisements, school books. However its use as a tool to “expose strategies that appear normal or neutral on the surface but which may in fact be ideological and seek to shape the representation of events for particular ends” (ibid, p.5) make it useful in revealing the kinds of power interests in many political texts, especially ones that form part of a contested reform process and a vocal Secretary of State well practiced in journalistic techniques.

The value of taking a CDA-based orientation to policy analysis is that it offers an approach to the social analysis of discourse that is particularly relevant to processes of social transformation and change (Hyatt, 2013). It offers a systematic framework for analysis, uncovering how language contributes to the construction or reinforcement of power relations, especially where the policy-creation is seen as an arena of struggle over meaning, and produced policies are seen as the outcomes of struggles “between contenders of

competing objectives, where language or more specifically discourse is used tactically” (Fulcher, 1989, p. 7).

The utilisation of CDA to analyse the process of the educational reforms within this research follow similar approaches to that of Bowe, Ball and Gold (1992) and (Taylor, Rizvi, Lingard, & Henry, 1997) in that they use discourse as a central concept. Moving away from focusing solely on the produced policy (i.e. the outcome of the reform process that would form an aspect of document analysis) this research focusses on policy as process – the “production, reification and implementation of policy” (Bowe, Ball, & Gold, 1992), through which the ideological positions of those involved can be examined through scrutiny of the texts.

David Hyatt’s (2013) ‘Critical Policy Discourse Analysis Frame’ relates CDA to a policy setting, specifically focusing on “the investigation of the relationship of language to power and to other social processes, actors and relations” (ibid, p.837) and “more recent approaches to educational policy analysis which have utilised a discourse theory perspective, seeking to interrogate the ways texts and practices are shaped ideologically by relations of power” (p.836). These ideas are integral to the understanding of this reform process; Hyatt’s frame is thus adopted as the primary method of interpreting aspects of this reform and is split into two parts: ‘Policy levers and drivers’ and ‘warrant’.

“An engagement with drivers and levers is central to understanding the evolution of a policy, how it develops, and is interpreted in different contexts through the nuanced interaction of various actors at different times, at different levels, within local ecologies or contexts leading to its interpretation and recontextualisations by and within institutions.”

(ibid, p.838)

These ‘drivers, levers, steering and trajectories’ are conceptualisations of how the goals of policy shift and are enacted; attempting to identify and understand these includes how they are expressed in such things as “ministerial statements; through policy documents (e.g. in the UK, green and white papers); through press releases and website statements; or made manifest through inscription in legislation.” (ibid, p.838). These levers and drivers are

inherently “value-laden and multidimensional, resulting in intended and unintended consequences” (ibid) and are aided by the policy-trajectory approach suggested by Ball (1993a) in which a policy is tracked through from its formulation, internal and external struggles, and responses by recipients. They are also revealed by looking to the ways in which the state uses the tools it is afforded to direct, manage and shape change in public services . . . [and] functional mechanisms through which government and its agencies seek to implement policies” (Steer, et al., 2007, p. 177).

Warrant is “the justification, authority, or ‘reasonable grounds’... established for some act, course of action, statement or belief” (Cochran-Smith & Fries, 2001, p. 4), and can be more colloquially referred to as the rationale for a particular action. Hyatt considers three different forms of warrant:

- Evidentiary – that based on evidence. However evidence is not necessarily neutral; what is chosen or omitted as evidence, and how it is interpreted is “imbued with values and embedded in ideology” (Hyatt, 2013, p. 839). We must therefore consider aspects of credibility and trust, and how those who provide evidence to support their position sometimes use empirical data to declare their position undisputable.
- Accountability – that based on a result or outcome. This often presents justifications through what may happen if certain actions are not taken, policies not implemented, or as a counter to alternative suggestions.
- Political – that based on justifications relating to public, national, or societal good. Often rhetorical it is “usually couched in more general, evocative and positively evaluated terms, such as freedom, social justice, inclusion, social cohesion, or family values (ibid).

The importance of these considerations in educational reform is Hyatt’s suggestion that the language that is chosen when communicating ideas is a form of social control, especially when making attempts to persuade or when arguing a position that others may disagree with. To this end those with power use language to present their arguments as “common sense, inevitable and beyond challenge” (ibid) and thorough analysis of their arguments and the language that they use to express them is required. **Examples of documents and how they were analysed can be found in Appendix three.**

3.2.4 Other approaches

The methodological approaches that are used to evaluate the reforms from different perspectives involve **an autoethnographic element**, focus groups, and semi-structured interviews. As discussed in the introduction, such methods are not utilised in the research until that stage. It was debated whether to present them here, but for the sake of narrative structure and relevancy these methods are discussed at the opening of that chapter 'Considering the reforms in practice'.

Accordingly, the first phase, and next chapter, of the research is to begin with an exploration of what an A level is, why it was proposed that A level education needed to be reformed, and how both of these considerations can be contextualised through an application to Physics.

4. Why reform A level Physics?

The presentation of A level reform to the public, to learned societies, to awarding organisations, and to other government organisations was presented by the Secretary of State for Education as a largely complete process. The Secretary of State, Michael Gove, had reviewed the evidence and decided that educational reform was necessary in order to ‘fix’ the problems that he had seen or had told to him; all that was left was to carry out the reform process. While the qualification regulator, the Office of Qualifications and Examinations Regulation (Ofqual), is responsible for maintaining standards and ensuring that accredited qualifications meet the criteria that has been laid out, this criteria is set by the Department for Education (DfE). While the two organisations work closely, their correspondence regarding their work is detailed and publicly available, often so the head of the DfE, then Michael Gove, and the Chief Regulator of Ofqual, then Glenys Stacey, have an established account of what they are asking the other to do, and what they themselves understand that they have been asked to do. An example is in the following excerpt from a letter from Michael Gove to Glenys Stacey at the start of the reform process:

“In your consultation you were clear that changes to the structure of A levels would not have a detrimental effect on your ability to maintain standards, and would therefore be a matter for Government policy rather than a decision for you as Regulator. I am therefore writing to set out my policy decision to make changes to A levels in order to restore their reputation, and, given the importance I attach to this, it is important that Ofqual has regard to my views.”

(Gove, 2013a)

Here, Michael Gove reiterates Ofqual’s findings to the Chief Executive of Ofqual, explains why his input is required, gives his decision, and emphasises the seriousness with which Ofqual should take his directive. Yet, within this short paragraph regarding Michael Gove’s decision is a small glimpse into the rationale that he has for the reforms, “to restore their reputation”. Michael Gove rarely cites sources for his views, but does often explain why he has come to those views. In considering statements such as this it is my aim to outline the

various rationales stated by key policy players/actors regarding why the educational reforms take place, and what they hope to achieve through them.

Combining correspondence, speeches, consultation documents, and research carried out by the DfE and Ofqual, there is a large body of evidence through which this analysis can be achieved, however the advice that the two groups seek from outside groups, such as teachers, employers, Higher Education Institutions (HEIs), and learned societies is equally revealing of their positions. There are areas where the consultation documents seek evidence or support relating to something that it can be seen elsewhere has already been decided, blurring the line between what is an established rationale for the reform, and areas where the organisations are willing to alter their views. Similarly many groups who contribute to the qualifications clearly hope that raising concerns about aspects that are not asked specifically about may direct the reforms in various ways.

In breaking down the competing narratives within the above I have arranged the reform considerations into the specific areas, but these are heavily intertwined, compete, and respond to each throughout the five-year reform process. I have tried to separate them, but provide brief signposts to where something is discussed in more detail later, or previously. The rationales, views, and opinions could be separated by field (views of HE, Government, Learned Societies, etc.), however the reactive and responsive nature to some of their responses makes it difficult to fully do so.

The considerations are also largely kept within a particular timeframe, that of when reform decisions may have been made, but are yet to be enacted. In doing so I produce a guide to what all of the organisations involved in the reform process state that it should do, or consider, so that this can be used as a framework by which the result of the A level reforms may be evaluated later.

Through reasons previously outlined, in this work I use one subject as a lens through which to consider the reform process. Some reform considerations work across subjects, and at many levels within the educational sector, but focusing on one field, the sciences/STEM, and then further to Physics, builds a complex picture, that will subsequently look to how the

reform process has impacted on the teaching and experiences of the subject within a school setting. As such I consider the reform considerations in broad areas, often split into smaller sections.

I begin with a fundamental question that is useful when considering reforming a qualification; what is its purpose?

4.1 What is the purpose of an A level?

A levels are an “important and high profile qualification” (Stacey, 2012) taken by hundreds of thousands of students each year, however their purpose is ill-defined. Whilst there is tacit consensus amongst educators and institutions about what it can be used for, and what its students go on to do with their qualification, the main rationale for including A levels in the educational reforms of 2010-2015 was that they were ‘Not fit for purpose’:

“Freshers forget 60% of A levels: Are exams fit for purpose?” (BBC News, 2014)

“Subject content should be updated and strengthened to make sure it is entirely fit for purpose” (Department for Education, 2016)

“It is clear that A levels are not fit for purpose.” (Royal Society, 2011)

“Fit for purpose? The view of the higher education sector, teachers and employers on the suitability of A levels” (Ofqual & Ipsos MORI, 2012)

“the Russell Group...will form a new academic board to advise Ofqual on the content of A levels... identify where changes are required to ensure the subjects are fit for purpose” (Thrift, 2013)

The term ‘fit for purpose’ in the context of A level education reform formed the title of an Ofqual commissioned report into the A levels (albeit with a question mark at the end) (Ofqual & Ipsos MORI, 2012), and while this could be considered leading in its tone, many of the reform-instigating comments regarding A levels being ‘unfit’ can be traced to ‘The Sir Richard Sykes Review’ (Sykes, 2010). The report was commissioned by the Conservative party, and came to several conclusions regarding the ways in which further education in the

UK should be altered; many of the views and conclusions of the ten panel members⁹ later being the cornerstone of Michael Gove’s letters, speeches, and writings to justify the education reforms.

Whilst discussions surrounding the purpose of education are not within the scope of this work, the benchmark of being ‘fit for purpose’ highlights how the purpose of the A level qualification is not contested, despite it being largely undefined. While A levels informally follow the educational progression known as ‘Key Stages’, first defined in the 1988 Education Reform Act, this is due to its age-related nature and it does not form part of the statutory National Curriculum. However, when the Education and Skills Act 2008 introduced mandatory education or training until the age of 18, it solidified the role of the A level as the primary qualification choice for post-16 studies.

Key Stage	Ages	School years (Y)	Final Exams
0	3-5	Nursery, Reception	
1	6-7	1-2	SATS, Phonics and Reading Check
2	8-11	3-6	SATS, Eleven Plus
3	12-14	7-9	
4	15-16	10-11	GCSEs
5	17-18	12-13	A Levels, AS Levels, NVQs, National Diplomas

Figure 4: Mapping Key Stages to age range and school year

The National Qualification Framework (NCF) groups qualifications “according to their difficulty” with levels “based on the standards of knowledge, skill and competence needed” and includes the A level however while the NCF is hierarchical it is non-sequential and doesn’t include the Key Stages 0-3.

⁹ The ‘Review Group’ included senior leaders and directors from Imperial College, Durham University, Kings College, Eton, and two representatives of ‘ARK Schools’ – Amanda Spielman and Sir Michael Wilshaw (Sykes, 2010). The latter representatives would go on to be proposed by Conservative Secretaries of State for Education for the post of, and sequentially became, Her Majesty’s Chief Inspector at Ofsted, a non-ministerial department.

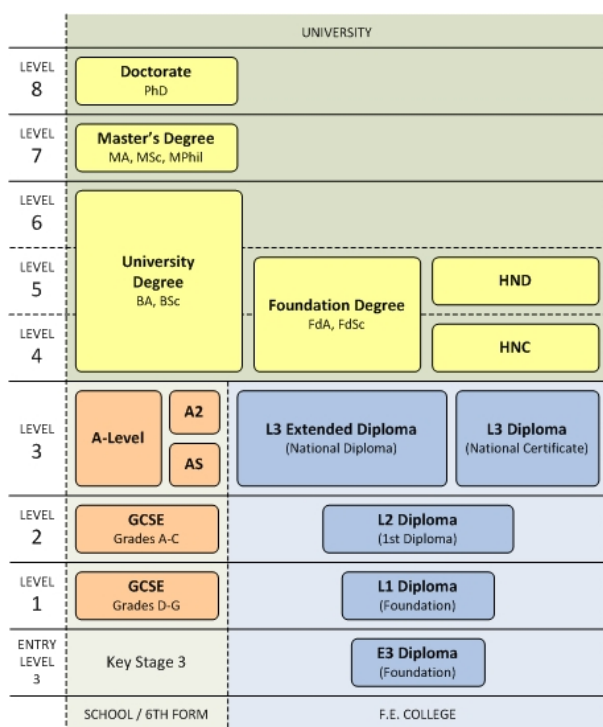


Figure 5: The National Qualification Framework (2012)

Ofqual (the qualification regulator) splits the eight levels into knowledge and skill descriptors, and defines Level 3 qualifications as:

Knowledge descriptor (the holder...)
<ul style="list-style-type: none"> • Has factual, procedural and theoretical knowledge and understanding of a subject or field of work to complete tasks and address problems that while well-defined, may be complex and non-routine. • Can interpret and evaluate relevant information and ideas. • Is aware of the nature of the area of study or work. • Is aware of different perspectives or approaches within the area of study or work.
Skills descriptor (the holder can...)
<ul style="list-style-type: none"> • Identify, select and use appropriate cognitive and practical skills, methods and procedures to address problems that while well-defined, may be complex and non-routine. • Use appropriate investigation to inform actions. • Review how effective methods and actions have been.

Figure 6: Level 3 Knowledge and Skill descriptors (Ofqual, 2015f)

These frameworks help to define what an A level **is** (or should be), and where it fits into England's educational structures, however it doesn't define what it is **for** (or what purpose it should serve).

The Qualification and Credit Framework classes Level 3 qualifications as "appropriate if you plan to go to university, work independently or (in some cases) supervise and train others in their field of work" (CCEA, 2017), however while employment is often cited in discussions of the A level qualifications, employers do not generally view the subjects being studied as particularly important. The sciences are held in high esteem, and good English or Mathematics grades preferred, but A levels have mostly become the minimum level of accepted qualification for employers to consider in their selection criteria, demonstrating general aptitude and a willingness for students to apply themselves (Ofqual & Ipsos MORI, 2012). This has led to confusion with learned bodies, employers, and teachers, regarding the status of the A level as now a de facto school leaving qualification. Given the compulsory school leaving age of 18, this suggests a requirement for A levels to prepare students for life after school, but there is ongoing debate about whether it should be emphasised as only for those who will progress to higher education (HE).

Whilst the A level has always been a school-leavers qualification, its primary function has always been to "facilitate the entry to higher education" (Ofqual, 2012a); however, as the number of A level candidates has grown steadily from just over 100,000 entries in the 1960s (and a 'Pass' rate of 75%) to 836,705 entries in 2016 (and a 98% 'Pass' rate) several changes have been made to the way that the A level has been structured, assessed, and graded (JCQ, 2018). The evolution of the A level qualification shows what changes have been made over time, and in what political contexts.

A-levels were introduced in 1951, as a replacement for the Higher School Certificate; while its predecessor required students to study a broad range of subjects, the A level was offered in individual subjects to encourage in-depth study of three or four subjects. The A level was graded on three levels; Distinction, Pass, and Fail, and those students who achieved a Distinction could further sit 'Scholarship Level' papers to compete for 400 national scholarship places at university.

In 1963, the grading system became norm-referenced, introducing the Grades A-E, with an O being a simple 'Pass' and a fixed percentage of students being awarded each grade; this was primarily to allow the A level to be differentiated due to increases in the number of students, and saw changes to the Scholarship Level qualification (now called S-Level)¹⁰. State Scholarships were abolished in and replaced with a system of student grants to account for more students wanting to pursue places at university (Select Committee on Education and Skills, 2003).

The norm-referenced system assumed that because the number of student taking the qualification was large then standards would not fluctuate greatly between years – the A grade students would be the top 10%, B grade, the 15% below that, etc. However, feeling about this being an unfair method of judging individual students and the performance of schools led to growing questions regarding its validity.

The grading system was changed to become criterion referenced in 1984, whereby grades 'B' and 'E' grade were defined and assigned by examiner judgements, with the intermediate grades assigned by an equal distribution of the marks in-between. In 1989, the Advanced Supplementary (AS) level qualification was introduced to be taught over the same a two-year period, and allow students to broaden their studies with a smaller qualification in conjunction with their A levels. As the AS level was only half the material of an A level, but the same level of difficulty, this began a gradual move from the main qualification being a two-year linear course to being modular, and in 2000 further reform took place to standardise the qualification.

'Curriculum 2000' embedded the modular nature of the A level qualification, with the rationale of increasing the options offered to students within certain courses, simultaneously offering modular examinations at different stages through the two-year course. This offered students the opportunity to re-take modular examinations before the end of their studies, and was largely seen positively as 30% of students were previously failing the courses at the end of two years of study. Curriculum 2000 also altered the

¹⁰ The S-level was still only taken by the most able A level students and existed as 'Special Papers' until 2001 when they were then replaced by 'Advanced Extension Awards'. These continued to run across the full range of subjects until 2009 when it was withdrawn for all subjects except Mathematics where it continues to be used as an additional pre-University selection tool akin to the UK Clinical Aptitude Test (UKCAT) or Physics Aptitude Test.

grading system, with subjects defining specific criteria for each grade (instead of just the B and E grades) however this varied between courses due to the perceived challenge in establishing criteria in humanities and social sciences compared to mathematics or science. This was described as “soft-criterion referencing ...a system which does reward attainment at the more general level than some very specific criteria would do” (Education and Skills Committee, 2003), in which the number of marks awarded would equate to a specific grade boundary rather than a ‘can do’ statement, but where some subjects would design specific questions that a B grade student would be expected to be able to answer, but a C grade would not.

Curriculum 2000 can be regarded as the last major change to the A level qualification prior to the educational reform of 2015-17, but there were changes in the intervening years. Awarding Organisations (AOs, but also referred to as exam boards) have added, removed, or modified the content of their courses on numerous occasions, however this has exclusively been alterations to their subject specifications (the structure and relevance of which will be later discussed). Significant reviews were made in 2004 and 2008, but resulted in no structural or grading changes. However it is worth noting that each year awarding organisations report on the examinations that have been carried out, and run training courses for teachers outlining areas where they may be refocusing the areas or skills they will be examining.

On 9 November 2012 Ofqual announced that all modular examination windows would close, including those for students who had begun courses with them designated. This marked the first revision to the A level qualification of the educational reforms that form part of this work, but is also of note for it being the first piece of A level reform that reverts the qualification to an element of its past structure, something that would become more common as the reform process continued.

Throughout this brief history, it can be identified that each reform was based around differentiating students more accurately across the grades. The reforms are all in response to increases in numbers taking the qualification and the increasing pass rate, making it more challenging to identify ‘the best’ students. Employers are not cited by the government in

any way regarding why the A level qualification should be reformed, simply that they would benefit, and it is almost exclusively stated as being a tool for university entrance. The views of employers were sought through open consultations but not directly approached, nor mentioned directly by Secretary of State Michael Gove, or Chief Regulator of Ofqual Glenys Stacey, when they publicly discuss the reform agenda.

Ofqual's A level reform consultation (2012a) sets out the objectives of what the reformed A level qualification should be "in order for us to be able to regulate in a consistent manner" (ibid, p. 15):

An awarding organisation must ensure that each GCE qualification which it makes available:

- Defines and assesses achievement of the knowledge, skills and understanding which will be needed for Learners planning to progress to undergraduate study at a UK higher education institution, particularly (although not only) to study the subject concerned;
- Sets out a robust and internationally comparable post-16 academic course of study to support that knowledge, skills and understanding;
- Permits UK universities to accurately identify the level of attainment of Learners.

It should also:

- Provide a basis for school and college accountability measures at age 18.
- Provide a benchmark of academic ability for employers.

(ibid, p.15)

While the purpose of the A level as a transitional qualification to university study is clear, and notably placed above that of employment, the consultation response from the Science Community Representing Education¹¹ (SCORE) warns against the inclusion of the consultation's latter points, stating that they would likely introduce "perverse incentives" and "continue to result in teaching to the test to improve results but not necessarily

¹¹ SCORE was the partnership of The Association for Science Education, Institute of Physics, Royal Society, Royal Society of Biology and Royal Society of Chemistry that was used during the educational reform period to represent the views of the scientific community. Individual organisations continued to produce independent reports and consultation responses as they saw fit.

understanding”, but acknowledging that “even if A levels were to be redefined as primarily for entrance to higher education, employers would still regard them as useful indicators of a defined level of performance”, and as such need not be specifically considered when redesigning the qualification (SCORE, 2012b, p. 4). The Royal Society (2011) and SCORE (2012b) are also in agreement on how trying to tailor a qualification to “satisfy two very different target audiences” resulted in the removal of the short-lived Science Diploma in 2010¹².

Summary

In tracking back its origins we can perhaps see the strongest exemplification of educational reform existing in context. The A level qualification has always been a university entrance qualification however, while it has been modified structurally and has been widened to act as a more general qualification, it has remained intrinsically linked to the higher education sector. As well as its importance to universities in their selection process as evidence of a student’s academic skills, it also acts a crucial grounding of knowledge that will be built upon during undergraduate study. This would suggest that while power over the A level rests in the hands of the Secretary of State for Education, considerations of who has authority over the A level would suggest that it is the Higher Education community.

Despite this the A level qualification has remained in control of the state, taught in state schools, and funded by the state. It is equally significant how other users of the A level qualification, employers, are not formally recognised, highlighting the value placed on HE as part of the A level. Without employers it is subject organisations and HEIs that are afforded a voice in the A levels, and in the subsequent reform process. While the inclusion of employers as decision makers within the A level is not what is being argued here, what is clear is that the educational reforms were a chance to potentially change this. They are mentioned merely as users of the A level qualification, highlighting how the purpose of an A level is again codified as a pre-university course and revealing the ideological placement of

¹² Michael Gove, as Shadow Schools Secretary, had stated back in 2008 that he intended to drop the “so-called academic diplomas” immediately as he “wish[ed] to preserve and enhance A levels”, highlighting the “examinations are not as rigorous as we would like them” (BBC News, 2008).

the HE community over all others involved in the A level by the Secretary of State for Education.

After considering what the purpose of an A level is and who it is for, we can now begin to turn to the issues that are identified within it. Accordingly, the next section will consider the technical issues with the A level structure itself.

4.2 Technical Issues

Criticisms and critiques of A levels in this area generally fall into two sub-categories; assessment and structure. While the focus of this thesis narrows to considerations specific to Physics, these are the broadest areas, but also important in two important ways; first is that they affect all A level qualifications, irrespective of the subject area; second is that these are areas that changed the nature of the qualification itself yet substantive changes were implemented prior to the reform process and without any consultation process by the Department for Education or Ofqual.

One of the most common criticisms of the A level was its modular nature that was softly introduced in 'Curriculum 2000'. These criticisms tended to be based around students compartmentalising knowledge, such that they would focus on it while studying the module, but then 'dump' that knowledge after their examination, leading to difficulties when students encountered the material again at an undergraduate level (Royal Society, 2011). First highlighted by Michael Gove in 2010, he proposed that a "shake-up" of A levels would "see fewer modules and more exams at the end of two years of sixth form and, as a result, a revival of the art of deep thought" (Gove, 2010a). University sources were often cited by Gove, Nick Gibb (the Schools Minister), and Department for Education spokespersons as the driver for this, however the only exemplifying example of 'deep thought' used was that:

"schoolchildren lack basic facts, such as who Miss Havisham is or who was in command at the battle of Waterloo...the great figures of literature that still populate the conversations of all those who regard themselves as well-educated should be known to all." (Gibb, 2010)

While no suggestions were made by the government at this stage regarding how reforms to an A level in Physics would increase a student's ability to quote Shakespeare, it was the structure to the A levels were at the forefront of the changes at this stage. With compartmentalisation seen as the result of the modular nature of most A level courses and "students preparing for exams almost as soon as they begin a course" (Truss, 2013), it was clear from as early as July 2010 that the government were intending to separate AS and A level courses into individual qualifications, and return to terminal examinations (Gove, 2010a). While it was not the government's proposal to eliminate AS level study, the terminal examination requirement would mean that any student wishing to complete two years of study could not have any examinations in their first year. A further result of this was a specified end to the "re-sit culture" through which students attempting to improve their modular results to gain higher overall grades and reach university offers "can be seen as undermining the qualifications and educationally inappropriate" (Department for Education, 2010b, p. 49).

The responses to these announcements were many and mixed. However, Cambridge University was the first HE organisation to respond to the proposals with the Director of Admissions, Dr. Geoff Parks, noting that without AS results from students they would "reluctantly be forced to fall back on GCSE results, interviews, bespoke admissions tests and predicted grades" (University of Cambridge, 2010), none of which Cambridge felt were as reliable as AS grades due to its 'semi-hooked' nature and that it makes up 50% of the A level result (excluding re-sits) (Sutch, Zanini, & Benton, 2015).

While the Department for Education refuted this, highlighting a correlation between GCSE results and degree classification (Department for Education, 2013a), a replication of their analysis by LSE showed a weak relationship between GCSEs and A levels (Johnston, 2014). As one of the "elite universities" that Michael Gove traditionally referenced regarding A level reform (Gove, 2012), Cambridge felt that it was possible to improve A level courses in the areas that they had concerns about, and that the removal of the January examinations in AS and A level courses would be sufficient. Notable also was that Cambridge was seeing significant rises in applications, especially in places won by students from state schools and colleges, and under-represented groups due to "the confidence engendered in students

from “non-traditional” backgrounds, when they achieve high examination grades at the end of Year 12” (University of Cambridge, 2010).

Within the sciences, SCORE was also in favour of retaining the AS qualification for use as a performance indicator for higher education institutions, on the whole highlighting how they were crucial in allowing students to start with studying a range of subjects in their first year, and then narrow them in the second year, making it more likely that students would encounter A level mathematics either in a mathematics course, or as part of a science AS level. They advised reweighting the current qualifications, so that the AS would be worth 40% and the A2 60%, but ensuring that the examinations in both years would “embrace a synoptic character”. They also agreed that students spent too much time preparing for examinations and that the system of “numerous re-sits” had introduced “perverse incentives for teachers to focus on accountability measures” (SCORE, 2012b, p. 6), reduced teaching time, and suggested that students may not take some exams seriously if they knew they could re-take them if they did poorly. SCORE’s advice was to limit A levels to one re-sit per examination and that only the most recently awarded grade should count towards a student’s final grade, even if it were lower.

Summary

Regarding the assessment of A levels the view of HE and learned organisations was clear: retain the AS examination part-way through the A level, eliminate the modular assessments, ensure all examinations are synoptic, and consider different options to limit (but not remove) the number of re-sits students can take. When we consider how highly the HE community was placed in a position of power over the A level it is important to note that their suggestions regarding the structure of the A level qualifications in schools were not adopted by the Secretary of State for Education. They have been afforded authority, but no power in the process. Their arguments are refuted by the Department for Education, despite subsequent data showing the statistics used by the DfE to be flawed.

While it is not suggested here that a position regarding removal of an AS level qualification is an ideological one, that this position is stuck to firmly shows how firmly the Secretary of State believes in his assessment of the educational landscape and what must be done to correct it. With only predictions of what might happen to university admissions and the

challenges faced by universities in selecting candidates, the interplay between truth and power becomes one of beliefs and power. Here Michael Gove overrides the organisations who he has suggested should take more of a role in the A level qualification, supporting the ideas that reform discourses are not necessarily shaped by who and what can be said, but by when.

While we have examined here the views of several Higher Education institutions and learned organisations, these have been related to the structure of the A level and decision around these structures were not part of the formal A level reform process. The structural changes were made before the announcement of the reforms, but it is to the wider issues that were raised during the reforms themselves that we now turn.

4.3 Issues within Higher Education

As previously highlighted, the government's 2010 White Paper set out a clear purpose of A levels as a "crucial way that universities select candidates for their courses, so it is important that these qualifications meet the needs of higher education institutions" (Department for Education, 2010b, p. 49). As student numbers taking A levels and applying to university has risen universities many universities have developed systems to help differentiate between applicants in addition to the A level examinations. This ranges from requiring students to take additional formal tests, assessing students' skills and thought processes via a range of problem-solving questions during interviews, reviewing GCSE results, or by a holistic impression of their candidates and other aspects such as personal statements or portfolios.

Michael Gove suggests that A levels are not fit for purpose because several universities use additional examinations to assess student competence when making offers. In light of these issues, the Secretary of State for Education for England pledged he would accelerate reform to allow universities to develop A levels to act as better preparation for higher education. He proposed that by doing this, there will be renewed faith in the 'gold-standard' qualification and universities would be able to select, with confidence, the right people for their courses (Gove, 2010b). However, if the education reforms were, in part, supposed to eliminate additional testing, it is notable that several of Michael Gove's 'top-tier'

universities operate organisations that provide such assessments. Examination boards and Awarding Organisations are strictly 'not-for-profit', however there may be a conflict of interest in a HE institution being involved in decisions which may affect it financially and reputationally (such as 'Cambridge Assessment', a non-teaching department of Cambridge University being the administrator of the Physics Aptitude Test (PAT)).

One of the frequent criticisms of the A level qualifications is that the percentage of students achieving the 'top grades' has increased year-on-year (The Guardian, 2011)¹³ and has also been accompanied by an increase in A level numbers, naturally leading to a larger pool of applicants for universities to have to differentiate between when making offers for a limited number of places.

With the A level's purpose as a selection tool being clear from the government's statements regarding the qualification it is notable that the characterisation of the qualifications as 'not fit for purpose' in this regard was not shared by all universities. Indeed, several cited that a clearer emphasis on 'stretch and challenge' "has the potential to identify the most genuinely able" (University of Cambridge, 2010). In the Ofqual commissioned report 'Fit for Purpose?' (2012), IPSOS Mori sought the views of many HEIs, and reported that there was a consistent belief amongst a wide range of institutions and individuals that A levels were 'Robust, Consistent, Fair, Transparent and objective, and Credible':

"They are recognised as the gold standard - even if people at the margins snipe, they're a pretty good tool." - Head of Admissions, HEI, England

"Overall, A levels are OK for ensuring fair admissions. At least they are a benchmark you can apply across the board. There's still unfairness in the system but it is probably not the fault of A levels alone - it is about teaching standards and varying levels of support given to students." - Head of Faculty, HEI, England, Sports Science

(ibid, p.41)

¹³ Of note is that individual subjects have fluctuated considerably and have not followed this pattern. Also notable is that the number of students taking A levels, and the percentages achieving particular grades has remained broadly static since 2010.

High demand for limited places would be an issue for any qualification, but the weakness of the A level is the large number of A grade predictions for students. HEIs interviewed believed that the large numbers of students applying with three A grade predictions makes it challenging to differentiate those with “genuine talent” from those who have succeeded by “learning by rote, re-sitting, taking less challenging modules, and have had high levels of teacher support” (ibid, p.43). Of ancillary concern to a small number of HEIs was the potential for variation between exam boards such that one awarding organisation may have different standards or levels of content for the same grade.

The A* grade at A level was introduced in 2010 as a measure that was supposed to assist in the differentiation between candidates at the top levels. Unlike a standard percentage grade boundary it is awarded to students who average an A grade overall, but achieve more than 90% in each of the units in the A2 year of their course (Ofqual, 2010). A number of HEIs had incorporated this into the offers that they give to students for their most advanced courses:

“It’s given us an external and objective way of saying that we’ve chosen between the excellent and the very good... it gives something tangible; you can say this person is differentiated from the next person because they have an A*.” - Head of Admissions, HEI, England

(ibid p.40)

However, the feedback on this strategy varied, with some suggesting that it merely showed that some of the highest performing students had a talent for examination and technical proficiency, but did not necessarily indicate students that were “creative and interesting” (ibid, p.40). While many acknowledged it to be challenging, the lack of granularity at the higher grades was largely only felt by those in the subjects where there was a requirement to select students; in those departments where students were recruited it was felt that there is a “notable difference in knowledge and aptitude between A grade and B or C grade students” (ibid, p.41).

The need for separating out students at the higher levels was also shared by learned bodies, who expressed that if the reforms were to tackle this issue it could be an opportunity to make significant alterations:

“There are more imaginative ways of dealing with the problem of discrimination than continually putting in higher borderlines and I’m worried that this will just lead to students being drilled even more, particularly in high performing schools.”

(ibid, p.41)

“The current grading system should include more information to provide higher education with a detailed picture of student performance and facilitate greater transparency in university admissions. For example, supplementary information could be made available on the students’ performance in relation to the national entry of a subject via a normal distribution, marks could be given in addition to grades and a detailed breakdown could be provided of students’ achievement in assessment components”

(SCORE, 2012b, p. 5)

While such suggestions may appear intensive, and that they may require significant modifications to the qualification, this breakdown of examination results into key skills, topic areas, and question types is available for teachers already following the publication of exam results each year. With many Middle/Low-tier universities already shifting their admissions procedures to centralised admissions offices rather than academic departments, the logistical impact on this would not be great, but would vary significantly subject-by-subject, and could potentially introduce extremely narrow criteria being used to select applicants (Ofqual & Ipsos MORI, 2012). Further positive arguments for reform in this area was that a completely new achievement reporting system or method would present the reformed qualification as something totally new, and avoid “invalid conclusions” and “unhelpful comparisons” to the previous qualification (SCORE, 2012b, p. 5)¹⁴.

¹⁴ The conclusions and comparisons that are warned of by SCORE here were proven to be well founded when the reformed GCSE qualifications began being taught in 2015 and the seven graded letter system was replaced with a nine graded numerical system. While this did split the previous A* and A band into three (Grades 7-9),

There was some disagreement as to whether the A level qualification should be modified to attempt to differentiate between students achieving high grades, or whether a new qualification was required, stemming originally from an issue raised by the Wellcome Trust - the Advanced Extension Award (AEA). Introduced in 2002 for 17 subjects, they were designed to stretch the top 10% of students through more challenging questions based on the same specifications (Rushton, 2013). The number of students taking the AEA fluctuated however it was regularly used a signifier to universities of a high-calibre student; despite this, the AEA was withdrawn by the government in all subjects barring Mathematics¹⁵ in 2009 following the introduction of 'stretch and challenge' questions (QCDA, 2009). While some HE institutions were comfortable that this was sufficient to improve their confidence in the top end of the A level qualification (University of Cambridge, 2010), organisations like the Advisory Committee on Mathematics Education (ACME) and SCORE felt that they would like to see the AEA continue in all subjects "to encourage more in-depth study in the sciences to stimulate and inspire students working at the highest level" (SCORE, 2012b, p. 5) but also because "it is well-nigh impossible to design a single form of summative assessment that serves students of all levels of ability, particularly in science and mathematics" (Science and Learning Expert Group, 2010, p. 19).

The removal of the AEA was also notable as there was a dramatic increase in the number of universities requiring additional entrance tests to select candidates at this time. In 2010, 21% of universities used some additional form of additional admissions test, an increase from 16% two years prior (Supporting Professionalism in Admissions, 2010) however, while Ofqual stated that this increase was "as [universities] felt that they could not rely on the results of school and college exams to select exceptional candidates" (Ofqual & Ipsos MORI, 2012, p. 15), the head of admissions at Oxford University said their increase from 60% to 85% of students taking admissions tests had "predominantly been driven by the significant increase in applications that we've seen in the last five years...it's not so much A-level; it's more the diversity of our applicant pool now" (Paton, 2012).

the Department for Education routinely produced matrices that demonstrated the comparison between the old and new systems (Ofqual, 2015b).

¹⁵ Mathematics remained accredited until 2015 at this time due to it being a requirement for many undergraduate mathematics courses and was then further extended until 2017 (UCAS, 2015).

Some of the learned organisations did wish to see changes to the type of questions that were used in A level examinations, particularly those of a synoptic nature “that require the synthesis of ideas” (SCORE, 2012a, p. 5) and this was highlighted as a key driver behind the government’s intentions to make A levels more aligned to the standard required by HEIs (Gove, 2013a). Specific suggestions were made to the DfE and Ofqual during the consultations from many groups about what these changes may look like:

“We would like to see a greater variety of question types, including more questions which require extended answers and multi-step calculations. Questions which allow students to show scientific and analytical approaches to problems should be encouraged, reducing reliance on signposted/scaffolded answers and marks awarded for mentioning only key words.”

(Society of Biology, Royal Society of Chemistry, Institute of Physics, 2013)

While the government criticised A level questions for being “overly structured” that “encourage a formulaic approach, instead of using more open-ended questions that require advanced problem solving” (Gove, 2013a) there were concerns that this may introduce difficulties.

“Assessing in the most consistent manner may limit the scope of the kinds of questions that can be asked on examination papers or the types of assessments that can be used. For example, essay questions that require a level of professional judgement in marking are less reliable than multiple choice questions.”

(Ofqual & Ipsos MORI, 2012, p. 10)

Of note is the potential of using advanced multiple-choice questioning as a method of improving consistency in marking of examinations, while still examining high level skills that can be used to differentiate between candidates. While primarily used in Physics A level examinations, but rarely elsewhere, they are the foundation of many of the HE entrance examinations such as Cambridge’s ‘Thinking Skills Assessment’, a 90-minute multiple choice test needed to study computer science, economics, engineering, land economy, natural

sciences, and politics, psychology and sociology (Paton, 2010). The Conservative party commissioned 'Sykes report' suggested that the educational reform could be an opportunity to introduce conformity amongst disparate subjects (making comparing students from similar but not identical subjects easier for HEIs) by introducing a Standardised University Admissions Test covering language, mathematics, and reasoning (Sykes, 2010), with the possibility that this would allow A level subjects more flexibility and freedom in choosing a style of assessment that best suited their courses (De Waal, 2009) (Kotecha, 2010). While this was acknowledged as a useful step by Michael Gove (the then Shadow Secretary of State for Children, Schools & Families) he stated that it may not be necessary, provided the Sykes' reports suggestions for potential A level reforms were successful (Watson, 2010).

