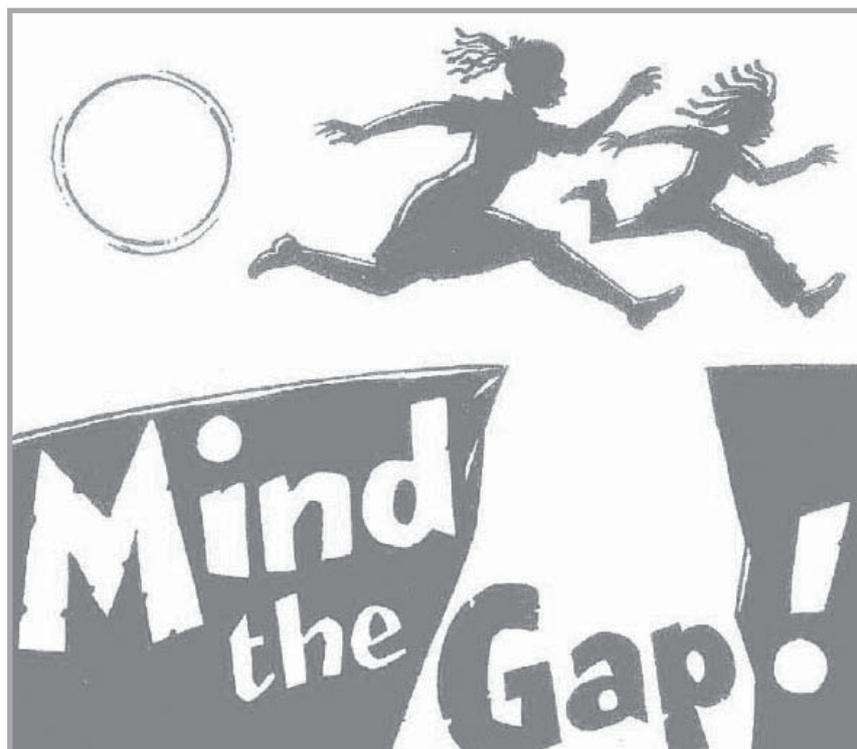


# Technical Report

21 October 2013

## Developing and Evaluating the First Phase of the Grade 12 *Mind the Gap* Study Guide Series



basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

© Technical Report: Developing and Evaluating the Grade 12 *Mind the Gap* Study Guide Series

ISBN: 978-1-4315-1869-2

21 October, 2013

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## Executive Summary

This report presents the processes of materials development and the results of an impact evaluation of the *Mind The Gap* study guide series in 2012 in South Africa. Phase one of this intervention produced study guides for Accounting, Economics, Geography and Life Sciences in two languages (English and Afrikaans). This intervention is an innovative attempt by the Department of Basic Education to improve the academic performance of Grade 12 candidates in the National Senior Certificate examination. The *Mind the Gap* series identifies the core knowledge and skills that learners need to pass and addresses the concepts that are most frequently incorrect, by means of an analysis of learners' examination responses, as captured in the examiners' Diagnostic Report on Learner Performance (2011). The *Mind the Gap* study guide series is designed to assist those learners who have been underperforming due to the lack of exposure to the content requirements of the curriculum. The series aims to 'Mind the Gap' between failing and passing, by bridging-the-gap in learners' understanding of core subject knowledge. The 'gap', therefore, refers to the typical errors produced in a subject which prevent learners from making progress.

All texts are shaped by social conditions that inform the processes of production. For *Mind the Gap* this involved finding ways of departing from ordinary publishing processes and production cycles in the interests of time: the team only had four months to originate, produce, print and distribute the four subject study guides in two languages. It is argued that the re-engineering of the materials development processes of production proved to be significant and created the conditions for ordinary innovation to flourish.

In sum, the *Mind the Gap* approach to ordinary innovation in education (Watson *et al.* 2013) provides four primary lenses: equality, respect, receptivity and creativity. These four components were simultaneously held in dialogic space and supported by the ten behaviours of a thinking environment, which in turn propelled the *Mind the Gap* writers to respect each others' expertise and to reach the limits of their own knowing both individually and as a group. In this sense, they allowed the social practices of ordinary innovation to disrupt their assumptions and prepare them to be receptive to the knowledge of their peers (referred to as expert readers), including teachers who understood the social conditions contributing toward learners' weak performance. The expert readers brought their own knowledge: discursive, tacit and affective to bear on the revisions they proposed be made to the first draft of each of the manuscripts. The content writers were then better able to creatively reformulate their understanding of what constitutes core knowledge and skills in succinct, explicit and clear ways for learners to more easily absorb. The representation of the writers ideas was also creatively supported by the aesthetic know-how of the production team. A visual depiction of the components of ordinary innovation and the premises informing the theory of change underpinning the materials development processes and the impact evaluation are presented in a composite diagram below.

Diagram 1: *Mind the Gap*: An example of ordinary innovation in education

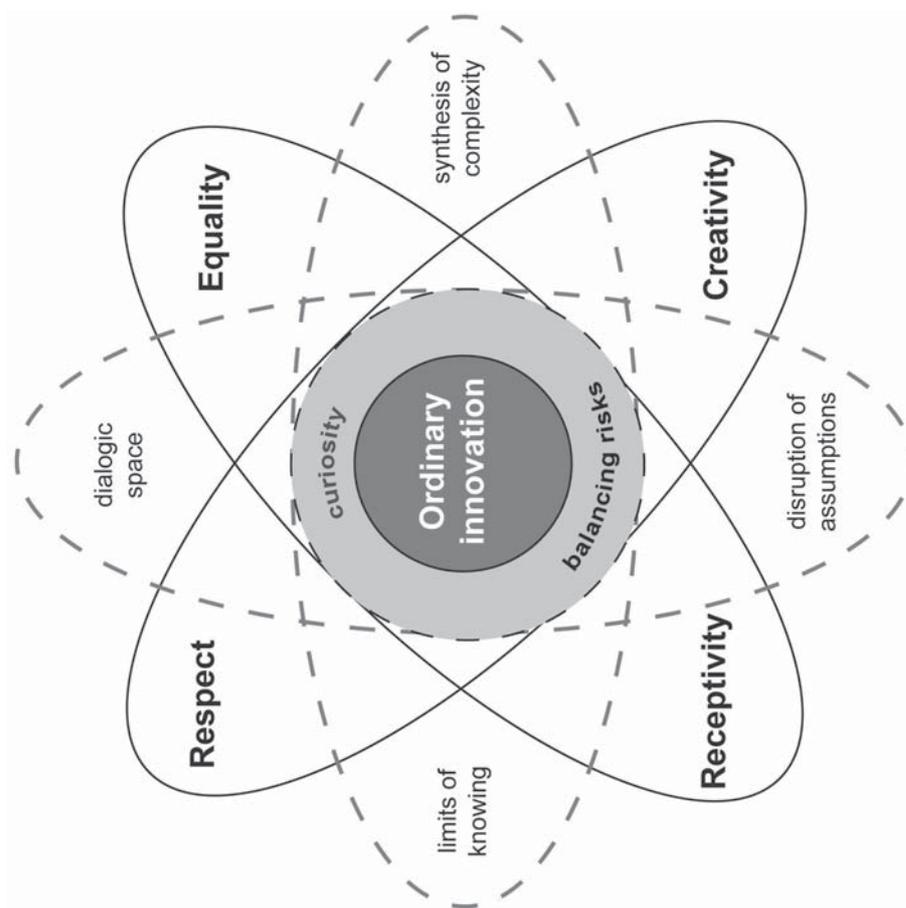
## ***Mind the Gap:*** **An Example of Ordinary Innovation in Education**

### **Theory of Change informing the materials development process**

1. Diagnostic assessments of learner performance.
2. Synchronistic processes of all knowledge workers – writing, designing, editing and illustration.
3. Heterogeneous groups of professionals with specialist knowledge and experience collaborate to produce and synthesise core knowledge in a dialogic space and in concentrated time frames.
4. Expert readers draw on their expertise and experience to revise the study guides; content writers acknowledge the limits of their knowing and are receptive to input from subject-peers.
5. Content writers and production team creatively collaborate to articulate and present accessible core knowledge and skills to learners.
6. Afrikaans translators of the guides are able to competently avoid losing meaning and mediation in their reception of adaptation processes.
7. The study guides are self-study, stand alone support for under-performing learners; and can be accessed from direct distribution through schools and / or downloaded from the national department's website: <http://www.education.gov.za>.
8. The impact evaluation of the study guides using a randomised experiment informs our understanding of the materials as a resource for improving learner performance.

### **Theory of Change informing the impact evaluation**

1. A cost-effective randomised control trial design can establish a reliable sample set to estimate the causal impact of the *Mind the Gap* study guides.
2. The *Mind the Gap* study guides are delivered to schools.
3. School managers distribute *Mind the Gap* study guides to learners.
4. Learners use *Mind the Gap* study guides to prepare for the Grade 12 National Senior Certificate exams.
5. The examinations for the four subjects Accounting, Economics, Geography and Life Sciences are well designed.
6. The learners' core knowledge and skills are increased by the *Mind the Gap* study guides as is reflected in their writing of their examinations.
7. The impact of the *Mind the Gap* study guides is demonstrated in learners' results from the National Senior Certificate examinations.
8. The results of the impact evaluation inform the systemic planning of interventions designed to improve learner performance.



The *Mind The Gap* study guides were developed during 2012 and were therefore not physically distributed to all schools in the country. The province of Mpumalanga could therefore be used to conduct a randomised control trial in which 79 schools received *Mind The Gap* study guides based on a computerised lottery, leaving a control group of 239 schools. Each school selected for the intervention group received the guides for four subjects: Accounting, Economics, Geography and Life Sciences.

This randomisation design allows one to estimate the causal impact of the *Mind The Gap* study guides in each subject. While the primary interest in this experiment was to evaluate the impact of this new government programme, it also has bearing on several other interesting research questions. Can a relatively cheap support material that is not mediated by a teacher improve performance in the NSC exam? Is the impact of study guides the same across subjects? Can we identify who benefits most from such an intervention?

The main findings of the study can be summarised as follows. The *Mind The Gap* study guides had a clear positive impact on performance in Geography and Life Sciences. There was, however, no observable impact on Accounting and Economics performance. Various reasons may exist for this result: the existence of other available material may differ across subjects and this may determine the impact of new materials; alternatively, it is possible that certain types of learning can be enhanced in a short space of time through the use of a study guide but that other types of learning are less responsive to a short intense treatment. There was some evidence, mainly in the case of Geography, that the impact was lower amongst seriously underperforming schools.

Improvements in Geography and Life Sciences achievement led to an increased probability of attaining a National Senior Certificate. The expected impact of distributing *Mind The Gap* at scale on the national matric pass rate is estimated. A simulation using matric 2010 data indicated that 5 609 children who did not pass matric in 2010 would have passed matric had the Geography and Life Sciences study guides been distributed nationally. This is a substantial impact given the low cost of this intervention compared with many of the other education programmes that operate in our schools.

In an environment where monitoring and evaluation is often conceived of rather carelessly it is important to emphasize that this was a rigorous impact evaluation where the design made it possible to accurately demonstrate the causal impact of the intervention on learning outcomes, something that is extremely rare. This study employs one of a variety of impact evaluation methods that can and should be used to evaluate DBE programmes in the future. Two things are required for measuring the causal impact of a programme:

1. A way to identify who received the programme and who can be used as comparable non-recipients;
2. An outcome measure such as a test score with which to measure the impact.

Sometimes one needs to collect new outcome measures but it may often be possible to use National Senior Certificate data or the Annual National Assessment data without any additional cost. Random allocation of an intervention during the piloting phase solves the first requirement in the best way making it easy to know who received the intervention and that the comparison group is truly comparable. However, even if not randomly allocated, keeping a clear record of who received interventions and when they received such interventions can be valuable for the purposes of conducting an impact evaluation.

Through a shared commitment to providing an evidence base for policy interventions, Dr Granville Whittle (the Programme Chief Director), Dr Patricia Watson (Director of *Mind The Gap* materials development), and the assessment, curriculum and classroom-based professionals with subject experience from provinces, districts and schools and Dr Stephen Taylor (Evaluation expert) collaborated to make the innovative materials development process and the impact evaluation of *Mind The Gap* possible.

This system-wide collaborative project is an example of how materials production processes can inform our understanding of ordinary innovation in education; and how the impact of the learning materials can be measured. Through the correct sequencing of programme roll-out a credible impact evaluation can often be achieved at a low cost relative to the overall programme cost. The unit cost per study guide (reflecting material development, printing and distribution) is estimated to be R41,82. A cost-benefit analysis was undertaken by calculating the size of the impact on learner achievement per \$100 spent and comparing this figure to other educational interventions from around the world that have been tested using randomised control trials. *Mind The Gap* turned out to be amongst the top five cost-effective interventions out of 15 that were considered.

The primary conclusion of this report is that the *Mind The Gap* programme can be expected to significantly impact on the performance of matric candidates going forward. The fact that two study guides did improve performance in Mpumalanga provides solid evidence that the innovative materials development process can accomplish its intended purposes. The impact evaluation thus provides a clear policy warrant for expanding the *Mind The Gap* intervention to scale, so that in 2013 all candidates registered for the four *Mind the Gap* subjects in all provinces receive the study guides. This finding also supports the ongoing development of more subjects. In 2013 the department has committed to the development of *Mind the Gap* study guides for Grade 12 aligned with the Curriculum and Assessment Policy Statements for English First Additional Language, Mathematical Literacy, Mathematics and Physical Science. There is also a commitment to CAPS-align the phase one titles and explore ways to support learner collaboration and the development of teachers' core subject knowledge. These *Mind the Gap* titles will be ready for uptake in the first quarter of 2014.

## Introduction to the *Mind the Gap* Programme's Technical Report Parts One and Two

Although South Africa is in the nineteenth year of its democratic dispensation, addressing the effects of an apartheid education system, fragmented along racial and ethnic lines and unequally resourced, is proving to be a lengthy and challenging process.

In the years since the first democratic elections in 1994, there have been major policy changes in education which can be divided into three broad phases: initial policy formulation; implementation of policy; revision or reformulation of policy in order to address problems identified during implementation. Despite important policy changes and significant national investment in education, the results of schooling are still unequal across the system.

The *Mind the Gap* programme was conceived in 2012 by the national Department of Basic Education and included two key interventions. The first was the materials development, printing and distribution of Grade 12 study guides in four subjects and two languages. The second was the monitoring of the delivery of the study guides and the evaluation of their impact using a randomised control trial to measure their effectiveness. The programme measured whether or not it is possible for study guides to have a positive impact on learner performance, without influencing instructional or institutional practices.

The aim of the *Mind the Gap* study guides was to improve the academic performance of 'at risk' Grade 12 candidates in the National Senior Certificate examinations. In particular, the study guides were intended for uptake in 2012 in Limpopo and Eastern Cape, as both of these provinces were under the administration of the national Department of Basic Education. The senior management of the national department recognised that these two provinces were potentially at risk of contributing to an increased bottleneck in Grade 12 in 2013 (if an inadequate number of learners failed to pass their final Grade 12 examinations in 2012). Contributing to the crisis in particular in 2012, in Limpopo was the delay of textbook provisioning as a result of provincial maladministration; and the delays experienced by the Eastern Cape in filling vacant teaching posts.

This report contributes to the formulation of a policy brief intended to inform systemic planning in education. The report concludes by proposing a way forward for the *Mind the Gap* programme and more generally for teacher training and development.