Standardised testing for all Higher Education entry has been used in the USA for many years, and while they are supposed to reflect a student's potential, there has been a significant rise in coaching students for the assessments both in and out of classrooms, and an emphasis on cramming for examinations that Gove would later admonish (Gove, 2010a). The suggestion of such testing, was also rejected by Cambridge's Pro-Vice-Chancellor for Education who, despite the university's aforementioned common assessment, had:

"...little sympathy for the narrow, one-size-fits-all standardised University admissions test recommended by Sykes. Such tests can and will be 'taught to'. It is also open to question whether a single test can encompass the diversity of the UK HE sector and simultaneously provide the fine-grained differentiation required to help select between the highest achievers."

(Cambridge Assessment, 2010b, p. 2)

These claims are also supported by the transition from the SAT format in the USA towards individual subject 'Advanced Placement' awards, similar to UK A levels (Watson, 2010).

Featured heavily in the 2010 Royal Society report into science and mathematics in schools (Science and Learning Expert Group, 2010) and the Sykes report (2010) were issues regarding the place of mathematics in school curricula. These issues formed significant

portions of Michael Gove's public statements and writings regarding reforms to GCSE education, but also where significant areas of concern in the A level qualifications were raised (Gove, 2012) (Gove, 2013a). Gove's speech to the Royal Society on 'Mathematics and Civilisation' ran from the importance of mathematics to Pythagoras and the fall of Rome, and to Richard Feynman by way of fascist Europe.

"For any politician anxious to ensure the next generation enjoy opportunities to flourish in an economy that is growing, in a nation that is confident and in a society that believes in progress, there is no escaping the centrality of mathematics and science."

(Gove, 2011b)

In his speech, he highlighted the newly commissioned 'National Curriculum Review', an "exercise in intellectual liberation":

"Of course, I am not prejudging the review. But there are strong arguments for introducing concepts earlier, for covering some topics more thoroughly, and for making certain subjects compulsory for longer. It is a debate worth having, and one I hope many of you will choose to be involved in."

(Gove, 2011b)

Despite Gove's assertions that he had no preconceptions about the review, he went on to list the numerous areas where he felt "we should concentrate on", presenting statistics, specific concepts, and several international approaches. Much of this related to the reforms to the GCSE qualifications and general place of mathematics in society, however he later expanded upon his view on compulsory subjects:

"That is why I think we should set a new goal for the education system so that within a decade the vast majority of pupils are studying maths right through to the age of 18."

(Gove, 2011b)

Mathematics is strongly represented by a number of groups educationally, the majority of them supported by learned societies and not limited to those chiefly concerned with mathematics or the sciences. Accompanying a series of reports and analysis by organisations like the IoP and SCORE is work by the Nuffield Foundation and the Royal Society. Although one of these organisations, SCORE, “strongly supports the recommendation that all students up to 19 should continue to study some form of mathematics” (2012a, p. 2), such support was not shared by the groups who represented mathematics at a HE level.

Returning again to Gove’s assertion that he was not pre-judging an independent review, his comments regarding making mathematics more challenging followed direct communication from ACME in which they raised serious concerns about the content of his previous speeches. They were concerned that the DfE were not recognising the “wide range of universities, representing the diversity of the sector, and not just the mathematical elite”, and particularly those subjects outside of mathematics, sciences and engineering. ACME placed the importance with reviewing mathematics within subjects and stated that “it is actually the absence of mathematics and statistics from many students’ post-16 choice of subjects that is the major issue, and not simply making mathematics more rigorous” (ACME, 2010). They also provided evidence that prior changes which made A level mathematics more challenging had shown “the extreme sensitivity of the subject to details of the assessment regime” and caused mathematics A level entries to “plummet”.

“We feel it is very important that we warn you that implementing such a policy runs a genuine risk of repeating the collapse in the numbers studying A level mathematics witnessed in 2002.”

(ACME, 2010)

Referenced by several consultation responses by awarding organisations and learned societies concerned with the sciences is a report from SCORE, in which the mathematical content of every 2010 science A level examination was evaluated.

“A large number of the mathematical requirements listed in the 2010 biology, chemistry and physics AS and A2 specifications were assessed in a limited way or not at all within the examination papers. Participants in our survey felt that in some cases the amount of mathematics assessed in A-level science examinations was too low.”

(SCORE, 2012c)

Essentially suggesting that the awarding organisations had accredited specifications that listed mathematical skills that were not being sufficiently examined, the counter to this is that a Physics specification would detail all that should be taught to a student, but not all this knowledge would be assessed in an examination. There is also the recommendation that to counter the perceived lack of mathematics in the exams, a strict quota should be introduced. That is to say that there should be a specific percentage of marks in examinations allocated towards questions that require a use of mathematics to solve.¹⁶

“The examination questions that did require mathematics were felt to be of insufficient difficulty; too many involved only single step calculations, require only simple recall, and were only set in familiar contexts.”

(SCORE, 2012c, p. 4)

“There were many mathematical requirements identified in biology, chemistry and physics A levels that go beyond the current GCSE mathematics “

(SCORE, 2012c, p. 4)

These two findings, taken together, present a challenge for the awarding organisations creating questions, and Ofqual setting the requirements of a course. Despite the potential for students continuing to study mathematics following their GCSEs there is no requirement to do so currently. While many students planning to study a science at university are made offers that include the mathematics A level alongside the relevant science, the A level

¹⁶ SCORE did not suggest what this percentage should be, simply presenting their data of what the percentage was in the 2010 examinations. This would later form a recommendation from Prof. Mark Smith in ‘The Smith Report’, discussed later.

courses must account for those with no such intention. 15% of students studying A level Physics do not study mathematics, and this figure is higher in the other sciences (JCQ, 2018). The response from most awarding organisations has been to limit the mathematical demands of the science papers to the standard expected in a Higher GCSE Mathematics paper, while introducing some advanced mathematical concepts and tools through the course such that they can be taught in context during their science lessons such as exponentials, logarithms, and inferential statistics (OCR, 2015)¹⁷. Some of the mathematical content of the A level courses has changed over time, with earlier forms of the A level science courses requiring the use of calculus, but these were removed when the A level Mathematics course became less popular and it could no longer be taken for granted that science students would also be studying mathematics (ACME, 2010).

“Obviously not everybody needs to study the more advanced calculus that is contained in the A level syllabus, but it seems to me genuinely bizarre that in the 21st Century so many children leave school essentially trapped in a mathematical world predating Newton and Leibniz, essentially unaware of the development of calculus.”

(Gove, 2011b)

No contributors to the consultations, nor reports cited by Gove, had identified specific areas of mathematics that their incoming students lack, however they focused on student preparedness for undergraduate study (where calculus is applied and used). Michael Gove had placed his comment on calculus in statements regarding being “more ambitious in the secondary curriculum”, where calculus currently has no application outside of mathematics lessons, highlighting the possibility of bringing degree-level science applications and A level mathematics into GCSE courses.

Debates about what mathematical content should be on A level courses were highlighted by several organisations, using research conducted as part of a Royal Society ACME report that suggested that two-thirds of undergraduates did not have sufficient mathematical skills for

¹⁷ Issues relating to the mathematical competence of A level science teachers naturally follow and are discussed later when considering teacher training.

their course (ACME, 2011). SCORE suggested a programme that would promote coherent teaching across mathematics and the sciences, reporting that:

“Current study programmes are not adequately preparing learners with the knowledge and understanding of mathematics, particularly within the context of the science, to progress into STEM Higher Education or STEM related work”

(SCORE, 2012a)

Such a programme was not unwelcome by ACME (with both organisations committing to work together (ibid, p.4), however they warned that a mathematics A-level was “not just a precursor to degree-level STEM subjects” (ACME, 2010) making it clear that while the sciences were a large user of mathematics, they were not the only subjects that may be considered in such a programme.

Alongside SCORE, the Institute of Physics looked at issues pertaining to mathematics in physics and engineering degrees. While they favoured a survey approach and presented several pieces of anecdotal evidence that regarding a lack of sufficient mathematical preparation (Institute of Physics, 2011), their concerns formed two key areas:

- First year undergraduates are not proficient in the mathematical skills needed
- The lack of mathematical content in the physics A level was not motivating students who enjoyed solving mathematical problems to take further related study

While the IoP did not present any solutions to these issues, they made it clear that university academics did not feel that their students were coming to the university truly aware of the amount of mathematics that was required to study Physics, with 55% of academics surveyed feeling “that the students were not very, or not at all well prepared to cope with the mathematical content” (Institute of Physics, 2011, p. 12) and with 92% of respondents feeling that the lack of ‘mathematical fluency’ was the main barrier to students achieving their potential.

They recognised that it was difficult to change this, as increasing the level of mathematical demand in the A level would likely reduce the number of A level students applying to HE Physics courses. However the IoP suggested that there were a number of A level students who were not choosing to study Physics at university because of a **lack** of mathematics in the A level course, such that A level was presenting the course as more conceptual rather than problem solving and students were instead choosing more engineering courses because they offered what students felt the physics courses lacked (Institute of Physics, 2011).

In their commissioned review of mathematics within HE bioscience sectors, alongside echoing feelings regarding the lack of mathematical ability of incoming students, the UK Centre for Bioscience highlighted that it was becoming difficult to design appropriate courses due to the “very wide variety of mathematics qualifications” that students were entering their courses with (Koenig, 2011, p. 1). Such comments were not unusual; alongside the previously highlighted work of SCORE in analysing A level science examinations, they concluded that some exam boards tests “do not meet the needs of students in terms of the way they assess the mathematical and analytical nature of science”. (SCORE, 2012a, p. 4).

“There is a measurable variation between awarding organisations in terms of the amount and difficulty of the mathematics that is assessed in biology, chemistry and physics AS and A2 examination papers.”

(SCORE, 2012c, p. 4)

Variation between exam boards is discussed later, but is a difficult issue when HEIs make offers to university students. A physics admissions officer may wish their applicants to be skilled in certain techniques and thinking, however only certain exam boards may involve these skills. This raises a question of whether HEIs should consider the specific exam board that a student’s A level is administered by, however this is rarely the choice of individual candidates and is hard to quantify fairly.

The challenge in variability between identically graded qualifications from different awarding organisations is not unique to the sciences. A Nuffield Foundation report into the mathematical content of A level assessments in Business Studies, Computing, Economics, Geography, Psychology and Sociology (2012) found even greater disparities than in the STEM examinations examined by SCORE:

“For Psychology, for example, one exam board required students to use mathematics in exam questions worth just 10% of available marks, but, for another, this figure was over 40%. This is despite psychology having mathematical requirements set by Ofqual in its subject criteria, akin to the three sciences.”

(Institute of Physics, 2012b)

“The amount of mathematics required to earn a particular grade is also affected by which units of study the school or student chooses, and by which questions students choose to answer in exams. For example, two students studying Business Studies could get the same grade, with one using no mathematics at all, and another gaining almost 50% of their mark from exam questions that require mathematical work.”

(Institute of Physics, 2012b)

The Institute of Physics supported the Nuffield findings, and their conclusion that the variation was such that the qualifications did not give universities a meaningful indication of the mathematical understanding or skills of applicants (Nuffield Foundation, 2012), and they presented them alongside their own research to emphasise that it was a HE-wide issue that could be tackled by mutual co-operation between exam boards, Ofqual, learned organisations and universities. Ofqual’s commissioned report into HE’s view of A levels outlined a shared view amongst interviewees that, to aid candidate selection, A levels should be designed with comparability in mind; while this was specifically suggested for a secure skill level being demonstrated for students receiving a B in Physics, no matter which examination board they sat, but also between subjects, such that a student with a B in Physics could be considered to have broadly similar skills and abilities to a student achieving a B in Biology (Ofqual & Ipsos MORI, 2012). This latter point was not widely raised by organisations considering A level reform at this stage, however the issue of subject grade comparisons was not shared by all. The Pro-Vice-Chancellor for Education at Cambridge

University cited international undergraduates as examples where different global standards had resulted in published lists of academically suitable qualifications for each course (Cambridge Assessment, 2010b, p. 2). SCORE later went on to suggest that a central document could be produced by learned societies in which all the available A level qualifications were analysed, so that HEIs take the specification that students were studying into account when making offers.

In final contrast, one Awarding Organisation (AO) suggested that it was the drive for reliability and confidence when selecting students for HE that was responsible for the problems that they were highlighting. It was suggested that, rather than make A level qualifications more rigid and test specific skills, there was “greater scope for producing valid assessments of the skills that students need to succeed in higher education” if “admissions officers were prepared to accept a small reduction in the reliability of A level results” (Ofqual & Ipsos MORI, 2012, p. 11). Pointing to the Extended Project Qualification (EPQ) that a large proportion of students take each year, this AO suggested that it is flexible, student driven, has marking criteria that does not specify what the students work should contain, and allows students to be creative, independent, and develop their research skills. Universities consider the qualification in high regard (Ofqual, 2012a), and as such it may be worth considering when reforming the A level qualifications.

Summary

One of the key goals of the educational reform process was to tackle the combined problem of an increase in the number of students being awarded the top grades at the end of their A level studies and first year undergraduates not having the skills that were required in their degree. However, the significance of this problem is tempered by an apparent confidence in the A level qualification by the HE community. Furthermore, this confidence is expressed to the Department for Education through a consultation carried out with the specific purpose of informing them about the views of HEIs. While there is clear support for changes to the A level qualification it is a misrepresentation to declare the view of the community as unified on issues regarding the A level. This is one of the initial examples in the reform process where the mediatisation of policy making plays a role. In making declarative and absolute statements regarding the unfitness of the qualification to the media, Michael Gove

identifies himself as the power to restore the qualification's reputation within the HE community. To later acknowledge that a significant portion of that community are confident in the qualification and that only minor adjustments are required may undermine his previous calls for vital reforms and how he is viewed by the public. In 'getting ahead' of consultation responses and independent reviews the Secretary of State can shape the discourse from one regarding whether reform is necessary to one where what should be done during the inevitable reform.

Considerations of policy in multiple dimensions, layers, and sites are also identified here, as what holds true in one environment is not the same as another. Where increasing the mathematical challenge to A level STEM courses would potentially aid one subject, it would disadvantage another. Before the reform has even begun it is clear that its implementation will likely be complex and could produce unintended consequences unless the reforms are structured to allow either flexibility or compromise.

A final aspect worth noting is how the government wholly absorbs HE considerations regarding the differentiation of high-achieving candidates. It accepts this as an issue and explores what can be done about it on a qualification level, rather than suggesting that universities accept that there are more high-achieving students than before and that they should reconsider their selection processes. It is rare for a government to suggest that an increase in top grades is a negative trait however, in engaging HEIs in conversations regarding standards the Secretary of State begins to suggest that they should take a lead role within the qualifications themselves. An exploration of the role of Higher Education within the A level is where this consideration of reform rationales now turns.

4.4 The Role of Higher Education

As highlighted when previously discussing the purpose of the A level qualification, there is an accepted view that it should act as a precursor to higher education. Being the primary user of the qualification naturally leads to a symbiotic relationship between the two forms of study. However, universities, as previously noted, had begun to raise concerns about how far it was acceptable to modify their long-established courses in response to a perceived

lack of skills in their undergraduates. Michael Gove highlighted what, again, was a comment originating from the Sykes review:

“There is clear dissatisfaction among leading university academics about the preparation of A level pupils for advanced study.”

“I am concerned that some natural science degrees have become four-year courses to compensate for problems with A levels. Linguists complain about the inadequacy of university entrants’ foreign language skills. Mathematicians are concerned that current A level questions are overly structured and encourage a formulaic approach, instead of using more open-ended questions that require advanced problem-solving”

“Many leading universities are concerned about the current A levels, and nearly three-quarters of lecturers say that they have had to adapt their teaching approaches for under-prepared first year undergraduates.”

(Gove, 2013a)

In reporting the dissatisfaction of HE Michael Gove highlights a specific view of A level education as providing what universities require from their entrants. The suggestions that universities must adapt to their entrants is presented in a damning statement regarding the quality of the A level qualification, and not a gradual change based on shifting educational priorities or teaching methods during a student’s schooling. When combined with a continual upwards trend in A level grades, this was used as the rationale to ‘fix’ whatever was causing students to achieve highly, yet not demonstrate the qualities that HE desired (often attributed to teachers coaching their students to pass examinations). However, this educational conundrum was not tackled with the same calls for educational reform when secondary schools repeatedly highlighted that their Y7 students were lacking the skills that their KS2 grades suggested, and the suggestion that primary teachers were ‘coaching’ their Y6 students.

When the government did call for educational reform they framed their commitment in the 2010 White Paper thus:

“To ensure that they support progression to further education, higher education or employment, we are working with Ofqual, the Awarding Organisations and higher education institutions to ensure universities and Learned Bodies can be fully involved in their development. We specifically want to explore where linear A levels can be adapted to provide the depth of synoptic learning which the best universities value.”

(Department for Education, 2010b, p. 49)

While in 2010 Michael Gove suggests that universities and learned organisations “can” be involved in the process, the Sykes report noted that “the development of examinations and qualifications should be in response to the demands and needs of its end-users (Sykes, 2010, p. 28). This change from HE involvement to de facto control later becomes Gove’s stated preference; in his letter to Glenys Stacey outlining the reforms Michael Gove states:

“There is much support for much greater higher education involvement in A levels”

“It is of paramount importance that new A levels command the respect of leading universities. I am delighted that the Russell Group is planning to create an organisation to provide advice to Ofqual on the content of A levels”

(Gove, 2013a)

Notably absent is mention of employer involvement and the role the awarding organisations have in guiding specification content¹⁸; similarly, the DfE ‘working with’ Ofqual, is the directive that Ofqual should consider the involvement of a specific group of UK universities. This redistribution of power and control of the A level is not new, however Cambridge Assessment highlight how there was previously a “more balanced ecology” where “schools, awarding bodies, and Higher Education institutions existed in a close set of relationships”

¹⁸ Potentially due to the media reports and subsequent investigation by the DfE and Ofqual regarding “unethical practices” by A level exam boards (The Telegraph, 2011).

(Cambridge Assessment, 2012a). Reports to the Education Select Committee also highlighted that the “ancestors of the current Awarding Bodies were linked to universities” and that they had inherited “a commitment to high academic standards” (Education Select Committee, 2012, p. 6)

They suggested that this system created a form of balance with the role of the exam board as a mediator; should schools exert pressure on the exam board to lower grade boundaries the exam board was restricted by having to consider the quality of students required by universities, and vice versa. With awarding organisations being run by universities, but employing examiners and course directors from teachers in schools, there was also a culture of trust in both the academic validity of the examinations from universities, and trust from teachers that the exam boards were treating students fairly (Hunt, 2011).

During the 1990s these links between universities, awarding organisations, and schools were weakened through a number of factors, replaced by powerful interactions between the state and these institutions. Pressure on schools reduced the scope for practicing teachers to be involved with the exam boards with the Walport report noting that “the best teachers, those active in schools, FE colleges and HEIs, no longer participate in the design of qualifications or examination processes” (Walport, 2010), eroding trust and familiarity between schools and examination boards. Simultaneously, A level exam boards passed from university ownership and had their remit expanded to cover a number of purposes in addition to their primary purpose of entry to HE, such as for life, for work, and for accountability (Cambridge Assessment, 2012a). This reduced the links between universities and exam boards, with teachers and lecturers becoming increasingly disengaged from the design and delivery of the exam system and reducing their ability to influence it (Walport, 2010). Where examiners were still recruited from the teaching community, this led to a situation where examiners had strong links into schools, but fewer links into HE; the exam boards were still concerned with accuracy, but lacked the guidance from a ‘parent’ university and so complaints about the quality of the A levels and the separation between the sector and HE began to grow (Cambridge Assessment, 2012a).

Over the past forty-five years the British state has taken an ever-increasing mediation role between those developing courses, teachers, employers, learned organisations and subject groups, and HE; as their involvement in defining syllabi and setting conditions for examinations grew it was this that the exam boards led to the ‘divorce’ between the producers and users of the A levels (Cambridge Assessment, 2011).

AQA attribute the effects of this ‘divorce’ to the QCDA and Ofqual (and their precursors), who “forced” them to work to “inappropriate bureaucratic rules and unrealistic timetables” (Hunt, 2011). In his evidence submitted to the Education Select Committee in 2011, Andrew Hunt¹⁹ described the challenges with an example from 2011 and is worth repeating in its entirety:

“The stages in the introduction of the new GCSE Science specifications for first teaching from 2011 illustrate how things can go wrong. The process started with writing of National Criteria by QCA (then QCDA). The process was badly organised and, thanks to staff changes at QCA, was led by people who had lost sight of the thinking underpinning the changes to the National Curriculum and National Criteria five years earlier. Far too much of the time available was taken up over the drafting of, and consultation on, the National Criteria so that the Awarding Bodies had too little time to make a good job of preparing new specifications, assessment methods and sample assessment materials. During the process accreditation was taken over by Ofqual leading to desirable but challenging alterations to the definition of assessment objectives and other reinterpretations of the criteria at a late stage in the process. As a result the procedure of accreditation was drawn out and the dissemination of the changes to schools delayed.”

(ibid)

Michael Gove’s statements at the start of the reforms describe how “elite universities” should be more involved in the design and content of A level specifications (Gove, 2013a). However these frequent comments are challenged by the awarding organisations, who do

¹⁹ Andrew Hunt is an experienced Chief Examiner with extensive experience of exam boards, work with learned societies, and authoring textbooks and course materials.

accept that links to universities are “very much reduced” (ibid) from what they once were, although they already run and maintain the groups that Michael Gove is proposing and have done for many years. One exam board, OCR, refers to their ‘Central HE Forum’ that involves many levels of HE staff, from academics to admissions tutors and university leaders:

“In addition, eleven subject groups were set up with over 70 institutions and nearly 200 HE staff, as well as learned societies, employers and teachers being involved in direct development discussions.”

“Science: more than 30 members including 9 HEI reps + BAE Systems, Nuffield, The Association of the British Pharmaceutical Industry, Royal Society of Biology, Wellcome Trust, SCORE, Royal Society of Chemistry, Gatsby Charitable Foundation, Association of Science Education, Institute of Physics”

(Cambridge Assessment, 2012b)

The argument could be made that as these structures within the exam boards have existed for many years and yet the qualifications have become increasingly criticised, then they are not functioning effectively. However, this again relates to the regulatory effect and its direction from the government. Although exam boards can alter the content of their specifications the overarching content, and the structure of the examinations and the qualification, are directed by the government and their agencies²⁰. It is interesting that Michael Gove is careful in his critiques to never approach ‘blame’ for the situations that he believes demonstrate a pressing need for reform, merely that they happened.

The defensive, and occasionally pointed, tone that the awarding organisations adopt in their consultation contributions do not, however, signify a reluctance to change, or a belief that the suggestions are without merit, merely that they have been working diligently to try to achieve the aims that the Department for Education suggest, but are now imposing (and are

²⁰ An A level specification must be accredited by Ofqual in order for it to be taught and examined, and the specification must include information that is found within the ‘A level Subject Content’ criteria set by the Department for Education. A review of this content becomes important later as the Smith report finds that no Physics content needs to be added to the government’s subject criteria. Also notable is that an exam board has a discretionary 10% of content that they may choose use to include and assess in a qualification knowledge independently of the DfE or Ofqual.

perhaps a little offended by the tone of the announcements). All the exam boards that submitted responses to the DfE and Ofqual support the role of HE in the new curricula, and the assessment of the decline of the link between HE and awarding organisations:

“Cambridge Assessment, consisting of three awarding bodies and a large research capability, agrees that HE should have a greater role in the design of post-16 qualifications in the UK. We have concerns that over recent decades the ‘users’ of qualifications, i.e. Higher Education and employers, have become divorced from the ‘producers’ of qualifications, i.e. awarding bodies.”

(Cambridge Assessment, 2011)

Many of the learned societies within the sciences also agree:

“SCORE strongly supports greater involvement of Higher Education on A-level design but considers the only feasible way of achieving this properly and transparently is through the establishment of national subject committees.”

(SCORE, 2012b)

For the sciences, SCORE highlight examples from the outset as to how such groups can be of benefit with suggestions relating to the importance of regular reviews,

“Examples of applications and technology should be reviewed regularly to ensure that they are still relevant. Some chemistry specifications include examples of spectrometers which most HE academics would call ‘museum pieces’.”

(SCORE, 2013c)

but also explaining how exam boards do include several advanced concepts that universities have suggested. However, as they are not on the subject criteria set by Ofqual, then they are not assessed in the examinations (ibid).

It is noteworthy that the language used by different parties involved in the reform varies subtly as the reform process goes on. HE representatives talk of HE being involved in the

design of the qualifications and offering subject advice to the awarding organisations, whereas Michael Gove describes a system that ‘re-couples’ HE to the A levels following their ‘divorce’. In his communication with Glenys Stacey he expresses his wish that HE will begin by “providing advice to Ofqual” (Gove, 2012), and then suggests that Ofqual should “step back” from decisions regarding the A level (Gove, 2013a) while having previously stated publicly that Ofqual should be:

“move[d] from being an organisation that perhaps in the past provided reassurance, to one that consistently provides challenge to politicians, to our education system overall and to exam boards and awarding bodies. That is why I think it is so important that Ofqual, like all regulators, if it is to be an effective watchdog....sharper teeth.”

(Gove, 2011a)

This stance, while still seeing Ofqual in regulatory control of the qualification, is quite different to the previous working relationship between the DfE and Ofqual, but not one that Awarding Organisations disagree with. Cambridge Assessment run several international qualifications and note that “the best” (to them the IB, Pre-U, and IGCSE) “are such because they have the minimum of state intervention” (Cambridge Assessment, 2010a, p. 2). Using these qualifications as a model they propose a system in which a ‘community of interest’ is created, with the regulator going from making decisions on qualification standards, to providing an environment in which the ‘users’ of the qualification and the ‘producers’ of qualifications work together to maintain it.

Where awarding organisations, learned societies, HE groups, and government officials had all agreed thus far about the key role HE should play in guiding the qualification, no mechanism for this was suggested by the Department for Education or Ofqual. The intention was for groups to organise themselves and form committees (and some HE groups had already made these commitments). However, only one awarding organisation suggested that there may need to be a mechanism that could encourage HEIs to take an active role. Encouraging stronger educational links between HEIs and schools (at a higher level than outreach events) is suggested by SCORE and discussed in a later section.

However, the awarding organisations, as previously mentioned, had actively been seeking the support of HEIs for some time. The outcome of their work forming subject advisory groups up until this stage is a qualification that some were describing as ‘unfit for purpose’ and so Cambridge Assessment made the suggestion that the Research Excellence Framework could provide a “helpful lever”:

“There is a perfectly reasonable case to be made that disseminating knowledge to the next level down of the education system is nearly as important as some other REF criteria. Clearly, it would not rate as importantly as the publication of a serious piece of work in a peer-reviewed journal but is of great importance to the long-term health of Higher Education and, therefore, the nation.”

(Cambridge Assessment, 2011)

This suggestion is lightly touched upon by the learned societies, but it is worth considering that, up until this stage, the examination boards are the only group to have tried engaging HE in the manner suggested by Michael Gove, and are suggesting that a ‘lever’ may be needed.

Summary

In this section it can be seen how a contested reform process is not necessarily apparent in the final policy texts. From the outset of the reform it was stated by those in power that universities were unhappy with A level education, and so they should be more closely involved within the qualification. When reforms attempt to involve universities, it is not as straightforward, and universities do not wish to be as involved as the Secretary of State wishes.

This reform ‘messiness’ highlights an interesting consideration with the reform regarding power and authority over A level education. While the qualification would still be regulated and the DfE would still set the content, Michael Gove suggested ceding power over the contents and style of the A level. However, it is notable how he suggests this to a group who have not requested this power and, when offered it, decline it. Instead they suggest that structures already in place regarding feeding into the subject content and assessment of the

A level may need strengthening, but that the groups that Michael Gove talks of proposing already exist. It raises the question of whether the Secretary of State was as aware of the views of HEIs as he claimed when announcing the educational reform process or whether he was announcing a wide-reaching reform of A level qualifications, knowing that only small changes were required.

Regarding power and control it is also notable how, despite the assertions that HE should be more involved in the A level qualifications, this does not extend to the structural aspects that were suggested by HE and learned organisations in the previous section. In this regard universities are given a voice within the qualification, but not the power to shape it. The opposite, however, is true for the awarding organisations. Where exam boards previously ran subject groups and liaised with HEIs, the DfE does not recognise their previous contributions nor suggest that they have a role to play in the reform process.

After these considerations of the role that Higher Education will play in the reform process it is now to those within the A level sector itself that we now turn, examining issues within the Further Education sector pertaining to the A level qualification.

4.5 Issues affecting Further Education

As mentioned at the beginning of the chapter, narrowing the reform considerations from broad cross-qualification issues to a specific set of subjects, and then one individual subject can help to reveal the impact of the reforms and how these are enacted on multiple levels. Here I take research and issues presented by STEM fields, but primarily issues pertaining to Physics in order to reveal the possibilities of, and tensions between, micro-level perspectives on macro-level A level education reforms.

While subjects have risen and fallen in popularity over the course of the history of A levels, the most common combination of A level subjects has been the three sciences and mathematics (JCQ, 2018) and for students in 2014 the most popular combination was Biology, Chemistry and Mathematics A levels, supplemented with an AS in Physics and General Studies or Critical Thinking (Sutch, Zanini, & Benton, 2015). Despite the popularity

of the sciences, Physics has struggled for many years with a decline in student numbers. Whether it is the place of a piece of educational reform to focus on an increase in students taking a particular subject is not the focus of this thesis, however aspects related to this issue are.

4.5.1 The need to attract students

Michael Gove has given somewhat contradictory statements regarding his views on which subjects were the most important, defining certain subjects at GCSE and A level as ‘facilitating’, giving priorities to these subjects over the arts, yet heavily criticising remarks by James Dyson on the importance of STEM subjects over the arts (The Telegraph, 2012b). However, focusing on STEM, Michael Gove has, in various capacities and on numerous occasions, highlighted the importance of the field and its importance to the future of the country (Gove, 2011b). The validity of this view is not considered here, nor are the arguments regarding any views as to the relative importance of subjects to society or in education; they do however provide the context for a potential policy direction.

The Social Market Foundation (SMF) estimated that, in light of governmental policies regarding immigration²¹ a “massive uplift” in the number of UK STEM graduates would be required just to replace an ageing workforce; this increase was estimated at 40,000 extra graduates a year from STEM subjects at university, an increase of almost half of the current level (Merry, 2013). While this figure is representing graduates from HE, there is very little that could be done to increase their numbers to that level without a significant drop in the grades that they require of their applicants; thus this pressure is passed down to an increase in sufficiently qualified A level students in the science subjects²².

Whilst initiatives to promote the sciences to all are discussed by many organisations there are specific areas within the sciences that were identified that could help; tackling underperformance among boys at GCSE and a low A level science take up among girls was

²¹ This study was conducted four years before the referendum regarding Britain’s exit from the EU and as such figures have since been revised upwards.

²² The SMF, along with SCORE and the IoP recognise that the majority of this work would be pre-GCSE, and would require significant efforts to engage students in the sciences from an early age, however that is beyond the scope of this work.

estimated to result in 12,000 more pupils taking science A levels, and 7,000 more STEM graduates if the numbers equalised. The ‘redressing’ of gender, socioeconomic and regional disparities was also estimated to produce a further 18,000 STEM graduates (Broughton, 2013).

Physics is frequently cited as a facilitating subject for STEM and non-STEM courses (Russell Group, 2016) and the Institute of Physics do not challenge this view. The IoP believe that “the best way to resolve the STEM skills gap will be to widen participation so that underrepresented groups increase their participation” adding students from minority ethnic backgrounds to those highlighted by Broughton. (Institute of Physics, 2016b). As a learned society the IoP is one of the most data-oriented, and is the most research active of the SCORE contributors, perhaps in part due to the decline in the subject through the 1990s and 2000s, but also because Physics has a lower representation than most other STEM subjects of girls and women and students from ethnic minority backgrounds.

Although all STEM subjects focus on increasing their graduate numbers, the disparity within Physics in these areas is a priority for the IoP and they are also the most active in programmes to improve these effects, but highlight that widening participation in HE must be addressed by improving access and participation in the STEM subjects in schools. While this may take place at a general level, discussed later, encouraging students into FE STEM subjects is a priority for the IoP, particularly A levels, as 92.4% of students who begin an undergraduate degree in the sciences do so with a combination of A-levels (2.9% from a Vocational FE qualification, and 4.7% from a mix of the two) compared to the HE average of 79.8% (Cambridge Assessment, 2015).

Changes to the A level specifications may not be intended to attract more students to the A level qualification however, just as the Royal Society highlighted that perceptions regarding the difficulty of the A level in Mathematics following a reform process in 2000 led to a decrease in student numbers (ACME, 2010), public comments regarding increasing the challenge of A levels may lead to same effect for physics. This could be mitigated by building on the largest cultural cachet of physics since the 1960s (with the influence of ‘The Big Bang

Theory', the Large Hadron Collider, and Brian Cox) and using a reformed A level in Physics to capitalise on a high level of interest and awareness.

One limiting factor to the number of students choosing STEM-related A levels is that progression from 14-16 to 16-19 education relies on local availability. A-level physics qualifications are not available in approximately 500 schools and colleges (Royal Society, 2011). Where this relates to schools without a sixth-form this is understandable, and it may be cause for a student to seek it at another institution. However, this raises an issue of how many students who are unable progress to A level studies in subjects like Physics as it is not offered to them locally. The issue of qualified Physics teachers is picked up in a subsequent section but highlights one aspect of issues related to progression rates.

4.5.2 Progression rates

Progression rates are a significant factor relating to the number of students applying to university to study Physics. With a lack of Physics as a stand-alone subject at GCSE as a barrier, an increase in this number comes at two points. First, students must choose A level Physics; second, they generally must continue the subject from AS to A2.

There is a link between taking Triple Science at GCSE, and students receiving high results at A level, even outside of the science subjects (Broeke, 2010), suggesting that if more Triple Science students, already ones with a higher aptitude for science, took subjects such as Physics then there may be an increase to the pool of potential university students. Of the Triple Science students, boys are more likely to choose A levels in Physics and Chemistry, with a higher likelihood amongst boys from lower socioeconomic backgrounds. However, when considering the destinations of particular grades 63% of those attaining an A* in GCSE Chemistry go on to study the subject at A level, 54% of A* students transition from GCSE Biology to A level Biology, but only 48% of students with an A* in Physics go on to study a Physics A level (Department for Education, 2012). The 'Raising Aspirations in Physics' agenda run by the IoP attempts to increase the number of students choosing to study science through a number of methods, generally focused on increasing 'science capital' and improving awareness, however they note the pressures that schools are under as a major factor as to why outreach work in school is challenging (IoP, 2014).

Students' attitudes towards Physics are shaped by three key influences:

- Self-concept - Students' sense of themselves in relation to the subject, the value they place on it, and their willingness to engage in it
- View of Physics - How students experience physics at school (but to a limited extent outside of the classroom)
- Teacher-student relationships - How personally supportive students find their physics teacher

(Hollins, Patricia, Ponchaud, & Whitelegg, 2006)

Yet these factors are challenging for an outside agency to try to improve. Much of the IoP's work attempts to influence the first and second aspect, but they highlight their work with teachers and schools as being the most important area that may increase the uptake in Physics A levels. The recruitment and retention of subject-specialist teachers has been shown to be extremely important in increasing attainment and progression in schools (Institute of Physics, 2016b) and the IoP have engaged with this aspect directly. However they believe that universities should be encouraged to take a more active role in their local areas than currently:

“As relatively centralised local actors, and significant employers, they are well placed to support efforts to build science capital within families in their vicinity. Universities may also be able to help schools in the short term with, for example, regional shortages of physics teachers.”

(Institute of Physics, 2016b)

The family aspect is particularly challenging to become involved in, however families with low 'science capital', those “without positive associations or experiences of, or understanding of science” are less likely to see their children choose a STEM subject (Institute of Physics, 2016b). This is beyond the scope of educational reforms to an A level qualification, but is important when schools communicate with schools regarding options and 'pitch' each qualification.

Once students have chosen to study Physics there is a second issue of progression, highlighted previously, specifically the separation between the AS and the A2 qualification. One aspect that was not raised in response to the criticisms of the AS qualification was that of progression between the AS and the A2, and that most colleges require students their students to pass the 'first year' before moving on to study the A2 and gain a full A level. Physics is one of the most dropped A level subjects, with students leaving after the AS, and within the three sciences the AS level to A level progression rate is the lowest in Physics, 72% compared to 74% for Biology and 77% for Chemistry (Sutch, Zanini, & Benton, 2015).

Although the number of physics AS levels has increased over the past decade, it has not risen by as high a percentage as the other science subjects. Although the number of AS Physics students increased by 23.3% from 2002/2003 to 2009/10 the number of A level entries for these students only increased by 14.5%. What caused more students to choose Physics as an AS option did not persuade them to consider it as facilitating as an A level. If the figures were identical then another 2,500 students would have received A levels in Physics, producing a 78% progression; however, even if Physics achieved the highest progression rate, History's 86%, then the number of students receiving A levels would only have been 19% higher, 6,250 students (JCQ, 2018). As this increase in students would not necessarily mean that students finished with an A level grade that they would be able to progress to HE with, and that a student may choose Physics at the expense of another science, it is unlikely to be an area that would tackle the STEM shortfall (Broughton, 2013).

When the relevance of, and debates around, the AS qualification were described earlier both sides highlighted the examination aspect of the qualification; one side believing it to be excessive, and damaging to students and the quality of the qualification, the other believing it an important tool used by HEIs when making offers to undergraduate candidates. Only SCORE raised the usefulness of the AS for students in allowing them to decide what it was in their best interests to consider as they moved from Y12 into Y13. Issues around progression between AS and A2 often focus on students passing examinations, but while some students may drop the AS Physics qualification because of poor exam performance, others may do so

because they deem the qualification less facilitating, thereby raising questions about how the different qualifications are viewed.

4.5.3 Differing levels of challenge

The relative challenge of subjects to students is a long-standing issue, but one of new and increasing levels of research. An inquiry into inter-subject comparability was launched by Ofqual in 2015, and this resulted in a joint letter from the ASE, IoP, Royal Society, RSB, and RSC (in essence those making up the organisation SCORE). In their letter they raised concerns that “A level examination standards are not aligned across subject areas” and that “this is having adverse effects on candidate choice, particularly for the sciences” (Ofqual, 2017c).

Ofqual were impressed by a data representation technique SCORE used when carrying out ‘Comparative Progression Analysis’ and set up a research group to consider how they, as regulator, should approach the issue. Subject comparisons are not new, and had been used by Cambridge Assessment into a hypothetical issue: ‘how a candidate could maximise their A level grade when all other things are equal’ (Bell & Emery, 2007). However, while this work suggested aspects such as student motivation, school resources, quality of teaching, and population subgroups, SCORE felt the opposite:

“We disagree with the suggestion that the differences in outcomes are the results of a range of factors other than grading severity. The consistency of grading data suggests that it is far more likely that they result from the same, uniform, influence: severity of grading”

(Ofqual, 2017c, p. 3)

The data analysis presented in the previous section that was carried out by the Department for Education had previously described patterns between A level result comparisons, and made the suggestion that some subjects could be more difficult than others:

“It can be seen that over 50% of pupils with a grade A in GCSE physics that go on to A level physics achieve a grade C or lower and, as such, physics could be seen as being more difficult at A level than the other sciences.”

(Department for Education, 2012, p. 18)

The suggestion had been that a student with a strong set of GCSE results across a majority of subjects was more likely to achieve high grades outside of the sciences and mathematics, relating back to previously-raised arguments from learned societies about whether a B in History is equivalent to a B in Biology. The Department for Education did little with this data when talking of A level qualifications and its reforms, however SCORE had been carrying out the same analysis using a much larger data set (Coe R. , 2011) (Coe, Searle, Barmby, Jones, & Higgins, 2008) and raised this issue with the DfE in response to the A level consultations.

While SCORE recognised that it was extremely difficult to enforce subject comparability, they had become increasingly concerned that the reduction in Ofqual’s post-reform role had led to a proposal to remove the issue from their remit. Where the DfE felt that it was not a significant issue, and that HEI involvement in the design of the new qualifications would solve such issues, SCORE believed that it was vital for it to be addressed directly in the reforms themselves (SCORE, 2012b). Their suggestion was that, should Ofqual’s work in the area be reduced, then it “must coincide with a more transparent university admissions process and pressure to avoid using A-levels as an accountability measure” (SCORE, 2014a).

SCORE’s concerns regarding school accountability often read as support for schools, colleges, and teachers. However, in the aspect of the A level qualification they believe that if the reforms reinforce a perception that the sciences and mathematics are ‘harder’ then uptake in these subjects is likely to decrease (SCORE, 2013c), not just through student choice, but because schools and colleges “may be incentivised to allow students to do qualifications that are less severely graded at A level in order to ensure that school averages are maintained or improve”. They also suggest that general knowledge that progress data shows that students are unlikely to achieve highly in science and mathematics at A level without an A in that subject at GCSE would discourage students from opting to study the sciences and instead pick a subject where they may achieve more highly.

4.5.4 Accountability

Where SCORE see the potential for schools, knowingly or not, to rate their accountability statistics more highly than the number of students choosing STEM subjects, the Institute of Physics also points to HEI accountability. University league tables rate HEIs on their A level entry grades and low drop-out rate which the IoP feels causes some institutions to “play safe with traditional entrants” (Institute of Physics, 2012c). Where students have lower GCSE scores, yet bucked the national trend, the competition for a small number of places at some institutions may bring GCSE grades into consideration and they may be rejected in favour a student who performed identically at A level but had higher GCSE grades.

Similarly limiting are the additional skills and experiences that are often required (or highly rated) in the sciences, mathematics, and modern foreign languages. Work placements, additional qualifications and experiences abroad may all have an effect on a student’s offer for HE study and unfairly affect students of lower socio-economic status. While HE is often criticised for being too narrow, particularly considering aspects such as social mobility, the IoP consider it difficult if schools and colleges only produce potential candidates from the higher socio-economic classes (Institute of Physics, 2012c). While they did not feel a lowering of standards was appropriate, they suggested that additional school level accountability might alleviate the issue.

Regarding the issues of gender in Physics, 49% of mixed maintained schools did not produce a single female A level student in 2011; while the figure was different in other schools, the IoP considered whether gender stereotyping may be more prevalent in this type of school, but also how it should be tackled. Physics entries are lower in several student groups (as mentioned previously) however schools have a public sector equality duty to not discriminate against students; while the IoP does not suggest there is active discrimination taking place within Physics departments in schools (and that it is more how various groups relate to Physics in the manner suggested by Hollins et al. (2006)) they do state that such a duty would signify a requirement for an institution to consider its statistics in these areas:

“However, there is currently no real incentive or requirement for schools to measure their progression rates (in physics or other subjects) by gender or to address any problems that the measurements reveal.”

(Institute of Physics, 2012c)

The IoP believe that an appropriate incentive for schools would be for Ofsted to take such statistics “more seriously”, including them as part of the Ofsted inspection criteria and asking schools to provide evidence for the measures they are taking to redress situations where the school is performing badly against the national or local averages (ibid). Targeted inspection points such as this are not uncommon during Ofsted inspections, already such inspections seek to determine the appropriateness of provision for certain groups of students, and how schools may be spending the money that they receive for them; but it would also match similar diversity responsibilities that are expected of HEIs from RCUK and HEFCE via the Research Excellence Framework. The IoP similarly pointed to Ofsted’s subject specific inspections when asked to submit views to the Education Select Committee regarding the annual Ofsted report. In it they described how the thirty inspections carried out each year (on average) were not reliable enough for them to learn what is going on across the nation’s science departments due to this small number and what subject-specific data was being collected. As a learned society who offer guidance to teachers directly and through published materials they wished to get an independent review of “progression rates, the amount and quality of practical work and the number of specialist teachers in each of the science subjects” (Institute of Physics, 2012a). A lack of specialist teachers is not unique to Physics, and is raised in the following section, but of relevance here was the suggestion that schools may be evaluated based on the amount and quality of CPD that schools were using to tackle these aspects.

Summary

Across these four areas it can be seen how a suggested A level reform process can involve considerations from policies in many varied fields and across multiple sites. Gender issues within Physics were not mentioned in any reform announcements, however these issues are directly linked to A level education within Physics, and are highlighted as being of importance to the future of the country. While one may argue that educational reform may

involve compromise behind what a reform can try to tackle, and what it can realistically accomplish, the aspects identified in this chapter linked to A level Physics have clear impacts outside of this environment. If they are not tackled during a period of educational reform, then when will they be?

The direction of the A level reform process is set by the Secretary of State, but when informed of concerns relating to subject comparability from Ofqual and SCORE, the Department for Education made no comment and gave no directions pertaining to this to Ofqual as regulator. Notable here is that while subject grade equality was not publicly discussed by the DfE, subject equality was – by the Secretary of State for Education in the media. It is understandable why a Secretary of State for Education would defend the validity of all school subjects, however the strength and voracity of his response, even when expressing a view that was contrary to his previous policy actions, demonstrates that he only wished for certain voices to be part of the educational reform discourse.

Finally, the Physics context allows us to see the complexity of a reform and the challenge of considering its potential impact. If the long-term goal is to ensure an increase in the number of STEM graduates then there must be more A level students, yet if numbers decrease because the media report A levels are considered not fit for purpose, and that the reformed A levels are more challenging, then this will have the opposite effect. In this regard A level challenge is a highly complex policy lever. If shifted in the opposite direction, and standards are lowered, this will produce more A level candidates but is unlikely to produce the intended effect of an increase in the quality of STEM undergraduates. Notable here is that Michael Gove publicly said that he would make A levels more challenging, and we will later discuss the changes that were made to A level Physics to evaluate the impact of this.

In considering issues that were related to A levels and suggestions for what may be included in the reform there were some policy areas and suggestions that did not directly fit into the above three categories. They are, however, worthy of consideration when considering the breadth and detail of responses to consultations during the reforms and as independent policy proposals. These are discussed in the following section.

4.6 Broad Issues

The label of ‘broad issues’ does not signify an issue pertinent to all A level courses, but ones that are tangentially related to the educational landscape in the UK. While these are unlikely to be solved, or could in any way be tackled through reforms to A level qualification, they were all highlighted by learned organisations in consultation responses, and letters to the Secretary of State. They are perceived by these organisations as barriers to the field, or areas that should be focused on, and while not suggested as areas that should be prioritised, when including them in such communications the groups are signalling their importance. The three areas included here are those which consider the potential ramifications to physics as a field if nothing is done to tackle them, making them crucial to Michael Gove’s suggestion that facilitating subjects, such as physics, were critical to the future demands and success of the nation.

4.6.1 Teachers

Subject specialist teachers are those who teach a subject in which they have a relevant degree. The importance of such teachers is recognised by the Department for Education, which states “research strongly suggests that subject knowledge as well as overall attainment [of teachers] is a key determinant of success, especially in the sciences and mathematics” (Department for Education, 2010a)²³. However, one third of teachers who teach a science subject do not have a degree in a relevant subject (Department for Education, 2011) and a study for the Gatsby Foundation found that 25% of secondary schools in England no longer had any specialist physics teachers, rising to 50% in inner-London schools (Smithers & Robinson, *Physics in Schools III. Bucking the Trend*, 2007). Despite a £7 million investment from the then Training and Development Agency to provide enhancement courses to those with related degrees, and £140 million to aid the recruitment of physics and chemistry graduates and retain them through financial incentives, there is still “a severe shortage of physics teachers, a shortage of chemistry teachers and an under-recruitment of biology teachers” (ASE, et al., 2016).

²³ As mentioned in the introduction, the DfE cited the work of Smithers and Robinson (2005), Goldhaber and Brewer (1997) and Wilson et al (2001) to support this point. Once the educational reforms had been instigated however, the services of educational academics to support the educational reform process were no longer used.

The shortage of physics teachers has been at a significant level since at least the mid-90s, however while these initiatives have not reversed the problem, the group of scientific learned societies and the Association for Science Education believe that government should continue to act to promote teaching at a secondary level (Association for Science Education, et al., 2015). The disbanding of the TDA and transfer of bursaries for teacher training to individual subject societies, the establishment of a tiered bursary dependent on a graduate's degree classification, and the educational reform process playing out in the media is, however, felt to be confusing and off-putting for potential trainees (Association for Science Education, et al., 2015). Despite the more varied routes into initial teacher education, and no limit to the number of places that can be allocated funding for training physics teachers, there has been little change to the shortage of physics teachers, with the National Audit Office suggesting the complexity of the system could be a potential barrier (2016).

SCORE has concerns about the selection processes used in the current educational climate and are concerned that the variety of entry methods leads to a wider variety of candidates entering the teaching profession. They caution:

“It must not be assumed that highly qualified graduates, attracted through the bursary offers, will all have sufficient depth and breadth of school-level subject knowledge to become effective teachers without substantial further provision as part of their teacher training course.”

(SCORE, 2012d)

They believe that the ITE provider should be selected based on their subject knowledge using common and transparent standards (SCORE, 2014c) and that there is a strong case for lengthening teacher training courses to 18-24 months to match overseas teacher training programmes, as well as giving opportunity for knowledge and skill development (SCORE, 2012d). Alongside this they suggest that the criteria for judging ITEs should include subject specific elements and be carried out by inspectors with subject expertise so that inspections

can be more targeted regarding the skills expected of 'good' science teachers (SCORE, 2012d).

A further aspect noted by the Gatsby Foundation was that while the percentages of specialist physics teachers were lower in inner-London, they were higher in Yorkshire and Humberside, where only 10% of schools did not have a specialist physics teacher (Smithers & Robinson, *Physics in Schools III. Bucking the Trend*, 2007) raising the interesting, but challenging, effect of geography.

4.6.2 The availability of HE Physics

Only 36 out of 131 HEIs across England offer undergraduate courses in Physics, meaning that there are large areas where students, schools, and industry have no convenient access to a university physics department (Institute of Physics, 2012c). Due to rising living costs and concern regarding university funding, the proportion of students choosing to live at home while studying at university has increased (The Independent, 2017). While the government, universities, and learned organisations are seeking to increase the number of students from lower socio-economic classes, ethnic minorities, and women choosing to study STEM subjects, there is a greater chance that students within these groups choose to live at home during their studies, potentially cutting these students off from considering institutions further away from home (Institute of Physics, 2012c). Furthermore, while universities are not evenly distributed geographically, this is more so within practical subjects, especially physics.

The small number of university physics departments is primarily funding-related, as several departments either merged or closed between the early 1990s and 2006. These closures are attributed to a number of factors; increased competition between former polytechnics and established, research-led institutions; the 'Research Assessment Exercise' which harmed departments with a strong applied bias; and the combination of relatively static physics entrants and a decrease in funding per student during the 1990s (Institute of Physics, 2012c). While this latter point is historic, the IoP highlighted concerns to the DfE regarding student number controls for specific grade combinations, and institutions with differing fee levels in the period 2012-2014 would result in middle-ranked HEIs struggling to

offer laboratory-based subjects at a time when STEM courses should be expanding into those institutions (ibid).

The IoP feel that the combination of these factors makes it challenging to build strong links between university physics departments and local schools, in which they may be able to assist. One suggestion was that university lecturers may be trained to teach STEM subjects at school level, particularly those in physics and engineering, to provide some relief and capacity to schools where they need it (Institute of Physics, 2016b). However, it is not solely the link between university physics departments and local schools, but also a smaller number of universities, generally those 'middle-ranked', that have education departments offering teacher training but no physics department, suggesting that links between education researchers and science faculties are too often "completely separate entities on a campus" (Institute of Physics, 2016a).

4.6.3 Links between educationalists and science faculties

In their response to the government's 2016 green paper on 'Opportunities and Challenges for teachers, researchers and policy-makers in educational research' the Institute of Physics highlight what they view to be "weak links" within HEIs between the education researchers, the subject specialists and the teacher trainers. Where institutions have teacher training carried out by those who are not active education researchers themselves they believe that there is potential that trainee teachers do not benefit from the most current research findings. However their primary concern is that the number of education researchers and teacher trainers linked to the relevant department within institutions results in a system where physics academics are not supporting trainee teachers nor benefiting from the pedagogic work being carried out on their own teaching (Institute of Physics, 2016a).

The IoP also note a decline in subject-specific research within Physics, such that much of the educational research published in the ASE's 'School Science Review' and IoP's 'Physics Education' comes from teachers and physics academics rather than educational researchers. They do not criticise this, merely comment on it being an untapped resource that could benefit the teaching of STEM subjects and be of benefit when learned organisations participate in consultations and have their views sought regarding educational reforms.

Summary

These three aspects are all identified as problem areas that are outside the remit of A level reform but are all clearly linked to wider Physics education. A supply of well-qualified teachers often provided from areas of the country with university Physics departments results in a varied landscape. Confidence in an A level qualification so far has been related purely to topics that are taught and the preparedness of students to enter undergraduate level studies, yet there is a human element to this. This is not to say that a teacher must have a Physics degree in order to teach A level Physics, however it highlights a significant contrast in the discourse.

Where the Department for Education and Michael Gove are focused on providing STEM graduates and involving HE in qualification design, learned organisations like the Institute of Physics are looking to the long term supply of teachers, and how the Physics community might assist in an area that the DfE has not even recognised.

4.7 Chapter Conclusions

The A level reforms launched by Michael Gove were rationalised by publicly critiquing the qualification and declaring it 'unfit for purpose'. While the A level has changed over time Ofqual's own review concluded that it was viewed as a 'gold standard' that was used by many organisations in its current form.

As a non-ministerial department the qualification regulator, Ofqual, had the power to implement the reforms as they saw fit, however they are guided by the Department for Education, effectively directed by the Secretary of State for Education.

During the consultations many organisations wrote to both government organisations, and key figures within them; these organisations responded to public comments made regarding the reforms, and produced detailed consultation responses that spoke both in support of the reforms and in defence of the A level qualification as it was at the time.

The areas raised by the Physics community and learned organisations also serve to highlight areas of discontinuity in educational policy making. The government split considerations, decision making, and reform processes into School Key Stages, FE, and HE. When they seek views during considerations they shape their responses to fit their codified aim of the reform and the outcomes that they wish to achieve. Subject communities consider their field more longitudinally and identify many potential levers, as well as consequences. As such they respond by engaging with the government through letter writing and reports to accompany the consultation replies in the standard frameworks provided by Ofqual and the DfE. However, in reducing the scope of educational reform to specific stages and carrying them out at different times, the government reduces its ability to tackle the wider issues that subject communities raise, despite the governments stated wish to engage such communities during the education reforms.

If the role of the consultations was seeking advice from outside Ofqual and the Department for Education then they were given much to work with:

- Clarifying the purpose of the A level as a qualification for Higher Education selection
- Reducing the number of re-sits taken by A level students
- Removing the modularity to A level courses in terms of assessment (no January examinations)
- Keeping the AS qualification for use as selection tool and to allow student choice part-way through their course
- Ensuring uniformity in the way in which A levels are assessed
- Review how students who attain the highest grades can best be differentiated (and whether this requires additional testing)
- The involvement of HE in the production of subject content
- A need for A level subjects to produce strong candidates and in increasing numbers in the STEM subjects
- Potential that the reforms could approach the issue of subject comparability
- Whether other structures may be altered at the same time as A level reform, regarding subject-specific inspections and teacher training

- How wider issues affect specific subjects, and may require additional thinking, reform, or resources

Throughout this chapter we have also seen how the starting point for the educational reform process corresponds with the concepts set out in the research aims. A level education is presented simply, as too are the rationales by the Secretary of State for Education for the need for it to be reformed, yet it is vast and multi-faceted. Numerous policy levers and drivers have been revealed, but the impact of shifting these levers or prioritising one driver above another was met with caution and contention by those within the communities that the Secretary of State repeatedly highlighted the reforms were for.

So far, the nature of who holds power and authority over a qualification, and who is afforded a voice in the discourse, has been isolated to a period before the educational reform began. While these ideas are of clear importance it is to how these are seen during the reform process itself that we will now examine. As such the next stage of this work is to consider how the reform process played out, and how the reformed qualification reflects the changes, possibilities, and suggestions put forward by the consultation rationales.

5. The reforms to A levels

Throughout 2012 numerous reports, letters, consultations, and consultation responses were produced in response to concerns raised regarding the structure and purpose of A levels. In their consultation of Summer 2012 Ofqual concluded that it was their role to “maintain standards” and that, while they did present possible changes to the A level qualification, the standard of the A level qualifications was being maintained in line with the current regulations. In this section I consider what these regulations are, how they were altered during the reform process, and the structures and influences that were used to achieve this. In essence, the technical side of A level educational reform and how it was controlled and managed.

After considering the findings of the consultations and Ofqual’s response, Michael Gove (then Secretary of State of Education) wrote to Glenys Stacey (then Chief Executive of Ofqual) to acknowledge the conclusion that “changes to the structure of A levels would therefore be a matter for Government policy rather than a decision for you as Regulator” (Gove, 2013a) on 22nd January 2013. While there is no official date for the commencement of the reform, this letter is the first recorded indication that the Department for Education would be making substantive changes to A level education in England

The interplay between the Department for Education and Ofqual is revealed through Michael Gove and Glenys Stacey’s correspondence, where one often reminds the other of previous conversations or to confirm their understanding of the other’s view. While their letters cannot necessarily be taken as official policy stances, they reveal shifts and developments over time. Alongside this the letters are also revealing in the language and phrasing used, and the regularity of which certain views and ideals are used to demonstrate a rationale.

Ofqual are clear in their statement of “Who we are and what we do” in a postcard published on their website in 2015, where a large box containing the words “We are **independent** of government and report directly to Parliament” is followed by an arrow pointing directly at the Palace of Westminster rather than the Department for Education (Ofqual, 2015c). On the rear of this card Ofqual add that they do “work within the context of government

policy”, and it is the nature of the relationship between the two organisations and the policy creation and implementation that are the focus of this chapter. Specifically, the aim is to uncover who is ‘in charge’ of the educational reform process in England and, as a result, who changes what happens in a classroom.

5.1 What the reforms are intended to do:

In his January 2013 letter to Glenys Stacey, Michael Gove writes to “set out [my] policy steers about A level reform”, emphasising that “it is important that Ofqual has regard to my views.” (Gove, 2013a). There is no record of a reply to this letter (which in 2011 and 2012 was the normal practice), however the two correspond regarding GCSE reform in early February 2013 and refer to “GCE reviews” (Gove, 2013b). Both meet with Elizabeth Truss (then Parliamentary Under-Secretary of State for Education and Childcare) and Professor Sir Nigel Thrift (Vice-Chancellor of the University of Warwick²⁴) to discuss A level linearity. This meeting results in a second letter to Glenys Stacey regarding Michael Gove’s policy stances and together these documents highlight Michael Gove’s thinking following a year of discussion, debate, and reports regarding educational reform, before any reforms had taken place “to restore their reputation”²⁵ (Gove, 2013c).

“I would like as many subjects as possible to be in place for first teaching by that date (September 2015). It is essential the new A levels command the respect of leading universities: I would therefore expect that Awarding Organisations should draw on the expertise of university academics in making any necessary changes to curriculum content for these subjects. We will look to you to define how this requirement should be met. The Russell Group will be setting up subject panels to advise on subject content in the facilitating subjects and as far as possible you will also want to draw upon these for advice once convened.”

(Gove, 2013c)

“We should also clarify that an AS is a qualification in its own right, so performance in an AS will not count towards an A level.”

(Gove, 2013c)

“There is a critical task to make sure that new qualification are reviewed each year so that they are supporting the rigorous and high quality education that is needed. It

²⁴ and future Chair of the A level Content Advisory Board

²⁵ While the reforms had been discussed widely in the media over several months, the only two changes had been an announcement that Ofqual would remove the January examinations within the A level qualifications, and change from the intended ‘first teaching’ from September 2014 to September 2015 following advice to the DfE from Ofqual.

is right that Ofqual should lead this process, but I am pleased that the Russell group has agreed to be involved. I am very keen for you to engage their advisory board and subject panels, once established, at the earliest possible stage in the post-examination review cycle.”

(Gove, 2013c)

“It will be important that the new core mathematics qualifications are valued and respected by universities and are able to be taught alongside reformed A levels. We also need to ensure that the mathematics A level is able to keep pace with wider development. I would be grateful for your advice on this and it would be extremely helpful if you could discuss this further with Elizabeth Truss. Her office will be in touch to arrange a meeting.”

(Gove, 2013c)

As mentioned previously, Ofqual report to Parliament but the ‘policy guidance’ that they follow is produced by the Department for Education. They are an independent body who, until this point took direction from policy documents produced by the government to outline the nature of a qualification and what it should contain. However, seen above in the highlighted sections are the Secretary of State’s clear goals and tasks, in the guise of advice and explanation. Raised here is not official policy, but policy intentions yet it is notable that the Secretary of State does not give specific instructions that must be followed. Instead he asserts his authority over Ofqual through a language of command, persuasion, and control.

On 21st March 2013 Glenys Stacey writes to Michael Gove to thank him for his correspondence and outlines Ofqual’s understanding of “your policy intentions, and what we plan to do” (Stacey, Letter to Secretary of State for Education, 2013). While this letter is useful for the latter of these functions, it is its interaction with the former that is particularly pertinent. At several points Stacey comments to demonstrate that she understands Gove’s aim, but that there are potential challenges or difficulties with implementing them. The following table summarises Stacey’s responses to what she believes are Gove’s policy intentions:

Policy Intent	Comment
Reduce the number of A level resits	“We are removing January assessments. This will limit resit opportunities and provide more time for teaching and learning.”
Teaching from September 2015	“You have proposed an ambitious timetable for the full redevelopment of A levels in England, alongside GCSE reform.” “Qualifications need to be in schools and colleges by autumn next year. That is challenging for exam boards and for Ofqual.”
Alter the structure and assessment of A levels by decoupling the AS, introduce more synoptic assessment, and make all qualifications linear	“In some subjects, it may be appropriate for the AS to be designed to be co-taught with the first year of the A level.” “The priority for exam boards will be to make sure that both the A level and AS qualifications in each subject are coherently designed and assessed.”
Decisions about structure are curriculum policy decisions for Government, provided they do not affect our ability to meet Ofqual’s objectives	“Your decisions do not jeopardise our ability to maintain standards and meet our wider objectives. However, they may affect the volume of assessment and the costs of qualifications.”
A level subject content should be reviewed and further reviewed following every exam series	“Exam boards will now be reviewing the content requirements in these subjects over the coming months, using their established subject review arrangements to see if any change is needed.” “We will welcome any advice from the Russell Group.”
Reformed A levels and reformed GCSEs should be introduced simultaneously	“This promotes coherence between the subject content for new GCSEs and A levels.” “The introduction of new GCSEs and A levels at the same time will place a considerable burden on schools and the effect of this should be monitored.”
A levels should command the respect of universities	“The process we are now putting in place will allow us to oversee real, evidence- based improvements to A levels, so that they support and recognise high quality learning and meet the needs of universities.”

Figure 7: A summary of Michael Gove’s policy intentions, as understood by Glenys Stacey (2013)

Glenys Stacey’s comments and Ofqual’s next steps are notable in that they do not oppose Michael Gove’s wishes, by rights they cannot, but present ‘public’ notes of caution that contribute towards the considerations of power in the reform process.

For example, Michael Gove expresses in his January 2013 letter that he “would like the AS level to be as intellectually demanding as an A level, covering half the content of a full A

level and delivered over one or two years” (Gove, 2013a). Glenys Stacey’s response highlights how the AS qualification could be ‘co-taught’²⁶ and that some exam boards would likely pursue this (Stacey, Letter to Secretary of State for Education, 2013). That indeed did happen with the exam boards who produced A level science specifications that were subsequently accredited by Ofqual.

This co-teaching aspect is not referred to in Michael Gove’s policy intentions, and is not responded to publicly, however in addition to Michael Gove, Glenys Stacey sent copies of her letter to the chief executives of the four exam boards who offer A levels in England²⁷. While Michael Gove is firm on the decoupling of the AS and A level qualification, it is Ofqual who first publicly suggest to the awarding organisations that this may not necessarily result in isolated courses. Additionally, although the exam boards could have produced qualifications that treated an AS as a wholly separate, new, two-year qualification, they did not.

These three players (the DfE, Ofqual, and the Awarding Organisations) work separately, producing documents for the others that relate to an accreditation process that becomes increasingly more technical. Alongside this are the contributions of universities and learned societies who are engaged by all three players in the production of their respective documentation, and can, therefore, wield potentially significant influence. This influence, however, is predicated on the three key policy players accepting the views of the universities and learned societies that they engaged. The reality of their contribution to the reform process in reality will be discussed later, as too will be the relative power of the DfE and Ofqual demonstrated within this process.

In the next section the regulatory structures and accreditation process is examined in more detail, demonstrating how policy intentions and external contributions are ultimately codified into policy.

²⁶ This is where the AS and the first year of the A level contain identical material so that the students may be taught in the same class – generally this is done as it reduces the number of classes required, alleviating various pressures on schools.

²⁷ Edexcel, OCR, AQA, and WJEC

5.2 The role of the regulator

In this figure below (produced by Ofqual) (2015d) the process of accreditation is shown, but it is the three initial elements that are most pertinent to this chapter:

- The conditions that must be met in order for a specification to be accredited
- The subject content that must be included in a specification
- Guidance from Ofqual on how exam boards should meet the criteria for qualifications, A levels, and individual subjects

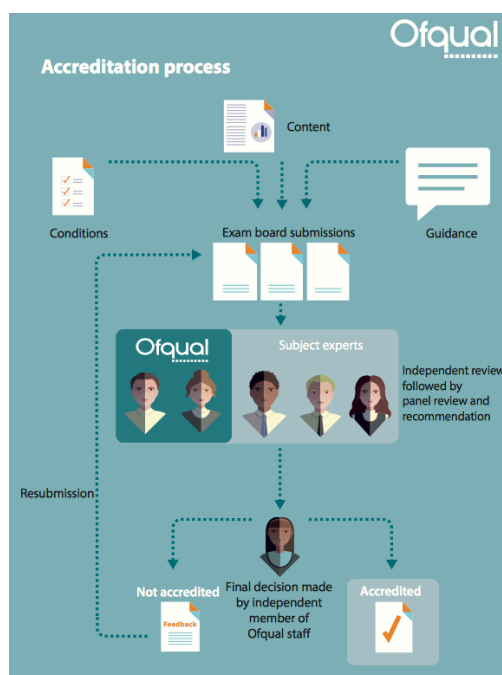


Figure 8: An Ofqual postcard to outline the accreditation process (Ofqual, 2015d)

This figure and its accompanying documentation present a simplified version of the complex interplay between a ministerial government department with a specific political agenda, and an independent non-ministerial government department which implement the former's will but are not controlled by them. By examining the process of accreditation and the origins of different sections of the constituent elements, the underlying tensions and complexities can be revealed.

“The Department for Education determines the subject content for reformed GCSEs, AS and A levels, which exam boards use to produce submissions that must also meet

our rules (known as Conditions). We determine the assessment rules and we produce guidance about our rules. Exam boards must use all of this to develop their qualifications.”

(Ofqual, 2015d)

“Decisions regarding the content taught in new GCSEs, AS and A levels rest with the Department for Education; we review that content and decide whether to incorporate it into our regulatory framework. Exam boards then use this information in their proposals for reformed specifications.”

(Beach, 2015)

Ofqual’s work is arguably never truly independent due to it reporting to Parliament via the Education Select Committee, the Ofqual board does, however, lead the work that Ofqual do, the standards and frameworks they produce, and the decisions that they make. Very little of the internal work carried out by Ofqual is public, with much of their board and committee minutes classified as ‘Official Sensitive’ and redacted “as its publication would be prejudicial to the effective conduct of public affairs” (Ofqual, 2017a). However, the records of their meetings show that during the reform process they discussed many aspects of the reform consequences, examined external reports, and internally produced papers and consultations. The Ofqual board contains several committees, of which two are relevant when considering A level reform. The ‘Standards Advisory Group’ during the 2013-2016 period was made up of current and ex-educators and school leaders, educational researchers at HE institutions, and directors of research of several exam boards; they produced several reports for the board. The advisory group’s contributions focused on “matters concerning comparability between regulated qualifications, international comparisons, validity, reliability, predictability and standards” (Ofqual, 2017b, p. 44) and made no suggestions regarding A level reform, the process of A level reform, or the content of A levels. To deal with matters relating to the educational reforms the board established a separate ‘Reform Committee’ in 2013, and in May 2014 were:

“delegated authority to the Reform Committee to take decisions on: -

- (a) proposals for changes to the accreditation requirements and any revisions to the accreditation criteria;
- (b) consequential changes to the General Conditions of Recognition necessary to require awarding organisations to submit regulated qualifications not subject to the accreditation requirement directly to the register; and
- (c) the form, content and duration of the consultation on proposals to change the approach to accreditation.”

(Ofqual, 2015a)

Unlike the wide range of external and independent members who contribute to the other Ofqual committees, the reform committee was comprised of four members: Amanda Spielman (Chair of Ofqual), Glenys Stacey (Chief Executive), and two “ordinary members”. These members had been selected and/or approved to join the Ofqual board by the Secretary of State for Education Michael Gove, with only Glenys Stacey having been approved by the Education Select Committee²⁸. Unlike all other committees of the Ofqual board the reform committee scheduled no meetings in advance, and the members met only once in 2014-15 (Ofqual, 2017b, p. 44). All reform suggestions that were produced by internal policy teams within Ofqual were approved by the committee and the board and these suggestions were produced as a series of ‘Reform Programme Update’ papers. These papers were produced by the director of the ‘Reform Programme’ team within Ofqual, Marc Baker, a consultant and programme manager with a background in high-level organisations such as Royal Mail, Financial Conduct Authority, and City of London Police but with no educational work history or experience of education policy (gov.uk, n.d.). While Beach (2015) may suggest that Ofqual takes its direction from the DfE but decides for itself what to incorporate into its regulatory frameworks and accreditation processes, key reform policies and decisions were taking place within teams with little or no educational experience and were agreed by Ofqual members with close ties to the DfE. The documents produced by these teams suggest little independence from the DfE, other than those relating to timescale and funding issues.

²⁸ However, in 2016 when Amanda Spielman was selected by Secretary of State for Education Nicky Morgan to take over from Sir Michael Wilshaw as HMCI, she overrode the Education Select Committee’s rejection and Spielman’s appointment was confirmed by the Privy Council.

If the DfE and Ofqual can be considered at this stage of the reform process as working as one combined organisation then the only independent participants in the reform process are the exam boards.

“We designed our accreditation process so exam boards can demonstrate that, for each reformed qualification, they are capable of complying with all of the regulatory requirements associated with that qualification (the accreditation criteria) on an ongoing basis.

We have provided guidance to help exam boards comply with our conditions without stifling innovation.

Exam boards must consider this guidance but, unlike conditions, they can take a different approach provided they demonstrate that they can meet the conditions to which the guidance relates. Our guidance varies by subject.

Exam boards must also show how they will design, set and deliver high quality and effective assessments.”

(Beach, 2015)²⁹

Here the onus is on the exam boards to provide evidence that they are complying with all of the criteria set by Ofqual, yet it is for the exam board to decide what A level assessment should look like. Assessment was a focus of the DfE and a key aspect of the reforms, yet here it is passed to the exam boards to implement this with little guidance from either the DfE or Ofqual. In this situation there is power being granted to the exam boards to design courses, but not freedom, creating a difficult situation. The second and third quoted

²⁹ Phil Beach CBE is Director of Strategic Relationships for Ofqual and began working for Ofqual in January 2015. Similar to other Ofqual personnel he does not have a background in education, but within the RAF. Again, this is not a criticism, but the lack of educationalists responsible for introducing and maintaining education policy is noteworthy.

Also noteworthy is that this citation refers to a document that was published on Beach’s ‘Ofqual Blog’ in order to explain the reform process. He is speaking on behalf of Ofqual and that Ofqual felt it necessary to explain the process outside of more official documentation is interesting. It is curious as to who they regarded as the audience for such explanations of the reform process.

sentences above highlight this difficulty – innovation is encouraged, so guidance is provided (which must be considered), however exam boards can take a different approach to the guidance, yet it must continue to meet the conditions that are explained in the guidance.

In addition to Ofqual’s statements about how free the exam boards may be, the below figures show the timetables used by Ofqual to demonstrate the different aspects of the reform process. It highlights on multiple tracks when different stages of the educational reform process must be completed in order for the qualifications to be ready for teaching in September 2015.

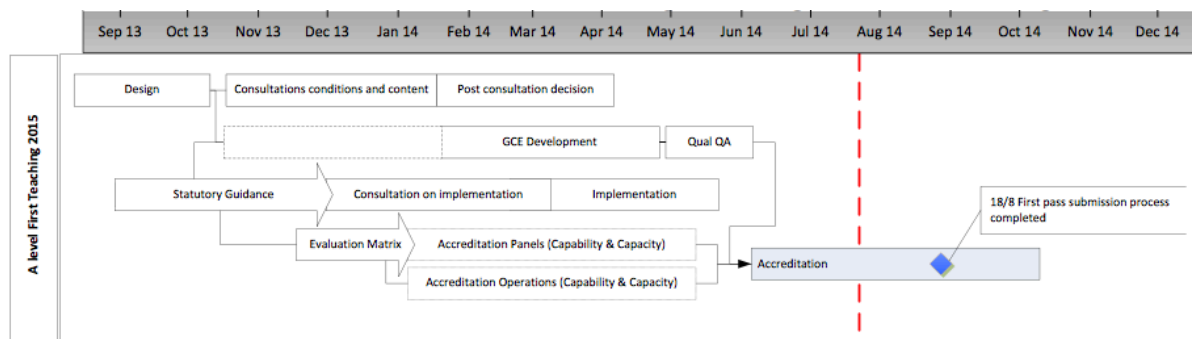


Figure 9: The timeline produced by Ofqual for the reform process (Ofqual, 2014c)

Note how layered this process is. Consultations on proposed subject content are taking place while exam boards are writing specifications using the initially proposed content; the guidance produced by Ofqual to use is being written at the same time as qualification development; and accreditation panels are scheduled to produce the criteria by which the qualification will be accredited after the window given to exam boards to write their qualifications. In all ‘GCE Development’ is allotted three and half months. Fourteen weeks for an exam board to start from statements on course content and develop new specifications, new assessment materials, and all of the accompanying documents required for certification by Ofqual.

For exam boards who spend their own resources and finances developing material in this window, deviation from guidance (even if encouraged) is risky. Consider if the accreditation panel were not to approve of the innovative approaches taken by exam boards and to ask for changes; the tightness of Ofqual’s layered schedule would mean this would delay

releasing the specification to schools. While this would affect the time that teachers have to plan, exam boards must also consider that they have competitors who could use this opportunity to improve their market share. In a situation where exam boards spend many months producing specifications, assessment strategies and sample assessment materials, the risk to be innovative is great, and security could be found in producing material in-line with Ofqual and the DfE's intentions. This potential mechanism for policy compliance is further exemplified in Glenys Stacey's 2013 letter to the Secretary of State in which she stated that:

“The process we are now putting in place will allow us to oversee real, evidence-based improvements to A levels, so that they support and recognise high quality learning and meet the needs of universities.”