## **1. PART ONE:**

# **The Materials Development of the *Mind the Gap* Study Guides: an Example of Ordinary Innovation in Education**

## **1.1 Introduction to Part One**

In the first phase of the *Mind the Gap* programme in 2012, the study guides were developed for four subjects: Accounting, Economics, Geography and Life Sciences and in two languages (English and Afrikaans). It was decided not to focus on Physical Science and Mathematics as these two subjects have been the focus of both government, social corporate investment and non-governmental organisations' interventions for approximately ten years and it was assumed that through the Dinaledi Programme an extensive range of learning programmes and study materials already exist. Further, while many commercially published study guides aim to enrich and extend core content so that learners will be equipped to score high marks in examinations, *Mind the Gap* focuses on the content required to achieve a pass.

The *Mind the Gap* study guides are designed as self-study materials for learners who speak English as an additional language, thus attention is paid to mediating both specialist subject language and language in general throughout the study guides. The developers also focused on assisting learners who have been underperforming due to the lack of exposure to the content requirements of the curriculum for a particular subject. Underperformance in Grade 12 is accumulated minimally in the last three years of schooling from Grades 10 and 11 to Grade 12. It was therefore important to identify the specific concepts and skills that learners most frequently get incorrect, by means of an analysis of learner responses to examinations, as captured in the National Diagnostic Report on Learner Performance in the National Senior Certificate examinations. Thus the study guide series aims to 'mind the gap' between failing and passing, by providing support that should enable learners to understand commonly-assessed core knowledge and skills. The 'gap', in this instance, refers to the knowledge and skills gap which prevents learners from making progress in a particular Grade 12 subject and which also prevents them from performing adequately in the National Senior Certificate examination.

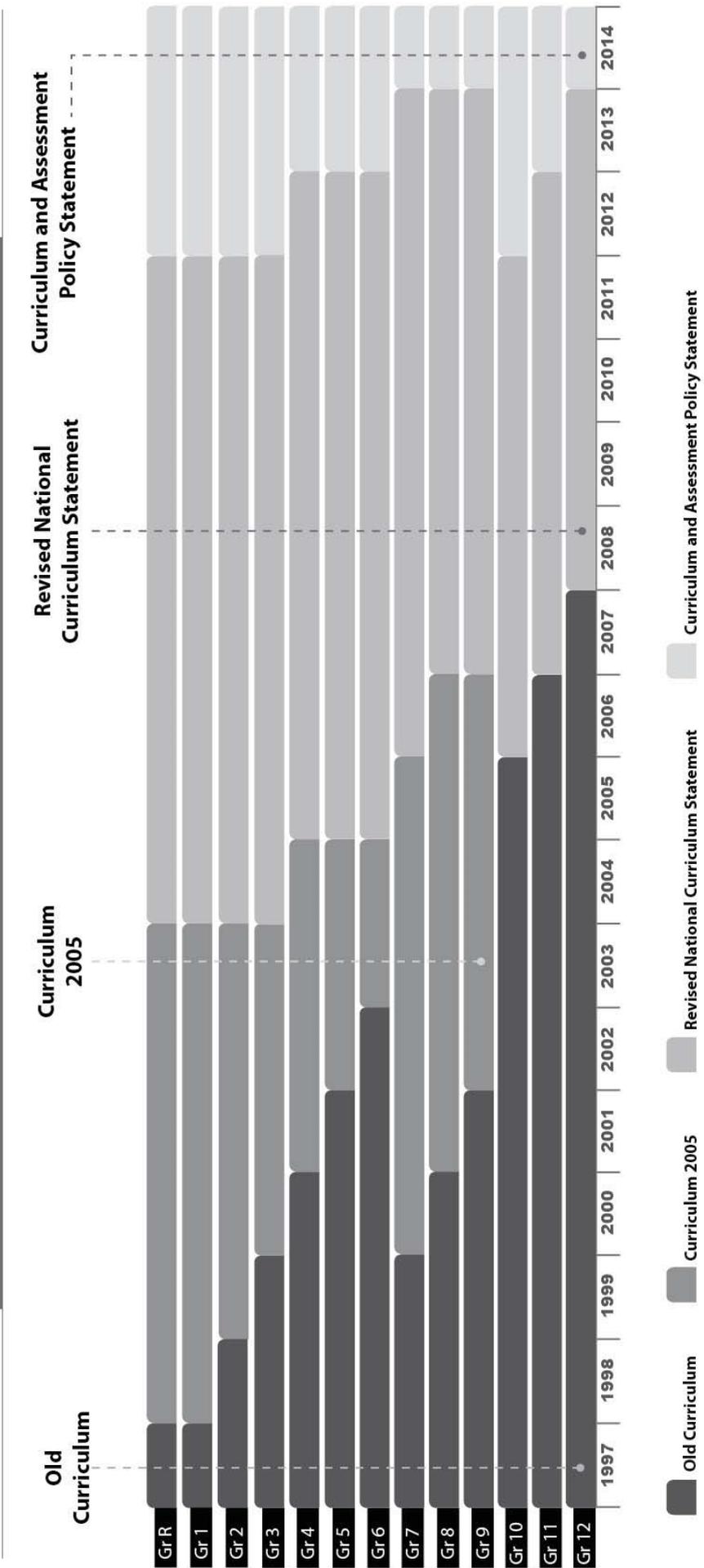
## **1.2 The Context of Curriculum, Assessment and Publishing**

It is significant that the *Mind the Gap* programme was conceptualised and implemented in 2012, because it is the learners enrolled for Grade 12 in the period 2012 to 2014 who have experienced a particularly complex curriculum history since they began schooling in Grade 1. The following graphs (prepared by Gustafsson, 2012) provide a representation of the three waves of curriculum change that have occurred in South Africa since 1997 as a result of official policy. Graph 1 indicates which curriculum regulations applied in particular grades in particular years. Graph 2 (1997 to 2013) and Graph 3 (2003 to 2019) elaborate on the information in the first graph by indicating the history of curriculum regulations that different groups of learners would have experienced to date and are still going to experience up to 2019.

# An overview of the three waves of curriculum change in South Africa

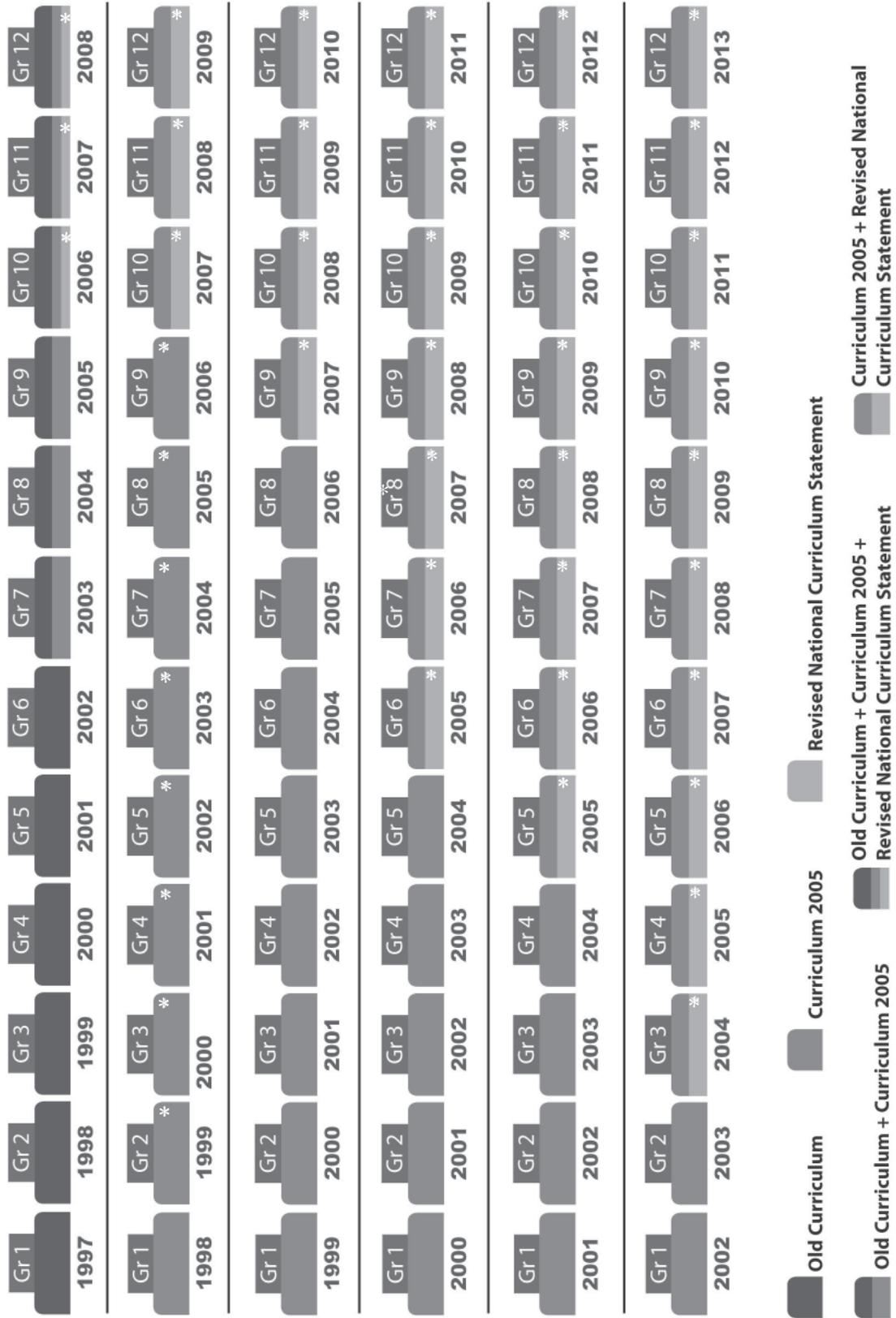
(October 2012)

**Graph 1: Curriculum rules applied in particular grades in particular years**



## Graph 2: Histories of curriculum experiences per learner/cohort from 1997 to 2013

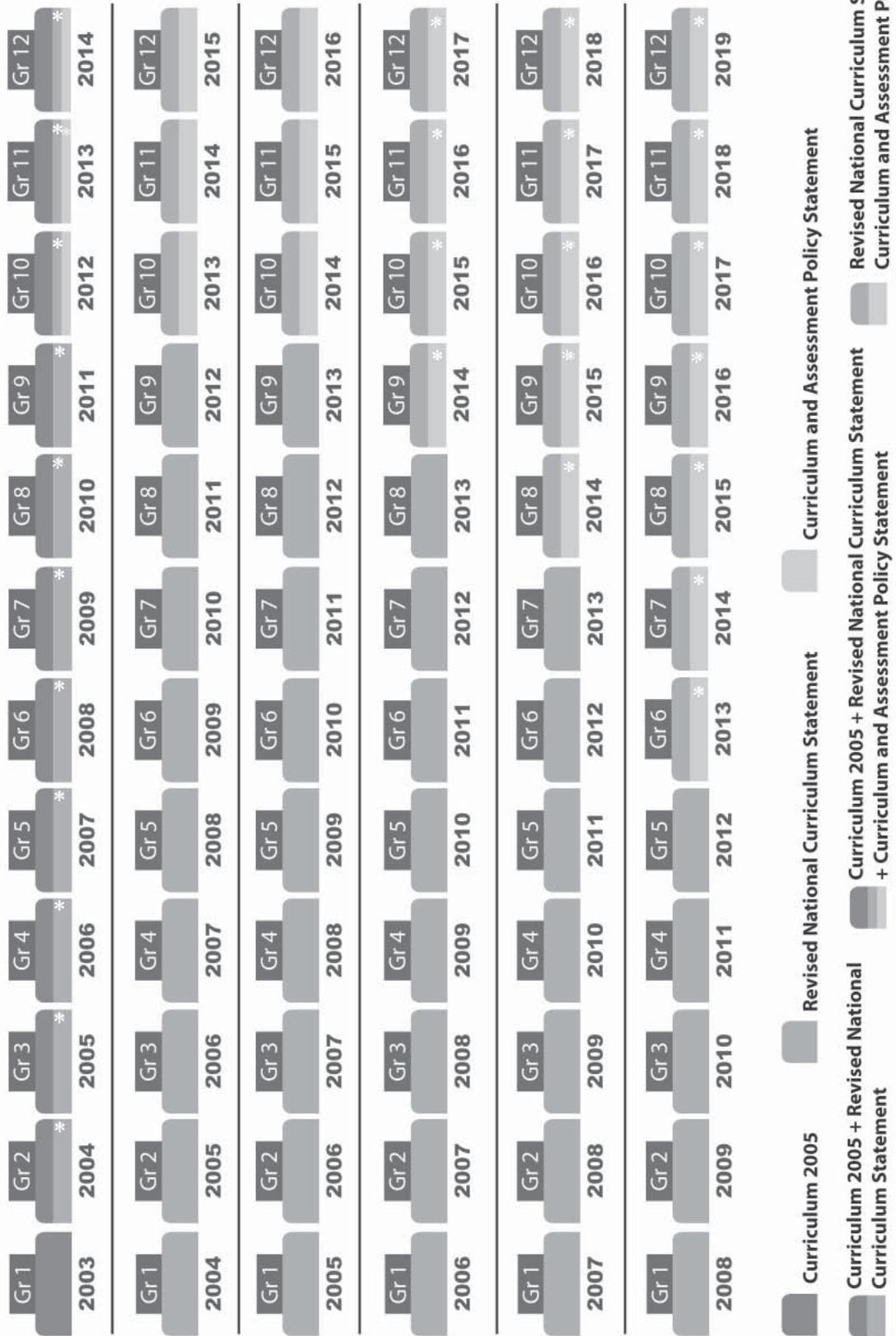
This tracks history of curriculum rules different groups of learners/cohorts would have experienced, from the start of Grade 1, in a particular year, up to Grade 12 from 1997 - 2013



\* The asterisk indicates a cohort's experience of a new curriculum when it had just been introduced

# Graph 3: Histories of curriculum experiences per learner/cohort from 2003 to 2019

This tracks history of curriculum rules different groups of learners/cohorts would have experienced, from the start of Grade 1, in a particular year, up to Grade 12 from 2003 to 2019



\* The asterisk indicates a cohort's experience of a new curriculum when it had just been introduced

The South African schooling system places much emphasis on the the National Senior Certificate examination at the end of Grade 12, also known as the final matric examinations. Those passing this examination attain a 'National Senior Certificate' and those meeting certain higher level requirements obtain a 'Bachelors Pass' which qualifies one for entrance into university. The study guides target learners who just fall short of passing matric. In this sense, 'mind the gap' refers to the potential of such learners to transition from being a scholar to pursuing life post schooling. The *Mind the Gap* programme did not set out to have an impact on the performance of those learners aiming to further their studies at institutions of higher learning, however, the impact assessment shows that this was an unexpected consequence of this intervention.

Ordinarily, commercial publishers and not-for-profit publication units in educational institutions usually commission one or more authors with expertise in both subject knowledge and pedagogy to write curriculum material (e.g. a textbook) and suggest artwork. Contracts between authors and commercial publishers usually stipulate that authors will receive a royalty payment based on either the nett or gross price of the publication. Academics working in educational institutions (particularly those that specialise in distance learning) are expected to produce materials as part of their existing workload. It is common for several months to be allocated for the drafting of the material and iterations of the manuscript are informed by editorial feedback that is usually exchanged electronically between the author/s and their content editors.

Since the introduction of Curriculum 2005, commercial publishing processes and practices have had to be accelerated in order to keep pace with the three waves of curriculum implementation in the country, and authors and production teams have had to compress their efforts into ever tighter time-frames. Once the author/s finalises the manuscript it is handed over to a production team where editing takes place, the artwork brief is commissioned and responded to, picture researcher/s source photographic and archival sources, and a designer prepares a 'look and feel' for the layout of the manuscript. The edited manuscript is set according to the design template and on average three or four iterations known as 'proofs' are edited before the manuscript is print-ready and sent for duplication and distribution. This linear, time-bound publishing cycle can take anything from six months to two years. Printing often takes place offshore and distribution cycles are planned at least eight months in advance of end-user requirements.

All texts are shaped by the processes of their production and by the social conditions which influence these processes (Fairclough, 1989: 25). The *Mind the Gap* project had to respond to the contextual factors described above. This began with finding ways of departing from ordinary publishing cycles in the interests of time: the team only had four months to originate, produce, print and distribute the four subject study guides in two languages. It is argued that the re-engineering of the materials development processes of production proved to be significant and created the conditions for ordinary innovation to flourish.

## 1.3 The Materials Development Process and its Theory of Change

The four *Mind the Gap* study guides were written during two residential workshops, each three and a half days in duration (running from Thursday night to Sunday night) in a period of three weeks in the month of June 2012. After the first writing weekend the manuscripts were shared with expert readers who were given a week to comment on the first draft manuscripts and their feedback was incorporated in the second writing weekend. This residential approach to generating the manuscripts saved a lot of time. The residential workshops also included all the production team roleplayers. The premises informing the theory of change underpinning the *Mind the Gap* materials development processes are articulated below in order of contingent dependency:

1. Diagnostic assessments of learner performance; examiner guidelines; and past examination papers are available at the outset.
2. Synchronistic processes involving all the knowledge workers: writers, expert readers, illustrators, picture researchers, editors, designers and programme administrators cohere through the facilitation of the content aggregator.
3. Professionals with specialist subject knowledge and system-wide experiences collaborate to produce, revise and synthesise core knowledge and skills in a dialogic space and in concentrated time frames.
4. Expert readers are able to draw on their discursive, tacit and affective expertise and experiences to revise the study guides and content writers are able to acknowledge the limits of their own knowing and be receptive to the input from their subject-peers.
5. The content writers and production team are able to creatively collaborate and synthesise complexity so that the articulation and representation of core knowledge and skills is accessible to the learners.
6. The translators of the Afrikaans versions of the study guides are able to competently avoid losing meaning and mediation in their receptive processes of adaptation.
7. The *Mind the Gap* books provide self-study, stand alone support for underperforming learners preparing for the exams as they are able to access the study guides through direct distribution to schools and/or download PDF versions from the national department's website: <http://www.education.gov.za>.
8. The impact evaluation of the *Mind the Gap* study guides using a randomised experiment informs our understanding of materials as a resource for the improvement of learner performance.

These contingent premises of change cohered through the components of ordinary innovation in education (Watson *et al*, 2013) as these components are made relevant through the re-engineering of the processes of producing the study guides.

## 1.4 The Components of Ordinary Innovation in Education

The word ‘innovation’ comes from the Latin, *innovatus*, meaning renewal or change; while the adjective, ‘ordinary’ means to have no distinctive features, being decidedly normal. A particularly ordinary characteristic of human innovation across time, from the stone tool to the Silicon chip, is curiosity – a strong desire to know or learn something. The knowledge workers involved in developing the *Mind the Gap* guides were a particularly heterogenous group comprised of teachers, examiners, curriculum officials and academics with discipline expertise in each of the four subjects.

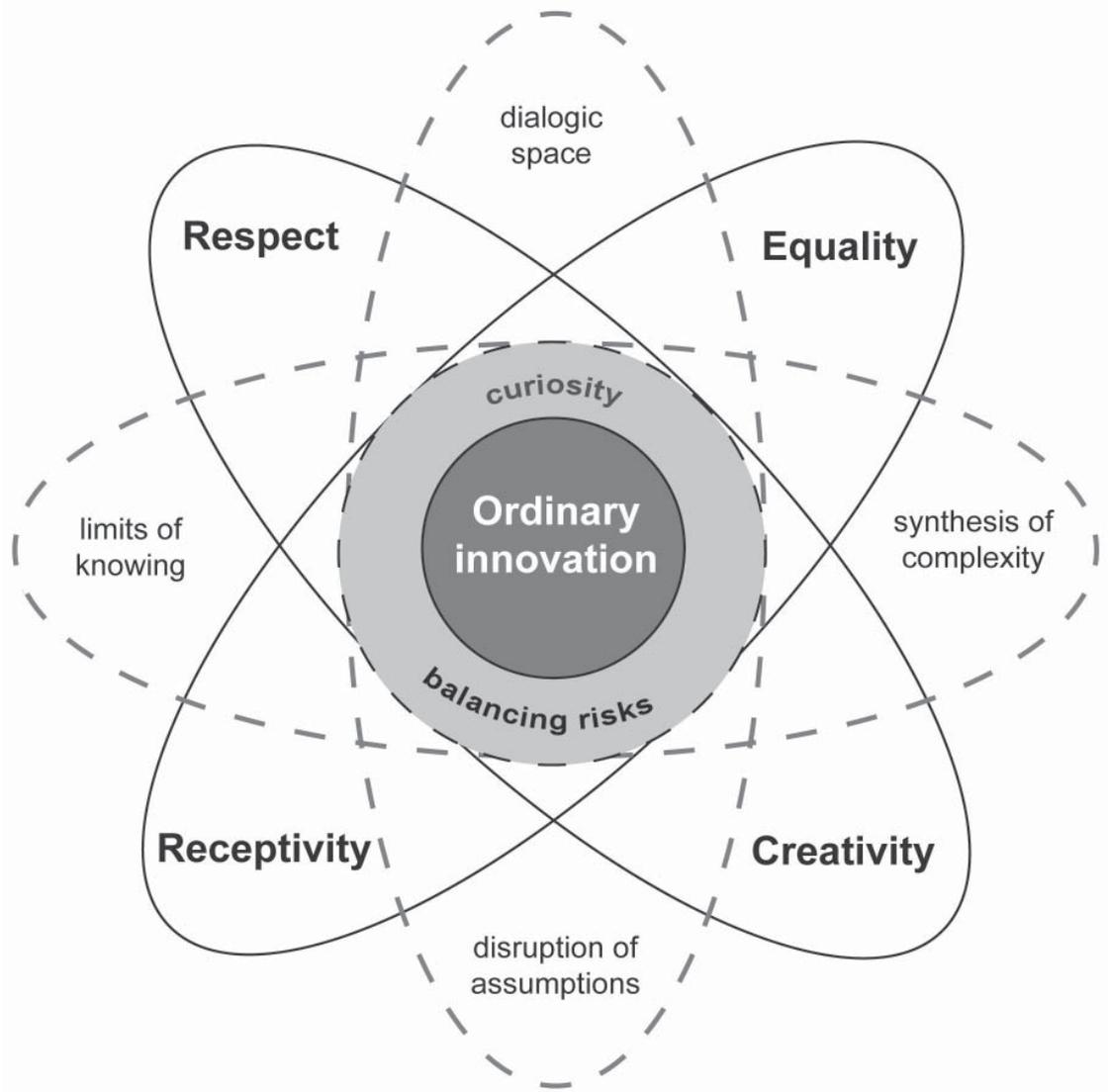
The knowledge workers collectively shared a system-wide understanding drawn from a plethora of experiences at all levels of the administration responsible for curriculum and assessment implementation, management and oversight. In addition, high school teachers whose own learners had achieved excellent results in previous National Senior Certificate examinations were invited to join the writing teams. This invitation was made in order to facilitate writing for success as these teachers know what learners are capable of achieving when learning is appropriately mediated.

The remainder of part one of this report explores the incisive question:

**How did the knowledge workers involved in the development of *Mind the Gap* study guides harness their curiosity and apply their know-how in innovative ways so as to assist those learners that have been underperforming due to a lack of exposure to the core content requirements of the Grade 12 curriculum in 2012?**

An understanding of this question is proposed in the discussion of the components of ordinary innovation. In sum, ordinary innovation provides four primary lenses: equality, respect, receptivity and creativity. These four components were simultaneously held in dialogic space and supported by the ten behaviours of a thinking environment, which in turn propelled the *Mind the Gap* writers to respect each others’ expertise and to reach the limits of their own knowing both individually and as a group. In this sense, they allowed the social practices of ordinary innovation to disrupt their assumptions and prepare them to be receptive to the knowledge of their peers (collectively referred to as expert readers). The expert readers brought their own knowledge: discursive, tacit and affective to bear on the revisions they proposed be made to the first draft of each of the manuscripts. The content writers were then better able to creatively reformulate their understanding of what constitutes core knowledge and skills in succinct, explicit and clear ways for learners to more easily absorb. The representation of the writers ideas was also creatively supported by the aesthetic know-how of the production team. A visual depiction of the components of ordinary innovation is presented in Diagram 2 and each of the components are discussed in more detail below.

**Diagram 2:** Ordinary innovation in education

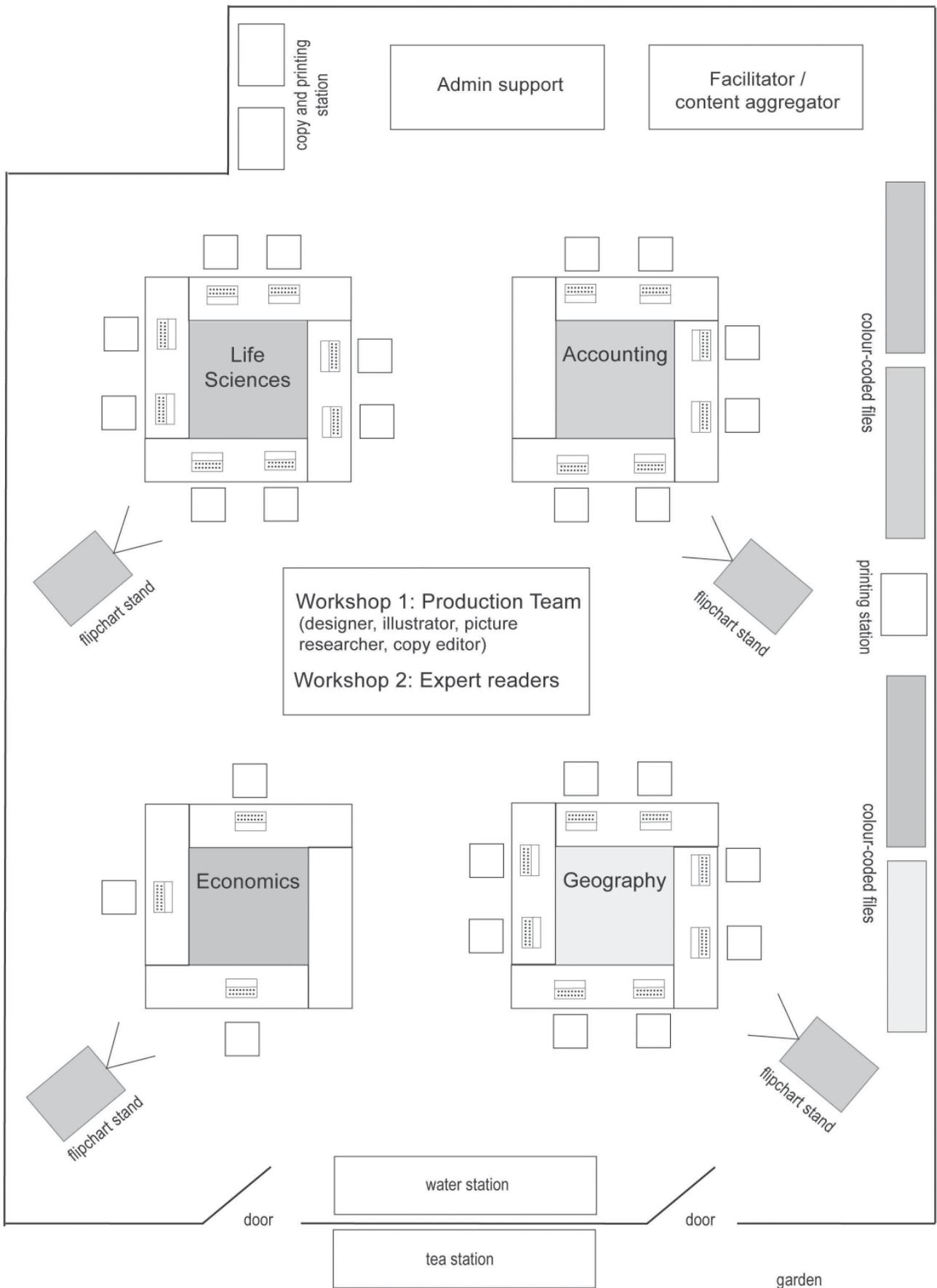


### 1.4.1 Ordinary innovation and the component of equality

Collectively, the expertise in each of the writing teams well exceeded the 10 000 hours of practice that Malcolm Gladwell in *Outliers* deems necessary for innovation to take place. Each subject-group was able to bring their respective professional life times of learning, thinking, processing and problem solving to bear on the manuscript development task, especially since they were all equally valued.

The component of equality was initially interpreted in material terms in two respects. Firstly, all of the knowledge workers were paid at the same rate for their contributions to the project. That is, not according to 'rank' as stated as the basis for the payment of educators employed in terms of the Employment of Educators Act, 1998 and further explicated in the Government Gazette Notice No. 30536 of 2007. Secondly, all the writers were equally resourced as they were all provided with their own laptop and WiFi modem. The physical layout of the space (depicted in Diagram 3) was also crucial to the component of equality.

**Diagram 3:** The *Mind the Gap* phase 1 workshop writing space



The *Mind the Gap* writing workshop space ensured that:

- All the subject writing teams worked in a common space at a hotel with a large venue. Because the workshop was residential, the writers were able to sustain their conversations over meals and in the evenings thereby maximising the time available for work;
- The content aggregator, the IT Facilitator and the three administrative support staff members' workspaces were in an alcove off to the side of the large room, but still in the same space as the writing and production teams. This group were on-call 24/7 to support the writing and production teams;
- The production team, located at the centre of the room, included the designer, copy editor, illustrator and picture researcher. This team supported the writers to make decisions about content and language, the visual representation of content and layout that would aid learning including font size, white space and the information limitations of double page spreads;
- In the second workshop, the expert readers were invited to join the process and conveyed their feedback to the members of each subject group individually using the 'spin cycle' method (explained in more detail later in the report).

The layout of the space and its resourcing created a specific habitus (Bourdieu, 1987) and demarcated the social structure for the writers to work in pairs, as a subject-group and as a whole group. More importantly their interactions were informed by the ten behaviours of a thinking environment (Kline, 1999) listed below:

1. **Attention:** Listening with respect, interest and fascination;
2. **Incisive questions:** Removing assumptions that limit ideas;
3. **Equality:** Treating each other as thinking peers. Giving equal turns and attention, keeping agreements and boundaries;
4. **Appreciation:** Practicing a five-to-one ratio of appreciation to criticism;
5. **Ease:** Offering freedom from rush and urgency;
6. **Encouragement:** Moving beyond competition;
7. **Feelings:** Allowing sufficient emotional release to restore thinking;
8. **Information:** Providing a full and accurate picture of reality;
9. **Place:** Creating a physical environment that says back to people, "You matter";
10. **Diversity:** Adding quality because of the differences between us.

These behaviours ensured that the participants did not feel over-socialised or infantilised, but rather in Fairclough's (1989) sense, they became 'agents' in the process.

The component of equality not only operated on a material spatial and behavioural level, but also symbolically where inter and intra-textual knowledge networks were actively negotiated, animating a dialogic space. Bakhtin's (1981) dialogism maintains that enunciation does not have meaning in itself, but rather all meaning is negotiated. This means that meaning is not given, despite the extent to which curricula and assessment artefacts become institutionalised and carry normative authority.

The dialogic space supported the formation of four communities of professional practice (Wenger, 1998) and the members had to negotiate what constituted core knowledge and skills; and the aesthetics of text-based learning. The willingness to rework what we know invites us to question the limitations of our assumptions. This enquiry inevitably effects a change that disrupts existing relations of power. The component of equality can assist us to negotiate this change, as it assumes we are all experts; and equally responsible for the shared goal of ordinary innovation. In this context, the goal was to bring about positive change in the way in which core knowledge and skills in a particular subject are represented and made explicit for learners to consciously acquire a degree of competence before they write their final examinations.