(Stacey, Letter to Secretary of State for Education, 2013)

Interesting here is the terminology that she uses – ‘process’, ‘oversee,’ and ‘improvements’. This persuasive language not only shows the firm position of the regulator as guiding the reforms, rather than merely accrediting the work of exam boards against a government policy, but also shows how Ofqual has absorbed the educational ideology of the Secretary of State. The ideas of ‘real improvements’ and ‘high-quality learning’ are common terms but ones that could be contested and difficult to define and raises questions of whose evidence and political ideologies they will be based upon when applied to the new qualifications.

Interestingly ‘improvements’ may arguably be a more colloquial way of describing the changes to the A level sector, but it does also suggest that Stacey may not view the A levels as truly ‘new’. The A level content reviews are worded in such a way where each panel suggests changes to courses but does not suggest that any courses must start from first principles when designing their reformed qualifications (Smith, 2013). With exam boards having little time in which to work with the documents that Ofqual produce, and the DfE and Ofqual bestowing apparent freedom on them, to what extent an exam board would consider drastically changing its practices is questionable. In this regard it would be the former terms in Stacey's sentence that perhaps suggest where exam boards may turn. If they know the criteria by which their new specifications would be judged then they may

merely modify their qualifications to fit said accreditation criteria. During previous changes to the A level specifications (made by exam boards independently on four-year review cycles) new content was added and some structural and assessment aspects altered. Here nothing more complex is being suggested, however the exam boards are being given a powerful statement that the alterations must be in accordance with the government's ideology position regarding the purpose and nature of A level education, rather than their own as creators and custodians of the qualification.

Ofqual are tasked with overseeing the reform process, but not setting policy themselves, something both Glenys Stacey and Phil Beach both highlight in key sections of their writings when describing the work of Ofqual (Stacey, 2013) (Beach, 2015). However, it is how they oversee the process where they do have latitude and the 'black box' of accreditation is worth exploring. Again, Beach (2015) explains the process in detail in an attempt to clarify the accreditation process. However, in doing so his explanations both reveal more about specification accreditation than has previously been publicly available, but in turn invites further questions about the rationale for certain aspects of it. To exemplify this, sections of his descriptions are quoted below followed by the questions that are raised by them.

“We consider each subject proposal by arranging a dedicated accreditation panel. Each panel includes two of our staff, who provide regulatory expertise, and independent subject experts. These panel members meet to undertake collective training prior to the receipt of submissions for accreditation.”

If both the staff members and subject experts require training, on what basis were they selected, and what training do they require?

Who selects the independent subject experts, and what are their qualification?

“Each panel is chaired by one of our senior managers, and one of the subject experts is assigned to maintain an overview of the submissions from all exam boards. The panel is supported by advice from the Accreditation Technical Advisory Group; an Ofqual-led group that provides additional technical expertise, particularly in the area of assessment.”

What qualifies as assessment expertise and does this vary by subject?

“Before any accreditation panel meets, each specification is considered independently by a minimum of two of the panel’s subject experts. Their systematic desk-based reviews provide objective evidence of any potential areas of non-compliance with our regulatory requirements.”

Subject experts consider the specifications independently but evaluate them according to Ofqual’s regulatory requirements. As these requirements do not consider subject knowledge, then why are subject experts involved if their expertise in the field is not used?

“To assist these reviews, the conditions that apply to each subject are consolidated into subject-specific accreditation templates. These set out each condition that has to be met before a qualification is considered to be compliant with our regulatory requirements. These completed templates form a key input for the accreditation panel. Following the desk-based reviews, the panel meets to consider in turn each exam board’s submission against our regulatory requirements.”

The conditions are already mapped into subject-specific accreditation templates, but not by the subject experts. Why?

“Crucially, accreditation is not a comparability exercise. It occurs at the start of the lifecycle of a qualification when there is insufficient evidence to compare each board’s specification with the others. For example, no students will have sat the proposed exams (nor necessarily been taught the new subject content, if it is new). The accreditation panel does, however, consider the expected level of difficulty of each submitted SAM (sample assessment material) and will only recommend accreditation where the expected level of difficulty is judged to be within acceptable tolerances and allows differentiation of performance across the full range of student ability.”

How are the difficulty of examinations judged and how broad is this tolerance?

“The final stage of the panel meeting is to recommend whether or not to accredit a board’s specification. Where the recommendation is not to accredit, the panel discussions inform a detailed, evidence-based report to the exam board with issues

of potential non-compliance illustrated with examples, which are shared with the exam board when a decision is issued. Discussions on any one subject normally last a full working week.”

The final decision, whether or not to accredit a qualification, is made by another member of Ofqual staff, who has the opportunity to challenge the panel’s decision and clarify any areas of misinterpretation. This staff member must accredit specifications they believe meet the relevant criteria, but, in turn, cannot accredit a qualification if it does not. This process ensures that we adopt a consistent regulatory approach for each individual specification.

“Once a decision is made, the accreditation result is sent to the respective exam board. Where accreditation has not been successful, a follow-up meeting is organised with the exam board to explain the reasons for rejection, and to discuss resubmission. The entire process from submission to decision takes about 8 weeks.”

The deciding member of staff makes their judgement on whether they “believe” the relevant criteria are met, they are an outsider to the process – but who is this Ofqual staff member?

Ofqual’s accreditation process is thus revealed, but cannot be easily challenged or investigated. The public are not privy to considerations or debates that take place about what is considered an appropriate level of assessment, or whether an exam board did enough to be accredited but could have gone further in some aspect. All that can be determined is whether specifications submitted to Ofqual passed or failed this accreditation process and how these specifications were different to the ones that came before.

5.3 Chapter Conclusions

In this chapter A level reforms have been considered in practical, but general terms. How the reform processes were instigated, who was instructed to do what and when has been explored, and the key players within the reforms at these levels have been identified. What has also been examined is how the reform process is messy and convoluted. Letters are sent

back and forth, many significant pieces of work that rely on each other all have to take place at once, and the criteria by which something is inevitably judged are both plainly explained and hidden from view.

The communication between Michael Gove and Glenys Stacey shows how it is two voices from within the organisations of the Department for Education and Ofqual who are the most represented in the reform discourses. While this is not unexpected given their positions, it means that everything that they say in these letters has meaning and power, whether they intend this or not. Both write in ways that assume that others are looking to these documents, making firm ideological statements, confirming their understandings of meetings that took place, and reiterating their own positions on multiple occasions. Notable when they do this is their different expressions of warrant, where Glenys Stacey presents her interpretation of Gove's policy intentions in 'accountability' warrant, stressing justifications for her opinions and the effects of various actions or inactions, Gove stresses his voice through 'political' warrant. His speeches, letters, articles, and rationales are always expressed in relation to national or societal good; persuasively phrased and hard to argue against. Their letters do, however, show how there are elements of compromise within the reform process. While some notes of caution from Ofqual are overruled, the timetable of GCSE reforms and which A levels will have their introduction staggered is accepted by Michael Gove.

The reform timetable, however, is a clear example of reform policy 'messiness'. With three staggered timetables regarding A level reforms, two for GCSE qualifications and a prior reform to the KS3 National Curriculum and all of the associated tasks, consultations, and meetings, it is no wonder that groups tasked with reforming the qualifications required clarity. It is questionable whether the reform timetable set out by Ofqual is intentionally complex, or is a transcribed version of a chaotic reform process, but it suggests that alongside the consideration of policy reforms as 'multi-dimensional, multi-layered, and multi-sited' it should also be considered as occurring at multiple times. The A level reform for one A level is built up of lots of complex processes all happening simultaneously, yet overlaps significantly with other A level courses, and reforms elsewhere. This also leads to very short timescales for consultations on the reform processes or suggestions of new

subject content, but also little time for a reflection on the outcomes and how to build this into the policy process.

At this stage of the reform process the power relations become more diffuse and the question of 'Who is in charge of an A level?' becomes more complex. No organisation or person so far appears to have overall control of the reform process, yet they do not freely designate control to other organisations or embrace it themselves. The Secretary of State and the Department for Education direct Ofqual what to do in aspects that they are required to do, but also regarding aspects where Ofqual are independent. Ofqual produce criteria and regulations to judge qualifications yet present exam boards with guidance on its interpretation, and with a nod to innovation. As a result, exam boards are in a position of tension where they have a level of freedom however their specifications must be produced to fit specific criteria in a limited amount of time or Ofqual will not allow them to offer qualifications to schools. In this regard the exam boards have no voice in the reform discourse, despite previously acting as the only organisations who were previously engaging with universities and learned societies in the manner that was sought in this reform. That is not to say that they are not without some power, even if they do not have influence. With their internal structures they were successful in producing a method which led to a co-teachability of AS and A levels against the wishes of the DfE (but supported by HEIs), and still have their specifications accredited.

When considering the role of Ofqual and the accreditation process of new qualification significant power relations are revealed. With the structure of the Ofqual board being closely linked to the Department for Education it can be seen how the neutrality of Ofqual may be questioned. The appointment of persons with no educational experience to run internal Ofqual groups may seem to counter arguments surrounding neutrality, but the accreditation process required an understanding an understanding of policy impacts, issues regarding subject content and assessment, and other technical aspects. When those with responsibility of these areas are not selected from the educational community it raises the question of why they were not. The competence of managerial staff within educational environments is not being questioned here, however the training processes of such staff in these areas is noted in Ofqual's explanations of its procedures. Alongside this, the identity

of those delivering such training is not identified yet is of clear importance when the results of the accreditation process are of such significance.

What has not been discussed here in detail in this chapter is the aspect of subject content. A significant portion of what is to be taught as part of an A level is set by the government; this was noted as one of the three elements that make up the initial stages of the accreditation process, and what is used by exam boards to produce their specifications. For the A levels this was not in fact produced by the government themselves but was the acceptance of recommendations by a review carried out under the direction of Professor Mark E. Smith. In order to examine the A level educational reform in further detail, the following chapter turns to the subject criteria in order to consider what the reform process within a single subject can tell us further about the reform overall.

6. The reforms to A level Physics

Slightly more than half of all A level subjects on offer in England were chosen for the first wave of the A level reforms; Art and Design, Biology, Business, Chemistry, Computing, Economics, English, History, Physics, Psychology, and Sociology. These were described by the government as facilitating subjects (Department for Education, 2015) in that they were those held in the highest regard by universities and were, as such, a priority for the reforms³⁰.

As the reform process moved from general considerations of the whole FE landscape into specific subjects, so too does this thesis. Physics has been chosen as one subject through which to examine how the reform process is enacted in specific detail, a lens through which to scrutinise important contextual decisions that, while perhaps small overall, affect an individual subject greatly, and hold a mirror to show how the reform process plays out in practice.

In this chapter the decisions that impact on A level Physics are examined, but it is important to note from the outset that Physics is situated within considerations that affect all three sciences. No other individual subjects are treated similarly during the A level reform process, and many subject decisions by the government, exam boards, and Ofqual are to all of the sciences, albeit not always in identical ways. As such, voices from all scientific communities are represented, and references made regarding the science A levels as a group are frequent.

Subject specific decisions begin to unfold in 2013, with the commissioning of a review of A level subject content. Decisions that affect subjects had been made prior to this, specifically those to decouple AS qualifications and to remove non-exam assessment (i.e. coursework) from every AS subject except for Art and Design. With announcements, reports, and consultations all affecting what will ultimately be enacted, a year later saw proposals to co-teaching of AS and A level courses in the first year, and Ofqual's 'Regulatory Impact Assessment' highlighting that the practical aspect of the new A level Science courses was still not firmly decided (Ofqual, 2014a). In their impact assessment Ofqual referred to the

³⁰ Mathematics, though not included in this first group of subjects, was classed as facilitating, but placed in a second wave based on views expressed to Michael Gove in the early stages of the reform process (Gove, 2013c).

changes in focus of non-exam assessment and the introduction of a separate practical grade. This would not ultimately be the case but it is clear that the reform process contains a great deal of tension and decision making that is worth exploring, and recognising who is ultimately responsible for A level qualifications and what they are.

The following section presents an analysis of this A level subject content review, commonly referred to as 'The Smith Report', and examines what resulted in arguably the most important document in the A level reform process.

6.1 The Smith Report

On April 9th 2014 Michael Gove wrote to Professor Mark E. Smith, of Lancaster University to thank him for his "stewardship" of the 'Consultation on revised A level subject content', and the report that Prof. Smith had submitted to the Secretary of State in the previous month. The recommendations within the report were shared with Ofqual by the Secretary of State, who agreed to adopt them for the A levels due to be taught from September 2015 (Gove, 2014).

The report was the culmination of a process that had begun a year before when Professor Smith, then Vice-Chancellor of Lancaster University, was asked by the Department for Education to chair a review of the A level content in "key subjects" (Department for Education, 2013b). Professor Smith was previously the Deputy Vice-Chancellor, Pro-Vice-Chancellor for Research, Chair of the Faculty of Science, and Professor of Physics at Warwick University (n.d.). In addition to these roles he was, at the time, a member of several HE research and career-related boards and a member of the Council of Trustees of the exam board AQA (n.d.). He was, therefore in a position to act as a bridge between school, FE and HEI communities.

During the consultation Professor Smith examined thirteen A level subjects that included all of the Russell Group's 'Facilitating Subjects' (with the exception of modern and classical languages): biology, chemistry, mathematics, physics, psychology, sociology, history, art and design, business studies, economics, English, computing and geography. The aim of the consultation was to examine "What changes to subject criteria (content and skills) were thought necessary by stakeholders, (especially, but not exclusively HE)" and "The likelihood

of being in a position to offer a new A level by 2015 in each subject.” (Smith, Independent Chair’s report on the review of current GCE ‘specification content’ within subject criteria - A report to Ofqual, 2013, p. 3)

While the wording of the first aim tacitly assumes that changes were necessary, the processes designed were to determine the extent of them and involved three main stages:

- Initial reviews, involving responses from teachers, higher education and learned societies
- Scrutiny meetings, involving exam board subject specialists
- Final review meetings, led by the Independent Chair

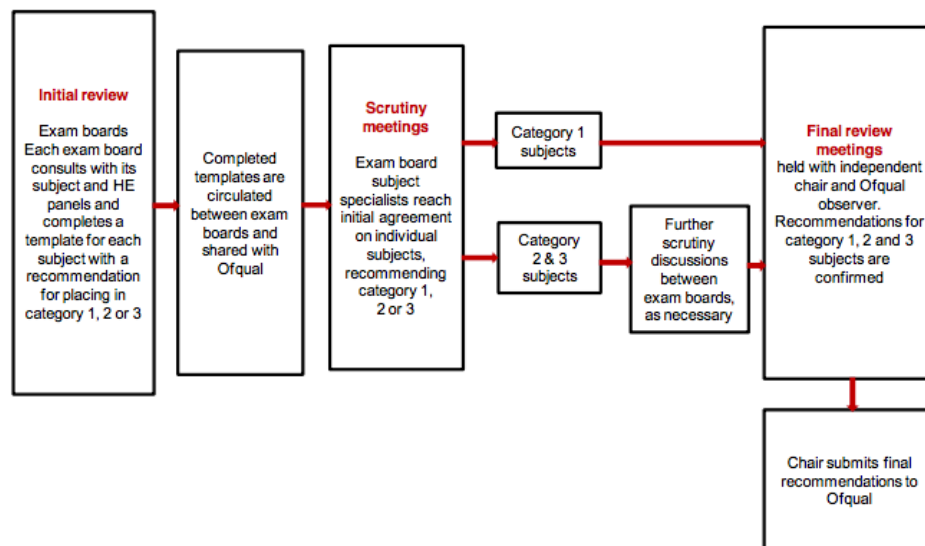


Figure 10: Diagrammatic representation of the Smith Report’s review process (ibid, p. 4)

Notable here is a slight omission in the description of the initial reviews between the brief description of the stages and that shown in the figure. The review group, stated to engage teachers, HEIs and learned societies did not do so directly, nor did it ever intend to. Instead it was exam boards that were asked to carry out this step, and report the extent to which they had done so.

Smith reports that all of the exam boards “had extensively consulted to obtain good evidence from higher education” and that they had all gone beyond their already existing HE advisory boards (ibid, Section 1.3). However, this engagement is not without query and criticism from the organisations that are purported to have been consulted, as we will

subsequently see. Additionally noted in Smith's introduction are his expectations of the reform process:

“The concerns that brought about this review were mostly about the extent to which A levels prepare students well for HE, so stakeholders were asked what changes were necessary for 2015 to make A levels more suitable for entry into HE. The review has attempted to address these concerns, looking for ways of adapting the ‘specification content’ of the criteria to allow a smooth progression from A level to degree course. However, the review has also considered the broader purposes of A levels, such as the value of the A levels to business/employers.”

(Smith, Independent Chair's report on the review of current GCE 'specification content' within subject criteria - A report to Ofqual, 2013, p. 5)

Here the reform makes references to 'changes', 'more suitable' and 'adapting'; all terms that suggest that discussions with exam boards are based around modifications to what they already do; rather than starting from scratch and following Ofqual's suggestions to be innovative, they instead place the reforms as making guided alterations. Also of significance is that Smith designates the decisions over what being 'more suitable' means to stakeholders, yet the process of engaging with these stakeholders is, again, carried out by the exam boards.

While the exam boards had a significant amount of power in this process, it is through the scrutiny meetings that this was supposedly checked. The make-up of these meetings was separate to each individual subject, but included “the Independent Chair, the Senior Responsible Officer for each of the four exam boards and normally two other representatives from each of the exam boards, a subject specialist and a further senior person with responsibility in the subject area” (Smith, Independent Chair's report on the review of current GCE 'specification content' within subject criteria - A report to Ofqual, 2013, p. 5). As with Ofqual, there is no record of who these people were in the report, nor what credentials were used when engaging specialists or those with experience. At this stage exam boards are reporting to a group of three people the views and thoughts that

each has independently sought and then shared with each other, and the final decision “records the Independent Chair’s findings after scrutiny and challenge by him and the four Responsible Officers at the final subject review meetings” (ibid). The second “and” is significant here, suggesting that the decision is made in collaboration with the exam boards, and collaboration that produces subject content that they will then interpret to produce qualifications. The likelihood of bias and self-serving potential of this are considerable, but the involvement of the exam boards is also curious given how A level reforms were instigated following an exam board scandal and questions over their ethics in 2011.

For each subject that is reviewed a list of organisations involved and engaged by the exam boards is produced, however the report notes that because of the short timescale of the reform process “not all interested parties felt able to take the opportunity to feed into this review” (ibid, p. 7). This is a significant deviation from the wishes of the Department for Education and Ofqual and, although Smith notes that both organisations have acknowledged the time constraints “to compensate for this, the exam boards were able to cite recent input through other mechanisms available to them on an on-going basis” (ibid, p. 7). These other mechanisms were often reports from learned societies and prior review meetings held with the exam boards and universities, but dilute the original intentions of the Department for Education to involve these groups in reforming the qualification.

The scrutiny committees would ultimately grade a subject as to whether it required change, required minor change, or required significant change, “to allow change to linear form and allow progression to HE” (ibid, p. 6). These were later expanded to “tidying up”, “minor but substantive change”, and “major substantive change” respectively, but it is the terminology that again signifies that Smith has interpreted the reform process to be purely based on moving examinations into a linear format (rather than modular) and that HEIs should support the qualification. Given the HE sector signalled their support for many of the current A level qualifications in Ofqual’s 2012 study ‘Fit for Purpose?’ (Ofqual & Ipsos MORI, 2012) then the extent to which exam boards may consider changing their qualifications to satisfy the Smith criteria is potentially minimal.

Considering briefly what would happen if a subject were considered to require major changes, it was suggested that the work to develop that subject would pass to the A level Content Advisory Board (ALCAB), comprising members of the Russell Group. They would supposedly work on these qualifications, but would also have a role for all subjects in “an annual review to determine whether or not they need to change in the light of developments in the subject area and as the effects of the changes proposed here work through to students progressing to HE” (Smith, Independent Chair’s report on the review of current GCE ‘specification content’ within subject criteria - A report to Ofqual, 2013, p. 6). Subsequently, ALCAB were closed down in January 2015 by the Department for Education, ten months following the formal acceptance of this report’s findings, nine months before any of the reformed qualifications were taught, and after carrying out no annual reviews.

To consider the how HEIs and learned institutions responded during the subject content reform it is useful to again examine one subject in detail, specifically the Smith report’s scrutiny of Physics, and how this was responded to.

6.2 Changes to Physics

While this thesis is not a specific examination of A level Physics education it is a context through which the reform process can be considered. Already issues within Physics education have been discussed in the chapter ‘Why reform A level Physics?’. The educational reform has been painted in relatively general terms so far, but with the involvement of subject specific groups and HEIs who are involved in a process in order to “allow a smooth progression from A level to a degree course” (Smith, 2013, p. 5). In addition to these broad contributions, the Smith report offered a potential opportunity that subject groups and HEIs could avail themselves of, using the reform process to alter the A level Physics course in order to tackle some of the issues that they face.

The outcome of the Smith report was to rate Physics as requiring “minor but substantive change”, the second of the three categories outlined in the previous section. The report went into detail about which changes should be made and these were to:

- “• Resolve issues about assessment of practical skills
- Exemplify mathematical skills and agree on assessment weighting
- Work with other sciences to agree assessment objective weightings
- Resolve tensions with emerging physics GCSE”

(Smith, 2013, p.8)

The latter of these two points are technical aspects, but the first two presented are key areas that reports before and during the initial stages of the reform process all highlighted (Royal Society, 2011) (Institute of Physics, 2011) (SCORE, 2012c). These were now being agreed by Professor Smith as two areas that needed to be considered during the reform, but no other aspects that had been identified (such as progression rates or demographics) were included. It could be argued that this is because they are unable to be solved by educational reform, but if not mentioned as an issue, then when would they otherwise be tackled by the groups responsible for education?

The Smith report considers that “The evidence has identified a requirement for A level students to have stronger mathematical and numerical skills” (Smith, Independent Chair’s report on the review of current GCE ‘specification content’ within subject criteria - A report to Ofqual, 2013, p. 8) yet “If the new A levels are perceived to be explicitly increasing the mathematical content in a range of subjects, there is a risk that candidate entry in those subjects will fall” (Smith, Independent Chair’s report on the review of current GCE ‘specification content’ within subject criteria - A report to Ofqual, 2013, p. 9). The suggestion made by the exam boards here is to deal with a potential drop in student numbers by producing a list of mathematical skills relevant to teachers of each subject and, in Physics, “showing how that skill can be embedded in the subject, while making it clear that the mathematics underpins the entire subject” (Smith, Independent Chair’s report on the review of current GCE ‘specification content’ within subject criteria - A report to Ofqual, 2013, p. 11). Producing material for Physics teachers regarding the place of mathematics within Physics (even if the goal is that this be shared with prospective students) is curious as it suggests that these teachers did not already know this, or consider it to be true.

Alongside this, the report makes a second recommendation to ensure that 50% of all Physics assessment should involve mathematical skills (ibid). The Physics percentages determined by SCORE were that Physics exams contained between 47% and 63% already (SCORE, 2012c), however the Smith report concluded that by eliminating questions lower than a GCSE level, more higher level mathematics questions would be included. There was, however, no data suggested from any participant, nor in the SCORE report that exam papers were asking questions involving questions lower than GCSE mathematics, just that they were not specifically prohibited (ibid)

Finally, regarding practical assessment the report makes it clear that at this stage of the reform process there was no agreement as to what form practical assessments should take in A level physics, or indeed if there should be any practical assessment at all. It noted how HEIs and learned societies called for an increase in practical skills, but that there were arguments whether the assessment of these skills should be internal or external, and exam- or classroom-based “while still maintaining a method of assessment that is robust” (Smith, Independent Chair’s report on the review of current GCE ‘specification content’ within subject criteria - A report to Ofqual, 2013, p. 9). The exam boards had the opportunity during the Smith review process to work together and arrive at a consensus decision. Because they had not done so, this decision was passed to Ofqual, who would ultimately announce a decision in April 2014 on the same day that Michael Gove accepted the conclusions of the Smith report.

With regards to Physics specifically, the following content changes were proposed:

- “The addition or making more explicit:
 - Newton’s laws of motion;
 - projectile motion;
 - principle of conservation of energy;
 - radian measure of angle and angular velocity;
 - mechanical properties of matter (stress, strain, energy stored); Young modulus, force-extension graphs)
 - charge curves;

- interference;
- electrical and gravitational potential and changes in potential energy.
- Two elements of content proposed for deletion:
 - (i) the qualitative treatment of free and forced vibrations, damping and resonance, because these cannot be addressed satisfactorily without a quantitative treatment, which is not within scope
 - (ii) appreciation that $E=mc^2$ applies to all energy changes, as it is understood that it has never been examined, and “appreciate” is not amenable to assessment.
- Changes in relation to the mathematical requirements:
 - identifying uncertainties in measurement and the use of simple techniques to determine uncertainty when data are combined;
 - changing the subject of non-linear equations
 - solving quadratic equations
 - distinguishing between instantaneous and average rate of change
 - solving equations involving rates of change - interpreting logarithmic plots
 - use of small angle approximations.”

(Smith, 2013, p. CII-V)

The views of physicists and educators are important in considering these topics, and this will be done so later, but it is worth noting for the moment that the report does not explain how aspects from the first bullet point should be made more explicit to those exam boards where they are already included (or what exactly should be taught if they are being introduced for the first time). Where the DfE wished to reform A levels, the changes to the Physics specification take up sixteen statements, less than 200 words, but do not explain the level that is ultimately required of the A level course, and eliminate consideration of $E=mc^2$ because it is not “amenable to assessment” (Smith, 2013, p. CIV).

Regarding specific assessment decisions the changes suggested were minor. An examination structure to provide the governments requirement for decoupled AS and A level courses was readily confirmed by the awarding organisations (ibid) as this was already the case in the current offering by the exam boards. In the ‘assessment objectives’, the phrase “how science works” was suggested to be replaced by “working scientifically” and “knowledge

and understanding” was suggested to be replaced with “knowledge with understanding”. As well as being minor changes the former was not present in the assessment objectives later published by Ofqual, and the latter specified change was not made. Changes to the weightings of the objectives were also minor where applying knowledge was adjusted from 35-45% across the Physics exams to 40-50%, and analysis of data was adjusted from 20-40% to 20-30%. These limits were followed by one exam board, AQA, which did not change the existing weightings at all as they were already within the overlap (AQA, 2014).

As previously mentioned the conclusions of the Smith report were accepted in April 2014, and subject recommendations published, but the initial report was sent to the Secretary of State for Education in July 2013. In the intervening time further consultations took place regarding a number of issues relating to the reforms, including one on the initial report recommendations outlined above.

6.3 Sector Analysis

In describing how the four exam boards that were part of the Physics review meetings obtained the evidence to support their conclusions, the Smith report notes:

“Each of the four awarding organisations undertook its own review and presented a summary report based on that to the scrutiny meeting. Each awarding organisation also took account of responses from learned societies to a request for evidence from JCQ. The sources of external evidence noted by each awarding organisation are as follows:

AQA: HE Expert Panel, SCORE, Institute of Physics, Ofqual, OECD, Association for Science Education,

Pearson: External Stakeholder Advisory Committee, HEIs (by questionnaire), SCORE, Institute of Physics, Ofqual, 59 Club.

OCR: OCR Science Consultative Forum, OCR HE Forum, SCORE, Ofqual

WJEC: HE Advisory Group, SCORE, Institute of Physics, Ofqual.”

(Smith, 2013, p.CII)

Notable here is that SCORE is present in each of the exam board's sources of evidence (as is Ofqual), the engagement of HEIs is generally limited to using the exam board's already established panel, and that OCR did not consult the Institute of Physics at all. While the exact nature of their consultations are internal to each organisation, Professor Smith was satisfied with the extent that they had consulted externally (ibid) and Michael Gove expressed thanks for this (Gove, 2014).

SCORE however published a statement shortly after the initial findings of the Smith report were announced:

"We support Mr. Gove's notion that the main users of A levels - higher education and employers – should have a stronger say in devising A level content. We do not believe, however, that the process used for reform has been effective in achieving this."

"The learned societies within SCORE represent the three core sciences in schools – biology, chemistry and physics – and are ideally placed to play a leading role in any qualifications reform, being independent and able to bring together all of the stakeholders concerned."

"However, despite claims to the contrary throughout the report published on Friday, SCORE has not been involved in any meaningful way in discussions around the content of the science A levels. As it stands, the process will not improve the process of assessment or build coherence between the sciences and mathematics."

(SCORE, 2013b)

The organisations that make up SCORE had individually and collectively responded to every reform consultation that took place, but alongside this there were some significant additional contributions:

- On May 13th 2013 the education leads of the learned societies expressed their concerns to the DfE about the reform process and how they would be unable to commit the time

or resources to the level of curriculum design that the DfE was suggesting, instead proposing individual subject committees (Institute of Physics, Royal Society of Chemistry, Society of Biology, 2013)

- On May 16th 2013 SCORE explained to the JCQ and exam boards that the DfE were reluctant to create individual subject committees (SCORE, 2013a)
- On 24th June 2013 the individual three science societies wrote to Professor Smith directly to express their “concerns with the review he was undertaking, offering to work with Ofqual and the Russell Group to address shortfalls with the qualifications in their subjects, but this offer was not acted upon” (Society of Biology, Royal Society of Chemistry, Institute of Physics, 2013)
- On 31st July 2013 the Council for Science and Technology wrote to Michael Gove to express their feeling that neither Ofqual or the Smith report fully appreciated the importance of practical science and the assessment of it (Council for Science and Technology, 2013)
- On 9th September 2013 the above statement from SCORE was produced (SCORE, 2013b)
- On 20th December 2013 SCORE produced an official response to the DfE’s consultation on subject content outlining their views and concerns (SCORE, 2013d)
- On 17th January 2014 the CST wrote to Glenys Stacey to clarify that the reforms were not considering malpractice and raise concerns about practical assessments (Council for Science and Technology, 2014)
- Also on 17th January 2014 SCORE asked that the new science A levels be postponed and highlighted serious concerns about assessment in the sciences (SCORE, 2014a)
- On 30th July 2014 SCORE responded to a third Ofqual consultation, raising concerns about subject content and the extent to which exam boards had been included in the design of the new qualifications (SCORE, 2014b)
- On 13th July 2015 the IoP respond to an Ofqual consultation on practical skills, specifically around maladministration and malpractice (Institute of Physics, 2015)

While this group of organisations were said to have been listened to during the reform process, and engaged in the creation of new A levels, they did not share this perspective.

While the specific details are not necessarily relevant to consideration of the reform process overall, it is important to note that these organisations made substantive contributions, and not simply one-page press statements. They made detailed and specific requests and recommendations on a number of issues that were not included as part of the reform.

These included:

- The suggestion of an accountability measure that could be incorporated alongside the new accountability measures for students with disabilities and pupil premium students that would highlight STEM specific issues such as a gender participation measure (SCORE, 2013c).
- That the AS should continue as a recognised qualification and be co-teachable, but also contain recognition for the practical work that it was proposed to contain (SCORE, 2014a).
- That the mathematics content of A level sciences should not be restricted to the level covered at GCSE due to the potential need for topics such as calculus in Physics (Society of Biology, Royal Society of Chemistry, Institute of Physics, 2013)
- That the A level should be designed so that students studying the double award in science would have covered the material required by the A level course, as opposed to just triple science, in order to make the qualification accessible to the majority of students (SCORE, 2013d).
- That the reform process had “divorced assessment from content drafting” and that Ofqual conducting reform of content and assessment in parallel rather than in unison has had a negative impact on the reform of A-levels (SCORE, 2013d).
- That the established curriculum committees within the Institute of Physics, the Royal Society of Chemistry and the Society of Biology be used to have “a formal place in the development of qualifications” (SCORE, 2014b).

- That focus should be placed on scientific understanding and competencies rather than rigid adherence to subject specific guidance (which would stifle innovation) (SCORE, 2014b).
- and, quite boldly, a change to the educational market such that there was only one awarding organisation that would offer multiple interpretations of the specification (in order to remove the challenge of regulation and the pressures of competing exam boards) (SCORE, 2014b).

None of the proposals mentioned here received a response from the DfE or Ofqual, although some were referred to in Ofqual’s summaries of their consultations (Ofqual, 2015e) (Smith, 2014) (Ofqual, 2014b) (Ofqual, 2012b). The origin of the first three of these highlighted points are clear, but the latter three less so. SCORE expresses the view that while an emphasis to involve HEIs is laudable they do not consider that institutions can lead it:

“Higher education is a diverse sector with 165 separate institutions and a range of differing requirements for entry, and there is no single umbrella body that could take responsibility for their involvement in A-level design. Such a model would leave schools, universities and employers having to navigate a market of qualifications developed by a range of different institutions, all accredited by the regulator but possibly of variable worth.”

(SCORE, 2012b)

The primary concern with HEI involvement is that those choosing to study A levels, or apply to university at the conclusion of their courses, would read too much into which universities were involved in the creation of which exam board’s specification.

The learned societies were also concerned about their level of involvement and how, while they are sought for advice:

“As we know from previous reform, this is often done in a piecemeal and perfunctory way, with little opportunity for meaningful input, but with AOs later claiming a significant contribution from those they have spoken to”

(SCORE, 2014b)

Concerns relating to the exam boards did not stop with how much they had claimed SCORE’s involvement in the reform process, but also the reform itself, and how it was run by Ofqual.

“SCORE is concerned at the extensive involvement of awarding organisations in regulatory decisions concerning A-levels. The criteria will be used by Ofqual to judge whether awarding organisations’ specifications meet appropriate Conditions of Recognition, so it is clearly a conflict of interest for those criteria to have been developed by awarding organisations themselves. Awarding organisations operate in a competitive market driven by commercial interests and the motive to attract school and college custom. In addition, there is no guarantee that awarding organisations are able to consult with a full range of stakeholders on content or that awarding organisation subject experts are entirely neutral in the approach to criteria drafting.”

“The heavy involvement by the Department for Education and awarding organisations in this process has highlighted a vacuum in subject-specific oversight of qualifications.”

(SCORE, 2014b)

While this response may read as quite scathing, SCORE’s concerns should be compared with AQA’s response to Ofqual’s 2012 consultation on A level reforms, at the very start of the reform process:

“However, from AQA’s engagement with universities and sector level groups, we are aware that there is a question over available resources (time and cost) and priorities (with research necessarily prioritised in most institutions) which would affect

awarding body engagement with university staff and difficulty in meeting a challenging timetable for redevelopment.”

“Universities and learned societies have questioned how far they might be able to replicate the level of engagement envisaged. For this reason, we cannot agree that universities should necessarily be able to provide this level of engagement.”

“Thus, there needs to be a clear mechanism whereby learned societies as ‘guardians’ of content standards and assessment principles minimise variability within A-level subjects between awarding organisations whilst at the same time providing reassurance to all institutions that new A-levels are fit for purpose.”

(AQA, 2012)

HEIs, learned societies, and exam boards all reported the same difficulty with engaging with the reform process in the way that was envisaged by Michael Gove and the Department for Education; they all suggested the role that the learned societies should play in the oversight of the A level qualifications, yet their concerns were not acted upon. Where the group of HEIs, learned societies and exam boards did agree with the Secretary of State was in his suggestion that an independent organisation could be set up in order to assist engagement with A levels with all groups. In this regard they suggested that members were drawn from academics, schools, and employers. This was indeed the case for ALCAB and it acted exactly as was suggested for Mathematics, Modern Foreign and Classical Languages, and Geography. The potential that ALCAB could have offered was outlined by AQA:

“There is a risk that, where there are subjects with particularly small subject communities, the level and quality of support envisaged by Ofqual might prove to be too challenging. The subject community for minority languages, for example, is likely to be very small. There are some subjects (for example, Citizenship) where it is harder to identify a clear subject community. There are some subjects (for example, Law and Accountancy) which are not universally welcomed by universities, but enjoy strong support among other stakeholders, such as employers.”

(AQA, 2012)

However, as mentioned previously ALCAB was closed by the DfE before the introduction of the reformed qualifications (ALCAB, 2015), thereby removing the potential aspect of guardianship.

The reasons behind the decisions to close ALCAB, to not to establish national subject committees, or to utilise those set up by learned societies is unclear. The idea of a unified subject group was supported in 2012 by the House of Commons Education Select Committee, and the exam boards OCR, AQA, and Edexcel had agreed to fund the committees (as they would not need to maintain their own individual subject groups) (SCORE, 2012b). In the letter officially closing ALCAB to the ALCAB board in 2015, Nicky Morgan (Michael Gove's successor as Secretary of State for Education) commented how their services may be useful in the future but, due to them receiving funding through a grant from the DfE, she was unwilling to fund the group (Morgan N. , 2014)

6.4 Chapter Conclusions

In this chapter we have seen how the reform of the A level qualifications during this period was carried out on a subject-specific level. By examining the process in this detail, we can identify crucial aspects regarding this reform and consider what drove it and how the reform process produced a policy text.

This analysis shows how the power of the state reaches into the lives of teachers and their students. Here is where what is taught to students is decided and debated, however, despite the amount of work that has gone into consultation processes, liaising with multiple organisations, and extensive letter writing, the work reviewing each individual subject content is channelled into two review meetings. No representatives from Higher Education Institutions are present at these meetings, nor any representatives from the subjects themselves. This is a considerable shift from what was suggested by the Secretary of State for Education regarding the intended involvement of those sectors, yet this was not widely publicised and the recommendations of the Smith report were gratefully accepted by Michael Gove. This raises questions relating to elements of truth within the reform process. If the Secretary of State were unhappy with this level of involvement by HEIs then he could

have made this clear, however the commitment to an introduction of the newest qualification in September 2015 had already been announced. Also potentially significant is that while the Secretary of State did not respond to letters and consultation responses from HEIs saying that they could not be involved directly, it is possible that Michael Gove was aware that this involvement through the awarding organisations was the best that could be achieved at this time. The mediatisation of policy reform, and political climate could potentially contribute to how a delay to the reform for a lack of interest from universities would be viewed by the public.