### **1.4.2 Ordinary innovation and the component of respect**

While participants in the first workshop had curricula and examination expertise, as they worked together they began to recognise that they lacked knowledge that was vital to the success of the project because they were unable to answer with any confidence the following incisive question:

**Who are the underperforming learners and why do they find the curriculum and examination challenging?**

The Mind the Gap writing teams realised that they had reached the *limits of their own knowing* and now needed to respect the expertise and experiences of teachers from so called ‘underperforming’ schools, in other words teachers who worked every day in schools in which the majority of learners had obtained poor results in previous National Senior Certificate examinations.

The content aggregator was responsive to this knowledge gap and between workshop one and workshop two, she recruited teachers of Accountancy, Economics, Geography and Life Sciences from a number of schools termed ‘underperforming’ to act as expert readers of the materials drafted at workshop one and then distributed the draft material for their subject to each of them.

The draft materials for each subject were also distributed to expert-peers who the writing teams identified as experts in their respective knowledge domains. These experts were located at tertiary institutions, as well as national, provincial, district and school levels of the education system.

It should be noted that while the term ‘underperforming’ is useful at a systemic level (e.g. for identifying resource needs), it is problematic when applied to teachers at schools identified as underperforming. The content aggregator was sensitive to the effects of such labelling for such teachers’ professional identities. For the second workshop she took a ‘spin cycle approach’ so that each of the groups of expert readers consisted of pedagogic, subject, and context experts who had experience of the challenges of weakly performing learners at ‘underperforming’ schools. The capacity of the writers to hear the feedback of the expert readers was informed by the component of receptivity.

### 1.4.3 Ordinary innovation and the component of receptivity

A 'spin cycle approach' to the constitution of groups is named for its approximation of a washing machine's spin cycle during which items of clothing become entwined in one another; similarly the feedback from the various experts is allowed to freely engage our thinking without interruption or censorship. We allow our mind to invite 'chance' and for new ideas to emerge without forcing them to assume a particular form, logic or purpose.

The subject writers were asked to hear the feedback from the expert readers without having to immediately respond, defend or resolve the implications of the incoming feedback. This was achieved by instructing the writing teams to only listen with attention: respect, interest and fascination; while resisting the urge to interject, "Yes, but..." to the person giving the feedback. On reflection, the subject writers found this a very difficult thing to do; they were made palpably aware of how strenuous it can be to sustain the ten behaviours of a thinking environment.

However, the writers also acknowledged how this kind of disciplined listening made them more receptive and sensitive to the psychological demands placed on an expert reader in this context, where the social is understood as the effect of meaning (Wittgenstein, 1988). An expert reader with less social status may perceive themselves as less knowledgeable than a writer and find it challenging to say, "I do not understand this section...", for fear that s/he may reveal more about themselves than the text. The converse is also true, a writer may be driven to defend "the section" to disguise his/her perceived limitations as a writer; even though the reasons for why a section may be inaccessible could be due to a range of factors, including but not limited to, diagnostic fallibility, misguided assumptions about the relevance of prior knowledge or conceptual dependency and/or ambiguous articulation, resulting from language play, etc.

The component of receptivity is also informed by Paolo Freire's (1972) seminal work, *Pedagogy of the Oppressed*, which makes us conscious of the power relations at work between dominant and subordinate social actors. In this context, unequal power relations existed between the writers and the expert readers: the former held both epistemological and social status; while the expert readers collectively represented the needs of the primary target audience. In other words the 'weakly-performing' learner could no longer be thought of as an abstract category, because the conditions informing underperformance were concretely brought into focus.

The experts from the 'underperforming' schools described features of the teaching and learning contexts in these school communities which impact negatively on learners' success: limited resources at the schools (e.g. the absence or minimal presence of photocopying facilities and materials; the absence of computers and/or lack of knowledge about optimal use of computers); learners' limited proficiency in the language of learning and teaching; poverty; hunger; child-headed households; learners' roles in income generation during school terms; limited or no access to space or light for studying at night. They also indicated aspects of subject curricula which teachers also found difficult to understand and/or difficult to teach well.

Once the expert readers had shared all that they had to share with the writers, they left the workshop venue and the writers shared with one another what they had heard and collectively set about redrafting their manuscripts.

#### 1.4.4 Ordinary innovation and the component of creativity

The writing teams had to adopt a creative attitude of mind towards the feedback that they had received. They had allowed their assumptions to be disrupted, their ideas thrown up in the air for recatching – so to speak – by using the element of chance (De Bono, 1967). The component of creativity draws on the resources of lateral thinking in so far as this allows one to see an idea from many different points of view; and this commitment made the writers aware of the difficulties that others may have in making sense of the core knowledge and skills that they were trying to make explicit.

The component of creativity is best exemplified through the many ways in which the writing teams negotiated the relationship between content and its forms of representation. The incisive question organising this process of creative engagement was:

##### **What does it mean to lower learners' anxiety levels and promote their engagement with the content?**

The writers explored this question and decided to implement the following features in consultation with the production team and content aggregator:

- Include more terminology – word glossaries of subject specific terms;
- Clarify the ordinary and colloquial meanings of discursively loaded words;
- Pay more attention to the language used to explain content; keep it clear and simple;
- Ensure headings give clear explicit sign posts for the content that follows;
- Use short simple sentences with literacy-friendly line length;
- Allow there to be white space on the page so that there is thinking space for the learner;
- Use diagrams, drawings and photographs to support meaning making;
- Condense content and make it easy to access through step-by-step structuring;
- Be aware of conceptual dependencies (what should you know before you can know more);
- Ensure that the scaffolding of skills is in place by using step-by-step explanations;
- Aim for self-contained double page spreads to minimise disruption to concentration;
- Answer all questions immediately, as the learners are studying under pressure and need to know what they don't know immediately, if they are to reformulate their understanding;
- Use devices to aid recall of content: e.g. mobile notes, spray diagrams, mind-maps, rhymes and mnemonics;
- Script the 'talking head' learning companion meaningfully so that it guides, encourages, shares helpful tips, gives reminders and exam-relevant commentary;
- Expert copy editing is essential so that no errors in the text disturb the learners' navigation of the content.

Each team also made specific decisions relevant to their subject. For example, in Geography the writers made a point of substantially developing the section on map reading and the design team decided to create a packaging solution that would allow this study guide to be inserted into a box that could carry three orthophotographic maps and three linked topographical maps related to three past examination papers. This was so that the learners would have access to the maps they needed to practise developing their map reading skills.

In Life Science, the authors decided to include a full set of biological drawings, as they realised that inaccurate labelling was linked to inadequate access to blank, accurate representations of specific structures such as the eye and the brain, amongst others.

In conclusion, the components of ordinary innovation created the necessary conditions for the development of the *Mind the Gap* study guides. The process valued different kinds of expertise and facilitated the contribution of each kind to the materials development process. The experts in subject curricula, assessment, pedagogy and local conditions of learning who came together to develop the study guides exhibited one of the key characteristics of Lave and Wenger's (1991) community of practice: commitment to a joint enterprise (the development of guides for self-study by learners). However, because they all brought particular expertises to the enterprise, they were not divided along the lines of 'competence' and 'non-competence' into the central and legitimately peripheral participants proposed by Lave and Wenger as typical of an evolving community of practice. Instead, all were both competent and 'not competent' and recognised the importance of each other's areas of expertise to the achievement of the enterprise. Each expert was conscious and accepting of the limitations to his or her own knowing.

The next section explains the processes of dissemination and the extent of the print and distribution of the study guides and the uptake of the resources through word-of-mouth advocacy and online availability.

## **1.5 Monitoring the Dissemination of the *Mind the Gap* Study Guides**

As indicated in the introduction, the printed study guides were purposely distributed to high schools throughout the Limpopo and Eastern Cape provinces and the impact study schools in Mpumalanga; as well as to a small number to the writing team members. What is significant is the large number of unsolicited requests for printed guides outside the targeted provinces and the number of web downloads, despite the absence of publicity about *Mind The Gap*. The quantity of study guides downloaded from the website between September 2012 and the beginning of March 2013 and from March to August 2013 is remarkable.

### **1.5.1 Electronic downloads of the *Mind the Gap* study guides**

There were 22 660 electronic downloads of the *Mind the Gap* study guides from the time they were placed online in September until the end of October 2012, a period of approximately two months. From the end of October 2012 to 4 March 2013, a period of three months, the downloads increased by a further 37 126. The total number of downloads to 4 March 2013 was 59 786. The figures suggest an increase of downloads month-by-month with a drop during the summer holiday period.

**Table 1: Electronic downloads of *Mind the Gap* study guides**

SUBJECT	LANGUAGE	DATE UPLOADED	DOWNLOADS 29 October 2012	DOWNLOADS 4 March 2013
Accounting	English	12 Sep 2012	5 953	11 213
Economics	English	12 Sep 2012	3 523	8 646
Geography	English	12 Sep 2012	4 491	13 168
Life Sciences	English	12 Sep 2012	7 498	18 447
Lewenswetenskappe	Afrikaans	12 Oct 2012	1 195	4 260
Ekonomie	Afrikaans	12 Nov 2012	No data	1 773
Geografie	Afrikaans	12 Nov 2012	No data	2 279
Totals		0	22 660	59 786

The downloads of the *Mind the Gap* study guides have continued throughout the 2013 school year. A **total of 171 761** was recorded, the breakdown for these downloads per subject from the date of first upload to 30 August 2013 by language were as follows:

**Table 2: Total downloads of the four *Mind the Gap* study guides (English version):**

Title	Size	Number
Accounting	8.69 MB	21 589
Economics	10.50 MB	16 081
Geography	13.35 MB	38 816
Geography Maps	17.25 MB	8 782
Life Sciences	6.61 MB	44 002
<b>Total</b>		<b>129 270</b>

**Table 3: Total downloads of the four *Mind the Gap* study guides (Afrikaans version):**

Title	Size	Number
Lewenswetenskappe	10.72 MB	11 849
Rekeningkunde	13.14 MB	9 020
Ekonomie	10.36 MB	11 222
Geografie	24.65 MB	10 400
<b>Total</b>		<b>42 491</b>

## 1.5.2 Print and distribution of the *Mind the Gap* study guides

The following is a summary of the distribution figures for printed copies of *Mind the Gap* study guides to the targeted provinces:

Eastern Cape:	97 691
Limpopo:	107 847
<b>Total:</b>	<b>205 538</b>

In addition, printed *Mind the Gap* study guides were distributed, on request, to provincial departments, schools, other institutional spaces and to individuals as follows:

Western Cape:	20 783
Northern Cape:	945
Free State:	4 100
KwaZulu-Natal:	24 548
Schools/Other:	4 603
Individuals:	54
Other institutions e.g. Corporate:	92
National Libraries:	88
Teacher Resource Centres:	160
<b>Total:</b>	<b>55 373</b>

When the number of printed study guides distributed up to the beginning of March 2013 is added to the web downloads to 4 March (59 786), the total distribution achieved in approximately six months, excluding the distribution to the 79 impact study schools in Mpumalanga, was 320 697.

Given the lack of publicity about the first phase of the *Mind The Gap* study guides, it is argued that the impressive take-up of printed and downloaded guides beyond the targeted provinces can be attributed largely to the championing of the guides by enthusiastic participants in the development process on their return to their respective work sites (national, provincial and district education department offices, schools, teachers' centres, etc.). The office of the Director-General has received a significant number of unsolicited expressions of verbatim appreciation for the study guide of which the following are broadly representative:

"I'm a grade 12 learner living in Gauteng in Pretoria. I'm doing commercial subjects and I have been using mind the gap study guide of economics and accounting. I found them helpful to me and my problem is that I'm in need of the same study guide of business studies. Can u please help me please. Thank you."

"I teach at a high school. I would like to thank u for the Mind the Gap book. It is an excellent resource for learners who are struggling. I had 3 girls in my class last year who passed because Mr Pillay gave me copies for them. They did not pass the whole year but managed to pass at the end of the year. Mr Pillay asked me to pass this message to you."

"i'm currently doing grade 12 at sebaka high school in limpopo at tzaneen. i just want to thank the department of education for every contribution you made for us! we thank the study guides provided by you! what a nice job! god bless you. you guys are great leaders who are working for the people."

## 1.6 Evaluating the Impact of the *Mind the Gap* Study Guides

The evaluation of the impact of the *Mind the Gap* study guides was seen as a very important part of the programme, especially since the system required evidence on whether or not the self-study materials were in themselves able to improve learner performance. It was a priority of senior management that the investigation be well designed, especially since there has been an excess of qualitative research in education that relies too heavily on narrative observations and socio-cultural and historical forms of reflection, rather than quantitative experimental forms of enquiry, typically found in disciplines such as medicine and economics. It was with this in mind that the *Mind the Gap* impact evaluation adopted a randomised control trial research design.

The impact study took place in the province of Mpumalanga and used a computerised lottery to select the 79 schools that received the *Mind The Gap* study guides in all four subjects: Accounting, Economics, Geography and Life Sciences. The national department ensured that the study guides were delivered directly to these schools via courier and the proofs of delivery notifications confirmed receipt by the schools. The 79 treatment schools were then compared with 239 control group schools. This kind of design allowed the programme managers to estimate the causal impact of the *Mind The Gap* study guides in each subject. The theory of change underpinning the impact evaluation is as follows:

1. A cost-effective randomised control trial design can establish a reliable sample set to estimate the causal impact of the *Mind the Gap* study guides.
2. The *Mind the Gap* study guides are delivered to schools.
3. School managers distribute *Mind the Gap* study guides to learners.
4. Learners use *Mind the Gap* study guides to prepare for the Grade 12 National Senior Certificate exams.
5. The examinations for the four subjects Accounting, Economics, Geography and Life Sciences are well designed.
6. The learners' core knowledge and skills are increased by the *Mind the Gap* study guides as is reflected in their writing of their examinations.
7. The impact of the *Mind the Gap* study guides is demonstrated in learners' results from the National Senior Certificate examinations.
8. The results of the impact evaluation inform the systemic planning of interventions designed to improve learner performance.

The findings of the *Mind the Gap* impact evaluation are presented in detail in part two of this report.

## PART TWO

### The Impact Evaluation of Phase 1 *Mind the Gap* Study Guides: Evidence from a Randomised Experiment

#### 2.1 Introduction to Part Two

The *Mind the Gap* study guides were written by four subject teams comprising teachers, examiners, curriculum officials and academics. The study guides were designed to be effective for self-study without requiring a teacher to mediate content. Item response analysis was used to identify specific concepts and skills that are most frequently incorrect and to target these in the *Mind the Gap* study guides. The study guides use simple explanations to clarify key terminology and content. In addition, the guides orientate learners to the examination requirements by drawing on the official Grade 12 Examination guidelines and through providing examples of specific questions from previous examination papers and their memos.

The *Mind the Gap* study guides were not intended to replace textbooks, but were designed to fulfil a different purpose which would be complementary to textbook use. This intervention can be seen as part of a broader policy emphasis within the DBE in the last few years on providing materials specifically targeted to schools in poor communities. A major intervention since 2011 involves the distribution of colour-printed workbooks for literacy and numeracy to all learners in Grades R to Grade 9. Ironically, this emphasis on materials has overlapped with extensive media critique of textbook delivery, prompted by specific delivery problems experienced in the Limpopo province in 2012. However one looks at it, learning support materials are currently receiving much attention in South Africa.

Despite the intentions of official policies and funding norms, school-based surveys indicate that access to textbooks in South Africa is erratic. For example, the School Monitoring Survey of 2011 indicates around 72% of Grade 6 learners having access to a mathematics textbook, with a figure of 90% for Grade 12. Previous surveys such as the SACMEQ 2007 survey and the NSES survey of 2009 suggest even lower access. Low access to school resources such as textbooks reflects inefficiencies in delivery, as well as non-existent or poorly managed inventories and retrieval systems at the school level.

The majority of schools in poor communities can therefore be characterised as having limited access to learning materials and incomplete curriculum coverage. Furthermore, learners in these schools typically lack home-based support in the forms of additional learning resources such as books and computers and tutors or parents who can assist with school work. Therefore, an additional resource such as the *Mind the Gap* study guides can be expected to provide a valuable secondary site of learning acquisition for these learners. With the high-stakes National Senior Certificate exams close at hand, learners may well have a stronger motivation than ever to use available learning materials. This reinforces the theory of change underlying the *Mind the Gap* intervention presented in Part One of this report.

However, the local and international economics of education literature is not particularly optimistic about the impact of additional resources on educational achievement. Hanushek (2002) argues that input-based education policies around the world have failed to produce any systematic improvement in achievement. According to Hanushek, the more effective avenues for improving achievement have proven to be aspects of teacher quality that are unrelated to resources and policies that change the incentives facing teachers. Kremer, Brannen and Glennerster (2013: 297), discussing 30 experimental studies of educational interventions in developing countries, conclude that, “despite very low levels of resources, providing more-of-the-same educational inputs without changing pedagogy or accountability typically has very limited impact on test scores”.

Similarly, additional school resources have generally not been found to have substantial effects on school performance in South Africa. Van der Berg (2008) proposes that the effectiveness of resources appears to be conditional on the managerial efficiency of schools to convert resources into outcomes. Most large-scale school surveys provide weak measures of school management thus restricting estimation of this notion. The NSES survey contained a richer than usual amount of information on school management and teacher practices. Using this data, Taylor (2011) highlights several indicators of effective management that are significantly associated with learner achievement in multivariate education production functions. One of these indicators is the quality of inventories for learning support materials. Schools with inventories that were evidently in operational use performed better, *ceteris paribus*.

Despite the wide use of study guides around the world, there is little evidence regarding the impact of study guides on learning. Horton and Lovitt (e.g. 1989) and their collaborators conducted several small-scale experiments in the United States during the 1980s to investigate the impact of study guides. Horton and Lovitt (1989: 447) found that study guides, by extracting the main ideas from text material, can be an effective remedial intervention for students with poor reading ability. Their research indicated that study guides benefited learners with learning disabilities, those with learning deficits, and regular learners.

Glewwe, Kremer and Moulin (2007:1) point out that even those sceptical about the benefits of spending more on education are often optimistic about the impact of certain non-teacher inputs such as textbooks. However, such optimism has been based mainly on priors and on estimates from retrospective studies using observational data which may be biased if the correlation between textbook availability and learner performance is actually driven by other aspects of school quality. Lockheed and Hanushek (1988), for example, in their review of four retrospective studies focusing on textbooks, observe that significant and large effects were obtained in all four studies. Similarly, Heyneman, Farreland and Sepulveda-Stuardo (1978), Fuller (1986) and Fuller and Clarke (1994) all observed significant effects of textbooks in the majority of studies they reviewed.

Experimental or quasi-experimental studies on textbooks are less common, although two of the earliest Randomised Control Trials (RCT) in education involved textbooks. Jamison *et al.* (1981) conducted a Randomised Control Trial in Nicaragua which found that workbooks improved first grade Mathematics achievement by about a third of a standard deviation. Heyneman, Jamison and Montenegro (1984) randomly allocated textbooks to learners in Grades 1 and 2 in the Philippines. Twenty-six schools received one textbook per learner, 26 more schools received one textbook for every two learners, and 52 schools served as a control group. Both treatments improved test scores by a similar magnitude – about 0.4 standard deviations.

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<sup>1</sup> SACMEQ stands for Southern and Eastern African Consortium for Monitoring Educational Quality.

<sup>2</sup> NSES stands for the National School Effectiveness Study, which was undertaken by JET Education Services between 2007 and 2009.

More recently, the results of an RCT focusing on textbooks in Kenyan primary schools have been widely disseminated. Glewwe *et al.* (2007) found that schools receiving textbooks did not perform significantly better than the control group. They did, however, find that textbooks improved performance at the higher end of the student ability distribution. Glewwe *et al.* contend that most students were not sufficiently fluent in English to benefit from the textbooks, which were in English, and that this explains why the textbooks only benefited more advanced learners.<sup>3</sup> Glewwe (2002), reflecting on the RCTs in Nicaragua, Philippines and Kenya, suggests one other possible explanation that would be consistent with all three experiments: it may be that textbooks are only effective when teachers have been trained to use them.<sup>4</sup>

The South African literature on the effect of textbooks is limited to analyses of observational data. Education Production Function analyses using PIRLS 2006 data have not found textbook availability to be a significant predictor of Grade 5 reading achievement (Taylor, 2010; Shepherd, 2011). Similarly, Taylor's (2011) production function analysis of the NSES data indicated that textbooks were not significantly associated with literacy or numeracy in Grades 4 and 5. On the other hand, analysis of SACMEQ data has suggested a positive effect of good textbook access on reading achievement in Grade 6 but not on Mathematics achievement. This finding was obtained in analyses of the 2000 SACMEQ dataset (Gustafsson, 2007; Van der Berg, 2008) and of the 2007 SACMEQ dataset (Spaull, 2011). One possible explanation for the emergence of a mixed picture from these studies is that the available selection of control variables may influence whether a significant effect is observed – a key limitation with observational data. The estimates in these studies may therefore be biased if textbook availability in South Africa is endogenously determined: important unobserved school characteristics such as management efficiency may influence textbook access. Therefore, observed correlations between textbook availability and test scores may reflect unmeasured school efficiency rather than the causal impact of textbooks.

No rigorous impact evaluation of study guides or textbooks has previously been conducted in South Africa. One study randomly allocated Mathematics workbooks (a hybrid between a textbook and an exercise book) that were developed by a non-governmental organisation to 21 primary schools and conventional textbooks to another 21 schools (Fleisch *et al.* 2010). Both groups improved test scores by a similar amount over the treatment period, indicating that the two interventions could not be distinguished. However, the lack of a counterfactual (the outcome with no intervention) means that the overall impact could not be measured.

The *Mind the Gap* study guides were developed during 2012 and were therefore not physically distributed to all schools in the country. The guides were made available electronically on the National Department of Basic Education website and were physically distributed to certain underperforming districts in the Limpopo and Eastern Cape provinces and to a lesser extent in the Western Cape, KwaZulu-Natal, Gauteng, Northern Cape and Free State. The province of Mpumalanga was used to conduct a randomised control trial in which 79 schools received *Mind the Gap* study guides based on a computerised lottery, leaving a control group of 239 schools. Each school selected into the treatment group received the guides for all four subjects: Accounting, Economics, Geography and Life Sciences.

This research design allows one to estimate the causal impact of the *Mind the Gap* study guides in each subject. While the primary interest in this experiment was to evaluate the impact of this new government programme,

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<sup>3</sup> Note that the impact of the *Mind the Gap* study guides should not have been substantially affected by this factor, as Grade 12 learners would have been exposed to English instruction and materials for much longer.

<sup>4</sup> The *Mind the Gap* study guides were not accompanied by teacher training and their use would almost certainly not have been mediated by teachers.

it has bearing on several other interesting research questions. Can a relatively cheap support material that is not mediated by a teacher improve performance in the National Senior Certificate exam? Is the impact of study guides the same across subjects? To the extent that we have information on learner and school characteristics, can we identify who benefits most from such an intervention?

The next section explains the methodology of the experiment in greater detail and introduces the data that was used for the evaluation. Section 3 reports the results from a number of estimation strategies employed to evaluate the impact of each of the four *Mind the Gap* study guides. This section presents analysis of overall impact, an investigation of whether the impact varied across different types of learners and schools (heterogeneous effects), a simulation to estimate what the overall effect of the study guides might be on the National Senior Certificate pass rate if all candidates across the country received the guides; and various placebo tests to assess how likely it is that the observed results are a peculiar artefact of the data rather than a reflection of a true impact. Section 4 discusses the significance of the findings for policy-making and for research on the determinants of educational performance. Section 5 concludes.

## 2.2 Data and Methodology

The available budget (funds for transport costs and the number of guides already printed) dictated that a maximum of 79 schools could be chosen to receive *Mind the Gap* study guides within the impact evaluation component of the programme. The province of Mpumalanga was suitable for the purposes of conducting a Randomised Control Trial given that this is a predominantly poor province and given prior commitments to distribute the study guides to some school districts in several other provinces.

National Senior Certificate registrations data collected by the Department of Basic Education by June provided a sampling frame from which to select treatment and control schools. The sampling frame was restricted to schools in Mpumalanga that had registered to write the exams in English. The latter restriction excluded a small proportion of schools writing in Afrikaans, most of which would be more affluent and better-resourced schools. The sampling frame was then further restricted to include only schools in which all four subjects under evaluation were offered. Schools in which fewer than five candidates were registered for any of the four subjects were then excluded. Schools in which more than 170 learners were registered for any of the four subjects were also excluded. These restrictions were imposed to improve the ratio of statistical information to the cost of distribution. This process yielded a final sampling frame of 318 schools.

Using a computerised lottery, 79 schools were then randomly selected from these 318 schools to receive the *Mind the Gap* study guides. This left a control group of 239 schools.<sup>5</sup> Importantly, given the randomisation, there is no reason to expect the 79 treatment schools to be systematically different in any way from the control schools. Therefore, after allocating the study guides to the treatment schools, the control schools provide a legitimate estimate of the counterfactual – how the treatment schools would have performed had they not received the study guides.

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<sup>5</sup> Using all the remaining schools in the sampling frame affords extra statistical power when estimating whether performance in the treatment group was statistically significantly different from performance in the control group. Around each group's estimate there is a confidence interval. The size of this interval is a function of the number of observations – a large sample allows one to be surer of the estimate and therefore the confidence interval will be narrower. Therefore, a large sample of control schools will narrow that group's confidence interval thus decreasing the chances that the confidence intervals for the two groups will overlap when there truly was a difference in performance. Since there was no cost associated with increasing the number of control schools, all 239 were included.

Delays in the printing process meant that it was only possible to deliver the study guides between the 24th and the 28th of September, 2012. This was just less than one month before the first examination amongst the four *Mind the Gap* subjects (Accounting, 23 October) and about two months before the last (Economics, 21 November). The short period in which to use the study guides may have limited their potential impact, although it was precisely during this period that the guides might be expected to have maximum impact and during which there is the strongest incentive to use them.

The distribution of the study guides was successful. A private company couriered the books to the treatment schools and proof of delivery notes were returned to the Department of Basic Education for all schools. However, it is not possible to know to what extent school staff distributed the study guides to learners or to what extent learners actually used the material.

A minimal amount of treatment spillover into the control group might have occurred since electronic versions of the study guides were available on the Department of Basic Education website from September. However, in a poor and largely rural province such as Mpumalanga where most households do not have internet connectivity it is unlikely that many learners would have downloaded the study guides. Moreover, there was not a high degree of public awareness around the release of this new material.

No assessment costs were incurred in the evaluation since outcome measures at the learner level for all schools and for all subjects could be obtained from the National Senior Certificate database. This contributed to the extremely light nature of the treatment in the sense that there was no additional testing, no training accompanying the materials and no visits or monitoring by officials or fieldworkers. Therefore, one can confidently rule out any potential Hawthorne effects (where the treatment group changes its behaviour due to the extra attention rather than the intervention itself). There was absolutely no intrusion into control schools and therefore no reason to expect any John Henry effects (where the control group changes its behaviour in response to the experiment).

National Senior Certificate data for 2011 and 2012 was used to measure impact. While the schools are the same across the two years, different learners wrote the examination in each year. Therefore, two estimation strategies were used; one using data aggregated at the school level and treating it as a panel, and one treating the data as two cross-sections at the learner level. Table 1 shows the numbers of learners in treatment and control schools in each subject in 2011 and 2012. Note that individual learners are duplicated as each writes several subjects, including some that are not on this list. The 10 subjects shown here include the four *Mind the Gap* subjects and six other popular subjects that are used in some of the analysis as a control and in several placebo tests. For both years and all subjects these learners were grouped in 79 treatment schools and 239 control schools (though one control school was not found in the 2011 data). Note that 'treatment schools 2011' is used when referring to 2011 characteristics of those schools that were treated in 2012 – no treatment occurred in 2011.

**Table 1:** Number of learners in treatment and control schools by subject and year

	Control schools 2011	Control schools 2012	Treatment schools 2011	Treatment schools 2012
Accounting	6 374	5 989	2 229	2 029
Economics	7 310	7 337	2 422	2 297
Geography	12 130	12 252	3 674	3 765
Life Sciences	12 931	12 694	4 206	4 271
Business Studies	8 446	8 780	2 799	2 805
English First Additional Language	23 964	24 145	7 811	7 660
Mathematics	9 587	8 976	3 169	2 928
Mathematical Literacy	15 085	15 753	4 817	4 890
Physical Science	8 240	7 822	2 748	2 604
Tourism	6 645	8 350	1 637	1 763

Due to the randomisation the identification of the causal impact of treatment is straightforward. Firstly, for each of the four *Mind the Gap* subjects the following regression model is estimated using Ordinary Least Squares:

$$Y_j = \beta_0 + \beta_1 T_j + \beta_2 X_j + \xi_j \quad (1)$$

where  $Y_j$  is the mean score in school  $j$  in 2012 (endline) expressed in percentage scores,  $T_j$  is a dummy equal to one if the school was in the treatment group receiving study guides, and  $X_j$  is a vector of school level control variables. In the fully specified model  $X_j$  includes the mean score in school  $j$  in 2011 (baseline) and the official poverty quintile of the school.<sup>6</sup> In one model the treatment dummy is interacted with the baseline score in order to estimate whether the impact of study guides differed according to the overall level of school performance. In other models the outcome ( $X_j$ ) is not the mean score but performance at various percentiles of scores within the school. In another model the outcome ( $X_j$ ) is the school pass rate in the NSC (not for a specific subject but overall).

Secondly, a triple-difference model is estimated using learner-level data for learners in treatment and control schools, in 2011 and 2012, and for treated subjects and non-treated subjects. In this model, the subjects that were not affected by *Mind the Gap* form another control group. Although there is no reason to expect it, this strategy is robust to the possibility that treatment schools experienced overall improvement in all subjects relative to control schools. As a sensitivity check this model was also estimated. The performance of learner  $i$  in school  $j$  in year  $y$  for subject  $s$  is modelled as a function of being in a treatment school ( $T$ ), the subject ( $S$ , which equals one for the *Mind the Gap* subjects and zero for other subjects), the year ( $Y$ , which equals one for 2012 and zero for 2011), interactions amongst all of these variables, and a vector of learner and school characteristics ( $X_{ij}$ ):

$$Y_{ijys} = \beta_0 + \beta_1 dT + \beta_2 dY + \beta_3 dS + \delta_0 dT.dY + \delta_1 dT.dS + \delta_2 dT.dY + \delta_3 dY.dS + \beta_4 X_{ij} + u \quad (2)$$

<sup>6</sup> For the purposes of funding norms, schools in South Africa are categorised into five poverty quintiles based on community-level measures of socio-economic status.