The structure and the process within Professor Smith's review and the established rationale that it uses confirm the reach of the Secretary of State's wishes, further embedding the idea that curriculum production, even if it is carried out by a separate person, group, or body, can still be 'non-neutral and stridently ideological'. This is not to question Professor Smith's independence during the report, but that it uses parameters such as an involvement of HEIs and modes of assessment within its decisions over the quality of the A levels it is examining.

Despite this stress over the involvement of HE, the review involved exam boards researching and presenting what they believed should be taught on the A level courses following exam board engagement of the approved HEIs. While this is not unusual, it is efficient during a reform period where rapidity is required, and allows exam boards to make use of their existing networks (or forge new networks that they can utilise during subsequent refinements) it is unusual in that examination boards had previously been left out of the reform process. It is clear that their skills at curriculum building were recognised by the government, Ofqual, and Professor Smith, however they are not afforded a voice in the reform process. This is not to say however, that they are without significant power.

For a reform process that began with proposals for Higher Education to control A level education (or at least to have a guiding role in it), it is notable how the Smith review did not begin at first principles. It did not seek to engage institutions and learned organisations to build a new curriculum for the A level subjects or engage in a process that could then be presented to the government and awarding organisations to tell them what the Physics community believed should be taught in an A level Physics course. This is not to say that the

work that the exam boards produced did not involve this, however this power was devolved to separate exam boards and checked by the subject groups that made up the Smith review process. There is no evidence available to say what this checking process was, or what criteria there were beyond statements that exam boards took into account responses from learned societies.

In using Physics as a lens through which to view one subject in detail, further aspects of devolved power and aspects of truth within the process are highlighted. The level and amount of mathematics that is required by HE Physics courses is emphasised by the Secretary of State for Education even before the official commencement of the reform process, and the Smith report reflects this in its statements regarding bolstering the mathematical component, however the reality is that there was little change (and none of substantive significance) across the A level Physics specifications. Areas that exam boards needed to strengthen, such as how to give a particular topic in Physics more emphasis, are given no direction in their feedback from the Smith report's subject groups, leaving exam boards to decide this for themselves. Instead the Smith report considers removing topics because of their lack of amenability to assessment in an examination as more important in the educational reform process.

The feelings of subject organisations over how they were consulted and the extent to which they were consulted during this reform process also brings into question the validity of the Smith report and how HE and organisation involvement was rated. They are vocal and vociferous in their assessment of the process, but it is clear from the extent of which the STEM organisations contributed that they were extremely willing to participate and did so via the procedures that were afforded to them by the process. This is a curious outcome of the subject consultations particularly given how the STEM communities are very receptive of the idea of subject organisations to lead on A levels in the future and how examination boards are willing to fund them. That this did not take place is a clear deviation from the proposed plan that was argued for by the Secretary of State for Education from the beginning of the reforms, and of note because it is a significant aspect of how the role of HEIs and learned institutions were supposed to take control of A levels not just through this reform process, and beyond it. While it has been repeatedly seen how educational reform is

extremely complex and 'messy', this is not the case here. It raises the question of why this is not pursued by the government, and whether the Secretary of State was more concerned with making policy suggestions in order to start an ideological reform process, than he was with implementing some of the ideas that he used to persuade people that it was necessary.

While organisations such as SCORE are clear about how they do not feel to have been meaningfully consulted in what will result in the shape of their A level qualifications there are two clear voices that are absent from the reform discourse entirely, students and teachers. These reforms have a significant impact on both groups and yet they have no agency in this process. Accordingly, it is from the complexities of the reform process, to the practical implications of the reform on these groups that we turn to in the next chapter.

7. Considering the reforms in practice

The overall intentions of the 2015/6 educational reform have been discussed previously, however my role as a teacher and the leader of a department tasked with ultimately delivering a 'reformed qualification' adds an additional layer of complexity to considerations of educational reform – what does such reform mean for schools and teachers, and how does practice change in order to bring about the government's intentions?

As the Head of Physics at a secondary school with a sixth form I was keenly aware of the reform process from its outset, and its continuing developments. The primary communication of information about the reform process came from how it was reported in the media, and subsequently through communiqués from the exam boards, together providing a layer of translation and inherent bias between what the government/Secretary of State/DfE/Ofqual may have intended to present and what was ultimately provided to or understood by teachers and leaders within schools.

While student experience may appear as the most fundamental result of any educational reform, to look at the potential impact and change that a reform process has, individual students are some of the least affected. Ultimately they complete the new qualification, but they do not experience the 'old' qualification or have to work through the myriad of differences and the new planning and preparation that goes into the teaching of it.

In this chapter I attempt to critically analyse the effect of the educational reform process on teachers, how that will lead to changes to the students' experiences, and how the many facets of the reform were seen in one sixth form centre.

In addition to this I seek the views of two groups involved intrinsically with the reform, students and university physics lecturers. Their considerations of the reforms shed light on a process that is supposedly carried out with them in mind. Their feelings and opinions about Physics education and the educational reform are explored.

7.1 The research methods used

In this chapter the experience of the educational reform is explored from three perspectives that were not involved directly with the process of the educational reform itself but were directly affected – teachers, students, and universities.

There are many stories and narratives woven through the thesis, that of the relationship between Michael Gove and Glenys Stacey, the views expressed by the learned societies in response to policy intentions, and how situations and people within review panels and organisations such as Ofqual caused the reform process itself to morph and change. It is clear that the policy reform process was not purely technical, it involved many people, oftentimes with conflicting views. The aim of this chapter is to explore these views, and a variety of methods are used to do so.

An ethnographic approach was considered, drawing on the experiences and thoughts of a range of people within one environment, and a discussion pertaining to ethnographic research follows. However, in considering the nature of the reforms and the reform process, the three groups given above (teachers, students, and universities) had very different locations within them. Their experiences, thoughts and views were not unique, but were worthy of exploration as individual groups before being grouped as ‘people who would be affected by educational reform’. In considering how best to explore these groups, different methods presented themselves as the most appropriate way to engage and probe their experiences. As mentioned in the previous methodological chapter, a mixed methods approach was selected for the study in order to fully explore the policy reform process from multiple angles. In addition to supporting the ultimate conclusions provide through a triangulating effect, the different methods aim to capture as much of the participants experiences of the reform process as possible.

In this chapter I use an autoethnographic approach to lay out moments, questions, thoughts, and processes that I experienced that I feel are relevant in order to examine what the effect of the educational reform process was. This is presented narratively, and some dates are given to help place events in the lead up to the introduction of the qualification in September 2015. In addition to this a series of interviews with HE Physics lecturers and

focus group findings from groups of students at different ages were conducted. Their observations and thoughts regarding Physics education and the, then suggested, reforms to Physics are presented, and compared.

These methods are considered, in turn, below.

7.1.1 An autoethnographic element

Bolen (2017) describes ethnographers as those who document experiences that often go untold in other research, storying “life-altering epiphanies or turning points, mundane or taken-for-granted happenings” (p. 75), and utilising evocative personal narratives that show meaning-making. In wishing to reveal how the reform process being studied played out in a school setting, with all of the tensions and effects associated with it, ethnography was selected as an appropriate method to use. Mills and Morton (2013) see ethnography as a way to offer the researcher and reader a “unique insight” into the pedagogic policies, institutional discourses and individual ideals that make up the educational worlds in which we now navigate, using human experience as a way to illuminate the increasingly more complex and dynamic environments that have been potentially been easier to distinguish in the past (“state versus private, academic versus vocational, policy versus practice”) (p. 2). Chang (2008) however sees ethnography as a more culturally focused method to exploring perspectives of individual and group culture in order to further sociocultural understanding through its combination of cultural analysis and interpretation with narrative details (p. 45). What constitutes ethnography may not necessarily be categorised as entirely contested; indeed the requirement for the narrative to maintain an analytical or critical insight, to interpret the account and place it in a broader context, and to illuminate the theoretical issues around it all feature in the descriptions of Chang (2008), Mills and Morton (2013), and Ellis and Bochner (2000). However what constitutes ethnography is debated, and it is common for authors writing about ethnography methodologies to avoid restricting the approach to firm criteria by giving examples of what they consider to be ‘good’ ethnographies and letting their readers construct their own personal definition. As Mills and Morton argue, “there may be as many ways of being ethnographic as there are ethnographers” (2013, p.12).

Geertz (1988) describes ethnographic writing as “about being there”, and the lens through which this study is focused was chosen because of the nature of myself being within the field of Physics. While many researchers may prefer to disconnect their personal voice from their research, keeping a distance between their subjects to preserve objectivity and neutrality (Cohen, Manion, & Morrison, 2011), to fully present the view of how the delivery of a physics A level changed from one qualification to the next, a Head of Physics would have the most significant voice when commenting on a school implementation. It is their job to take the product of the reform process, a new physics specification, and be responsible for the implementation of it, whereas one teacher may only teach or plan to implement part of it. My location within the research, as someone both studying the development of a policy and then implementing it also gives me a unique perspective, and a way in which to view how some of the wider, and seemingly irrelevant aspects of school life, may be worthy of consideration. This led me to consider that, rather than analysing the effect of the reform process in a Physics department within ‘a’ school, it was valid to analyse the effect within ‘my’ school. As an autoethnographer I could use my own experience as primary data in a way where “the richness of the autobiographical narratives and autobiographical insights are valued and intentionally integrated in the research process and product, unlike conventional ethnography” (Chang, 2008, p. 49).

Autoethnographies have been criticised for being narcissistic and self-indulgent (Coffey, 1999), however “we can no longer pretend that our research personae are separate from the places and contexts we seek to understand” (Mills and Morton, 2013, p.2) and that, “in a sense, all ethnography is self-ethnography” (Goldschmidt, 1977, p. 294).

Autoethnographies are reflexive narratives of researchers’ lived experiences (Bolen, 2017, p. 74) and this study contributes to understanding such lived experiences of reform processes and their impact. There are however pitfalls in characterising a portion of the study as merely ‘autoethnographic’, “it is not simply enough to tell the story or write a journal entry (Taylor & Coia, 2006, p. 19).

Ellis and Bochner (2000) note that social scientists’ interest in self-narratives fall into one of four categories:

- (1) "Reflexive ethnographies" in which "authors use their own experiences in a culture reflexively to bend back on self and look more deeply at self-other interaction"
- (2) "Texts by complete-member researchers" who "explore groups of which they already are members or in which ... they have become full members with complete identification and acceptance"
- (3) "Personal narratives" written by social scientists about "some aspect of their experience in daily life"
- (4) "Literary ethnography" written by an autobiographical writer who "focuses as much on examining self autobiographically as on interpreting a culture for a non-native audience"

(p. 740)

There are a further thirty-nine 'labels' that indicate autoethnographic orientations (such as first-person accounts, lived experience, narrative ethnographies, personal experience narratives) that may be placed into these different categories (ibid, p. 739-740). Within this multi-layered description where one piece of writing may be described using multiple, but subtly different terms, it becomes important to define what each researcher using an 'autoethnographic' term means by it (Chang, 2008), potentially as a way to prevent the work from "fall[ing] into the pit of confessionalism, therapy on the page, or naked self-absorption" (Gornick, 2001, p. 9).

Taking these previous observations into account, through this autoethnographic element I am not telling 'my story' through which to explore the group to which I belong, nor examining my own experiences and behaviours reflexively. More, I attempt to describe what happened to me and what I thought about when making decisions relating to the reforms and their process. An element of self-reflection plays a part, but the goal is not an exploration of my feelings and how the reforms affected me as a person. As such I focus on a combination of Ellis and Bochner's latter two categories, a personal narrative through which I interpret my experiences for an audience who may be considered 'other' to myself. It is to these considerations that I now turn.

Bolen (2017) criticises autoethnographies that are entirely composed of personal narratives for their lack of academic analysis, but this is furthered by Chang (2008) who believes that it

is the “context of the bigger story” (p. 49) that makes autoethnographic ethnographic, and that without a wider cultural context “self-indulgent introspection is likely to produce a self-exposing story but not autoethnography” (p. 54). This creates something of a tension between myself and Chang as she does not define what she means by the wider cultural context. Much of her work is focused on examining specific environments and peoples either ethnographically or autoethnographically, but her focus is predominantly sociocultural-oriented, even when in a school setting. As such my experiences of a Head of Physics during a three-year reform process are embedded within a broader framing of ‘culture’, in this sense professional, educational, and political cultures in addition to the social. This is supported by Mills and Morton who do not focus on the cultural dimension, instead suggesting that it is the micro-experience being used to exemplify or explore the macro-issue that is the defining characteristic of ethnographic work: “the ethnographer’s challenge is to weave the immediacy and rawness of the educational experiences into a context from which analytical patterns and insights can be discerned”... “if education is always risky, always unsettling, then ethnography is the perfect method to capture its dynamism and power” (2013, p.2). For the latter their interpretation of ethnographic research (and by extension, autoethnography) is that which uses “the vividness of experience as a springboard from which to open up much broader debates (ibid, p. 28).

In categorising this aspect of the research as autoethnographic, I do so on the basis that it is a lived experience, written by me, about “some aspect of [my] daily life” (Ellis and Bochner (2000, p. 740). Throughout the thesis, the writing it is aimed to “illuminate the larger issues at stake” (Mills and Morton, 2013, p. 28) with “thick description and sharp analysis” (ibid).

In attempting to construct a narrative situated within a political environment that is rarely focused on, namely the technical aspects and issues of the implementation of educational reform, it is potentially challenging to consider what is of relevance within a complex and dynamic process. What constitutes ‘relevance’ within such a narrative is difficult to define in advance as “social life is messy, uncertain, and emotional.” (Adams, Holman Jones, & Ellis, 2015, p. 9). However:

“If our desire is to research social life, then we must embrace a research method that, to the best of its/our ability, acknowledges and accommodates mess and chaos, uncertainty and emotion”

(ibid, p. 9)

In explaining the reasoning behind what was relevant to me at the time as Head of Physics, and now feels relevant as a researcher of the reform process, then this autoethnographic element is grounded in Adam’s suggested principles that autoethnography:

“Uses a researcher's personal experience to describe and critique beliefs, practices, and experiences.”

and:

“Shows people in the process of figuring out what to do, how to live, and the meaning of their struggles”

(ibid, p. 2)

As this research is looking at changes that took place over a span of more than a year I decided that a broadly chronological approach was most suitable, however this is generally isolated from the descriptions of what was unfolding outside of the school environment described in previous chapters. This is to help distinguish between descriptions of what was known and understood at the time, and what is now known to have happened during that time as one may unduly affect recollections of the former.

A rough chronology is also important when assisting recall of thoughts and feelings at the time, and while the telling of any narrative may introduce questions of validity or truth, Ellis (2004) believes that autoethnographers should “try to construct the story as close to the experience as [they] can remember it...but it’s not so important that narratives represent lives accurately – only ‘that narrators believe that they are doing so’ (Bochner, 2002, p. 86 cited in Ellis, 2004)”. Chang (2008) similarly cautions that “autoethnographers can fall into the pitfall of over-relying on their personal memory as the source of data” (p. 55). The goals identified by Adams, Ellis, and Jones for assessing autoethnographic research methods are that they should “extend existing knowledge and research while recognising that knowledge

is both situated and contested” (2015). As such I do not claim that my experiences are identical to those in similar positions, because they may be contested by others. However, the nature of my work places me in a collaborative environment with other Physics teachers, heads of other science subjects in the same school and with Heads of Science and Physics in other schools. This autoethnographic element looks to this one experience but that experience is not isolated and is shaped and shared by others. A chronological approach is also a useful aspect as both a framing device and an important aide-mémoire. Rather than being shaped by a series of themes or questions that arise from my own thoughts at the conclusion of a three year process, the chronological aspect affords the use of emails, document trails, notebooks, meeting minutes, to-do lists, journal entries in order to both ‘jog’ memory, but also to ensure that I do not wholly rely on my own memory of events, thoughts, and ‘what occurred when’³¹. Similarly, its placement and links to the broader reform contexts, the document analysis presented previously, and the interviews and focus groups also provide further triangulation of experience; a view on a particular aspect of Physics being removed from the syllabus is highlighted by myself during the narrative, by a HE lecturer during their interview, and by the Institute of Physics in a consultation response. As such, this autoethnographic experience is my own experience, but it does not stand on its own; it is used to illuminate one part of a much bigger ‘story’ both regarding the specific details of the reform process and the power relations that are revealed by examining a lived experience of it. Accordingly, the personal element is considered a valid and worthwhile inclusion.

In recognising the value of my situation in the process, and richness of an ‘insider insight’ into the reform process, then I feel that my voice as Head of Physics is trustworthy when attempting to combining personal experience with the wider educational reform process. As described previously, the voices and experiences of students and HE lecturers are also considered a valuable addition to considerations of the reform process. The proximal nature

³¹ For example, a particular piece of INSET training that I considered relevant to how I was preparing for the reform process. My memory was that it was a cold, wet day, and that I attended the course at a local university; I remember the session clearly, but not whether it was in October or November. The month was however important with respect to the timeline of events, and I was ultimately able to check the date by searching for the email confirmation.

Similarly, a particular planning document was drawn up by myself, the exact date of which could be confirmed as I remembered that I had taken a photograph of it in order to send it to a colleague.

of the participants in the focus groups and interviews led to some initial consideration as to whether this study may be considered an ethnographic study, combining the experiences of myself, my students, and the links that I/we³² have with the Higher Education institution in which the lecturers were based. In refining and strengthening my understanding of the natures of ethnography and autoethnography, it is not claimed that this study should be considered ethnographic. The views of students and lecturers are considered separately, were gained in different ways, and are not part of the autoethnographic element and its narrative.

It is to the gathering of data from students that this section now turns.

7.1.2 Interviews

The perspective of the Higher Education Physics community has already been reported on several times through publications from organisations such as SCORE, the Royal Society and the Institute of Physics. However, as the aim of this chapter is to explore the educational reform from the perspectives of those who inhabit educational physics on a day to day basis, then the views of physicists in a HE setting was required.

A semi-structured interview approach was chosen as the method to recognise the relevance of both ordinary and situated knowledge that interviewees hold, and that is best uncovered by asking the right questions in the right situations, while also allowing flexibility to explore an interviewee's experiences and follow-up their answers to questions given the potential value of their situatedness and local context (Mason, 2002). The interview schedule can be found as appendix six.

Personal and professional links to a local university were made use of to approach interviewees, and two hour-long interviews were carried out. The relationship between researcher and participant was recognised as a potential factor, however during the interviews this created a less formal atmosphere that was felt to be more conducive to participants sharing their own thoughts and inner reflections, and for a more open interview

³² Collectively, five of the students that participated in the focus groups had attended summer schools in Physics that had been organised and run by the two lecturers that were interviewed.

to take place. Kitwood (1977) conceptualises three forms of interview – pure information transfer, a transaction containing bias that should be recognised and controlled, or as an encounter necessary to sharing everyday life. With revealing a participant's thoughts about the reform process being the aim of the interview, and how this may impact on the participant's life it was decided that incorporating Kitwood's third conception with that of Woods' (1986) attributes of an interviewer (trust, curiosity, and naturalness) would foster the potential for rich and revealing responses.

Researcher positionality was an important consideration when carrying out the semi-structured interviews, especially when such interviews can be seen as a form of social interaction (Mason, 2002). However, the questions and themes were selected and phrased in order to gain the participants' thoughts about (and around) an issue, rather than asking closed questions that may contain coded bias or questions that required a specifically structured response; these questions and themes were prepared and shared in advance, although answers or responses were not expected to be prepared, and were not by the participants.

Both participants are experienced physicists and lecturers with an interest in the pedagogy of physics teaching; both teach undergraduate physics students at a Russell Group university of high-standing (in accordance with the DfE's recognition); and both engage in outreach work with schools and the general public. While not of particular relevance to this research, but of significance within the physics community, one participant was male and one was female.

7.1.3 Focus Groups

In this research the views of students were sought to provide their insight and interpretation of Physics and of the period of educational reform. Their perspectives were considered valuable as everyone involved in the process is supposedly working for them – the aim of the reform being to alter a qualification that students will take, supposedly to better tailor it for some future need, as discussed previously. Students, however, have arguably the least power and ultimately no voice in this process, no government official or exam board employee at any point made reference to meeting with children or how they

had considered what students (current and potential) may think about the unreformed qualification or, in the specific case of entry numbers to Physics courses, what may make them consider studying it.

Access to students was relatively straight-forward as I already had some latitude as a teacher and head of subject within a school that often meets with groups of students to gain their opinions on a range of school issues (often termed 'student voice'). Permission was sought from the Headteacher of the school, and the parents of involved classes were informed that their children's views were being sought for an external piece of research. The only condition placed on the school was that the focus groups would not disrupt or take time away from teaching.

Much of the noted research on interviewing children was valuable but raised methodological questions. There were suggestions that, amongst some of the potential difficulties were "avoiding the researcher being seen as an authority figure (e.g. a teacher)" and "get the children's teacher away from the children" (Cohen, Manion, & Morrison, 2011, p. 434) – however this is advice that I elected not to follow. Meeting with students that I did not teach was possible for younger students, but not those already studying on the A level physics course. The classes themselves dictated my decision to continue with the selected groups due to a number of factors.

1. The relationship and dynamic of that I had built with each group, and my style of teaching these students; the classroom environment was convivial and relatively relaxed, and the students would often engage me in wider conversations about science or their personal life – I thought that it would be unlikely that they would be intimidated by me in a position of power.
2. Their age; all of the students were above the age of fifteen, and much of the research on interviewing students was pitched at much younger children – these were all eloquent students who, as previously mentioned, had all been comfortable talking with me.

3. Trust – they knew who I was, my role in school, that I had been teaching them for a significant period of time (in one case almost four years), and that I was asking them these questions for a university project, and not for something internal.
4. The context – I was asking them questions specifically about what they did and did not like about Physics, what they thought about changes in education, and why they picked some options and not others. An established relationship here was felt useful in eliciting a response, however these questions were not challenging or personally invasive. There was the potential that they may provide challenging and personal answers, perhaps relating to them not enjoying an aspect of my own teaching³³, and them not wishing to tell me, but I felt that framing this aspect properly could suitably alleviate this problem – in effect upending the power dynamic and asking them to be honest about my teaching because I could learn from their comments and potentially adapt in the future.

Following Morgan's (1988) suggestions of issues to be addressed when planning focus group work I planned to meet with groups of between six and ten students, ensured the students knew when the focus groups would be taking place in advance, and what the topic would be (allowing them to not take part if they did not wish). I planned to run the session in such a manner where I would bring all of the students into the discussion, and to be wary of the most confident students dominating the discussion. Following Newby's (2010) and Greig and Taylor's (1999) suggestions, the interviews took place in our regular classroom and at times that were not disruptive or unusual. Students from my own classes were openly invited and the interviews took place during a lunch-time and in two lessons where the course had been completed at the end of the academic year.

Cohen et al. (2011) consider a distinction between a group interview and a focus group, where the first can be considered as a series of back and forth interactions between interviewer and group, and the second as the interaction between members of the group when discussing a provided stimulus. Due to the rationale for interviewing students

³³ Preparing for brutal honesty was my personal potential issue, however this research was primarily focused on Physics; while the style in which material is delivered to students is of clear importance, teachers are not (as this research has demonstrated) in charge of what is required to be taught.

mentioned above, but the likelihood that they would not necessarily know much about the reform process, this section of the research can be conceptualised as a hybrid of the two methods. Here I would provide a topic for discussion, with some background if necessary, and then ask students to give their opinion, asking questions to probe deeper – in essence a semi-structured focus group interview.

7.1.4 Participant Sample Selection

Group	Y11 Students	Y12 Students	Y13 Students	HEI Lecturers
Number	Eleven	Eight	Seven	Two
Invited/Asked	Thirty-one	Nine	Seven	Two
Gender Split	Five Male, Six Female	Two Female, Six Male	Two Female, Five Male	One Male, One Female

Figure 11: Table of participants

As described above, the participants in the interviews and focus groups were either my students or those through which I had a professional or personal acquaintance. While this may seem to fall within the categorisation of a ‘convenience sample’, one that involves choosing the nearest individuals as respondents (Cohen, Manion, & Morrison, 2011), I follow Gall, Borg, and Gall’s (1996) view that a proximal sample is not automatically weak if the sample suits the purpose of the study. It is argued here that the selection of participants is purposive; that is to say that they have been selected because of some characteristic other than convenience (Cohen, Manion, & Morrison, 2011).

Combining the ideas of Patton (1990) and Teddlie and Tashakkori (2009) the student focus groups were intended to represent a combination purposive sample, in that they afford triangulation with nationally reported statistics (as well as each other), and that they demonstrate multiple interests and needs. For example, within the classes that were selected there is useful variation - a mix of boys and girls, some students who have chosen to study Physics further and some that have not (or are intending to drop the subject part-way through the course), some that achieve highly and some less so, those that seem to enjoy Physics and some that do not. Thus my knowledge of the classes as a teacher assisted in their selection.

The views of these students are considered useful and valid, however they are not intended to be described as representative of all students nor a particular sub-group that is of interest as a 'stratified purposeful' case (Patton, 1990). The nature of the Y11 self-selection resulted in volunteers who, while unique individuals, could all be described as eager and articulate. While this does limit the extent to which these students' views may represent those of all students, that is not the intention of their inclusion or invitation. In seeking to understand why these students made certain life decisions, and to interrogate why they enjoy certain school subjects and aspects of the curriculum, a varied sample was considered. However, the focus of the research on A level Physics required additional considerations. Of the three groups, two are made up from those who selected to study it; the Y11 group, as the Triple Science group, are those more likely to consider Physics as an option (rather than a Combined Science group of low ability, who would not consider studying the subject for reasons beyond the scope of the study). As such the research does not attempt to suggest that these students' views will be reflective of all students; instead, the nature of the focus groups is to continue to narrow the focus of the study into smaller regions in order to contextualise the wider issues and discourses and see how they are experienced in local environments and contexts.

Turning to the HEI interviews I chose a 'confirming/disconfirming purposive' approach. Ball (1990) considers the selection of participants because they are knowledgeable people purposive (and of intrinsic value) in of itself. Hence the HEI lecturers were selected due to their in-depth knowledge of physics and its teaching, their experience of HE Physics and experiences within the sector, their specific professional roles affording them knowledge and understanding of the A level to undergraduate transition, and their experience of working in schools during outreach programmes. I did not, however, believe that this was sufficient grounds to consider the views of HEI lecturers on the basis of being a 'critical case' – despite the possibility that they may "yield insights that might have wider application" and "illuminating issues on the topic which are of wider concern and use" that is the key feature of Teddlie and Tashakkori's sub-category (2009, p. 174). The notion of a 'critical case' suggests an element of uniqueness, significance, and elements of power that I believe is lacking from the lecturers' definition. This is not to say that their views and experiences did not contain illuminating aspects or wider application, but that part of their selection and

inclusion in the study was to consider their experiences as Physics lecturers and to search for areas of similarity and difference with that which was suggested by the document analysis, thereby acting as a triangulation with other publicly expressed views of other HEIs and the IoP. This was more akin to Patton's (1990) description of a confirming or disconfirming sample, with an opportunistic element and a flexibility from a semi-structured interview approach allowing for the possibility that new avenues, considerations and areas may emerge during the interview (Mason, 2002).

As described later, the students involved in the research were invited to attend the focus groups. The focus groups were optional, with the Y11 session taking place at a lunchtime that was during a lesson with me³⁴, and the Y12 and Y13 sessions taking place in an optional lesson. This was the chosen strategy due to a will to combine two suggestions, the first from Greig and Taylor (1999, p. 131) that as natural a setting as possible is preferred – interpreted here a session with myself (their teacher) and in 'our' classroom. The second was a synthesised combination of slightly contradictory suggestions from Cohen, Manion & Morrison (2011, p. 433) that an informal setting is helpful but also that a formality can convey how important the session is. To do this the session was informal and optional, but with the classroom setting and my presence affording an element of formality and routine. Further description of the nature of the interviews and focus groups such as contextual participant information, location, length, and make-up of the groups/interviewees is found at the beginning of each of their respective sections. I now turn to the ethical considerations of the study, in particular the interview and focus groups.

³⁴ This situation is due to some year groups at my school having their lunchtime scheduled part-way through a lesson. Here the students left the lesson, ate their lunch, and returned to the classroom before the start of the lesson resumed.

7.1.5 Ethical Considerations

Ethical approval was sought and granted by the University of Sheffield and the documentation can be found in Appendix four and Appendix five. The three described approaches to data collection present a number of ethical considerations and are tied to the previously described exploration of my role within the research. These considerations are described here.

With the groups and interviewees that participate in the research I share “common languages, themes and experiences with their participants” (Kim, 2012, p. 264) which can lead to “a sense of belonging” and a familiarity that can make participants feel more comfortable (McNess, Arthur, & Crossley, 2015, p. 301), and generate an openness that produces rich data (Couture, Zaidi, & Maticka-Tyndale, 2012). There are, however, careful ethical considerations with such research. Kim (2012) suggests that insider researchers are less likely to cause their participants harm and that they have an ease in obtaining informed consent, and Hult (2014) describes this easy access to participants and local contexts as a positive. However, a researcher must not take ethical issues lightly and not give careful consideration to a situation simply because they are familiar with it (Cohen, Manion, & Morrison, 2011). More facility in obtaining informed consent may, for example, lead to aspects of consent to not be considered as stringently. In considering the ethical issues relating to this aspect of the study I consider it useful to consider the three aspects in turn, beginning with the autoethnographic element.

As discussed in the section relating to the purpose of the autoethnographic element, it is to present my perspective from an embedded location. Sikes (2015, p. 1) considers that autoethnographic researchers who tell stories “as they see it” do so “from their perspective and/or as they want to re-present it” which can have considerable potential for harm when describing others. This is mitigated in the research by care to respectfully depict others when they appear in the research using Medford’s suggestion that autoethnographers should not publish something that they would not show to the person mentioned (Medford, 2006). Due to my role within the process I am primarily using the autoethnographic element to describe and explain my own actions and decisions, but in doing so also consider Tolich’s

(2004) caution with respect to internal confidentiality. The risk of these aspects is considered low, however further caution is taken given that my workplace can be considered less anonymous than the other participants. As such I mention other 'characters' into the autoethnographic element only when necessary and only in general or contextual terms.

To consider the interviews held with HE academics they have a clear ethical dimension in that they involved discussions on a wide-ranging set of areas including seeking the participants' thoughts on existing issues within Physics education. Their opinions are considered as valuable contributions to the research but could be considered by some as contestable and have an impact on the participants professionally and personally. Three primary ethical issues were considered – informed consent, confidentiality and the consequences of the interviews. In accordance with BERA's ethical guidelines (2011) and the University of Sheffield's policy on research ethics (The University of Sheffield, n.d.) the interviewees were sent an information sheet and consent form prior to the interview (which can be found in Appendix five), advised that they may withdraw at any time, and given an outline of the interview schedule. The interviews were transcribed in full to ensure accuracy, and participants were assigned random letters for the attribution of quotations and when referencing them as individuals both in the research and in the transcript. Recordings and transcripts were stored digitally on a secure computer in accordance with university policy.

Identical procedures relating to the treatment of data were followed with the data produced by the focus groups. However, Kvale (1996) considers that, when carrying out research with children, who should give informed consent, for what, and for whom? Although I am trusted in the capacity of the students' teacher, I considered that such a position does not afford me the right to act as 'gatekeeper' to the students in research that I intended to use outside of the institution. The risk to the participants is considered to be negligible, satisfying Grieg and Taylor's (1999) considerations relating to non-therapeutic research with children, and the Headteacher of the school in which the students and I are located gave informed consent for the research to take place. It was also considered appropriate and a useful introduction to research processes to seek the informed consent of

the students when they were approached for participation in the research, and at the beginning of the focus groups, despite Diener and Crandall's (1978) suggestion that children may not necessarily fully understand informed consent. I considered the students mature enough to engage with the concept of informed consent, following Cohen, Manion & Morrison's (2011) suggestion that 'children' is a broad term used when considering educational research, particularly when the participants were aged 15-18. Procedures for the anonymisation of data were followed, as mentioned previously, however students' responses were allocated a year group attribution in addition to a random letter so that the responses of those from individual year groups were clear.

Having described the research methods used for this method of reform consideration these will now be described, beginning with an autoethnography. It is to this three-year history of the reform process in practice that this thesis now turns.

7.2 A Teacher Perspective

7.2.1 In the beginning – 2012/13

While many of my colleagues had views regarding the reforms, the predominant feeling expressed in our science office was that the educational reform was being carried out on us rather than with us. It was not widely known or publicised that teachers were welcome to participate in the DfE and Ofqual consultations, and none of my colleagues in Physics or the other sciences did so, reflecting the lack of teacher responses to the consultations that was seen nationally. Broad timelines had been shared by the DfE during the 2012 initial announcements and there was initial concern about the potential for ‘first teaching 2014’, followed by relief to hear that new A level qualifications in the sciences would not be introduced until September 2015. This relief was largely centred around having time to prepare for these courses, at a time when we were still embedding a new KS3 national curriculum and knew that we would need time to prepare for the new KS4 curriculum that was also going to be reformed. At no point did anyone articulate that the reforms should not happen, just that they would likely result in a lot of work and a large amount of uncertainty both during the process and at its conclusion. The latter was not about what we would do, but that there was going to be a period in which we would not have as much confidence in our understanding of what our students needed to do in order to achieve certain grades in our courses, and we would no longer have the same wealth of past examination papers or questions available that would be suitable preparation for the examinations.

It was notable that the publication of reform information throughout 2012/13 echoed the reform announcement itself; they were generally discovered through the media reporting on the exchange of letters, and speeches given by the Secretary of State or from interviews when he appeared on Sunday morning political shows, rather than any contact from the DfE. This information often blended comments from the teaching unions with those of Ofqual and the DfE, rather than verbatim statements or policy announcements from the DfE. It was challenging to know exactly what was being said by a DfE or Ofqual spokesperson, and what was based on the journalist’s interpretation. The language and tone of the letters, speeches and interviews was often combative and talked about

standards and “fixing a broken system” and was not designed to transmit information about the reforms to teachers and those working in education, but to speak to the wider public.

The Smith report on A level subject content was released in July 2013 and this was the first significant piece of what the educational reforms would actually entail. They were significant and thorough, but not detailed; each subject received a paragraph or two of background, and then an outline of what aspects of the course would remain, what would be modified, and what would be removed. It was here that I noted most confusion around the percentages of mathematical questions on exam papers and the removal of $E=mc^2$ from the syllabus.

After more than a year of work, the academic year ended with no real idea about what the next would look like, or when teachers would receive more information.

7.2.2 In the middle...2013/14

With a full academic year to go before the reforms would be implemented, I spent some time in the Autumn of 2013 thinking about the reforms and what would need to be addressed. I keep quite detailed notebooks of all of my school work and meetings, and on October 30th, during a half-term holiday, I entered the following:

Questions about A level Reforms

Consultations

- Which organisations are running consultations and can we [teachers] participate?
- When will the results of the consultations be available, and how will they be acted upon?
- What do the Institute of Physics think?

Preparation and course design

- When will the new subject content be published?
- When will be able to compare exam board specifications and assessments?
- Are there any new areas or any significant differences?
- What are the minor changes or differences?
- When should we start writing schemes of work (and who should write them)?

Logistics

- Will we need anything to teach the new course that we don't already have?
 - Resources and Equipment
 - Knowledge / Training
 - Additional teaching time
 - Planning meetings
- What will be available from the exam boards or government to assist?

Informing students and parents

- What should we tell prospective students (and parents)?

What will we know by the A level open morning?
Will the numbers of students choosing to study A level Physics be affected?
What should we do about the extra emphasis on maths?
Will we need to increase the entry requirements?

Teaching, Examination, and Results

Do we need to think about our teaching approaches in order to deliver the new specification?
What will the new exams look like?
What are the 'Practical Skills Assessments'?
How can we prepare students for their exams without past papers?
Are there some unreformed questions that will still be useful?
How confident can we be in our judgements and predictions?
What will the first set of exam results look like?

Figure 12: Questions about A level reform taken from the author's notebook

These questions formed the starting point for my in-school strategic work on the reforms, and from the five areas that I sorted them into, it can be seen how I, as a teacher, compartmentalised the reform process. My general understanding of a reform process suggested that it would follow a specific, linear, process with distinct stages:

1. External creation
2. Scrutiny
3. Planning and Preparation
4. Communication to others
5. Application/Teaching
6. Examination
7. Review

These stages follow a rough chronology of the reform process and its implementation, showing how I thought through how each stage might unfold before moving onto the next stage, but the form of these does not necessarily reflect the messiness of the reform process, and how some of the answers to my questions did not come in this order.

A flurry of exchanges between organisations, politicians, and political commentators saw out the end of 2013 and the start of 2014 but no letter arrived in school from the Department for Education, and there was no mailing list to sign up to in order to stay informed about the ongoing process. This stood in stark contrast to the examination boards who, following the acceptance of Smith's subject content review in April 2014, actively engaged teachers in the initial design process of their specifications in various means and through extensive contact by post and email. As discussed previously, exam boards are non-profit making charities, but do require money to run themselves, and so a stable market

position (at the very least) is important to them. Publications from the exam boards showed two tones, a reassurance to school teachers who currently used their materials with talk of 'mapped changes', but also were designed to attract those who may use the reforms as an opportunity to consider all of the exam boards in more detail. One exam board even produced documentation to aid schools that may be considering switching from one of their competitors.

The Director of Science in my school was careful in how he engaged with the exam boards, often refusing to talk with them because he was 'too busy for a sales pitch', however they were eager to share what they were doing, what would be released, and how they were planning to assist and engage with teachers during the reform process. One exam board in particular began to offer more information and in greater detail than others, and this coincided with it being the one with the biggest proportion of the A level science market. Their financial resources may have afforded them more staff and more capacity to provide support than other exam boards. However, I examined closely the materials from all of the exam boards and did find their work to be the most thorough, and the most useful in terms of planning on implementing the reforms. Perhaps notable is that the most useful overview of the reform process came from the exam board AQA, a timetable that showed key future events and dates over the next two years, and when to expect certain documents from the government or exam boards. While not regularly consulted, it was the only document that was affixed to the wall of the science office about the reform procedure.