The OLS estimate  $\delta_3$  is now the coefficient of interest since it expresses the impact of being in a treatment school in 2012 for a *Mind the Gap* subject, over and above any overall year-, subject- or group-specific trends, and any year-subject-specific trends and any group-year-specific trends.  $\delta_3$  can also be expressed as follows, making clear the intuition of the triple difference (or “difference-in-difference-in-difference”):

$$\hat{\delta}_3 = (\bar{y}_{T,Sx,2012} - \bar{y}_{T,Sx,2011}) - (\bar{y}_{T,Sz,2012} - \bar{y}_{T,Sz,2011}) - (\bar{y}_{C,Sx,2012} - \bar{y}_{C,Sx,2011}) \quad (3)$$

where  $\hat{\delta}_3$  denotes the mean score, *Sx* denotes subjects affected by *Mind the Gap*, *Sz* denotes subjects not affected by *Mind the Gap*, *T* denotes treatment schools and *C* denotes control schools.

## 2.3 Results

### 2.3.1 Baseline differences

Despite the strictly random allocation of schools into treatment and control groups, the treatment group scored slightly better on baseline achievement in all four subjects. These differences were not statistically significant. In order to check whether the observed differences between the treatment and control groups were unusual, ten new draws of treatment and control groups were conducted using the same sampling frame and randomisation procedure. Table 2 reports the differences (in percentage points) between treatment and control groups for the actual draw as well as for the ten ‘placebo’ draws. Note that the numbers reported in the table are the coefficients on the ‘treatment’ dummy in an OLS regression predicting 2011 percentage scores based only on a treatment dummy. Evidently the differences between the actual treatment and control groups are not unusually large. This provides assurance that the treatment and control groups were well balanced.

**Table 2.** Typical baseline differences between treatment and control groups

	Accounting	Economics	Geography	Life Sciences
Actual	0.54	0.78	0.49	1.36
Placebo draw 1	-0.9	0.4	0.8	-1.1
Placebo draw 2	-0.63	1.36*	1.29	1.74**
Placebo draw 3	1.93**	0.95	2.55**	0.62
Placebo draw 4	1	-0.45	-0.45	0.04
Placebo draw 5	1.68*	0.78	-0.9	0.35
Placebo draw 6	0.27	-0.59	0.52	0.15
Placebo draw 7	-1.09	-0.19	-0.95	-1.62*
Placebo draw 8	-0.8	0.76	-1.34	-0.78
Placebo draw 9	0.99	0.79	0.87	2.94***
Placebo draw 10	-0.51	0.22	-1.02	0.34

Note: One, two and three stars denote statistical significance at the 90%, 95% and 99% levels of confidence respectively (\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ ).

### 2.3.2 Overall impact of the *Mind the Gap* study guides on subject performance

Using Kernel Density curves, Figure 1 provides a descriptive view of the endline scores for treatment and control groups in each subject. These curves depict the proportions of learners (along the vertical axis) who achieved specific scores (along the horizontal axis). Eyeballing these graphs suggests that treatment and control schools had very similar distributions of economics scores; treatment schools had a marginally superior distribution of accounting scores; and treatment schools had noticeably superior distributions of Geography and Life Sciences scores. However, this initial description does not control for baseline achievement and does not allow for conclusions about the statistical significance of any apparent differences.

**Figure 1.** Kernel Density curves of subject performance in 2012 (endline)

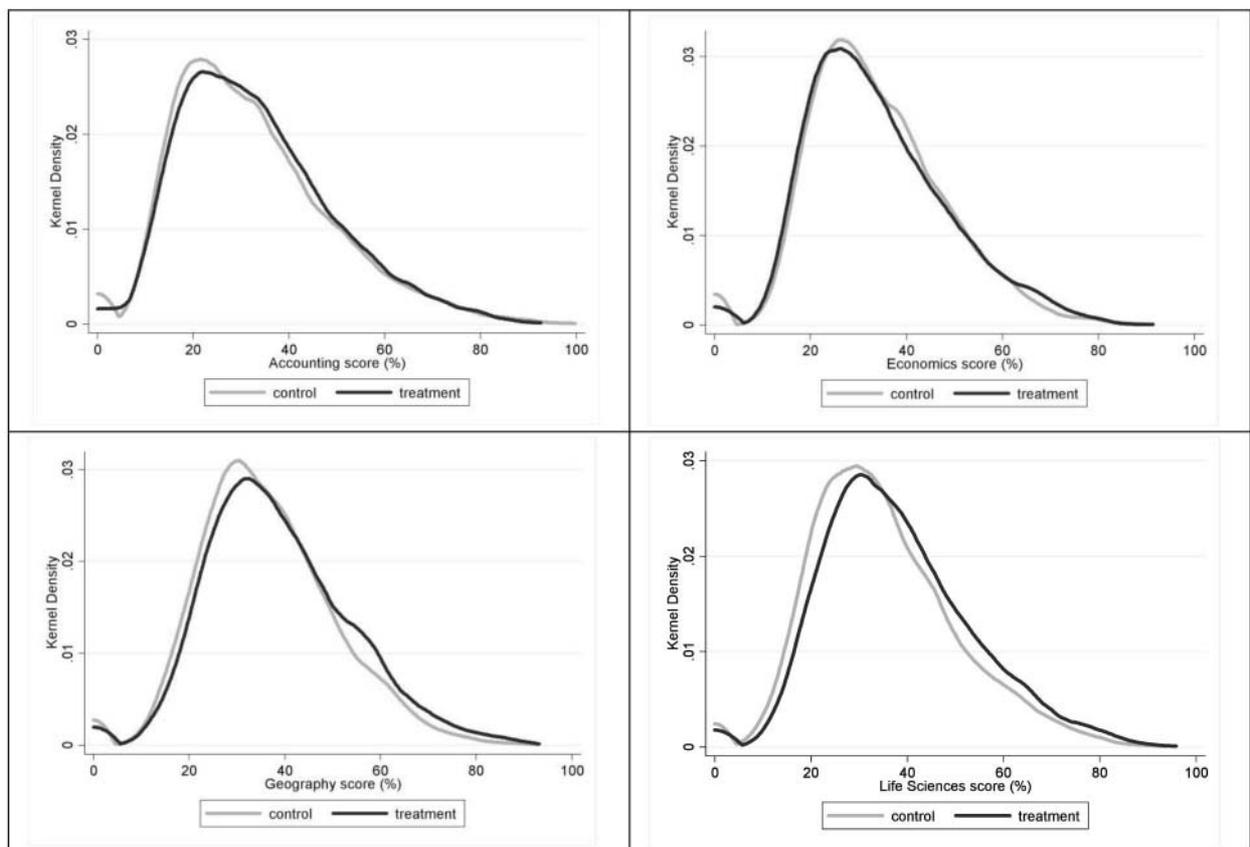


Table 3 reports a first set of regression estimates based on equation (1) above, predicting school mean achievement in 2012 based only on the treatment dummy. In the cases of Accounting and Economics treatment schools performed slightly better than non-treatment schools on average, but this difference was not statistically significant. However, the average scores in Geography and Life Sciences were significantly higher for treatment schools than for control schools.

**Table 3.** Simple difference OLS regressions

	<b>Accounting</b>	<b>Economics</b>	<b>Geography</b>	<b>Life Sciences</b>
Treatment	0.84 (1.12)	0.17 (0.88)	2.39*** (0.89)	3.01*** (0.81)
Quintile	No	No	No	No
R-square	0.0018	0.0001	0.0223	0.0421
Observations	318	318	318	318

Notes: In all school-level regressions, schools were weighted by the number of pupils that wrote that specific subject in 2012. Standard errors in parentheses. \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

Controlling for the school poverty classification hardly changes the estimated coefficients on the treatment dummy. This is to be expected given the randomised allocation into treatment and control groups. Table 4 reports these results.

**Table 4.** Simple difference OLS regressions controlling for school poverty quintile

	<b>Accounting</b>	<b>Economics</b>	<b>Geography</b>	<b>Life Sciences</b>
Treatment	0.46 (1.12)	0.09 (0.88)	2.49*** (0.89)	2.93*** (0.81)
Quintile	Yes	Yes	Yes	Yes
R-square	0.0481	0.0249	0.0488	0.0739
Observations	318	318	318	318

Notes: Standard errors in parentheses. \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

Table 5 presents the main regressions for estimating the overall impact of the *Mind the Gap* study guides. It is based on equation (1) and controls for the poverty quintile as well as the school mean achievement in 2011 (baseline). The estimates on the treatment dummy are slightly lower than in Tables 3 and 4. This is because the treatment schools scored marginally better on baseline achievement. Controlling for baseline therefore reduces the size of the estimated treatment coefficient slightly. Nevertheless, the overall picture is consistent with Tables 3 and 4: the impact of *Mind the Gap* study guides was not significantly different from zero for Accounting and Economics, but was significantly positive for Geography and Life Sciences. For both these subjects, a positive impact was obtained at the 99% level of confidence. The size of the impact for both subjects was roughly two percentage points.

**Table 5.** Difference-in-difference OLS regressions

	<b>Accounting</b>	<b>Economics</b>	<b>Geography</b>	<b>Life Sciences</b>
Treatment	0.29 (0.89)	-0.37 (0.76)	1.94*** (0.63)	2.17*** (0.63)
Mean 2011 score	0.74*** (0.05)	0.59*** (0.05)	0.64*** (0.04)	0.59*** (0.04)
Quintile	Yes	Yes	Yes	Yes
R-square	0.4182	0.2892	0.5342	0.4344
Observations	315	317	315	317

Notes: Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

The results of the triple-difference model, as explained using equations (2) and (3), are presented in Table 6. The positive coefficient on the ‘Year 2’ dummy indicates that on average, over all subjects and schools, NSC scores were higher in 2012 than in 2011. Overall, those in treatment schools were not significantly better-performing than those in control schools. All four of the *Mind the Gap* subjects were harder than the average of the other six subjects combined. In 2011, treatment schools did not enjoy subject-specific advantages over control schools in any of the four *Mind the Gap* subjects, as indicated by the non-significant coefficients on the treatment-subject interactions. Accounting and Geography appear to have been at a similar level of difficulty in 2011 and 2012, whereas performance in Economics was better for all schools in 2012 and performance in Life Sciences was lower for all schools in 2012.

The triple interaction terms combining year, treatment school, and subject are the coefficients of interest. These indicate that there was no particular effect for being in a treatment school in 2012 in Accounting or Economics. However, for those in treatment schools in 2012 there was a relative advantage in Geography and in Life Sciences. This confirms the earlier analysis demonstrating that *Mind the Gap* study guides did not significantly impact on performance in Accounting and Economics and that the guides did have a positive impact on performance in Geography and Life Sciences. The size of the impact is roughly in the same order of magnitude as in Table 5.

**Table 6.** Triple Difference OLS regressions across Year, Subject and Treatment

<b>Dependent variable:</b>	
<b>Score for student <i>i</i> in school <i>s</i> in time <i>t</i> in subject <i>z</i> (<i>Y<sub>istz</sub></i>)</b>	
Year2	1.46***
Treatment school	0.95
ACCN	-9.24***
ECON	-8.98***
GEOG	-4.90***
LFSC	-3.34***
Treatment*ACCN	0.17
Treatment*ECON	-0.38
Treatment*GEOG	-0.58
Treatment*LFSC	0.51
Year2*ACCN	0.75
Year2*ECON	1.88***
Year2*GEOG	0.02
Year2*LFSC	-2.78***
Year2*treatment*ACCN	-0.45
Year2*treatment*ECON	-0.48
Year2*treatment*GEOG	2.04**
Year2*treatment*LFSC	1.58**
Quintile	Yes
Gender	Yes
R-square	0.0513
Observations	293334
Number of schools	317

Notes: Standard errors clustered at the school level; \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

### 2.3.3 Heterogeneous effects

Two possible types of heterogeneity in the impact of the *Mind the Gap* study guides were explored. Firstly, it was established using a variety of models and for all four subjects that the impact of the guides did not differ by gender. Secondly, the impact was allowed to vary with the baseline level of school performance. Table 7 shows results from models where the treatment variable was interacted with the school mean score in 2011 (baseline). The interpretation of the various coefficients is aided by the graphs in Figure 2 which show the predicted values from the models in Table 7.

As before, the results confirm that Geography and Life Sciences guides had an overall impact on performance while Accounting and Economics did not. However, the Geography guides appear to have had a greater impact within schools with a relatively higher baseline achievement.

For Accounting and Economics the estimated impact of the guides, though not statistically significant, also appears to have been slightly higher at higher levels of baseline scores. In fact, in one specification (not reported here), in which schools with unusually large gains or losses between 2011 and 2012 were excluded and in which only schools with a baseline of above 30% were included, a positive impact of 1.70 percentage points was obtained (significant at the 90% level).<sup>7</sup>

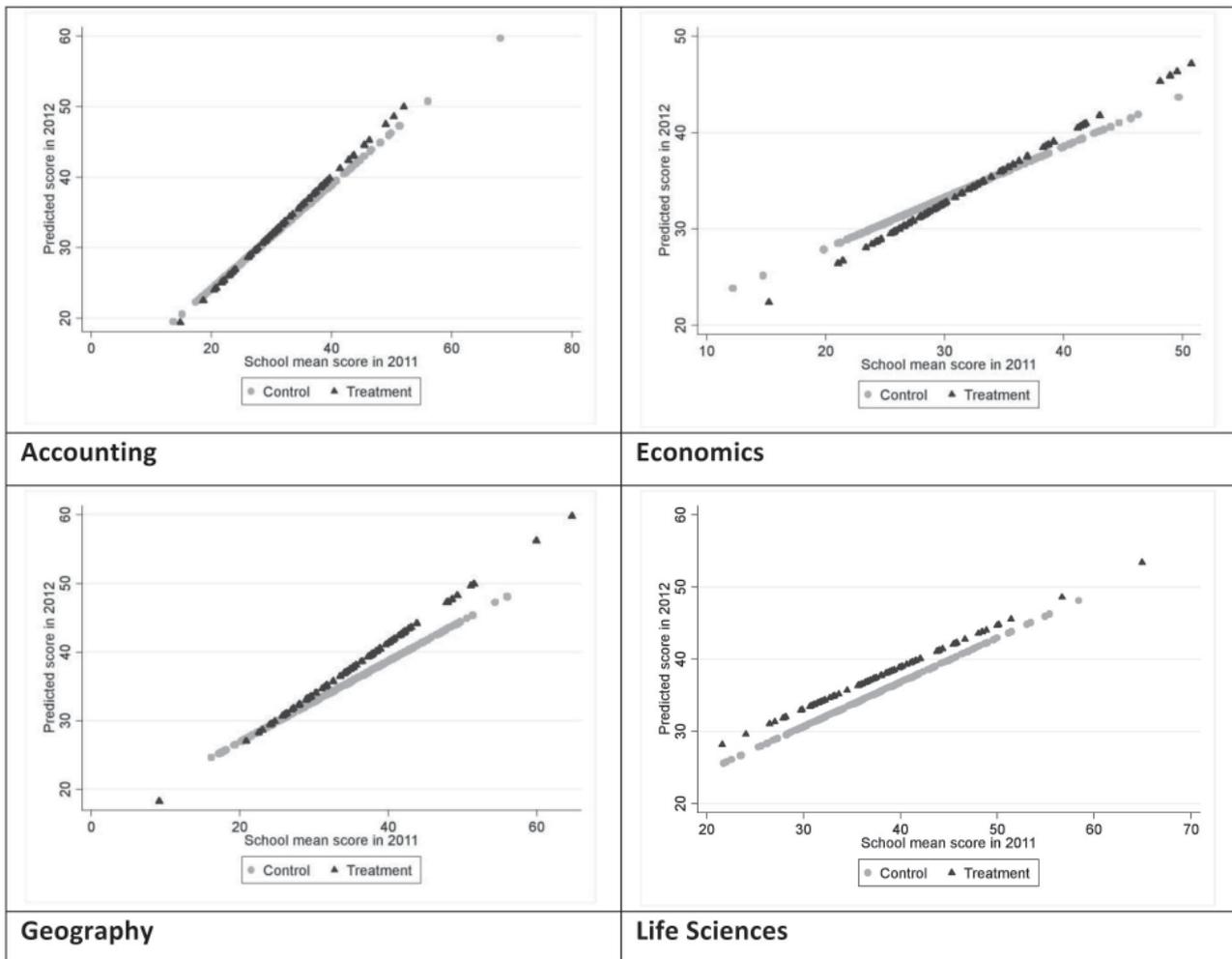
**Table 7.** OLS regressions interacting treatment with baseline measures

	<b>Accounting</b>	<b>Economics</b>	<b>Geography</b>	<b>Life Sciences</b>
Treatment	-2.17 (4.11)	-5.62 (3.87)	-3.61 (2.90)	3.42 (3.57)
Mean 2011 score	0.74*** (0.06)	0.53*** (0.07)	0.59*** (0.04)	0.61*** (0.05)
Interaction: Treatment & 2011	0.08 (0.13)	0.17 (0.12)	0.16** (0.08)	-0.03 (0.09)
Quintile	No	No	No	No
R-square	0.4038	0.2651	0.5332	0.4306
Observations	315	317	315	317
Treatment & Interaction Jointly significant	No	No	Yes***	Yes***

Notes: Standard errors in parentheses. \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

<sup>7</sup> Note that the adjustment for large gains and declines in school performance reduces the ostensibly negative impact (in any case not statistically significant) of the Economics guides at the low end of baseline scores.

**Figure 2.** Predicted scores for treatment and control schools based on Table 5 estimates



Taken together, these results suggest that better-performing schools were able to benefit more from the study guides. However, due to the type of schools in Mpumalanga chosen for this experiment, these ‘better-performing’ schools had mean scores in the region of 40% to 60%. Therefore, it is perhaps more meaningful to say that very poorly functioning schools were less likely to benefit from the guides. However, this finding applies mainly to Geography. In Life Sciences the impact of the study guides was uniform throughout the spectrum of school performance.

It would also be interesting to know whether the *Mind the Gap* study guides impacted equally on learners at different points in the within-class distribution of performance. Since there was no learner-level baseline measure, this is not possible to accurately estimate. However, one way to produce suggestive evidence is to change the outcome of interest from the school mean score to the school score at specific percentiles in the performance distribution. Table 8 reports the estimated coefficients on the treatment dummy for regressions with the outcome variable being the 10th percentile of achievement within a school, the 25th percentile, the median, the 75th percentile and the 90th percentile, for each subject.

As before, no significant impact of the study guides was observed in cases of Accounting and Economics, and this applied irrespective of the outcome measure used. Positive impacts were estimated for all models for Geography and Life Sciences.

Interestingly, in both of these subjects the size of the effect increased systematically as the outcome variable was set at higher percentiles in the performance distribution. This would suggest that the study guides had a greater impact for the stronger learners within each class.

**Table 8.** OLS regressions with the outcome score set at various percentiles

	10th percentile	25th percentile	median	75th percentile	90th percentile
<b>Accounting</b>	-0.04 (0.86)	0.55 (0.84)	0.22 (0.97)	0.59 (1.17)	0.2 (1.39)
<b>Economics</b>	0.57 (0.84)	-0.07 (0.78)	-0.62 (0.83)	-0.35 (0.97)	-0.24 (1.11)
<b>Geography</b>	1.33** (0.67)	1.57** (0.61)	1.82*** (0.66)	2.46*** (0.77)	2.57*** (0.94)
<b>Life Sciences</b>	1.46** (0.65)	1.79*** (0.65)	1.86*** (0.69)	2.92*** (0.80)	3.49*** (0.93)
<b>Quintile</b>	Yes	Yes	Yes	Yes	Yes
<b>2011 score at relevant percentile</b>	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

### 2.3.4 Effects on passing the matric examination

If the *Mind the Gap* study guides impacted on performance in Geography and Life sciences, then this should translate into more National Senior Certificate passes overall. For some learners an extra few percentage points in the Geography or Life Sciences paper would have allowed them to pass that subject, and in some of these cases passing that subject would have been the difference between attaining a National Senior Certificate and not. Estimating the effect of the study guides on passing matric is not straightforward, since there will be spillover across the subjects as some learners would have taken more than one of these four subjects. For instance, although the Economics study guides had no impact on Economics scores one might observe a higher pass rate amongst Economics learners in treatment schools owing to the impact of Geography or Life Sciences guides amongst those who took these subjects as well as Economics.

Therefore, a more appropriate model predicts the school pass rate only counting those learners who took both Geography and Life Sciences. This model thus reflects the combined impact of receiving effective study guides in two examinable subjects. Table 9 reports the results. Only 260 schools had learners taking both Geography and Life Sciences. Amongst learners taking both subjects in these schools the impact of receiving two effective study guides on attaining a National Senior Certificate is estimated to be 6.5 percentage points. This large effect is not unsurprising given the distribution of scores.

As Figure 1 illustrates, the bulk of learners have scores between about 25% and 40%. An increment of 2 percentage points in two subjects is therefore likely to be the difference between passing and failing for many of these candidates.

**Table 9.** Difference-in-difference OLS regressions predicting pass rate amongst those taking Geography and Life Sciences

	<b>Pass rate 2012</b>
Treatment	6.50** (2.69)
2011 pass rate	Yes
Quintile	Yes
R-square	0.2726
Observations	260

Notes: Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

A different way of assessing the impact of the study guides on NSC passes is to consider what the effect would be on the national pass rate if guides were distributed at scale. To this end, a simulation exercise was conducted using National Senior Certificate data for 2010 since this was a year in which no learners received *Mind the Gap*. We assumed that only the Geography and Life Sciences study guides impact on performance, and that those impacts are two percentage points in both cases. We then imputed an extra two percentage points to each candidate in the 2010 dataset for each of these two subjects, as long as their original mark was less than 80%.

According to our calculations (which differ slightly from official NSC 2010 figures due to excluding certain unusual candidates), 367 417 candidates passed matric in 2010 (a pass rate of 65.54%). Had learners who took Geography and Life Sciences achieved two percentage points more than they did (as we predict the *Mind the Gap* study guides would have caused) then 373 026 learners would have passed the NSC (a pass rate of 66.54%). This means that 5 609 learners who did not pass matric in 2010 would have passed had the Geography and Life Sciences study guides been distributed nationally.

### Placebo tests

Several placebo tests were carried out in order to check the likelihood that the observed impacts of the study guides were somehow an artefact of the data. The first set of placebo tests involved randomly selecting another 79 treatment schools and 239 control schools from the same sampling frame and then performing the same regression models on these groups. The schools that actually did receive *Mind the Gap* study guides would have been randomly distributed across the new ‘fake’ treatment and control groups and there is therefore no reason to expect the treatment dummy to be associated with performance. This procedure was repeated ten times and the results for the main difference-in-difference models for each subject are reported in Table 10.

Of the 40 regressions that were carried out only one significantly positive effect was obtained, although there were three significant negative effects. This is broadly in line with the expected frequency of type I errors at given levels of statistical significance.

**Table 10.** Difference-in-difference OLS regressions on placebo draws of treatment and control schools

Placebo dif in dif	Accounting	Economics	Geography	Life Sciences
Placebo draw 1	0.8	-0.15	-1.11*	-0.58
Placebo draw 2	0.19	-0.42	-1.32**	-0.25
Placebo draw 3	0.3	-0.09	0.94	0.92
Placebo draw 4	-0.17	-0.26	0.5	0.21
Placebo draw 5	1.16	0.97	1.27**	0.36
Placebo draw 6	0.18	0.46	-0.56	-0.38
Placebo draw 7	0.52	0.07	-0.3	-0.1
Placebo draw 8	-2.66***	-1.17	-0.01	0.06
Placebo draw 9	-0.44	0.32	0.29	-0.65
Placebo draw 10	1.23	1.04	0.94	-0.44
Baseline	Yes	Yes	Yes	Yes
Quintile	Yes	Yes	Yes	Yes

Notes: Only the coefficients on the treatment dummy variable are shown.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

A second set of placebo tests used the actual treatment and control groups but estimated the regression models for other subjects not covered by *Mind the Gap*. Model 1 replicates Table 3, Model 2 replicates Table 4 and Model 3 replicates the main diff-in-diff model as reported in Table 5. In the two models that do not control for baseline achievement a spurious treatment effect is observed for two subjects. However, once the baseline is controlled there are no statistically significant ‘impacts’ of being in a treatment school for non-*Mind the Gap* subjects.

**Table 11.** Three main regression models applied to other subjects

	Model 1	Model 2	Model 3
Mathematics	2.04*	2.41**	0.80
Physical Science	1.48	1.57	0.64
English FAL	0.66	0.51	0.13
Business Studies	0.98	0.73	0.35
Maths Literacy	1.87**	1.74**	0.73
Tourism	0.95	0.61	0.22
Quintile	No	Yes	Yes
Baseline	No	No	Yes

Notes: Only the coefficients on the treatment dummy variable are shown.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

A final set of placebo tests predicted 2011 performance using 2010 performance as the baseline. Six models were estimated for each *Mind the Gap* subject: the standard model predicting school mean score controlling for quintile and baseline mean score as well as the models with the outcome being school performance at various percentiles of within-school achievement. In none of these models was a statistically significant coefficient on treatment obtained.

**Table 12.** Predicting 2011 outcomes with 2010 as a baseline

	Mean	10th pctile	25th pctile	median	75th pctile	90th pctile
Accounting	0.09	0.15	-0.16	-0.36	0.25	0.73
Economics	0.24	0.28	0.11	0.2	0.34	0.48
Geography	0.9	1.35	1.12	1	0.29	0.61
Life Sciences	0.87	0.89	0.43	0.77	1.09	1.38
Quintile	Yes	Yes	Yes	Yes	Yes	Yes
Baseline (2010)	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Only the coefficients on the treatment dummy variable are shown.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

The various placebo tests therefore provide assurance that the observed impacts of *Mind the Gap* study guides on Geography and Life Sciences performance were not the result of a spurious data generating process.

## 2.4 Discussion

The main findings of the study can be summarised as follows. The *Mind the Gap* study guides had no observable impact on Accounting and Economics performance, but did positively and significantly impact on performance in Geography and Life Sciences. There was some evidence, mainly in the case of Geography, that the impact was lower amongst seriously underperforming schools. Improvements in Geography and Life Sciences achievement led to an increased probability of attaining a National Senior Certificate.

The fact that there was an impact, albeit in two of the four subjects, is perhaps surprising given how light an intervention this was: no teacher training or awareness campaign accompanied the delivery of the study guides to treatment schools; moreover, learners only had between one and two months to use the guides before writing their final exams. It is well known that the management of learning materials leaves much to be desired in many South African schools, with reported cases of boxes remaining unopened in storerooms and books getting lost throughout the course of a year. Therefore, the arrival of a new resource at exactly the time in the school calendar when all energies are targeted toward the high-stakes National Senior Certificate examination may have provided the right incentive to make proper use of the guides. This relates to an important interaction between policy interventions and the existing incentives facing stakeholders: when the incentives facing stakeholders are strongly aligned to the goals of interventions these will be most effective.

The findings in this study relate to several broad debates of policy and theoretical interest. Glewwe *et al.* (2007: 27) suggest that the textbooks experiment in Kenya pointed to a curriculum mismatch in that country: textbooks reflecting ambitious curriculum requirements were only appropriate for the most talented individuals. Similarly, Banerjee and Duflo (2011) argue that in many developing countries an unintended negative consequence of ambitious curricula is that the majority of learners fall behind. Despite recent improvements and simplifications in South Africa's Curriculum and Assessment Policy Statements (CAPS), national assessments demonstrate that across the grades, the majority of learners are performing substantially below curriculum requirements. One possible implication of this study is that well-designed study guides, which extract the core subject knowledge, can partly mitigate the unintended consequences of an ambitious curriculum in weakly performing schools.

This study also suggests that incremental improvements in educational performance are possible through interventions that do not involve teacher training or teacher mediation. Given the strong deterministic influence of learner socio-economic status and the central role of teachers (e.g. Hanushek, 2010), some are pessimistic about the impact of isolated interventions when these are not well integrated with deeper instructional and organisational reforms. Richard Elmore (1996: 25) argues that, "getting to scale with good educational practice requires nothing less than deliberately creating and reproducing alternatives to the existing flawed institutional arrangements and incentives structures". While fundamental and substantial systemic change no doubt does require this level of institutional reform, other research indicates that specific remedial interventions that to some extent bypass existing institutional arrangements can lead to incremental improvements. Banerjee *et al.* (2007) report on an RCT in India where remedial classes administered by young women in the community significantly improved basic literacy and numeracy amongst primary school learners. Similarly, Banerjee *et al.* (2010) found that remedial reading camps run by volunteer youth in India improved reading acquisition. The *Mind the Gap* RCT provides another example of a specific intervention that improved performance without fundamentally reforming instructional practice and institutional arrangements.

The finding that, at least for Geography, the study guides had a larger impact on better-performing schools may relate to the finding, for instance by Van der Berg (2008), that additional resources in South African schools matter conditionally upon the quality of school management and overall functionality. It is often found in education production function analyses that interventions and resources which may be intended to be pro-poor are more effective in more affluent schools, perhaps because the success of these interventions is dependent on other capabilities and the accountability structures within schools. It may well be that well-managed schools with a greater academic emphasis effectively distributed the study guides to learners and more actively promoted their use.

The fact that two of the study guides had an observable impact and two did not, despite the same delivery procedures, should caution against simplistic 'binary' views on whether resources such as study guides or textbooks matter. For example, the findings of the influential textbooks RCT in Kenya (Glewwe *et al.* 2007) should not be categorically interpreted as evidence that textbooks do not improve performance in African countries. The contextual caveats regarding language proficiency of pupils and curriculum mismatching must be given due consideration. Moreover, as Bold *et al.* (2012) demonstrate, the quality of treatment implementation in RCTs can play a strong role in determining whether an impact is observed. This study demonstrates that even when implementation is exactly the same, impact can vary across subjects.

Yet the burning question remains: why did the Geography and Life Sciences guides have an impact but not the Accounting or Economics guides? This study cannot conclusively answer this question, but one can think of several plausible hypotheses. The first possible explanation is that the quality may have differed across the guides. Separate teams of experts were involved in each subject so the possibility cannot be ruled out. However, there is no prior reason to expect this given the similar and extensive processes of materials development by teams of teachers, examiners, curriculum officials and academics. Related to the notion of quality, is the possibility that the four study guides may have differed in the extent to which the core subject knowledge extracted for the guides matched the items included in the final examinations.

A second possibility is that contextual factors predisposed Geography and Life Sciences to benefit from study guides but were different for Accounting and Economics. For example, study guides may have different effects depending on the availability and quality of existing materials in the specific subjects. For example, the Geography *Mind the Gap* guides contained mapwork materials, something which is crucially important yet particularly scarce in many poorly-resourced schools. Secondly, the nature of the course content and type of learning may differ across these subjects in ways that are more or less suitable to a study guide intervention. For example, the Life Sciences guides had extensive blank scientific diagrams, such as of the human eye or brain, on which to practice labelling. In contrast, there are arguably fewer modes of representing knowledge in Economics, with the result that the guide may have been rather congested with many abstract concepts.

What can be concluded about the magnitude of the observed impacts and the expectations in scaling up this intervention? Amongst the 318 schools in Mpumalanga used for this study, the standard deviation of pupil performance was 15.1 percentage points for Life Sciences and 14.4 percentage points for Geography.<sup>8</sup> Therefore, the coefficient in the main regression for Geography of 1.94 translates into an impact of 13.5% of a standard deviation, while the coefficient for Life Sciences of 2.17 translates into an impact of 14.4% of a standard deviation. A widely used rule of thumb is that a year of learning amounts to between 40% and 50% of a standard deviation. Viewed in this light, the impact of the Geography and Life Sciences study guides was large: providing learners with a study guide lead to an increase in learning roughly equivalent to a third of a year of schooling. While this casts a favourable light on the *Mind the Gap* intervention, the fact that this sort of 'slack in the rope' exists, points to serious deficiencies in teaching and learning in South African schools.