This is particularly significant as it suggests that the early dominance of one exam board allows them to further dominate the qualification market by having the finances to provide supporting resources and information to schools in the timeliest manner. It also raises the question of whether a school may choose to teach one exam board's specification over another because it is easier for the school to approach their own planning and preparation rather than necessarily better for the students.

Notable throughout the KS3-5 education reforms was the release of draft documentation during the curriculum design process; both the DfE and exam boards all released draft copies of the science content/programme of study, and proposed specifications

respectively. While the DfE materials were not specifically for teachers, and were to aid planning by examination boards in writing specifications, and publishers in producing textbooks, it was not without incident. Three re-publications were required to correct the GCSE science content that was released by the government after eleven errors (nine scientific, one spelling, and one grammatical (Anon., 2015)) were discovered, with two making the final version (The Guardian, 2014). For A level Physics the specification content was not particularly useful for me; merely stating the broad areas that we would be required to teach, and we could do nothing concrete until the exam boards produced their specifications.

7.2.3 In the end...2014/15

In September 2014 two new members of staff joined the Physics department at my school, one was a Newly Qualified Teacher, the other a Recently Qualified Teacher. Neither had previously taught A level Physics nor had a third, experienced, member of staff who was asked to teach the course in this academic year. In a team of four people, three would spend the year learning how to teach a course that was due to be retired at the end of the year.

The specifications that students' exams were based upon were produced by the exam boards at the start of October 2014, just less than a year before they were required to be taught, however this was only two weeks before the school's A level open morning. Held on the first Saturday of November, I had to very quickly make a decision about which exam board we would choose so that information could be shared about what course students would be studying. A prospectus is distributed during the open morning that outlines the structures of all of the courses on offer to assist students in their course selections. This needed to be printed, and so I had one week in consider all of the three exam board specifications and understand them enough to outline the structure of the qualification in the handbook that would be distributed.

The specifications that had been sent to the school by all three of the exam boards for consideration were the draft versions that were submitted to Ofqual for accreditation, but

working on what I had read through all of the materials I tried to filter my thoughts into four key considerations.

Content – Each exam board continued the similar styles, leanings towards certain contexts, and ways of describing physics that they had previously employed in their unreformed qualifications. One focussed on applying the knowledge to new or unexpected situations, another focussed on familiar and classic applications knowledge and calculations, and another on teaching physics through its historical context and developments.

Assessment – Two exam boards had sent copies of exam questions and papers that they had modelled as a suggestion of what their final examinations would look like. In this it was clear that one exam board had changed exam style totally, but the others had kept their exam papers and types of question relatively similar. One exam board had an online system available where teachers would be able to search for questions from the unreformed qualification that were still considered to be valid under the reformed assessment criteria and mean that there would be a large pool of questions for use throughout the course.

Coursework – A previous and significant difference between the exam boards was the ‘Practical Skills Assessment’ element to their courses, traditionally termed ‘Coursework’; the new A level science courses, irrespective of exam boards all followed exactly the same procedures in the reformed qualification, and a joint board would be set up for them to collaborate on how practical skills would be assessed. While this lack of difference eliminated it as a major consideration, I noted that one exam board were continuing to offer specific training courses for science teachers regarding how schools should approach the teaching of this aspect of the course.

Familiarity – I was a teacher of several years and had built up many resources for the teaching of A level Physics. I had a track record of good results with this exam board, and other Physics teachers in the department were teaching it for the first time. If

this exam board's reformed content and assessment were similar in style then it would be reduce uncertainty surrounding a 'new' A level course, but it would also mean that developed material would not have been used for one year. I also felt that it would be a gamble to switch, unless another exam board seemed to be superior or of a higher quality.

I concluded that I wished for the department to continue with the examination board that we were already teaching (AQA), and that we would spend time reviewing and adapt our current procedures and practices to match the reformed qualification, rather than implement a whole new form of teaching Physics. I presented this to my fellow Physics teachers, and they unanimously agreed.

At this point I had a week in which to produce a presentation to give at the open morning regarding how the new course would be arranged, and explain concisely the changes in the examinations. Feedback on the day was positive, but it was a fine balance between explaining that the qualification was new, with some information that we did not yet know, and ensuring that both students and parents had confidence in us³⁵. It was widely understood by parents on the day that every centre offering A level Physics would have the same uncertainties, and I had pleasant conversations with many families. Notable was a feeling amongst parents was they were nervous about the reforms, but knew that neither they, nor we, could do anything about the situation. Several people asked me why the A levels were being reformed or "What was wrong with the old course?", and I felt curiously obligated to present the reforms in an even and entirely unbiased tone, as if I were teaching a viewpoint in class that I did not hold, but that it would be improper to allow my own opinions to affect how I presented it. In some way it suddenly felt the most professional thing to do, but was not something for which I had expected or prepared. It was a feeling of being suddenly resigned to the process, despite its complexities and messiness. There was absolutely nothing I could do about the reform process, whether or not I agreed it was

³⁵ An unknown element that was part of the day was the mathematical demands of the new course. A few example questions that highlighted mathematics had been shared by AQA and I used them to demonstrate what students may be required to do – in my opinion these questions were accurate, but were of fairly low demand in comparison to what was actually asked of the students in the first exam paper of the reformed qualification.

necessary. The students there on that morning would choose Physics or not, but I knew what was expected to be taught and roughly how it would be assessed, even though the specifications had yet to be accredited. Accordingly, for me there was a sense of finality on that day, as if it talking it through with students and parents had set it stone. I was comfortable with this, but as I walked home at the conclusion of the open morning I felt that my opinion did not seem to have ever mattered, yet I was figuratively 'selling it' to parents and students on behalf of the government.

The AQA specification was accredited, along with those from the other exam boards in December 2014, and during the Christmas holiday I worked through the specification and identified any changes that I could find, no matter how small. The differences were, in my opinion, minimal and did not offer any significant changes to the physics content that would be taught as part of the A level course. There were some areas where content that had been proposed for removal in the Smith report had been kept by AQA, but the primary change seemed to be in the coursework element to the course, however details of this were yet to be confirmed.

Over the next few months the science department had two visits from science representatives from AQA. These visits were part of a programme from AQA that attempted to engage schools with incoming qualifications and ranged from buses that toured the country to canvas teacher input into AQA's curriculum design, to online 'webinars' in which new curriculum material was highlighted. The visits to the science department came at no cost to the school, and arose from emails sent to teachers who had registered for more information from the exam board about their offering for the reformed qualification. I had done this with all of the exam boards (and was sent draft specifications ultimately from all of the three UK science exam boards) but only had offers of additional support from AQA. These visits were from the regional head of science for AQA and the head of physics for AQA respectively, but both mentioned how they had been visiting many schools to explain their work, and did not only focus on the incoming A level curriculum in 2015, but also that of the reforms to GCSE Science. As mentioned previously Ofqual and the DfE had agreed the introduction of a suite of reformed GCSE qualifications to begin teaching in September 2016

and timetabled the first exams for the July/August exam period in 2018 – suggesting all GCSE courses would have a two-year duration.

During an online webinar I was part of a group regarding GCSE reforms in March 2015; thirty-two out of the thirty-six teachers responded to say that their science departments taught their GCSE courses over three years³⁶. For schools this meant that they would start teaching their GCSE courses in September 2015, and the simultaneous introduction of a reformed GCSE at the same time as the reformed A level, a year earlier than that anticipated by the government and Ofqual, and based on draft specifications (yet to be accredited by Ofqual) and national curriculum documentation only. The decision to do this was down to the school, but ultimately based on the school's leadership team looking to nearby schools. With so much work to cover, AQA's guidance and support material for both their GCSE and A level courses became crucial. Again notable, was that at this stage a structural understanding of the reformed qualifications was being delivered by examination boards, independently of the DfE and Ofqual.³⁷

On a staff training day in March of 2015 I broke away from the departmental moderation of GCSE coursework in order to fully map out the new A level course. I began by considering the number of weeks available in each two-year period, when key exam dates would be (both internal mock exam periods, and external examinations), where the school holidays would fall, and the number of teachers available who would provide simultaneous teaching. Schools are free to teach a course in any order that they wish but it is arranged into specific units; I mapped out each unit that had been proposed by AQA into the broad content that it contained, and then arranged this into general lesson themes. Each unit had a different length and so I then began to arrange these such that they fit into the previous outline. All of this has been quite standard practice for all of the new curricula that I have been part of introducing, however one factor in the new A level was not, that of the practical skills and mathematical requirements. These would be crucial to many different lessons and pieces of

³⁶ This began when the KS3 SATs were suspended in 2008, but the rationale for a three year GCSE course varies from school to school.

³⁷ While these AQA meetings did not give any information that was not available online it may have proven useful if the school's mathematics department had taken similar opportunities at this stage – interdepartmental confusion led to the department not teaching the full curriculum required for the first year of their students' reformed qualification.

practical work and had previously been taught as necessary. In contrast, in the reformed qualification they would need specific introduction and their own focus, indeed AQA had listed them as their own unit, which meant that they would need teaching first and that one teacher would not begin teaching Physics content straight away. This change, while not seemingly important to the overall course structure, would mean that students would only have been taught half of the usual material by the time of the Autumn school census. The statutory census is used to determine school funding and so students are not generally permitted to drop or change subjects after this period. To assist students to determine whether or not the physics course is right for them we aim to have completed two minor assessments and one test by this point, but now would not have the breadth of physics with which to assess the students.

When a new, revised, or reformed curriculum is introduced it has always been customary for some element of delegation to take place in the science departments regarding the preparation of 'schemes of work' but with the department focused on preparing material for the new GCSE, I took responsibility for all of this for the new A level Physics course (alongside my own contribution to the GCSE). During May and June 2015 I worked through specification materials, pre-release questions, and the teaching guidance that had been produced by AQA's own Physics team. A crucial aspect to preparing to teach the course was not the teaching itself, but knowing the level of detail and complexity that would be required of the students. In physics it is possible to teach about magnets, for example, to students in KS1 and as part of a degree, but what dictates the knowledge teachers impart is what the students should be able to do with that knowledge. Up until this point there had been many years of exam papers through which I could determine the general level of questions that would be asked and what skills would be required of the students, as well as having a bank of questions that I could use to give to the students – now there was a large element of uncertainty. Again, this had been raised by teachers in consultation with the exam board and they made available to teachers the example exam papers that they had sent to Ofqual as part of the accreditation process. They also updated their online question bank that suggested which questions from the unreformed qualification would still be applicable. Although this proved helpful, it meant a drastic reduction in the amount of questions that could be shared with students. We needed at least three mock exam papers,

and approximately twenty pieces of homework, which left very little to use as teaching aids in the classroom. On top of this I had to ensure that teachers in the department would not use questions in class that would later be part of any examination, and so I had to spend additional time preparing the year's worth of assessment material in advance³⁸

At the start of June 2015 information about the coursework replacement was released, and I turned the physics department's attention towards the 'Required Practicals', the replacement for A level science coursework. Previously all of the science coursework would take place in an allocated week during the spring term and the school would be sent specific instructions in October regarding what equipment the department may need to purchase. For the new course the school had more freedom in what equipment we may use, but had six pieces of practical work a year that we needed to resource for a whole class, rather than two pieces for half a class (who would then swap equipment). While it was logistically quite simple, this was again due to the exam board. They had produced a 'Practical Handbook' to alleviate the demands on science departments; instead of creating our own methods to fulfil certain experimental objectives, they had done so for schools to use if they wished.

Finally, in July 2015 I attended a workshop for physics teachers ran by AQA regarding the practical component of the reformed course. Similar workshops had been held throughout the year and this was the last that was being run that academic year, something I had intended as this would give the most up-to-date information. Unlike the online 'webinar' sessions 'Introduction to the new specification' and 'Preparing to teach the new A level Physics', that were at no cost, the fee for this course was £250 (an increase from the £210 that a very similar course had cost in December 2012). The session focused on Physics, however sessions were held on the same day for Biology and Chemistry, and my school sent a teacher from each discipline to attend. The session shared no materials that were not available online for free by September 2015, however it was extremely useful to receive details about some key structural elements of the practical skills, some suggestions for how AQA would be looking to assess practical elements in the written exam paper, and guidance on what our internal records would need to cover in case we were selected for a monitoring

³⁸ This planning was duplicated almost exactly in the following year for the second year of the A level course.

visit by the group that had been set up to maintain the standards of practical work. I returned to school and was able to finish planning these aspects, incorporate what had been shared, and then disseminate this to the other physics teachers in the last few weeks of the academic year.

Teaching began on the 4th September 2015 with the first year of the new A level qualification, three years and six months after being announced in a letter from the Secretary of State of Education (who had been replaced in a Cabinet reshuffle in July 2014) to the head of Ofqual (who had announced in August 2015 that she would be leaving Ofqual in February 2016).

Summary

My experiences as a teacher and head of department show that the lived experience of the reform process can be complex and chaotic. It is filled through periods of inactivity and then frantic decision-making. Those charged with delivering the reformed qualification are powerless and relatively voiceless in the process and are also some of the last to be informed of decisions. Despite this teachers play a mediating role, making sense of the reforms for their students and staff through attempting to unpack and impose order on a messy and unpredictable process.

What may be seen as freedom to choose the most suited examination board to fit a department, style of teaching, or students is actually led more by the resources and information available at specific points. The reformed qualification was introduced on time and without major incident, but what led to this was a significant amount of school-level multi-layered and planning independent of the Department for Education or Ofqual. While, cynically, one may highlight the potential financial and corporate motivations behind the role of examination boards in the UK, they are relied upon greatly by schools in the delivery of qualifications, especially when major changes are introduced. While benevolent and helpful, the power that has been afforded to them by the government is significant, and goes far beyond the remit of Ofqual to fully control.

Given that the reform process was complex and chaotic from a teacher's perspective, the following section turns to students, and their perspectives and experiences of students, of the reform.

7.3 Student Perspectives

In May 2015 three focus groups were carried out; they were:

- A Y11 high-ability group – they had recently made their choices for A level courses, and this was a dimension that would be worth exploring; 11 students were included in this focus group.
- A Y12 mixed ability group – they had completed the first year of the Physics course, and some had already indicated that they were not going to continue to the second year of the course, a useful aspect to investigate; 8 students were part of this focus group.
- A Y13 group who could be considered high-ability (though not selected or identified as such) – they had completed the full A level course and made applications to universities, this was useful to explore, alongside their considerations of how the new course was going to differ from what they had just experienced; 7 students were included in this focus group.

During the following section I present some of the key findings from each group in turn. Due to the Year Eleven students having a specific location of interest within the educational system (specifically some students having chosen to study Physics at A level and some having chosen not to carry on studying the subject) the students' perspectives are split into two discrete sections, Year Eleven and A level students. The themes and many of the questions for the Year Eleven and A level students were similar, with some differences between them in order to account for their place within Physics as pre-A level, mid-A level, and post-A level. The interview schedule for the groups can be found in Appendix six, as well as example pages from the focus group transcripts to show the coding process in Appendix seven.

In the following section, questions to the group are occasionally used to frame the theme being discussed; these are shown in **bold** text, as too are moments when I spoke during a quoted exchange. Key quotations have been selected for inclusion here in order to exemplify certain findings; as discussed in the chapter methodology incidents involving

repeated comments from different students, indications of agreement, and some less 'quotable' but still pertinent comments are not present but included as part of the discussion. In these ways, individual student contributions can be seen as each is attributed using an assigned letter.

7.3.1 Year Eleven students

In May 2015 I invited groups of Y11 students to meet with me to discuss their experiences of Physics. These students had one more week of their GCSE studies before 'exam leave' began and I felt this was a good point to gain the fullest picture of their experience of Physics so far (as well as the largest number of participants); at this point in the year the students had also already made their choices regarding compulsory Further Education which proved useful as I could probe their reasoning in more depth.

Eleven students voluntarily took part in the lunch-time focus group and represented a diverse group of students in both gender, ethnicity, and socio-economic status; while the students were all from the top-set, triple science cohort not all of them enjoyed studying Physics and only some had chosen to study it further. This focus group was thirty minutes long and was recorded digitally. The recording was transcribed in its entirety and the key findings are discussed here.

Key findings

If our economic future relies upon an increase in the number of STEM graduates (IoP, 2014) (Gove, politics.co.uk, 2011b) then it is logical that more students would need to take STEM FE courses. The IoP have suggested that to encourage this it is required to target students with Physics outreach in primary school (IoP, 2014). The students were asked a series of questions that explored their views on, understanding of, and experiences of Physics during the course of their life.

“When was the first time that you were told (or realised) that science was specifically split into three areas?”

[11-C] “When I used to watch Nina and the Neurons in Y3.”

[11-A] "In Year Seven, my cousin told me."

[11-J] "In year six due to my sister picking Triple Science."

[11-F] "Year Six, from older siblings."

The majority of students were not aware that science is divided into different disciplines until they reached secondary school. Of those that were aware, most identified older siblings or family members as the reason. Some were told by their parents, but none mentioned that it was specified in primary school.

"Now that you know about different parts of physics, how well do you think that your primary school taught physics?"

[11-E] "Not well at all, it wasn't clear that it even was physics."

[11-B] "We didn't do any science"

[11-A] "It was ok, but we didn't do much in Y6 because SATs were more important"

[11-D] "I don't think I was taught any physics at primary school"

[11-C] "If we did do science below Y6 it was always Biology"

[11-I] "I didn't really learn anything, but we did some basic things about circuits and electricity"

Again, linking to primary school, all but two students highlighted that they could not recall that they had ever had lessons that were identified as Physics. Some could recognise now that they clearly had been taught about some Physics concepts, however some highlighted an absence of science teaching in their final year of primary school³⁹.

³⁹ In my ten years of teaching this has commonly been expressed by Y7 students, particularly in classes made up of students who attended different primary schools. When students do report that they "didn't do science in Y6" this is always attributed to them focusing on Mathematics and English.

Thinking back to when you first began the Physics course, if you were asked to define Physics, or say what Physicists did, what would you say?

[11-E] "Space and Astronomy. I know there is more to it now, but I normally thought it was about space and stars"

[11-D] "Physics is the way the universe and forces and time work"

[11-C] "It's the section of science primarily focussing on forces, energy, space and planets"

It is a challenging question to ask what students previously thought, but the students seemed genuine in their answers, generally describing their younger selves as believing Physics as astronomy and being 'about' space and the planets. Other answers regarding what Physics was the study of involved answers related to energy and forces (and even mathematics) however none identified electricity as a topic area. At the conclusion of their course the Y11 students did all indicate that their views had shifted, with them describing several varied careers in and applications of physics.

The boys in the group were aware of more potential careers involving physics than girls, however this was difficult to ask without getting students to simply list possible careers. Male students thought that it would apply to lots of possible careers, but the responses of the female students were divided with one feeling that "I'm not really interested in it, I don't really know what job I would do in Physics other than be a Physics teacher" [B].

The students' answers to these questions would suggest that more consideration is needed at a governmental level about how a subject such as science is seen across the entirety of a student's educational life. While national curriculum content is in place for teachers to base their lessons, there are subjects that do not have the same level of recognition as others at lower key stages. If students cannot separate physics from the other sciences then this limits the amount to which they can internalise and identify with the subject, a crucial element described by Hollins et. Al (2006) and discussed previously. When asked about the

aspects described by Hollins et. al (ibid) the students were, however, sceptical of the effect of the media on decision making:

[11-A] "Maybe a tiny bit..."

[11-E] "I don't think 'The Big Bang Theory' and that influenced me like, but watching TV programmes about the Universe and that, they kind of show you how interesting stuff is."

[11-A] "Yeah, because you can watch stuff and think really, like, yeah, it influenced me to do Physics."

[11-C] "I think that it would influence me if you were already more drawn to it, because I think, like, if you just don't care then you're not going to."

[11-E] "Well also, if you're watching a Physics programme than it's probably because you like Physics already. It's not going to change your mind any."

[11-D] "But then, I've got an interest in Physics and I got a book in Year Four and it was all about the planets and the solar system and I read the whole thing like five times and I just started to love it. Maybe getting started at a certain age?"

[11-C] "Cartoons."

[11-H] "People see the glamorous side, but not the people putting hard work."

[11-G] "I think that these people, TV shows and the news have helped majorly, but I think it is in the stages of school around Y7,8 and 9 that influence people the most. More than Y9 and 10".

Regarding what affected a student's subject choice the results were slightly varied, but fell within the same themes:

"What kind of things go through your mind, or went through your mind when you were choosing an A level option?"

[11-A] "I looked whether I could do it or not, and whether I could do it at uni."

[11-B] “There’s things like Physics and Maths and Languages that always look good at university and that, no matter what you want to study.”

[11-F] “I think it’s the relevance to what you’re going to want to study, like in the future, and what you want to do as a job. I chose things that I would enjoy, and I didn’t want to pressure myself.”

“Physics appeals differently to different people. What things do you like/enjoy, and dislike/not enjoy about Physics at school and in general?”

[11-E] “I just like that when you have conversations about Physics it’s really difficult.”

[11-B] “I like everything about it except sometimes the maths is a bit difficult for me.”

[11-J] “It seems more boring and complicated, but it’s actually good, it’s just that people don’t make it sound good and there are no good experiments.”

[11-D] “I dislike there being so many equations and calculations, but I do like learning interesting, unknown, useful facts.”

A significant portion said their reasons for not choosing physics were that it was conceptually challenging, or too mathematical, or they found it hard. When asked to consider the numbers of students choosing to study physics further in relation to other subjects the students identified several ideas already noted in the literature, particularly gender:

“After GCSE some groups of people choose physics much less than others. Why do you think this is?”

[11-H] “They don’t think that it applies to the job that they want.”

[11-D] "It's renowned for being difficult."

[11-G] "My sister says people drop out as you need a mathematical brain and it's more hard work than a safer option. It needs perseverance, really I think it's easier than the other sciences, but less interesting."

[11-I] "I think it's perceived as a 'geeky' and 'boyish' subject. I think 'geeky' is associated with Physics."

[11-B] "Some don't choose physics because they don't like or enjoy it. Some people say physics is a more male subject and a bit sexist, but I haven't experienced it."

[11-C] "I think it's down to personality as well, some girls don't mind being around boys but some, like, it wouldn't bother me being in a class of boys because if you want to do that subject then you make friends"

"Do you think that's a problem though, because 'you have to not mind being the only girl in this group'?"

[11-G] "Yeah."

[11-E] "Yes."

[11-A] "Although boys who do Physics, they're not that bad."

[11-C] "It doesn't facilitate things but, you know, you get to a point where life isn't, like, forcing to be people making it easy for you. You're going to have to get tough at some point and if you don't then that's your problem."

[11-F] "If people like that subject then they should pick it because they enjoy it and not because of other classes that are different. They shouldn't let it influence it."

"You didn't choose not to study Physics because there are more boys than girls?"

[11-C] "Nope, I never really saw that"

[11-B] "Girls are more likely to leave physics than boys because of the jobs they choose."

[11-A] “And like, on the news and stuff, I mean, a lot of the Physics professors that you see on the news or on any TV programmes; I don’t think I’ve ever seen, like a female Physics professor go on the news.”

[11-C] “I have.”

[11-B] “It’s not to say that women can’t do it.”

When asked why they think people overall may not choose to voluntarily study Physics in as large numbers as the other sciences the boys described the challenge of physics as the potential factor; the girls linked it to jobs (despite what they said earlier) or that ‘different groups prefer different subjects’. Almost all students were aware of the perception of Physics as being more male (and interestingly this was ‘geekier’) but none of the girls could identify why it would be more male dominated.

Students wondered if younger students were made more aware of what Physics was then it may make it seem more interesting, however they were rather cynical of outreach projects from universities or encouragement to study STEM subjects as they didn’t always show how hard Physics could be or show “the people putting in hard work”.

Students all had thoughts on the gender imbalance in Physics, but none felt that it was an issue that they found off-putting about Physics. Despite some of their observations about physics and gender none of the girls present felt that it had had an effect on them but believed that it was present because the nature of Physics inherently appealed more to boys than girls. The girls felt that knowing that they may be the only girl in the class was the only negative aspect to A level Physics but that they “would get over it” if they were interested in pursuing it.

There was a subtle distinction between students finding physics hard, and them thinking the subject was challenging, but this was expressed in a way suggesting that they had confidence in their ability to cope with the demands of studying Physics, but that they felt that they would not face the same level of cognitive demand in other subjects. One student felt that it was the subject itself that was not interesting enough to be “worth” the challenge that it would be to study it – a conceptual way of thinking about subject choice that I had not previously considered.

In discussing some of the factors that they considered when choosing their A level options the students rated highly a further aspect identified by Hollins et. al (2006):

[11-A] "Oh yeah, and the teachers, like, depending on whether the teachers are terrible or not."

[11-F] "Definitely the teachers."

[11-E] "That's why I didn't choose Biology."

[11-J] "And why I didn't pick English."

[11-D] "I know which teachers I'll get."

[11-H] "It seems like a hard subject, if I wasn't being taught by a teacher that I knew and, like, felt comfortable learning with, then it my might have been difficult trying to learn with a teacher that I didn't like. I think it would have been hard."

A major factor behind students wishing to study Physics at a higher level was one that would be largely out of control of the government, teachers themselves. Students reported that it was one of the major factors behind their decisions. Some had already elected to study Physics further because they knew that I would be teaching the class, or that they felt that I was an engaging teacher who:

[11-G] "made it fun and easy to understand, even when it isn't easy."

And:

[11-A] "Especially because you're such an enthusiastic teacher. It rubs off on us."

No student mentioned that I had put them off further study of Physics, indeed one student specifically mentioned that he had chosen Physics specifically because he wanted to be in my class again, but it raises questions about whether the possibility of students knowing

they will be taught by a teacher they do not like would be enough to stop them pursuing a field that they would otherwise consider⁴⁰.

The educational reforms themselves were little known to the students, however there were some observations that were of particular note:

[11-B] "It's not that I don't necessarily like Physics right...but, like...it's really hard. And I don't tend to listen if I find something difficult. If not I tend to switch off, and that's why I'd never pick Physics. It's because it would never be worth doing, for me."

Alongside this comment the students throughout the course of the focus group identified the following:

- They thought that Physics could be improved if there was more practical work.
- They believed Physics to require a high level of mathematical ability, for some this is off-putting, for others they enjoy this or think that it will make Physics useful as a facilitating qualification.
- The GCSE Physics course had elements that students enjoyed, but aspects that they all felt made the subject less interesting.
- They felt that considerations of future university study and career options leads to students not pursuing Physics because they do not perceive it to be relevant.

The students here highlight aspects that could feasibly feature in some educational reform, but these would be drastic. The suggestion regarding practical work is clear and commonly expressed, and alongside the practical changes for the A level science courses that introduced twelve 'Required Practicals', ten were introduced per science subject when the GCSE science courses were reformed. SCORE (2015a) argue that this will ensure that practical work will take place, but caution that it limits teachers to a specific range of work that may be shorter than what may be undertaken if a teacher had free reign. The suggestion here was to free students from prescriptive practical work, and encourage

⁴⁰ Somewhat unfortunately the combination of his subject choices meant for this student was ultimately placed in another teacher's class. This student later dropped the subject after the first year of the course; the reason he gave for dropping the subject was that he didn't enjoy the teaching style of his new Physics teacher.

teachers to be creative when introducing high-quality practical work for students (SCORE, 2008)

Mathematics was a significant aspect of the educational reforms, and although some concerns were raised about the origins of a percentage requirement it is acknowledged as a crucial aspect of Physics (SCORE, 2015b). As discussed previously, the educational reforms specify that the A level in Physics cannot feature mathematics more complex than GCSE level (Ofqual, 2015f), however the student responses highlight that many students do not necessarily appreciate the importance of mathematics within science subjects. To appeal to students, and to improve student's mathematical skills, may require a stronger link within mathematics education and not solely from reforming science qualifications to place more of an emphasis on applied mathematics.

Individual fields within physics are touched upon throughout GCSE physics, and expanded further upon in A level Physics. Not all aspects of physics education need to be enjoyed, however the unified response to certain topics suggested that this could be tackled if they were, potentially, not included as part of an A level course. This would be unlikely to serve students well as they would have a full range of physics skills and knowledge should they wish to attend university, however it is worth noting that there are many degree-level subjects that have no A level course, Medicine or Dentistry for example; both are high-level but do not build on specific content that is taught, just that students are able to demonstrate their aptitude within certain subjects.

Exploring the students' consideration of the 'relevance' of A level subject choice to their future aspirations also raised interesting points. When students mentioned specific regions of the physics course that were the most 'relevant' they listed aspects that were applied to engineering, rather than pure physics (such as mechanical and electrical engineering). Few described aspects in a research capacity (like particle physics), or some of the emergent branches (such as medical and diagnostic physics), yet these are at the cutting edge of the field. Notable was how the most 'relevant' branches of Physics to the students were the ones that they had described as the least interesting previously. The opposite was also true as the most unanimously praised aspect of physics, and the one considered the most

interesting to them, was the unit on astronomy, which has arguably the least relevance to their everyday lives or a possible future career aspect. If it is engagement of pupils that encourages more students to study the subject, then perhaps educational reforms should be focussed on reforming the field of physics itself and considering more carefully a balance that may need to be struck between interest and academic aptitude.

The views of the students described here relate to those who were at the end of the GCSE in Physics and they had little idea of the reforms themselves, or how they may alter a course or educational experience. In the next section I move to consider similar themes but with older students who have experienced the A level Physics course

7.3.2 A level Physics students

In May 2015 I conducted focus groups in two lessons with two year groups. These were a Y12 group, who had just sat a first year exam paper but not received the results yet. The Y13 group had completed the two-year course and were having revision lessons in preparation for their final exams. The Y13 students had all applied to universities, but the Y12 students had yet to begin this process. As has been mentioned previously there is a gender disparity in A level Physics, and as such there were fewer girls than boys in these classes. The students came from a range of socioeconomic backgrounds, which is typical for the school, but not for A level Physics in general.

Each of the focus groups was an hour in length and was recorded. The recording was transcribed in its entirety and responses were consolidated into the topics and themes that are given in bold. These formed the questions to the students that were asked, and responses were probed to reveal further detail.

Key findings

“What kind of things went through your mind when you were choosing to study Physics?”

[12-A] “I just needed it. I hated Physics at GCSE.”

[13-A] “The A levels lead on to a good degree”

[12-B] “Well I was going to do Further Maths instead and I thought, no that’s stupid, so I decided to do Physics because I did enjoy it to an extent, but it was kinda just another subject that I wanted to do, and it kind of goes well with maths, which I liked, so...”

[13-B] “I think that Physics was definitely, at secondary school, the best science taught. It was the best teachers, it had the best, like, learning experience so I enjoyed it and that influenced me to pick that over other sciences.”

In addition to the aspects mentioned of students choosing subjects because they enjoyed them, and did academically well in them, these students identified some interesting additional points. There were two students who did not enjoy Physics during their GCSEs at all and one had taken it purely because it would lead them to the options that they required later; it was a unique answer, and certainly one that I had not anticipated. Here the value of the subject was recognised, if not appreciated. Two students who had applied to study mathematics at university had chosen Physics as a way to demonstrate that they were capable applied mathematicians, but interesting in this was how one of them chose Physics instead of Further Mathematics. He specifically chose some variation so that he would not get bored of studying one course in a large amount of detail. Quality teaching was again significantly mentioned as what drew students towards further study, although one of the most unexpected was the response of one student who discovered that he had initially chosen the same options as his older sister:

[13-C] “I didn’t want to do what my sister was doing so I picked the exact opposite of what she did.”

Interesting is his conceptualisation of Physics as the ‘exact opposite’ to Biology and Chemistry, but it was again, a unique response.

Combining these responses with those of the younger students it is clear that no student mentioned that they were particularly interested in the content that they would be learning about as part of the A level. While some mentioned finding “the space stuff” interesting it is clear that perceptions about Physics have already been made during the GCSE course. Where this is of significance is that the GCSE reforms subsequently removed ‘the space stuff’ from the standard science courses; in order to study aspects of ‘space science’ students must elect to take ‘Triple Science’. This is clearly an aspect that is relevant to students’ perceptions of Physics, yet the government severely limited those who will experience it.

“Why do you think not as many students want to study Physics?”

[12-B] “Because people want to be nurses and things like that and you don’t need physics. It’s more biology and chemistry”

[13-C] “I thought that Chemistry and Biology were, like, the main sciences and then Physics was just something on the side. And then, until you actually start, like, really learning about it, you realise that it’s actually better than it is. And then I realised that I actually enjoyed it more than the others. That sounded really nasty but you know what I mean.”

[12-C] “I think people get put off by them thinking it’s difficult, and that it’s only something super clever people can do.”

[12-D] “I hate Brian Cox. He just annoys me. As a person.”

[13-D] “I think that because it is so maths heavy or it seems that anyway from the GCSE perspective, I think that a lot of students think that it’d be more dull or a lot harder because it’s so maths heavy and I think that puts a lot of people off picking it.”

[13-C] “I don’t think that it’s always the content, I think it’s more the stereotype that people are being put off from, because your classic person who studies Physics is

what's not like...those? ...Yeah. But I can't really take that because no girls do Physics so you sort of get put off. People say "Oh, you're doing Physics? That's a bit...that's a bit manly", "or a bit weird". And then you're like "Yeah, but I like it". But you get put off because you're getting sort of, like, judged a bit by it."

[13-B] "You definitely get a lot of remarks, like, on my work placement somebody asked me why I decided to do engineering and not hairdressing."

Each of these comments regards not what the A level physics is, but how it is perceived. It is not perceived as necessary for some fields, yet the ones highlighted are not specifically necessary either. It is perceived as being for the "super clever", yet grades show that students could attain top grades despite not entering with them. Popular culture alters how physics is perceived (although it is worth noting that the student who disliked Brian Cox did choose to study Physics). It is perceived as dull because it contains mathematics, not a subject that girls study, and that physicists are not like regular people.

These perceptions are not things that could obviously be treated with educational reform, and the only one that could, mathematics, is a fundamental part of the subject. The factors that are suggested by students as to why students chose to not pursue physics are wider than just making the A level seem interesting, but again altering how physics is represented. With the low numbers of girls studying physics, I wished to explore this further, especially as the younger students had said that it did not concern them. The girls in these older groups had now spent time being underrepresented in their class, and I was interested in their views now.

"What do you think to the issues of demographics in Physics at HE?"

[12-E] "I think that the girls being less likely is interesting because when you think of famous physicists, like ones of the past, and of today Brian Cox, you can't really think of any women. So I'm sure that puts women off. I think that if there was a Brian Cox like figure that was female more women would do the course."

[12-F] “Because I just want to do engineering, I don’t particularly care if it’s a man’s or a woman’s sort of thing. I just want to do it anyway.”

[13-B] “It... I don’t think it put me off at A level as much but like, I want to go into like, engineering and the fact that it is so...dominated by males did put me off a bit. But like, I’ve been to, I’ve talked to engineers, I’ve been on a work placement where it is like, there’s one woman engineer there and it’s not as bad as long as you’ve, like, I think, you definitely need a thick skin.”

The girls in these groups demonstrated a strength, and a ‘rising above adversity’ element when discussing this, in the same way that the previous questions regarding Physics being considered as a subject only for the most intelligent students had across the whole group. Their comments did not suggest that it was the subject itself, or what was studied that was off-putting. This is useful when considering that educational reform may not seek to address it, however the lack of female representation within the physics community is something that could be addressed. At no point in the physics specifications have men been particularly highlighted over women, however it is hard to avoid the preponderance of male physicists. A possibility would be to establish within the curriculum specific discoveries made by women with wording that would encourage teachers to mention them by name. One interesting element of this questioning was that the boys in the groups made insightful suggestions and comments that showed they understood why girls may feel certain ways about male-dominated classrooms, and why they might be put off studying Physics further.

While the previous issues discussed were interesting contextually, the primary involvement of students in this research was to consider their perspectives on the educational reforms themselves. To assist discussion students were shown the mapped changes to the specification and the arrangement of the new A level course. They asked questions, and offered thoughts that fit broadly into two categories, structural changes, and content changes.

“What do you think to the structural changes of the A level course?”

[13-D] "It's hard really. You don't really have the resources or the, like the, I dunno...it'd be a lot harder to do the practicals for Physics than it would be for other subjects like Chemistry, I think that it's just, you should know that, when you pick it, it's gonna be a lot of theoretical work because, realistically you can't do it. It'd be ideal if you could have your own Hadron Collider in the classroom."

[12-E] "It's more realistic as well because if you go on and do Physics at university and you are a physicist you don't do a practical and then sit an exam on it. You do a practical and you write up your findings. So I think that it would be better practice for real life."

The comments around the changes to practical work tread an interesting line between supporting the new procedure of having many more practical assessments and spreading them across the year, but recognising that they had not been short of practical work in the unreformed qualification. The comment about complexity was also interesting as this student considered the limitations of what it was possible to do within a classroom environment and that, to some extent, the most advanced physics cannot be replicated in a school environment. A few students appreciated the system they were used to regarding the asking of practical questions in the examinations, but were uncertain how they would be able to revise or prepare for such a large number of questions. Regarding examinations in general they did have very strong feelings:

[12-F] "It's stupid, you forget things."

[12-A] "It's better because for now, I'm probably going to fail...and I don't really know what to do afterwards if I do."

[12-F] "Oh yeah, in the sense that you definitely get into next year, I think it's better, but overall..."

[13-C] "It's so much more stressful for us because we know we've only really got one shot, rather than, like, the chance of being able to re-sit. It's all at the end now. It's scarier."

[13-D] "It'd be harder for us now than it was for those who could re-sit and do January exams. But the qualifications still seem the same, so on paper we've had to work harder."

The students were split on this issue, but did not disagree. At the school students sat exams at the end of the first year and were required to get a grade D in order to continue to the second year of study. The Y12 students who were interviewed were pleased that the Y12 AS exams would no longer take place as they could no longer be 'kicked off' the course if they were not getting a D. It was interesting to note that the reason behind this was that they did not know what may happen if they had to transfer, but were not yet considering the possibility that they receive a D or lower at the end of two years' worth of study. The Y13 students found having to revise two years' worth of material challenging, but also that the lack of first year exams meant that there was no opportunity to re-sit them in order to improve their grades. This was often seen in the sciences and mathematics, and not just amongst those with lower grades. Some students applying to study Medicine, often students who were awarded an A or B in the first year, recognised their significant competition and utilised resits in to gain a higher average overall and qualify for the A* grade.

The comparison between their examinations and those in the years either side was discussed further, with several students feeling very strongly that the changing systems and the reasons behind them were unfair:

[13-A] "I think I'd have stuck to the system they had three years ago. Where it's...I don't think we need a new system. I think we needed to improve the one that we've got because, I think, in twenty years if say we go for a job interview then how can we compare our A levels with these new qualifications. Where is the crossover? They're going to be irrelevant qualifications. So, I feel a bit like, the work we're

doing now is sort of all a bit in vain because it's going to be for a soon irrelevant qualification."

[13-B] "I think that if they're changing the system then like, when they took away the January exams they should have changed the specification straight away so that we weren't learning modular units. Because we've been learning modular units and doing annual exams and it's not how it's meant to be. It's not how the specification was designed."

[13-B] "I feel as well, like the way in which they changed it, like, a lot of people are saying that because people were getting too many good grades and stuff and the exams were too easy, it was just putting students who were doing the exam down a lot because they weren't accepting that people could just be getting better results, it couldn't have been because, that it was obviously because the exams were, apparently, getting easier; and it was like, it put a bad impression on students and stuff."

The students' insight into how exam results are talked about in the media showed how the public comments about failing systems and declining standards might be felt by students. Irrespective of the year-on-year comparisons they felt that they were working hard at a challenging subject and deserved just as much credit as those who had gone before them (if not more so). Also of note is how the change to the examinations, elimination of one form of coursework, and then the change in specification had led to slightly different courses structurally all being known as 'A level Physics'. The students felt that they had studied a system that was in transition and that it was not understood widely enough by the public.

"What do you think to the content changes of the A level course?"

[12-G] "Oh god...that's stupid, surely you'd do A level maths if you wanted to do that."

[12-D] "It would give the people doing A level maths an advantage over people who weren't because those doing A level maths would be taught that twice. People who are just doing Physics would have to learn it"

[13-E] "I've heard that they're taking out $E=mc^2$. To me I think that's just like...what?"

[13-C] "It's just, I'd have been like, it's the most famous equation but we don't know what it is, and we're doing about it. What's the point?"

As discussed previously the content changes to the Physics specification were not drastic, but of the ones that were proposed by the Smith report the students honed in on the percentage of mathematics and $E=mc^2$. Once again mathematics was felt to be a barrier, but here the students felt that this barrier was being purposefully increased but also moving the field of Physics further towards being considered as nothing more than applied mathematics. They also focussed on a fairness aspect, this time in relation to those students who were studying mathematics and further mathematics having an advantage in areas such as mechanics where they covered the content in both physics and maths lessons.

[13-F] "I think the multiple choice stuff is so stupid."

[13-B] "It doesn't give you the right amount of marks for the amount of work you've got to do, it's not fair."

[13-D] "Some of the manipulating equations, if it was in the written section of the paper it would be worth three marks but why is it only worth one mark because I've got a list of four?"

In the specification and examinations that these students were preparing for they would encounter multiple choice questions in one out of the four exams that they would sit, accounting for one sixth of their overall grade. These questions were considered some of the most complex by the students, primarily for the amount of work that was required for one mark when compared to other questions, but also because the alternative options were

often multiple 'distractors' (answers that would be obtained if the students made an error). The new A level qualification was proposed to expand these questions to between a third and a quarter of the new specification, and the students did not feel this was a positive change. It could be argued that this increase in the multiple choice questions is an effective way of spreading out higher grades, given that the questions are considered the most complex.

Summary

An analysis of these students' views reveals many factors that affect a student's choice of subject and their perception of physics. These will be different for a subject in a different field, but some will not.

- Students highly rated how difficult they found the subject, but viewed this separately to the grades they received.
- Students tended to choose to study subjects that they found interesting, but the student-teacher relationship was a large component of what made a subject interesting to them.
- Physics is seen as a challenging subject, and one that even the most able students question whether studying it would be a risk for them.
- Mathematics is a significant consideration for students. The relationship that students have with mathematics is crucial to their decision to study physics, but also affects their experiences of physics while they are studying it. Many students are put off by the mathematics content, others do not recognise that the subject requires a high-level of mathematical skill when choosing it and find that this leads to them not enjoying the subject.
- The wider conversations about the demographics of those who study physics are reflected in the views of students. They do not suggest that students have not chosen physics because of them, but that they are something that students think about.

The education reforms did not attempt to tackle these issues, in fact the challenging nature of the subject and the level of mathematics found within the course may lead to the subject becoming even less popular with students when they are picking their A level options.

Regarding specific changes to the A level qualification, students feel strongly about linear qualifications and do not feel that they are more beneficial to a modular format, because they no longer have the opportunity to re-sit elements of their qualification, however this is exactly why the Department for Education said they wished to remove modular examinations. The students' thoughts about the changes to the way in which practical work was assessed was varied; some could see benefits and others could not, however even they, as students, recognised that it was a way of doing practical physics that better reflected what they would encounter in a university environment. The changes that were proposed to the content of the physics course were not well-received by students, they felt strongly that it took away a part of what physics was and even though these aspects were ultimately kept by the exam board AQA, the students noted that one of the most famous things in science – one of the most widely recognised equations by one of the most famous scientists – was removed from the A level, yet it was something that they were excited to learn about, and felt pride in being able to say that they understood it.

7.4 Higher Education Interviews

One-hour interviews were conducted with two members of academic staff of a university physics department. They were asked the same questions, but the semi-structured interview format allowed answers to be probed in more detail. The interviews were split into three sections, beginning with a similar contextual setting to the student interviews – what puts students off studying physics at a high level. Their perspectives were then sought regarding what, if any, issues they faced as teachers of first-year undergraduates who had just come to them from A levels in Physics. Following this they were asked about physics at FE; both had limited knowledge of the educational reforms, but made some comments regarding what they would have sought if they had some input into reforming the qualification.

Contributions from each interviewee are attributed with a [K] or an [M] as some context may be relevant in their separate considerations, especially if they are to be considered as representatives of the physics community. [K] and [M] are under 35, and have doctorates in physics fields, both are experienced in teaching physics, as well as carrying out their own research, and have completed postgraduate qualifications in education. [K] is female, and a mother, with a husband who is a teacher of A level Physics; [M] is male and carries out significant work in the teaching of practical physics in small laboratory settings. [K] and [M] are both members of the Institute of Physics, but neither were aware of any moment in which the Institute sought wider advice from its membership on the A level reforms, or any other educational reforms that they could recall. This would suggest that while they both regarded the IoP highly, and they pointed to several projects and agenda that they supported or were part of that were run by the IoP (such as Project Juno and Athena Swan), the Institute operates relatively independently and represents itself to the government via its own internal staff, and not the wider physics community.

The interviews were transcribed fully and what follows is a synthesis of views into the three main areas that were discussed in the chapter ‘Why reform A level Physics?’: Issues in Physics education, Issues in Higher Education, and Issues in Further Education. The interview schedule can be found in Appendix six.

7.4.1 Issues in Physics education

In this area we touched on previously mentioned aspects, that of women in physics and the lack of physics students overall. [K] believes that the lack of women in physics at a university level is more complex and challenging than many believe, but did not see how this would affect those taking A level physics. At this level she believed that it was social structures and subtle aspects that influenced less conscious choices about school subject choice, but also noted how difficult it is to try and change such things. More importantly however she noted:

“What do these students do instead? Would they have made great physicists?”

During the interviews both independently expressed that they had wondered whether or not students were actively being dissuaded from physics, or if it was just something that did

not have as large an appeal as other subjects. They agreed that so long as there was no male-dominated hegemony that actively sought to force women out of the field then it may be necessary to accept that Physics has never been hugely popular. [K] and [M] both noted that they did not have a role model within physics when they were growing up, or when choosing which subjects that they wanted to study. They hypothesised that as society progresses and female scientists become more and more valued and visible then this will benefit Physics, but it is not holding back the field; they highlighted how, to them the best physics students were the ones who persevered whatever barriers may be in their way. [K] highlighted that there is still a little undercurrent, but never anything overt, that is sexist; and that she predominantly attributed this to “the simple reality of being a minority”⁴¹.

As with previous considerations of these issues, nobody can articulate what it is that they think may change the gender statistics for certain, but that the interview is the first time that they have considered (on being asked) whether or not we should be worry if they do not change. Both concluded that physics should be seen by students as an option that is open to all, but if physics does not appeal to certain people, then perhaps it just does not appeal.

7.4.2 Issues identified in Higher Education

When the A level reforms were initiated, Michael Gove spoke several times about engaging HEIs and making a qualification that was ‘fit for purpose’; in effect, suggesting that HEIs should approve of the A level qualification and hold it in high regard. In this stage of the interview views of the A level in Physics were explored from the perspective of two university lecturers who had taken in students for several years. What did they consider to be the problems that needed to be improved or solved through the reform of A levels?

The chief criticism of the A level process was not to do with content, but “the skills that students come to HE with”. The key aspects that were focussed on were not necessarily

⁴¹ While considering barriers within Physics education, [K] expressed an issue that was not relevant to this thesis but was pertinent when considering gender issues across the field as a whole. [K]’s experiences were that trying to maintain a suitable work-life balance was a significant issue for women in Physics, mainly due to the CRF and having to produce research.

specific skills, but more generally “Literacy and numeracy at a degree level. Almost all of the physics courses now have to teach the required mathematics from the basic principles up.” While this is reported in other subjects previously mentioned, Doctors [K] and [M] note that this has the effect of reducing the amount of physics content that can be taught in some modules. Although it is the nature of physics degree courses to contain modules on mathematics both pure and applied, the timetabling of some modules is something that can cause unforeseen problems. [M] teaches a first-year physics unit that required an integration technique that is not covered on A level courses, and is therefore included in a first-year mathematics module. Unfortunately, the Mathematics department had placed it in the module at a point after it was required and so a lecture had to be spent going through the concept, and ultimately one of the physics topics dropped from the module in order for it to fit. The mathematical ability required of students was felt to be poorly understood by the government who had increased the percentage of mathematics, but not the complexity or techniques, leading to [K] describing the changes to A level physics over the past decade as a “dumbing down”. The feeling was that A level students should be required to do more complicated mathematical analyses because “If students can’t do maths then they’re probably not going to be a very good physicist”. What was notable to both [K] and [M] was how issues regarding general literacy, noted to be lacking in many physics students at university, formed no aspect of the reforms at all.

[K] described further limiting factors in “Computer programming, essay-based questions, and the ability of students to get up and talk about Physics” and both interviewees noted that the students lacked confidence in devising their own approaches to problems:

[M] “They’re sometimes plucking the scientific method out of thin air because it’s not something that they’ve been exposed to.”

This aspect of university physics lab work was seen by [M] as something that could be utilised in A level physics classes currently: “Honesty can be tough in coursework but students are often following set instructions like a recipe and can’t manufacture their own procedures for themselves”. He was pleased to see that the introduction of the required practicals was a move towards students keeping a lab diary and thinking about processes,

but was concerned that it was not entirely free because of the involvement of the teacher in the process. The new A level practical work does require students to carry out an element that involves data logging or graph work using a computer but nothing akin to the computer programming that was mentioned, yet when Y10 students attend university outreach sessions they often show that they are capable of, and enjoy, writing programs. “Talking about Physics” is, however, more challenging, and would involve a different direction than that taken by the government if included as a requirement of the A level course. At a classroom level this is at the discretion of the teacher, however the removal of school involvement in the assessment of practical science within schools as part of the A level coursework showed that the DfE did not have faith in individual schools or teachers to run classroom-based assessments that contributed towards a student’s grade honestly and fairly.

As the interviews moved towards questions that related specifically to the educational reforms themselves, [K] had a question for me. She asked what my opinion was on whether the A level specification had been “made simpler to make it more accessible to non-specialist teachers?” While this is not something that I believe is the case, it is interesting to consider how HE physics educators may be curious about whether FE has enough qualified physicists to teach physics, and that the field of physics teaching may ultimately have to change because of this.

7.4.3 Issues identified in Further Education

Where student considerations of the content of the physics A level course focused on one particular area, the HE interviewees were quite open to what should be on the specification.

[M] “I suppose you’d call the basics – mechanics, electromagnetism, electricity...all the general things that give you a nice foundation in what you’re doing. But then – the bit that I think is missing is being able to make connections between things.”

University physics departments have more freedom than schools in what to teach, and allow students to select modules; the lecturers felt that their first-year courses gave students a good grounding for them to specialise in certain areas, but that this grounding

could not be done from scratch. The students needed this foundation in order for them to build their knowledge, skills and understanding. Arguably this is the reasoning for entry requirements for undergraduate courses, and that a Physics offer would ask for students to attain above a certain level in mathematics as well as physics. This was further elucidated by [M]:

“I had a look at some of the syllabi and I think they’ve lost a bit of content and they’re not quite as rich as they used to be (almost year by year it seems) but you look at it and wonder why the students aren’t able to solve a problem which involves two little bits of knowledge that they have to pull together...why do they struggle with that? Then you look at the exam papers and think ‘Ah, right...that’s why’.”

Here it is the nature of the course assessment that is highlighted as the potential source of the problem. [M] specifically felt that the assessment at A level did not promote creativity or true problem solving, but instead was testing whether students could identify the correct processes to carry out in order to solve problems. [K] had suggested something similar but did recognise that part of this could be due to provide the foundation that could then be built on further, but that it would be useful to have some aspects that pushed students in this manner.

[K] “I don’t think what they’re being taught is wrong, I think how they’re being taught and what they’re being taught to do with it is...how you’ll be assessed and how the course is structured.”

[M] “The way that it’s having to be taught is very much assessment driven. If they’re being assessed in a compartmentalised way, why teach them to pull together things from three different exam papers? There’s no point to the student because the exam doesn’t tell you how good the student is as a Physicist; only how good they are at doing those questions.”

Assessment was a focus of the reformed qualifications, and although Ofqual did focus on analysing the complexity of questions asked on exam papers, Ofqual do not share the

criteria that they use to judge such questions. Here the physicists do not believe that the exam papers promote students' ability to think synoptically because the exams themselves are only designed to cover specific topics – electrical circuits on paper one, mechanics on paper two, but no questions where they would be combined (such as looking at the electrical and mechanical aspects of a motor, for example). This was tackled slightly with the removal of both January exams, and the lack of first-year examinations counting to a student's overall grade, but examinations are still split in discrete topics making this an area that would be worth re-examining in the future.

When asked if there was anything that could be taught as part of the A level Physics course, attention turned, once again, to mathematics:

[M] "Calculus would be useful, I think it's necessary although I think that you could, kind of, possibly, teach calculus without the maths. It sounds a bit weird but you could go through the physics and the definition. Because we find the other way around, and that students get quite good at calculus in maths, but when they do the physics they can't quite see what the calculus is physically. Whereas if they do this, like solving equations with rates of change, then it could be a good way to teach this at the same time as the maths."

This method of teaching concept and application simultaneously, or using a contextual setting, does take place within A level Physics, specifically in the use of logarithms and exponentials for solving nuclear decay equations and capacitor discharges. The mathematics is a higher level than GCSE, and not all Physics students take mathematics, therefore physics teachers must teach the mathematical techniques to their students. What is curious is how calculus used to be a part of the A level specification, specifically regarding the rates of change applications that were highlighted, but these were removed in 2008 for unspecified reasons.

Summary

The interviews confirmed many aspects that had been reported elsewhere regarding the state and appraisal of physics education⁴² but they were both resigned to, yet optimistic about, the demographic issues that are widely reported within physics. They feel that much effort is needed to ensure that it is structures (particularly in academia) that are limiting factors, but that the field can be off-putting to many just by its nature. Therefore, to actively change Physics to make it less so would change the nature of physics itself.

Mathematics is felt to be of huge importance within the field, because it is a required tool that is integral to physics and physics education and, if anything, more high-level skills are required. It was not felt that the educational reforms had gone far enough in this regard. Potential changes to the content that was taught as part of the A level were not seen to be at all controversial, with students arriving from different exam boards and with different skill levels cited as something universities were used to dealing with. What was felt to have been underutilised were changes in teaching and assessment that could have arisen out of the reforms, such as detailed problem solving and synoptic elements. Changes to practical work were well received, and it was noted that schools would never be able to replicate the ideal skills and experiences that universities may want students to come to them with due to the level of equipment and freedom required.

However, while the feeling amongst the interviews was that the educational reforms were not bad, it was felt that they were missing a crucial element.

[K] "Physics education is about dreams, being fit for purpose, student focussed and not employer focussed, and is currently weakest at applying the tools of physics."

It is notable that the interviewees mentioned the same issues with both Physics education in general and the recommendations made by the learned organisations that were described previously. The issues relating to mathematics, practical skills, assessment, all

⁴² see (Institute of Physics, 2012b) (IoP, 2014) (IoP, 2014) (Science and Learning Expert Group, 2010) (Royal Society, 2011) (Society of Biology, Royal Society of Chemistry, Institute of Physics, 2013) (Institute of Physics, 2016a) (Institute of Physics, 2016b)

were described in the same way. While this triangulation can be seen as a reflection of the effectiveness of organisations such as the IoP in representing their subject, it is also a reflection on the strength of feeling within the physics community, and of physics educators. Whether or not the interviewees thought it was as possible for the educational reform to have tackled the issues that were raised is debatable however [K] felt that:

“It all just seems like cat-herding to me...and it’s never going to be perfect.”

7.5 Chapter Conclusions

The views of Ball (1997), Nespor (1996), and Ozga (1990) suggested that to consider educational reform fully it is necessary to look to the micro-scale as well as the macro-scale, and to consider multiple voices, including those traditionally ascribed the role of consumer. In doing so here we have seen the effect that the policy has had in a school setting and the difficulties that were created by the process, whether intentional or not. We have seen what lecturers within a HEI think about Physics education, noted how the issues that they raise as needing strengthening are the same as those raised with the DfE and Ofqual, and know that they are aspects that were not recognised as part of the reform.

In relaying and reliving my own experiences within a school environment I have also shown how this policy reform confirms the view that policy is rarely straightforward when it is implemented. My own considerations, and those of other teachers, were largely more practical than theoretical, and add in additional layers to a reform process that are not considered by those leading or carrying out the reforms. This is not to say that myself and others did not grapple with ideological issues relating to the changes being made to our courses or the nature of A level education, however they were found to be, by-and-large, irrelevant; strident expressions of views in offices and debates over snatched lunches, but of little consequence to those carrying out the reforms. The chief engagement of teachers was through the news media, a sign of politics dominating educational discourses and how the political world is perhaps more concerned with how policy reforms are reported in the media amongst non-teachers than how they will be enacted in a classroom.

This chapter has also functioned as an environment to hear the voices of the largest group who were denied a voice in the reform discourse – students. It could be argued that students may not be interested in educational reforms⁴³, however students, despite their lack of agency, are of clear value when considering educational policy making. Not only can they provide an interesting check for one's assumptions, including my own as a teacher, but they are also in the best position to explain the complexities and simplicities of a young

⁴³ Notable was Michael Gove's speech to a group of students in January 2012 on educational reform. The footage of the students' less than enthusiastic response being subsequently lambasted in the media (The Telegraph, 2012a).

person's mindset. Here it has been explored what students think of a subject that was highlighted for reform and examined their likes and dislikes about that subject. Perhaps of most importance is that these students described how the subject being thought of as academically challenging and reliant upon mathematics was what most dissuaded students from studying it. Notable is how these are precisely the two things that were highlighted by the DfE and Ofqual, oftentimes publicly and vocally, as aspects which needed to be increased and made more challenging.

These analyses, drawing on the perspectives of different stakeholders, indicates that whether A level Physics has become more challenging and contains higher level mathematics is debatable. However, one micro-scale view is that the physics qualification has changed structurally, but not significantly in other areas. The question now to consider is whether the macro-scale discussion of the A levels being made more robust, respected, and rigorous can be considered accurate if micro-scale analyses do not show this. It is ideas such as these that are presented and reflected upon in the final conclusions of the thesis.

8. Conclusions

This thesis has considered the role of the government (and other key policy players) in defining what the purpose of the A level is; controlling who is 'in charge' of the A level; setting the narrative for why educational reform was necessary; and how the reform was carried out. Even where the government did claim to be delegating power and authority, it ultimately carried out a reform process where it retained control of the A level either directly, through the power structures at its disposal, or through key policy players through which its ideology was channelled. The impartiality of Ofqual and reviews of subject content is not being questioned, however all who were delegated authority had to, in some way, accept the government's policy directions and wishes, whether they were an exam board designing a new specification, or a teacher implementing it. In this manner they may all have the appearance of independence, but have little agency in the reform process. Relating this idea back to the operating concepts of the thesis we can see how it is not necessarily through direct control that educational policy remains in control of the state but through 'games' of truth and power (Ball, 1993a).

Utilising a broad theoretical framework, concepts of educational policy have been extended backwards and used to suggest the how a reform process reifies these concepts. As well as ideas of power and power effects, it is through voices and silences, and production and implementation processes that we can identify policy machinations. It has been shown throughout how contested aspects of the reform process have been, how chaotic and messy policy making is, and how ideologically driven this A level reform was.

Writing in November 2018, the A level reform that began in 2012 is still not yet complete. While some subjects have seen full cohorts pass through both years of the qualification, others will commence their first teaching of their reformed A level qualifications in September 2019. In the six years since the reform process began there have been four Secretaries of State for Education but, while this thesis is not about Michael Gove, this thesis has explored how the reforms that he instigated have had a significant effect on the educational community in England during his tenure and beyond. It is expected that the Secretary of State for Education would be a vocal voice in an educational reform process

and a significant policy player, and here he is in superposition. He uses multiple warrants to drive the reform publicly, particularly those framed politically rather than evidentially, in order to present his views and strategies as 'common sense' and 'beyond challenge' (Hyatt, 2013, p. 839). He further reinforces this through pulling multiple policy levers simultaneously, which as well as having a significant impact on the educational structures in which these levers are located, also made him appear even more powerful and authoritative to the public. In this regard it is argued how the mediatisation of policy suggested by Rizvi and Lingard (2010) can also be seen in policy creation. Notably absent is the voice of the Prime Minister, David Cameron, during Michael Gove's tenure. He introduces the White Paper (2010b) that set the educational agenda for his government, however the reform process is not mentioned within this document. Michael Gove often refers to "his" ideas and wishes regarding the educational reforms (Gove, 2013a) and those who respond attribute the reforms and their direction to him (Stacey, 2013). This is not to say that it is improper that such educational power be afforded to a Secretary of State through their elected office and the Department for Education's authority over schools, nor is this to say that Michael Gove should not express himself through media appearances and letter and article writing, however it means that one man's voice dominates the educational reform discourse and has resulted in an unarguable political and policy legacy.

It is clear that Michael Gove and the Conservative government had a specific idea of what the educational landscape in the UK should look like. They began a reform process that cited university complaints regarding A level education in England and suggested that the Higher Education sector should be more involved in the design and running of A level qualifications as a way to tackle this. However, the response from HE was clear. They lacked the time and resources to be able to be involved in the way that the government proposed and, while they wished for there to be changes to the A level content, they were generally happy with the structures that were already in place. This aspect to the reform rationale highlights a shift from evidence-based policy making to ideology- and policy-informed evidence within education. A 'crisis' that needed to be addressed, regardless of whether that crisis was shared by all of the key stakeholders or grounded in clear evidence. Not only does this highlight the non-neutrality in policy reform (Apple & Weis, 2013), but it demonstrates the lack of significance in government consultation processes. Where one might expect a

consultation to have a noted impact, in this case there was little to show for the involvement of respondents. The government is well within its right to instigate educational reforms, even for ideological reasons, however Michael Gove instigated a reform process before any consultations had taken place and there was little substantive impact when they did. Maguire and Ball (1994) suggest that educational reform discourses are governed by “what can be said and thought, who can speak, when where and with what authority” (ibid, p. 6), yet the consultative aspect to this reform process shows that there was no place for those who disagreed with the Secretary of State.

Moreover, these consultations were significantly responded to by many of the organisations that the government sought to involve in the A level qualification. Some policies were in agreement, such as the removal of the January examination windows, however this had been initiated before the A level reforms had been announced. This again reinforces an application of policy-informed evidence and going against the views of the Higher Education institutions and learned societies that the Secretary of State strongly emphasised when proposing the reforms. Not only does this bring into question what policy logic was at work but demonstrates how strong the government’s control of education can be. In some respects, it could be considered positive that hypothetical lobbyists cannot provide sufficient roadblocks to stop the implementation of policy by elected officials, however it raises a serious question about the strength of one leading figure within the Department for Education. Ball (1993a) notes how policy can be considered ‘value-laden, contested, and dynamic’ and the first two tenets can certainly be found within the STEM discourses. Outside organisations, and indeed some inter-governmental feedback, did argue against some of the government’s proposals, but they lacked sufficient power of their own to stop or reshape them.

Policy, however, is “never straightforward when implemented” (Rizvi & Lingard, 2010, p. 18) and, despite the government’s wishes, the exam boards pushed back. A high level of satisfaction with the AS qualification was reported, particularly as a selection tool amongst HEIs, and this led to exam boards structuring their new A level qualifications in such a way that the flexibility that was offered by them to students, teachers, and the university selection process was retained by subjects such as Physics. In addition to this, re-sit exams

were also retained however over time both of these aspects have diminished in usefulness due to reductions to FE funding. In this regard Rizvi and Lingard's further suggestion that policy "interacts with policies in other fields and can be a product of compromise" (Rizvi & Lingard, 2010, p. 18) was more of an interaction with more government policies that initially seemed a useful compromise, but ultimately produced the government's intended effect.

Taking care not to purely describe policy as 'messy' and suggest that that is too complex to analyse sufficiently (Ozga, 1990), Ball proposes that combinations of small-scale and sector-wide can help to unravel a chaotic environment (1993). In focusing on structures such as Ofqual's regulatory procedure we can see how awarding organisations must produce qualifications to be accredited, but that the conditions for requirement are set by the government. The government looked to an independent review of subject content, and directed that Ofqual follow this, however the review of subject content was undertaken through the exam boards. These exam boards engaged HEIs and learned organisations using the already existing networks that they used before the formal reform process as part of three and four yearly reviews to ensure that the qualifications being offered in each subject were an appropriate match to university courses and thus remained competitive in the educational marketplace. This would seem to confirm the suggestion regarding policy being "multidimensional, multi-layered, and occur[ing] at multiple sites" (Rizvi & Lingard, 2010, p. 14), but also introduces a further consideration of the government's involvement in the reform process. The suggestion is that a heavy-handed government response and intervention was implemented, with significant costs, that would likely have been solved within the structures that already existed.

In questions of power and the control of knowledge during the reform process, the exam boards have become pawns in a national strategy of headline and rhetoric. They were afforded no voice during the reforms and were not utilised by the government or its agencies until the specification writing stage of new A level qualification. When this stage was reached, they were tasked with carrying out the work of the government in the manner that it claimed to have prescribed if they wished their specifications to be accredited. The government is able to claim to have reformed the A levels, generating high levels of 'policy noise' throughout and gained the appearance of putting the A level qualification back in

order – making it once again ‘fit for purpose’ – but the reality is that the government wielded significant power structures and systems of control to change little.

At this stage of examining reforms we have narrowed to the consideration of the work of exam boards producing specifications, the policy texts that are at the end of the A level reforms. However, the ultimate policy is seen not purely in the process that goes into creating these, but in what happens in schools.

An autoethnographic element has been present throughout this work; my own life and experiences as a Physics teacher and a Head of Department, and as someone with a lived experience of the reform process of which I have been researching. This aspect has contributed to the macro-analyses of educational policy and reform as much as it has to a micro-analysis of the reform process located within Physics and Physics education, but it is through the latter through which I can most effectively judge how the government, and the reform that it instigated, has affected what happens inside a school environment. Just as this autoethnographic form of unpacking the reform process was used to provide a lens through which to view the wider reform, so too is it used here to contextualise the final conclusions of this thesis. This is framed within four personal questions and reflections; questions that I have asked myself throughout the thesis as a researcher looking at the reform process, and as someone who has been embedded within it. Three are based around the groups that I identified as being the ultimate users of the A level qualification (school teachers, students, and HEIs) and look to what the impact of the reform and reform process has been to the groups since the start of the reform process. The final concluding question is the simplest, but one that I feel is of significant importance to consider in a time where education policy announcements are used by individuals for wider political gains, and where rhetoric can garner more media attention than reality.

Has the educational reform changed the day-to-day teaching of an A level Physics teacher?

It has not. There have been slight changes to the content based on the recommendations to the DfE, but these have all been additions or restatements of things that were already

present. Where there were suggestions for deletion, these were overruled by the exam board and so the content has not changed in any meaningful way.

The removal of the January examinations and that AS level exams (when taken) do not count towards a student's A level grade. This does require an element of teaching with a longer end-goal, but not in the way that concepts are taught in the classroom. The removal of coursework has changed the dynamic of practical work in science, and increased the scientific realism, but this is merely a change of what was required to be recorded and assessed; the students do the same amount of practical work, carry out the same experiments, and gain the same skills as they did before.

Exam questions are presented differently, and the mathematical demands in the first year of the course have been increased, however this is due to the assessment structure of the course changing and not through changes suggested by the government. By the time students reach the end of their reformed A level study it is my view that they are just as good of a physics student as one who reached the end of the previous qualification.

What impact did the reforms have for Physics students?

More students are receiving A level Physics qualifications than in years prior to the reform, however the grades received have decreased. This thesis has not been about the funding of state education however it has had a significant effect on the teaching of Physics at the same time as the reformed qualifications. In altering the amount of funding that schools, particularly ones with sixth form centres receive, A level Physics in my school has been devastated. In previous years many students would begin an A level course and take exams at the end of the first year: the AS. If they received less than a grade D then they (generally) would have to drop the course (but keep their AS qualification), and if they achieved a D or greater then their scores would be absorbed into the A level qualification. This was not through academic snobbery but as part of a dialogue with a student involving what options would be best for them, and how a grade D in Physics was unlikely to open many doors for them. These students would be allowed to re-sit their exams to improve their grade, while taking up subjects in which they would perform better academically and in some cases the students would seek alternative FE provision. Sixth form funding then decreased making it more financially viable to have more students progress into the second year of A level study within our school – they were not allowed to drop courses after the end of the first year. At

the same time the educational reforms ensured that the AS exams no longer counted towards a student's A level grade. They were still co-teachable however the exams had to be paid for by the school. In an environment where school funding has reduced significantly for many schools, this meant that the AS exams were considered useful for gathering data, but a financial extravagance and they were not offered unless students paid for the exams themselves. AS exam entries have plummeted nationally and this has resulted in more students finishing A level courses – in line with the government's plan. However, the grades that are received in Physics now cover a far broader range than ever before. There is no increase in the number of students applying to university Physics courses, and eighteen-year-old students are now finishing their Further Education studies with lower qualifications and with no 'backup' AS exam qualifications or potential for re-sitting these examinations.

What impact has the reform had on Higher Education Institutions?

~~Yes and No.~~ The difficulties outlined above regarding the increased spread in grades is not, in of itself a negative to those outside of a school environment. An A level in Physics requires students to be 'good' at Physics in order to do well in it. The students in the situation mentioned above are unlikely to be the students applying to study Physics at university. Universities, therefore, can be largely guaranteed that incoming students have strong mathematical skills, however the high-level mathematical techniques and concepts that were requested by many HEIs were not reinstated to the Physics course. The practical skills aspect to Physics does more closely align A level practical science work to that which is carried out on university Physics courses, however these skills were largely covered prior to the reform. This shift from assessment of practical skills in an exam hall rather than in the classroom is not one that was suggested by any of the organisations that made recommendations to the government, nor the recommendations about practical work that the government used to support the need for reform. This new structure is the opposite of that, however it does require students to have a more detailed understanding and an ability to understand complex experiments being described on paper rather than in front of them to interact with. Some would argue this is a strong skill, others that it goes against one of the key natures of Physics as a practical subject in schools.

Finally, and with further respect to examinations, the exam questions in the new qualification are certainly 'harder' and 'more demanding' than in the previous course. This would have been an achieved goal of the reformed A level qualifications however it is undone by the grade boundaries being based on statistical treatments of the exam results, and not based around the inherent challenge of the questions. In this regard the grade boundaries so far have been lower than what they were previously and there has been little change within Physics at the 'top end' of the qualification for universities to better discern the most capable. In this respect it is now more challenging for 'elite' universities to better discern the most capable in a consistent manner due to the removal of the AS qualification on which to base their decisions. This in turn has seen universities outside of the Russell Group offer more 'unconditional' places than ever before. Students, now with no formal exam grades to reflect on and embedded within an environment stressing that A level exams are 'harder', have found security in these offers (which are predicated on the university being the student's first choice destination) and been tempted away from the very institutions that the government sought to aim the A level course at.

Could the reform changes to Physics have been delivered without the reform process?

This research can only speak to Physics and to this A level reform. It has not considered other subjects during the A level reform process, nor has it considered the reforms to GCSEs and other Key Stage curricula that were started during Michael Gove's tenure as Secretary of State for Education. However, the view of the macro and the micro in policy analysis, as well as in Physics, can reveal the complex nature things and attempt to understand a concept at multiple levels.

With so many organisations invested in the A level reform; with so many links between exam boards and learned institutions and universities; and with a history of the A level curriculum being modified to better fit it to its evolving requirements; the conclusion of this research, is yes.

The A level educational reform process was vast; it challenged the nature of the qualification and it created a significant amount of work for everyone involved. Educational reform, I believe, should do this. However, if the end result is only marginally different and

the changes would likely have been made anyway, then this A level reform of Physics was more rhetoric, than reality.

8.1 Limitations and Recommendations

8.1.1 The limitations of this study

As I have taken care to mention throughout the thesis, this study narrowed its focus in order to highlight one specific subject within one Key Stage. This allowed the wider picture of the recent educational reforms to be explored, as well as using descending orders of magnitude to highlight the increasing policy and reform complexities. This technique produces inherent limitations. As mentioned in the previous section the research study reveals the debates and discourses related to one subject (Physics), one subject area (STEM), and one Key Stage (A level/KS5) but there are further stories to tell. Some subject areas may have had more significant changes than Physics, some subject organisations may have had more of an impact on the reform process in terms of content, and some subjects may have found the assessment changes useful. These aspects were not found within Physics, nor were they part of the wider narratives that were told by professional publications or the wider media, however the broad picture of the reforms must be seen comprehensively and this study cannot, nor does not, claim to present an entire picture of the A level reform process. Furthermore, A level reforms did not all happen at once, and the nature of the reforms resulted in some subjects benefiting from coming later in the reform cycle in terms of familiarity with the process and structures, and negatively in terms of 'reform fatigue' (to give two examples). The chronological narrowing of focus while the reforms were taking place (utilising Physics as one of those in the first tranche of reforms) meant that some of later reforms in other subjects may have resulted in a different reform 'story'.

Alongside the narrowing within A level education this study also considered only one of the three educational reforms that were instigated by Michael Gove. The staggered reforms to KS3 and KS4/GCSEs also created significant responses from teachers, the media, the learned organisations, and the government. There were many significant reports and stories that reveal similar themes to the focus of this work but, unless specifically tied or of significance to an aspect being considered relevant to A level policy reform, they were omitted in order to ensure a clarity of focus. Elements of these are present within the autoethnographic section of the thesis, and within the discussions with students, however this is a further limitation – sample size, and location. This study uses my voice and experiences, a teacher

in one school in the North of England; the experiences of the students presented in this thesis are from groups of students who attend this school; and the views of the HEI academics interviewed are from a university department based in the same city as this school. Throughout the research a triangulation between macro- and micro-level perceptions and discourses has been used but the experiences of other micro-level inhabitants outside of this environment could result in a richer picture.

Finally, the Secretary of State for Education was replaced in July 2014, part-way through the reform process. This study has considered the work of his successor, Nicky Morgan, in concluding the reform process (for Physics), but it does not consider the political nature of this reshuffle nor how this shift in power and power relations may have subtly altered the reform process at this stage.

8.1.2 Recommendations regarding policy

When thinking of the title for this thesis I was drawn to a specific aspect of the A level reforms – the stated involvement of respected universities in the design of A levels and the subsequent refusal from such universities. The educational reforms that were proposed did not take place in the way that was envisaged by the Secretary of State that set them in motion; it could be argued that policy making being a reactive process and adapting to changing circumstances is a positive (such as in the delay on some of the reform's 'first teaching' dates), however this particular aspect highlights the danger of policy making via policy announcement. As a result of the research undertaken for this thesis the following recommendations are made:

1. Evidence-based policy making is almost a clichéd recommendation, but this thesis shows clear moments where the Secretary of State for Education expounded a narrative and a proposed solution that was flawed and failed. This demonstrates an increasing trend in policy making in England for a passionate articulation of a political view to override the reality of the situation. As such it is recommended that before educational reforms are announced an independent review of the educational environment could take place, making recommendations or suggestions that can be acted upon accordingly.