The true impact on those learners who actually used the *Mind the Gap* study guides was most probably significantly larger than the average treatment effects of about 2 percentage points. Suppose that of the 100% of study guides produced and delivered to schools only 80% actually reach teachers. Then suppose only 60% are handed out to learners and 40% of learners actually end up using the books. Because of this attrition effect, the true impact on those using the books is no doubt larger than 2 percentage points.

The National Senior Certificate result simulation demonstrated that the expected increase in the national matric pass rate associated with a national distribution of Geography and Life Sciences guides is approximately one percentage point. However, amongst those individuals taking both these subjects the increase in the pass rate is estimated to be about 6.5 percentage points.

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<sup>8</sup> Nationally, the standard deviation is only slightly larger. For Geography it is about 15 percentage points and for Life Sciences it is about 18 percentage points.

The impact of distributing eight subject-specific study guides in the future is arguably likely to be nearer to the higher estimate. With eight guides available in the main subjects it is likely that learners will each receive at least two guides, perhaps as many as four. If one assumes that on average each learner receives an effective study guide in two subjects, then the impact on the National Senior Certificate pass rate may be in the region of 6.5%. It remains debatable whether the estimate of a one percentage point increase in the pass rate (assuming only Geography and Life Sciences guides have an impact) is more relevant than the estimate of 6.5 percentage points (assuming that all pupils have access to two effective guides).

This is an enormous impact given the low cost of this intervention. The unit cost per study guide (reflecting materials development, printing and distribution) is estimated to be R41,82. Using a technique from Kremer, Brannen and Glennerster (2013), it is possible to estimate how many standard deviations of test score improvement could be generated per \$100 invested in the study guide intervention. This comes to 3.04 standard deviations per \$100, which expressed on a logarithmic scale is 20.9.<sup>9</sup> This places *Mind The Gap* study guides amongst the five most cost-effective interventions out of the 15 interventions for which Kremer *et al.* (2013: 298) calculated this value.

One potential criticism of this intervention is that it may not produce a sustained improvement in skills but only help learners prepare for a specific examination. There may be an element of truth in this, but even so, the ability to prepare for an examination is an important skill and one which is no doubt better taught in South Africa's top-performing schools. Therefore, one might argue that a study guide can partly offset the artificial difference in National Senior Certificate results reflective of better guidance rather than underlying skill. Moreover, through increasing the probability of passing the NSC, the *Mind the Gap* study guides helped learners in what is an important step towards labour market success.

It is important for policy-makers to realise that interventions such as this, and similarly the DBE workbooks intervention which provides workbooks to all learners in Grades R to 9, should not be viewed as blanket interventions. Rather, certain grade or subject-specific materials may be more or less effective than others due either to quality differences or contextual factors.

In particular, materials should continuously be revised to ensure relevant and high quality products. This is especially relevant when materials are centrally developed rather than in the private sector. Evaluations, such as that conducted by the Australian Council for Educational Research on the Department of Basic Education workbooks, are therefore important contributions.

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<sup>9</sup> A rand dollar exchange rate of 0.11 (as at 8 May 2013) was used. As per the earlier discussion, it was estimated that each Geography and Life Sciences study guide led to a test score improvement of 0.14 standard deviations.

## 2.5 Conclusion

This impact evaluation of *Mind the Gap* study guides represents one example of good impact evaluation practice in government. Similar evaluations of specific programmes can be accomplished at fairly low cost if there is co-ordination between programme managers and evaluation experts, especially if this occurs prior to programme roll-out. Randomised Control Trials are a fair way to distribute resources when there is a budget constraint and when doing any piloting exercise, and they provide the most robust measures of impact. They can be expensive but when outcomes data, such as national examinations data, already exists the cost is substantially lower. Even when an RCT is not possible, such as when a programme is in full scale operation, other quasi-experimental techniques can sometimes be employed with a little creativity. These techniques include the setting of a clear policy rule to determine who the recipients of interventions should be (allowing Regression Discontinuity Techniques to be used), encouraging or incentivising certain randomly chosen groups to participate in an available intervention (thus constructing an Instrumental Variable), or merely keeping accurate administrative records of who received interventions at which time (allowing standard difference-in-difference techniques to be used).

The momentum towards greater use of impact evaluations is slowly building within the South African Government. The Department of Performance Monitoring and Evaluation (DPME) in the Presidency, for example, has established a National Evaluation Policy Framework and a National Evaluation Plan through which it is encouraging all government departments to conduct rigorous evaluations of their main programmes. Even when the cost of an evaluation is high, the costs of the overall programme are usually exponentially greater. The lessons from evaluations therefore typically easily justify the costs. Government budgeting should increasingly prioritise this, rather than relying primarily on donor funding for this important activity.

A primary conclusion of this report is that the *Mind the Gap* programme can be expected to significantly impact on the performance of NSC candidates. The fact that two study guides did improve performance indicates that the basic intervention design can accomplish its intended purposes. However, the fact that two guides did not noticeably improve performance illustrates that well-designed interventions can sometimes not have the intended impact when certain contextual or epistemological factors prevent this. Rigorous impact evaluation can help dispel the myth that ostensibly well-designed interventions must surely be effective and can alert policy-makers to cases where barriers to effectiveness may exist.

This experiment using study guides also has bearing on the literature on textbooks and as well as school resources more generally. It indicates that additional learning support materials can be a cost-effective means to improve learner achievement.

The finding of greater impact within relatively well-performing schools is consistent with other literature arguing that resources matter conditionally upon school management (Van der Berg, 2008). The finding that study guides shifted achievement most at the high end of the within-class distribution is consistent with other findings that textbooks help high ability learners most (Glewwe *et al.* 2007).

The results of this study raise several interesting questions. Why did the Geography and Life Sciences guides impact on performance but Accounting and Economics guides did not? It is not possible to answer this question in the present study, but this result does suggest that impact may be dependent on particular contextual or epistemological features. The existence of other available material may differ across subjects and this may determine the impact of new materials. Secondly, the types of skills required in different subjects may differ in ways that influence whether a study guide is an effective tool for improving those skills. A variation of this possibility is that certain types of learning can be enhanced in a short space of time through the use of a study guide but that other types of learning are less responsive to a short intense treatment. Finally, this study illustrates that even when the treatment implementation is essentially identical, there can be different results across subjects. Therefore, influential Randomised Control Trials on textbooks must be interpreted with sensitivity to their context rather than taken as simplistic answers to questions such as, “Do textbooks matter?” Future studies should aim to illuminate the conditions necessary for interventions, such as additional materials, to impact on learning.

## The Way Forward

This intervention realised its aim to improve the performance of National Senior Certificate candidates by orientating them to the examination requirements, providing extensive opportunities for practice while clearly explaining core knowledge and skills in the four subjects: Accounting, Economics, Geography and Life Sciences (in both English and Afrikaans). The study guides would appear to be assisting Grade 12 learners to ‘mind the gap’ between failing and passing the National Senior Certificate (NSC) examination.

The Department of Basic Education has successfully distributed 320 697 print versions of *Mind the Gap* study guides in 2012; and the website downloads from 29 October 2012 to 4 March 2013 totalled 59 786; and downloads have continued through 2013 and at last calculation on 30 August 2013 totalled 171 761 downloads. This popular uptake suggests that the study guides are hitting the mark, inviting us to better understand how the study guides were developed.

All texts are shaped by social conditions that inform the processes of production. For *Mind the Gap* this involved finding ways of departing from ordinary publishing processes and production cycles in the interests of time: the team only had four months to originate, produce, print and distribute the four subject study guides in two languages. It has been argued in this report that the re-engineering of the materials development processes of production proved to be significant and created the conditions for ordinary innovation. A visual depiction of the components of ordinary innovation in education and the premises informing the theory of change underpinning the materials development processes and the impact evaluation are presented in a composite diagram below.

Diagram 4: *Mind the Gap*: An example of ordinary innovation in education

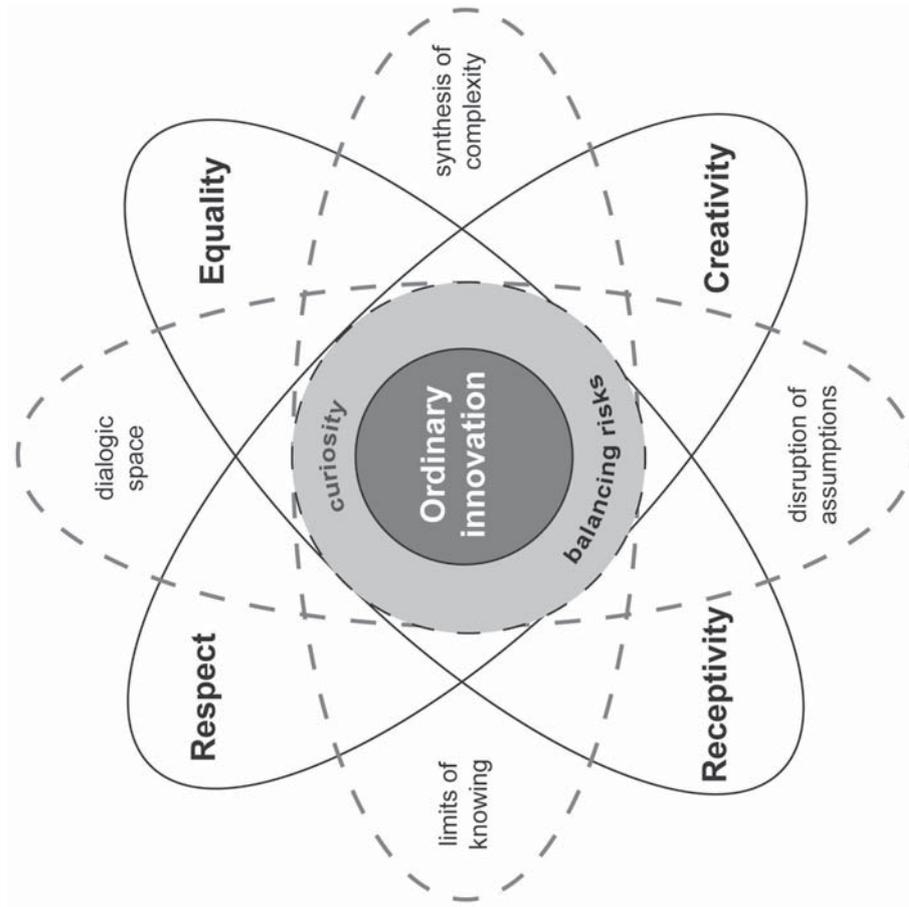
## ***Mind the Gap*: An Example of Ordinary Innovation in Education**

### **Theory of Change informing the materials development process**

1. Diagnostic assessments of learner performance.
2. Synchronistic processes of all knowledge workers – writing, designing, editing and illustration.
3. Heterogeneous groups of professionals with specialist knowledge and experience collaborate to produce and synthesise core knowledge in a dialogic space and in concentrated time frames.
4. Expert readers draw on their expertise and experience to revise the study guides; content writers acknowledge the limits of their knowing and are receptive to input from subject-peers.
5. Content writers and production team creatively collaborate to articulate and present accessible core knowledge and skills to learners.
6. Afrikaans translators of the guides are able to competently avoid losing meaning and mediation in their reception of adaptation processes.
7. The study guides are self-study, stand alone support for under-performing learners; and can be accessed from direct distribution through schools and / or downloaded from the national department's website: <http://www.education.gov.za>.
8. The impact evaluation of the study guides using a randomised experiment informs our understanding of the materials as a resource for improving learner performance.

### **Theory of Change informing the impact evaluation**

1. A cost-effective randomised control trial design can establish a reliable sample set to estimate the causal impact of the *Mind the Gap* study guides.
2. The *Mind the Gap* study guides are delivered to schools.
3. School managers distribute *Mind the Gap* study guides to learners.
4. Learners use *Mind the Gap* study guides to prepare for the Grade 12 National Senior Certificate exams.
5. The examinations for the four subjects Accounting, Economics, Geography and Life Sciences are well designed.
6. The learners' core knowledge and skills are increased by the *Mind the Gap* study guides as is reflected in their writing of their examinations.
7. The impact of the *Mind the Gap* study guides is demonstrated in learners' results from the National Senior Certificate examinations.
8. The results of the impact evaluation inform the systemic planning of interventions designed to improve learner performance.



Through a shared commitment to providing an evidence base for policy interventions, Dr Granville Whittle (the Programme Chief Director), Dr Patricia Watson (Director of *Mind the Gap* materials development), the assessment, curriculum and classroom-based professionals with subject expertise from provinces, districts and schools and Dr Stephen Taylor (Evaluation expert) collaborated to make the materials development process and the impact evaluation of *Mind the Gap* possible.

This system-wide collaborative project is an example of how materials production processes can inform our understanding of ordinary innovation in education; and how the impact of the learning materials produced through such a process can be measured. Through the right sequencing of programme roll-out a credible impact evaluation was achieved at a low cost relative to the overall programme cost.

The formal impact evaluation using a randomised control trial demonstrated the following:

1. There was no observable impact on performance in Accounting and Economics. Various reasons may exist for this result: the availability of other materials may differ across subjects and this may determine the impact of new materials. Alternatively, it is possible that certain types of learning can be enhanced in a short space of time through the use of a study guide but that other types of learning are less responsive to a short intense intervention.
2. *Mind the Gap* study guides positively and significantly impacted on performance in Geography and Life Sciences. Learner improvements in these two subjects led to an increased probability of candidates attaining a National Senior Certificate.
3. For Geography, students in better-performing schools gained more from the guides than students in low-performing schools. This may relate to other research showing that the impact of additional school resources depends on overall school functionality and management.
4. Distributing the Geography and Life Sciences study guides at scale (as is happening in 2013) is predicted to increase the overall National Senior Certificate pass rate by approximately one percentage point.
5. The low unit cost of *Mind the Gap* makes this a highly cost-effective intervention. The unit cost per study guide (reflecting material development, printing and distribution) is estimated to be R41,82. A cost-benefit analysis was undertaken by calculating the size of the impact on learner achievement per \$100 spent and comparing this figure to other educational interventions from around the world that have been tested using randomised control trials. *Mind The Gap* turned out to be amongst the top five cost-effective interventions out of 15 that were considered.

The *Mind the Gap* processes of materials production stand as an example of ordinary innovation in education and confirm the potential impact of high quality learning materials, something which has been prioritised by the national Department of Basic Education in recent years as demonstrated by the Workbook initiative. This evidence also points to the importance of reviewing materials development processes and outputs, as well as how these are used by learners, since their effectiveness may vary from title to title and may depend on contextual and/or epistemological factors.

The primary conclusion of this report is that the *Mind the Gap* intervention can be expected to significantly impact on the performance of matric candidates going forward. The fact that two study guides did improve performance in Mpumalanga provides solid evidence that the materials development process can accomplish its intended purposes. The impact evaluation thus provides a clear policy warrant for expanding the *Mind the Gap* intervention to scale, so that in 2013 all candidates registered for the four *Mind the Gap* subjects in all nine provinces receive the study guides. This finding also supports the ongoing development of more subjects. In 2013, the national department has committed to the development of *Mind the Gap* study guides for Grade 12 aligned with the Curriculum and Assessment Policy Statements (CAPS) for English First Additional Language, Mathematical Literacy, Mathematics and Physical Science. There is also a commitment to CAPS align the phase one titles and ensure that they are also available in Braille, as well as exploring ways to support learner collaboration and the development of teachers' core subject knowledge. The phase two *Mind the Gap* outputs will be ready for uptake by the education system in 2014.

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