2. The English National Curricula can be viewed as a continuum where subsequent Key Stages build on what preceded. The reality of this may be questioned elsewhere however, all of the Key Stages in the English education system had their National Curriculum reformed concurrently. The reforms, however, were not integrated and were produced independently with separate panels, committees, policy players, advisors. There are clearly different foci between what elements of Physics may be taught in primary school as opposed to during an A level, however the reforms were implemented as KS3, KS2, KS5, then KS4. A more cohesive and integrated reform process would produce a more continuous national curriculum and aid schools in their implementation and understanding of the overall policy reform intentions.
3. Subject panels that were suggested by the Secretary of State for Education were launched in some subjects for action during the reform process but were later disbanded due to a lack of government funding. Similarly, the groups that worked collectively as SCORE have since returned to work independently, in part because of the conclusion of the reform process, but also because of the lack of engagement by government with their policy suggestions. While the universities looked to 'leading' universities to design and maintain the A level qualification, the work of these subject groupings showed how clearly and willing they were to engage with their subjects in schools. Funding for such panels to have a permanent voice and role within curriculum design and monitoring is felt to be positive and worthy of consideration by the Department for Education.
4. This thesis has highlighted aspects of power and the power relations that existed during the educational reform process and considered several conceptions of policy and the extent to which they are reflected in or constructed during policy reform. One of the rationales for the reforms was the assertion that education in England was not 'fit for purpose'; however, when the validity of this assertion was examined the reform discourses and dialogues that came from this statement were contested with various policy players and organisations publicly criticising each other. The role of Ofqual as a regulator and maintainer of standards in qualifications was also explored. Together these aspects suggest that an educational review cycle that examines the curriculum on a regular basis could alleviate the combative and political/ideological rhetoric of the reforms and maintain confidence in the English education system. Such a cycle (perhaps

guided by Ofqual, learned organisations, the Department for Education, educationalists, and educators) may also lead to an environment in which changes would be implemented in an expected and consistent manner, as opposed to the policy reform ‘messiness’ that was revealed during this study.

8.1.3 Recommendations for practice

In utilising Physics education as a context through which to view a reform process this study analysed many documents pertaining to views and experiences on the teaching of Physics in schools, and recommendations from several groups and organisations who attempted to feed into the reform process. Alongside this analysis was the research with students at varying levels within my school in order to present the voices and experiences of students, and interviews with HE academics who work with those students and aim to continue their physics education in a university environment. In exploring the issues and areas that each of these three aspects raised they have reinforced many of my own views on physics education, but also presented a series of recommendations for practice:

1. The voices of teachers were almost non-existent in the reform narrative. As much as this may be seen as exclusionary due to the nature of the reform process and the power dynamics involved, the teaching community could and should have a much stronger presence in the creation and reform of educational policy. Little consideration from policy makers was given to the implementation of the reform outcomes in schools, particularly when many reforms happen in a short space of time, but there was a lack of teacher contributions in the public DfE and Ofqual consultations. With valid contributions on subject knowledge, pedagogy, and school environments, teachers and school leaders should feel able and empowered to contribute to such education reform discourses.
2. Subject organisations and examination boards had a strong voice within the creation of the A level and GCCSE specifications in spite of the DfE’s attitude towards both groups in earlier stages of the reform process. These groups do not, however, have as strong a presence within schools and with schoolteachers. Schools utilise the specifications created by the exam boards and make use of some occasional outreach by subject organisations, but there is a wealth of research and material that both groups carry out

to support education within individual subjects. Recognising and using this, such as IoP recommendations for addressing the gender imbalances within Physics, can be useful within individual schools but also beyond the classroom.

3. Engaging the views of students and their thoughts on the subject that I was teaching them was an extremely rewarding and useful experience. Meeting with students and discussing their ideas in the same format as was done in this study is not required but taking time during the academic year to gain the views of one's students in a meaningful way is a useful reflective and developmental process. Student voice is not a new educational concept but is not one that many teachers in my experience instigate themselves, particularly regarding their own practice. I found the process to be fascinating, informative, positive, and allowed me to understand several groups of students in a way that I may not have otherwise. This process was also useful for my work as a Head of Department. In examining the micro-experience of students at different Key Stages of their Physics education I was able to review the department's approach to certain topics, bring some discussions and ideas in at an earlier Key Stage, and encouraged other members of the department to independently seek the views of students regarding their career options, perceptions of AS Physics, and the views of girls studying Physics in Y9 through a series of action research projects. Such work is not a specific recommendation, but the utilisation of educational research methods has had a positive impact on the department and a lot can be learned from it.

8.2 Further research

This thesis has attempted to present as complete of a picture of the A level reform process as was possible, but there are equally important stories in subjects outside of Physics that could be considered and explored in a similar way. Alongside this the GCSE, KS3 and Primary curriculum reforms that occurred at the same time have equally important tales to tell regarding the nature of educational reform in England. Further work on this period in education in England is, I believe, worthy of further investigation and research.

It could be argued that every reform process is different, even within the same country and at the same time, however the structure of the education system in England means that organisations such as Ofqual have a significant role in what goes on in schools, yet very few

educationalists or educators know much about them or how they carry out their work. This thesis constructed significant insights from public documents and letters, but a piece of work relating to this quietly powerful organisation would be of interest.

Finally, this thesis was not about Michael Gove, but he was a key policy player within the reform process examined here. Since his tenure as Secretary of State for Education he has continued to be a prominent figure in politics. While it is not the suggestion of an EdD thesis to move out of an educational environment, the ideas explored relating to his use of power and power relations are of significance to this field of socio-political theorists and researchers. At time of writing, Michael Gove is being discussed in the media for refusing to rule out whether the government in which serves will follow legislation created by Parliament (BBC News, 2019). As such, a detailed study of Michael Gove's tenure as Secretary of State for Education, his first role in government, is worthy of further research.

Connecting these recommendations is a prominent theme of the study: power and power relations. Critically examining policy, education or otherwise, and using such tools and methods as critical policy analysis and drawing on the experiences of different stakeholders, it is possible to speak truth to power, reveal what is often hidden, and explore how policy is created and enacted.

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Appendix 1: Deploying the Theoretical Framework

Quintanilla
 15 more than the policy document or the legislation ①

- the processes of policy production and implementation are also significant
- 13 multidimensional, multi-layered, and occurs at multiple sites ②
- Exists in context ③
- is value-laden ④ — contested, value-led and dynamic
- remains a state activity ⑤ — a product of compromise
- interacts with policies in other fields ⑥
- is never straight forward when implemented ⑦
- has been mediated ⑧

Ball
 - Policy is a set of relations among games of truth & power ⑨

- involves discourses governed by what can be said and ⑩
- thought, who can speak, when, where and with what authority ⑪
- is chaotic (messy) but analyses of messes and imities help unravel this ⑫

Apple
 Curriculum production is non-neutral and inherently ideological ⑬

Summary Purpose of A level
 ③ ⑤ ⑬ ⑩-ish — Who can talk? — Not employers

Summary ~~Technical~~ Technical Issues
 Disagreement over removal of AS — ⑪ ⑬ ④

Summary HE Issues
 Differentiated of objectives ⑤
 Misorganisation of not fit for purpose ④
 Gifting ahead of nations & consultants ⑤

Summary Role of HE
 HE involvement — ⑦
 move from a close relationships — HE & AS feel key relations ⑪

Summary Issues in FE
 Importance of STEM — ⑧
 Student perception — ⑦
 subject competency — ④ — contrasts

Summary Broad Issues
 ⑫ ②

Conclusion

Neoliberalism
 Limits to how new A levels can be ④

Milly students
 No mechanism ①

Accountability ⑥

Why progress?

Conclusions - Refers to A levels
 Complex Timetable - ② Also multiple times
 The assessment process - ③
 - Hidden
 Govt and Stacey ④ ⑤
 Co-teaching - ⑦
 Spec. Initiatives ⑧ ⑨ ⑩
 Original Board ⑪ ⑫
 GCSE refers to ⑬

Conclusions - Refers to Physics
 - This analysis shows how the power of the state reaches into the lives of teachers and their students - those who have the responsibility in the reform process.
 - The state controlled/parameters from independent review - ⑬ ⑭ ⑮

Continual review process controlled ⑯
 ALCATS Smith - ⑰ - Criticism
 'incoming Sec. of St. Changes given to exam boards. Maths
 Power over curriculum

Conclusions - Considering the reforms

Final conclusions
 Not in election or white paper - Activity
 Did universities actually influence the qualification?

The thirteen points given here were ultimately refined into twelve due to the combination of points eleven and twelve.

Appendix 2: Document Timeline

2000 – Curriculum 2000 the introduction of AS levels and modularity to courses

2006 – Last review of A level subject content

2008 – Last revision to A levels

4th July 2010 – Gove announces the possibility of decoupling AS and terminal examinations

23rd July 2010 – Cambridge University write to Gove disagreeing on decoupling AS

February 2011 – Cambridge Assessment independently launch a consultation about links between awarding organisations and higher education

28th February 2011 – IoP respond to Cambridge Assessment

3rd October 2011 – QCDA is dissolved and its curriculum oversight passed to Ofqual (responsible to Parliament through the Education Select Committee, not Ministers at the DfE)

July 2011 – The IoP publish ‘Mind the Gap’ about preparation for HE Physics study

7th December 2011 – Gove asks Ofqual to investigate exam board ‘cheating’

8th December 2011 – Letter from Gove to Gallagher on Exam board ‘cheating’

20th December 2011 – Letter from Stacey to Gove on the investigation and exam errors

20th December 2011- Letter from Stacey to AQA on investigation report

21st December 2011 – Ofqual report into the investigation published

21st December 2011 – Letter from Gove to Stacey on investigation report and the first potential for educational reform

31st January 2012 – SCORE response to Ofsted consultation on ITE (highlighting practical skills of teachers)

30th March 2012 – Letter from Gove to Stacey on reform rationale

April 2012 – ‘Fit for Purpose’ report by IPSOS Mori commissioned by Ofqual

April 2012 – SCORE publish a report on the Mathematics content in A level exams

3rd April 2012 – Statement on Ofqual Website regarding A level report findings

3rd April 2012 – Letter from Stacey to Gove on A level reform

3rd April 2012 – Cambridge Assessment report from HE on A levels

3rd April 2012 – BBC article on Gove’s letter and potential consequences

June 2012 – Ofqual commence A level reform consultation (several events are run)

10th July 2012 – Stacey’s speech to Ministers about neutrality, consultations, purpose of A level, ALCAB, and stopping modular assessment in 2013 examinations

9th September 2012 – Ofqual begin to compile documents relating to reforms

11th September 2012 – SCORE respond to the Ofqual consultation on A-level reforms

11th September 2012 – AQA responds to the Ofqual consultation on A-level reforms

11th September 2012 – Ofqual consultation on A level Reforms closes

22nd January 2013 – Letter from Gove to Stacey on implementation of A level reform

23rd January 2013 – BBC News reports disagreement over the initial reform announcements

6th February – Letter from Stacey to Gove on GCSE reform principles from Gove

6th February 2013 – Letter from Gove to Stacey on GCSE reforms (and minor comment on GCE reviews)

4th March 2013 – Meeting with Stacey, Gover, Truss, Thrift on linearity of A levels

14th March 2013 – Letter from Gove to Stacey on delaying introduction of new A levels and involvement of HE in curriculum content

21st March 2013 – Letter from Stacey to Gove on understanding of Gove’s policy intentions

29th April 2013 – CEOs of AOs (as part of the JCQ) write to SoB, IoP, and RSC asking to share their views

13th May 2013 – Meeting with AO CEOs, Education leads of Learned Societies, and Truss. Societies say they cannot contribute formally but did discuss concerns.

16th May 2013 – SCORE respond to AO CEOs / JCQ on how the DfE have not engaged with the possibility of creating subject committees to monitor assessment

24th June 2013 – Letter from SoB, IoP, and RSC to Smith about science reforms and their concerns

3rd July 2013 – Prof Mark E Smith report on A level subject content (and ALCAB created)

31st July 2013 – Letter from Council for Science and Technology to Gove on importance of practical science and assessment of it

6th September 2013 – Letter from Stacey to Gove on Ofqual’s reform plans and publication of Smith report

6th September 2013 – Letter from Gove to Stacey on increased resources and reporting progress

9th September 2013 – SCORE publish a statement in response to the Smith report saying that they were not consulted in any meaningful way

October 2013 – Ofqual launches the consultation on the new A level regulations

End of 2013 – Consultation on A level subject content by Smith

20th December 2013 – SCORE respond to the DfE/Smith consultation on subject content

17th January 2014 – Letter from Council for Science and Technology to Stacey on Ofqual consultation and practical experiments in science (particularly malpractice and lack of assessment)

17th January 2014 – SCORE respond to the consultation on A level regulations expressing serious concerns about assessment and asking that new science A levels are postponed

5th February 2014 – Letter from Stacey to Council for Science and Technology on the rationale for removing practical assessment

March 2014 – Report on the results of the consultation on A level subject content passed from Smith to Gove

April 2014 – Ofqual release their analysis of the A level regulations consultation and Assessment Objectives for all 1st wave subjects

April 2014 – Ofqual release Impact Assessment for the A level reforms following the consultations

9th April 2014 – Letter from Gove to Stacey on dates for next wave on reforms for first teaching 2016 and first assessments of them

9th April 2014 – Letter from Stacey to Gove on coursework consultation (done by Ofqual) and confirmation of the development of new assessment objectives

9th April 2014 – Letter from Gove to Smith on accepting the subject content of the reformed A levels, Ofqual agreeing to it, and the DfE publishing the required content

9th April 2014 – DfE publishes the subject content and skills for the new A levels (for exam boards to begin writing specifications)

9th April 2014 – Ofqual confirms assessment arrangements for new A levels and announces details of science practical work (and why they made these decisions)

23rd May 2014 – Ofqual publish the first edition of subject guidance for new science A levels

June 2014 – Ofqual launch consultation about completing the reform process

June 2014 – Royal Society publish their ‘Vision’ report on the future of science and mathematics education

30th July 2014 – SCORE respond to the Ofqual consultation on the completion of the reform process raising concerns about subject content and the role of Aos in curriculum design

Autumn 2014 – New A level specifications (1st wave) available for schools

Autumn 2014 – The four exam boards run trials with 30 schools on new practical assessments

24th November to 5th November – AQA consult teachers via their educational reform buses

12th December 2014 – AQA announce their Physics specification is accredited

22nd January 2015 – ALCAB is closed down

4th February 2015 – Letter from SCORE regarding GCSE practical work and highlighting their issues with the consultation process

5th February 2015 – Dominic Cummings makes a statement regarding ALCAB closure

25th February 2015 – Letter from Stacey to Morgan on science practical work

2nd March 2015 – Letter from Morgan to Stacey on GCSE science practical work (and women in STEM)

March 2015 – Ofqual release confirmation of the new A level teaching and assessment dates

26th March 2015 – Ofqual announce decisions on first teaching 2017 subjects from June 2014 consultation

April 2015 – Ofqual produce the Conditions and Requirements of the new A levels and how the accreditation process works/worked

1st May 2015 – SCORE respond to a GCSE consultation with concern about where the mathematics weighting originates (specifically Biology)

2nd June 2015 – Ofqual release the 13th annual ‘Perceptions of A levels, GCSEs and Ofqual’ stating A levels are trusted and Ofqual is too close to government

2nd June 2015 – The four exam boards publish details of the Practical Assessment Criteria and school visits

8th June 2015 – Ofqual publish a consultation about assessing the practical skills in A level science

13th July 2015 – The IoP respond to the consultation on practical skills, specifically around maladministration, malpractice, and loss of Physics teachers as moderators in coursework

21st July 2015 – Ofqual publish the results of the practical skill consultation and updated requirements for science courses (some A levels are already accredited by this point)

6th August 2015 – Ofqual announce Stacey to leave in February 2016

September 2015 – New A levels (1st wave) begin to be taught

11th September 2015 – Ofqual release a series of documents explaining the reform process

29th January 2016 – Announcement of update information site about first teaching 2016 subjects


2nd February 2016 – ASE Science conference on Independent Expert Panels

24th March 2016 – AQA make some adjustments to the A level Physics based on feedback from teachers

Summer 2016 – 1st wave of reformed A levels have their AS examinations

Summer 2017 – 1st wave of reformed A levels have their A level examinations

Appendix 3: Example Documents


Rt Hon Michael Gove MP
 Secretary of State
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Clarey Stacey
 Chief Registrar
 Office of Qualifications and Examinations Regulation
 Spring Place
 Coventry Business Park
 Herald Avenue
 Coventry
 CV5 6UB

14/11 March 2013

Thank you for meeting Elizabeth Truss, Nigel Thrift and me on 4 March to discuss implementation of A level reform. The discussion followed my letter to you of 22 January, and I should be grateful if you would consider this letter alongside that one.

Both Elizabeth Truss and I acknowledge that the initial aim for reformed A levels to be ready for first teaching in September 2014 was ambitious. In recognition of the amount of work that will be required we have agreed that you should work on the basis of introducing new A levels for first teaching in 2015. When we met, I confirmed that our priority is to implement changes to A levels for first teaching in September 2015 in order to address the concerns that have been raised about the A level qualification and assessment structure.

We have been discussing which subjects should be included for September 2015. As we discussed, we would like Awarding Organisations to revise all the facilitating subjects except for languages, making these A levels linear qualifications with our assessment at the end of two years. Revising these subjects first aligns well with our timetable for GCSE reform. I would also like your advice on how many of the limited number of other subjects that are studied by a high number of students could also be reformed for 2015. I would like as many subjects as possible to be in place for first teaching by that date. It is essential that new A levels command the respect of leading universities: I would therefore expect that Awarding Organisations should draw on the expertise of university academics in making any necessary changes to curriculum content for these subjects. We will look to you to define how this requirement should be met by Awarding Organisations. The Russell Group will be setting up subject panels to advise on subject content in the facilitating subjects and as far as possible you will also want to draw upon these for advice once convened.

But are they linked?
 Many already do. Under HE.
 Does Gove know this?
 Was this happen?

Section 2
 What?
 Specific terms: Falsely through
 History of opportunity and why it is key to be aware

A letter about this meeting? Should I?

Reflecting the support you had during your consultation, the new linear A levels will have assessment that includes more open-ended and synoptic questions where appropriate for the subject. A levels in all subjects should eventually move to this linear structure.

The key educational argument for the AS qualification is that it provides students with the opportunity to study a broad range of subjects, which we know universities value in addition to a core A level programme. We are keen to preserve this breadth. As A levels become linear from 2015, the AS must be entirely decoupled to become a standalone qualification that is also linear. We should also clarify that an AS is a qualification in its own right, so performance in an AS will not count towards an A level. Any subject content changes made to the corresponding A level should be reflected in the design of the AS. You have advised me that you are not able to deliver more substantial changes to the AS for 2015. I remain committed to a reformed AS and we have agreed that the Department and Ofqual should continue to discuss the options for the longer term. I would also like you to keep the content and level of challenge of the AS under close review as part of your post-qualifications review process.

A highly significant change!
 This is not entirely true.

There is a critical task to make sure that new qualifications are reviewed each year so that they are supporting the rigorous and high quality education that is needed. It is right that Ofqual should lead this process, but I am pleased that the Russell Group has agreed to be involved. I am very keen for you to engage their advisory board and subject panels, once established, at the earliest possible stage in the post-examination review cycle.

Views AS as standalone but not what fully content must be engage.

By who? From the exam boards?

We also touched on A level mathematics and new core mathematics qualifications when we met. It will be important that the new core mathematics qualifications are valued and respected by universities and are able to be taught alongside reformed A levels. We also need to ensure that the mathematics A level is able to keep pace with wider developments, in particular the Cambridge University Maths Programme which involves world-leading mathematicians examining post-16 mathematics from first principles. I would be grateful for your advice on this and it would be extremely helpful if you could discuss this further with Elizabeth Truss. Her office will be in touch to arrange a meeting.

It will be important for Ofqual to set out the regulatory arrangements needed to secure standards in A levels and enable Awarding Organisations to take forward this work at pace. I understand the Ofqual Board is due to meet on 20 March and will discuss these arrangements. I look forward to hearing the outcome of this.

Littered with strong references of will and intent - Gove is asserting original very specifically
 -> Often remains of what was discussed in the meeting.
 -> Does not explain or explain views, or where source of his thoughts (derived from other's) originate
 -> Space/pace of reform + changes
 -> Priority subjects plan

Look for -> Response
 -> Letter in conjunction
 -> Origin of Gove's views
 -> What original ultimately do

MICHAEL GOVE

(Gove, 2013c)

Template for the Independent Chair's write-up of the final GCE subject review meetings

↳ what about other meetings?

The bulk of this form is to be completed by representatives from the awarding organisations. Shaded areas are to be completed by the independent Chair of the final review meetings.

Subject	Physics
Recommended category (1, 2 or 3) for consideration at the final subject review meeting	2
Agreed category (1, 2 or 3) at the end of the final subject review meeting	2

↳ Look to the source document for what these numbers mean.

Part 1: the process

How was this done?

Stages	Evidence from awarding organisations that the process has been followed	Chair's approval
1. Initial review, involving responses from teachers, HE and learned bodies (undertaken by each exam board independently, with learned bodies engaged jointly)	Each of the four awarding organisations undertook its own review and presented a summary report based on that to the scrutiny meeting. Each awarding organisation also took account of responses from learned societies to a request for evidence from JCQ. ↳ to this found anywhere? The sources of external evidence noted by each awarding organisation are as follows: ↳ Who? AQA: HE Expert Panel, SCORE, Institute of Physics, Ofqual, OECD, Association for Science Education, Pearson: External Stakeholder Advisory Committee, HEIs (by questionnaire), SCORE, Institute of Physics, Ofqual, 59 Club. ↳ who?	Yes

CII

	OCR: OCR Science Consultative Forum, OCR HE Forum, SCORE, Ofqual WJEC: HE Advisory Group, SCORE, Institute of Physics, Ofqual.	
2. Scrutiny meetings, involving subject specialists from each exam board (joint meetings, involving all four exam boards sharing responses)	A scrutiny meeting was held on 10 June 2013, with subject specialists from each of the four awarding organisations being present. A note of the scrutiny meeting, agreed by all participants, is available to the final review meeting. ↳ Find this	Yes
3. Final review meetings, led by the independent Chair (joint meetings, involving all four exam boards)	25/06/13.	Yes

↳ OCR has the least external evidence and nothing of the IoP

Part 2: the final recommendation for change

Consider the DfE's question: Do the current GCE subject criteria as exemplified by current qualification specifications, support the successful progression of individuals who have been awarded a GCE in a given subject to undergraduate study either in that subject or in a subject for which a GCE in the subject is a standards entry requirement? i.e. looking at current A Level subject criteria, is there anything that needs to change to enable awarding organisations to develop the qualifications that will meet HE needs, in accordance with the feedback gathered?

↳ Very clear that the goal is to use the A level as a step into University.

Content recommendations that require approval	Evidence gathered for recommendation	Chair's approval
Do aims and objectives need to change? If so, what change is needed? • a change to be made in the order in which the aims and objectives are listed, one being reworded to refer to practical, mathematical and problem-solving skills and	↳ From whom? ↳ The Chair? ↳ This was a report but this is clearly a formal statement A range of possible changes is suggested in the evidence, and there is consensus on the need to refer to the practical, mathematical and problem solving skills to be developed.	Yes

↳ Interesting ↳ was there not an emphasis on these types of skills before?

CIII

Why? Is this the same for other sciences?

associated with Physics but no longer is the A level about going into Physics

<p>remove reference to "how science works", and the reference to careers is changed to those "associated with the subject" rather than "in the subject".</p>		
<p>Does subject content need to change? If so, what change is needed?</p> <ul style="list-style-type: none"> The main changes include the addition, or making more explicit, of the following <ul style="list-style-type: none"> - Newton's laws of motion; - projectile motion; - principle of conservation of energy; - radian measure of angle and angular velocity; - mechanical properties of matter (stress, strain, energy stored); Young modulus, force-extension graphs) - charge curves; - interference; - electrical and gravitational potential and changes in potential energy. The only two elements of content proposed for deletion are (i) the qualitative treatment of free and forced vibrations, damping and resonance, because <u>these cannot be addressed satisfactorily without a quantitative treatment, which is not within scope</u>, and (ii) appreciation that $E=mc^2$ applies to all energy changes, as it is understood that <u>it has never been examined, and "appreciate" is not amenable to</u> <p><i>↳ All about the concept of examination but in terms of consideration of it being useful (in nuclear physics) or important?</i></p>	<p>A range of suggestions regarding additional content was considered, as detailed in the <u>report of the scrutiny meeting</u>. Several of the suggestions were considered to reflect the interests of individual HE teaching departments, and if the core is to <u>continue to represent 80%</u> of the overall specification content, then additions need to be restricted to topics on which there is a <u>high level of agreement</u>.</p> <p><i>↳ agreement between whom</i></p> <p>There were few specific suggestions for <u>content to be deleted</u>, and this selection is based on these topics not being able to be addressed satisfactorily at this level.</p> <p><i>↳ "addressed" sounds like taught well or sufficiently or in enough detail that it might be later on.</i></p>	<p>Yes</p> <p><i>↳ Interesting</i></p> <p><i>↳ Where is the report of the scrutiny meeting?</i></p>

What has changed within these areas?

↳ Within the scope of? How was it assessed before?

CIV

How is this being changed?

Show how this is supported by links to HE interviews

↳ Question

Strengthening the mathematical component is an idea but will it improve? Can HE institutions assist in the improvement of their students?

↳ Kathryn's statement about maths in Physics

Do I consider the potential waiting? → Logistics

↳ How is the Gatsby report reflected in the practical assessment changes?

↳ Yet this hasn't been the same uncertainty as HE Physics depts use

<p>assessment.</p> <ul style="list-style-type: none"> The main changes in relation to the mathematical requirements, as indicated in <u>Annexe 8</u> are: <ul style="list-style-type: none"> - identifying uncertainties in measurement and the use of simple techniques to determine uncertainty when data are combined; - changing the subject of non-linear equations - solving quadratic equations - distinguishing between instantaneous and average rate of change - solving equations involving rates of change - interpreting logarithmic plots - use of small angle approximations. In relation to the modifications currently proposed, it is suggested that these should be reviewed in parallel with the process of finalising the proposals for GCSE reform. In relation to practical work, a summary of requirements could be drawn up along the lines of Annexe 8 for mathematical requirements, drawing on evidence which includes the report commissioned by the Gatsby foundation: "Improving the assessment of practical work in school science" (Reiss, Abrahams and Sharpe, October 2012). 	<p>There is extensive evidence from HEIs and from SCORE regarding the need to strengthen the mathematical requirements.</p> <p>Proposals for reforms to GCSE Science and Mathematics are currently under consultation. Account will need to be taken of the final form of these, although the first and second cohorts for the reformed A Levels will be progressing from current GCSEs.</p> <p>The Gatsby report is considered to be one of the most helpful recent reviews that provide detailed suggestions in relation to practical work.</p>	
<p>The rationale for awarding the category rating (1, 2 or 3) given at the top of the form</p>	<p>2 – although there are numerous suggested changes to be made to the criteria, there is a considerable degree of agreement and the changes are not difficult to implement.</p>	<p>Yes</p>

CV

(Smith, 2013)

Also, Ministers have concerns about some aspects of current A levels. We are not accountable to Ministers. But A levels are a major influence on the wider education system, for which Ministers have responsibility. So when Ministers asked us, as they did eighteen months ago, to make sure that A levels are clearly owned by universities, then we have a duty to listen to that and think about how we can respond. No doubt Anna will talk more today about Ministers' thinking.

Wow!

I should say too that A levels are used across England, Wales and Northern Ireland, but we are the regulator only for England. So we are consulting only on A levels in England. We have yet to see how Ministers and our fellow regulators in Wales and Northern Ireland wish to go forward with A levels. We shall be discussing that with them.

Framing →

To prepare for the consultation, we have carried out and published two major pieces of research. One, conducted by MORI, on the views of universities, teachers and employers in England. And one comparing A levels to similar qualifications taken in other countries. This showed that A levels stack up well. I encourage you to read both. We have used this research to help inform our thinking about the proposals we have put forward.

So why change? →

Let me talk through the issues and proposals that are covered by our consultation.

First, we are proposing a set of purposes for A levels. The MORI research tells us that there is a lack of consensus on what A levels are for. And that creates confusion when A levels are being designed and evaluated. So we have proposed some purposes for A levels, and we are very keen to hear views.

We have proposed three primary purposes for A levels:

- first, that they define and assess achievement of the knowledge, skills and understanding which will be needed for students planning to go to university. For some university courses, for example science courses, students need to have a good grounding of subject knowledge and understanding in order to start the course. A levels need to provide that;
- second, A levels should set out a robust and internationally comparable post-16 academic course of study. There is no National Curriculum post 16. Whatever their course, what students study will be largely defined by the qualifications they are preparing for. We think we should recognise this for A levels;
- and third, to allow universities to accurately identify the level of attainment of students, particularly for the most competitive courses.

We propose two secondary purposes, too – around school and college accountability and allowing employers to assess academic ability.

(Stacey, 2012)

Appendix 4: Ethical Approval



Downloaded: 28/11/2018
Approved: 05/02/2015

Christopher Ince
Registration number: 110127842
School of Education
Programme: EdD Educational Studies

Dear Christopher

PROJECT TITLE: A level Physics Reform: the rhetoric and the reality
APPLICATION: Reference Number 002581

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 05/02/2015 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 002581 (dated 07/01/2015).
- Participant information sheet 004437 version 1 (07/01/2015).
- Participant consent form 004438 version 1 (07/01/2015).

If during the course of the project you need to [deviate significantly from the above-approved documentation](#) please inform me since written approval will be required.

Yours sincerely

David Hyatt
Ethics Administrator
School of Education

Appendix 6: Interview and Focus Group Schedules

Interview Schedule (for HE)

HE Interviews

HE experience / View of incoming students

- What skills, qualities, or knowledge do you expect in your 1st year students?
- If you had to prioritise, what is the most crucial thing that students need?
- What are the biggest challenges that you experience in students at a HE level (with a potential focus on the transition from FE to HE)?
- If extra support is needed what form does this take? Is it individual for the student, assisted by a member of staff or tutorial, done cohort wide?
- What are your thoughts on these as a lecturer, member of staff, and/or someone who works in outreach?
 - University of Bristol in the Journal of Physics education asked the same questions in their 1st semester over the course of 35 years and noted that while A level grades increased student performance on these questions decreased.
 - Peter Main, Director of Education at the IoP, highlighting the shift in exam style from older O-level Physics papers to those currently used shows a similar knowledge assessment but requires less thorough understanding.
 - In 2008 David Mowbray worked with LeTS on a review of the 1st year curriculum due to “an increase in student numbers and the physics knowledge base of first years being narrower”.

Contemporary issues in Physics education

- What would you identify as the current issues/problem areas?
- Discuss:
 - Most A level Physics students don't go into Physics (but do go into related fields)
 - Demographics:
 - Gender disparity (with a slight decrease at every level)
 - Socioeconomic status
 - Ethnicity
 - Cohort size
 - FE to HE transition (knowledge and/or skills)
 - What students learn (literacy and mathematics at degree level)
 - Academic appointments (appointment of academic staff from the UK continuing to fall)
 - Graduate opportunities (the destinations of Physics graduates)
 - Specialist Physics teachers in schools

- Student perceptions of Physics (what is Physics, how do they relate)
- Are there any we haven't discussed missed out?
- What are your experiences of any of these?
- Should we, should I, should you do anything about these?
- What could we, could I, could you do about these?
- How are such things tackled at a department level or individual/outreach level?

FE reforms

- What do you think should be taught (skills or knowledge wise) at FE?
- To what extent are you aware of the reforms?
 - Mathematics
 - Content
 - Assessment
 - Practical work
 - Coursework
- To what extent do you think such reforms will tackle any of the issues highlighted?
- What did you take into consideration when designing the SUPER project for Y10 and Y12 students (or other transition work)?
 - The French response to explanaet/Salsa)
 - Based on the level of task that you asked them to do, could we be doing more in schools?
- Unlike other subjects, Physics knowledge is rarely removed from the curriculum and often slides down, resulting in superposition of waves now being taught to all KS3 pupils but not GCSE, what are your thoughts on this? Are there some areas that should be prioritised or is it best to stay as broad as possible?

Other questions / discussion areas

- Based on the curriculum reforms who is 'in charge' of what Physics knowledge is being taught – Ofqual, the exam boards, teachers? Who should have 'power' of this knowledge and decide what should be taught?
- Amidst lots of reports, articles, and anecdotes Physics seemingly gives the impression (to some people) of, and is painted as (by a few people), a male-dominated hegemony. What are your feelings about such a picture? Is there any truth in it? Is it solely social pressures, a quirk that the subject doesn't appeal to some people, or have you felt/know of/experienced this?

Semi Structured Interview Questions

What things went through your mind when you were choosing your potential A level options?

Did you consider studying Physics at any point (if not why not – are you doing other sciences)?

Have any of your experiences in school made you consider Physics in either a positive or negative light?

Prompt to say that it's not just about the teacher but also things like the course content, teaching style, amount (lack) of practical work compared to other sciences, teaching time.

Why do you think some groups of students (rather than individuals) don't pursue Physics?

Some research by the Institute of Physics suggests that students choose Physics on three factors:

- How you see yourself in relation to Physics, do you value it, engage in it, feel that you can do it
- How you experience Physics in other forms, at home, in the media,
- Your relationship with your Physics/Science teachers

What do you think of their suggestions? Are there any that you agree or disagree with?

Y11 Transcript

In this research I'm looking at A level Physics. Over the past few years there have been many reforms and these changes have been made for many reasons that the government has put forwards.

What I'm doing is actually looking at what are the problems that we have within Physics and do any of these changes help to solve them. So, we might look through a number of these changes and what's in the Physics A level at the moment.

Now obviously you, at the moment, are not doing the Physics A level. You're just coming to the end of your GCSE however it's quite important because you've gone through a process of deciding whether or not you were going to study Physics or not. So your perception of Physics is quite important because if I only ask the A level students who have chosen Physics then they have a very different skew on it. Obviously we do have to accept some kind of bias, you are all dedicated students who are nice enough to stay behind so clearly you actually are a little bit interested but that's slightly out of the scope of today.

So, we start with the question that's really at the top of there *refers to sheet

What kind of things go through your mind, or went through your mind when you were choosing an A level option, it doesn't have to be Physics or another science. When you were first thinking about your A level subject choices what different things did you think about?

C [redacted] - I looked whether it was convenient

- Did it fit with other subjects

Consideration of university in 411

A [redacted] - I looked whether I could do it or not and whether I could do it at uni *

The university aspect is an interesting one with the majority of Physics A level students going on to university in some form.

F [redacted] - I think it's the relevance to what you're going to want to study, like in the future, and what you want to do as a job but I chose as well things that I would enjoy and I didn't want to pressure myself.

- Judge it to be difficult

How does it link to different careers *

C [redacted] - I based it on things I enjoy. Because, I dunno like, with a lot of subjects that we have now, if I don't enjoy I then I'm just not going to do it. So, like, I had to base it on something that, like, I would like doing or I would just get bored of it.

That's a perfectly fair comment

Enjoyment

A [redacted] - Yeah, I chose, like, enjoyment over anything else really because if you don't enjoy it then you're not really going to work at it.

I [redacted] - Out of all of the teachers we didn't write anything so I couldn't, I just couldn't understand it.

J [redacted] - It's better than English though

D [redacted] - Yeah, she just wants to get rid of me

F [redacted] - But it's...I used to have like one of my favourite subjects and then I changed teachers and it just became awful, my work, I just hated it

G [redacted] - I think the content affected my interested because, like, you know, P1 and P7 where it's all stars and that in't it. Like, I think that's right interesting but then Sankey diagrams and like...

C [redacted] - Gah, I hate Sankey diagrams

G [redacted] - didn't really click

C [redacted] - I HATE Sankey diagrams, I was talking about this yesterday, I hate them though.

GCSE content can be off putting

Really off putting

Why? Usefulness not clear?

There's a section later where we can talk about what you liked and disliked about Physics and where we're going to discuss content to be removed. But that's one of the interesting things, seeing if you can identify the things that you liked and disliked and if it matches.

D [redacted] - **Whispers** With some of it though, you just get bored.

D [redacted]

D [redacted] - I was just saying, and it's the same with Chemistry as well, I don't care...it doesn't matter which subject it's in, any teacher will say that Physics and Chemistry they're both really good subjects and it's just generally well respected.

That's a very good point.

Perceptions

F [redacted] - It's true

*Many others also signal their agreement by talking all over each other

E [redacted] - I just like that when you have conversations about Physics it's really difficult *

*They still talk over each other

E [redacted] - Whereas in Physics GCSE classes you just... *inaudible

I [redacted] - But then in languages and classical subjects they do recognise

*General hubbub. Talk of Further Maths and languages as difficult subjects and who is doing what.

E [redacted] - I don't care, maths is easy, that's why I'm doing it

- Mathematical aspect
↳ not all find it hard

Ok there are a couple of people talking over others and that's sort of fine but it makes it a little difficult to keep track of.

G [redacted] - Sorry

B [redacted] There's things like Physics and Maths and Languages that always look good at university and that no matter what you want to study

*
Thinking of it as
a facilitating subject

So lots of you think about looking good on future forms?

*General assent

C [redacted] - I do that all the time though, I'm just harsh

*laughter

F [redacted] - That's not...

B [redacted] - Write that down sir...

D [redacted] - Sometimes I just think 'What? You can't do science?'

A [redacted] - I think it's really interesting in lessons when you, like, you apply, like, a pretty, like, basic theories and how stuff works, like, the Doppler effect which is just an ambulance just going by. When it gives you an insight into everyday life you look at things a bit differently and it's, like, really interesting.

Physics in
everyday
life

E [redacted] - That's a good point

B [redacted] - You see when an ambulance passes me that's not what I think about.

*Laughter and some agreement

B [redacted] - Yeah, it's like 'Where's that going?', 'Who's dead?' But, you know, not the Doppler effect.

J [redacted] - Someone's dead?

B [redacted] - Or ill

H [redacted] - But you don't notice the pitch changing?

A [redacted] - I dunno