

## Protocol for the Systematic Review of Question 2:

### What is the evidence of the relationship between education, skills and growth in low-income countries?

Denise Hawkes and Mehmet Ugur

University of Greenwich

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<b>Authors IN ORDER OF CREDIT (Please include first and surnames, institutions. Include titles – Dr, Prof – if you want them to be used.)</b>	Denise Hawkes Mehmet Ugur	
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<b>Contact details (address, phone number, email)</b>	Dr Mehmet Ugur University of Greenwich Queen Anne Building, QA355 Old Royal Naval College Park Row London SE10 9LS 020 8331 8913 M.Ugur@gre.ac.uk	Dr Denise Hawkes University of Greenwich Queen Anne Building, QA357 Old Royal Naval College Park Row London SE10 9LS 020 8331 9877 D.Hawkes@gre.ac.uk
<b>Institutional base</b>	University of Greenwich	
<b>Review Group (with institutions)</b>	Dr Denise Hawkes, University of Greenwich Dr Mehmet Ugur, University of Greenwich	
<b>Advisory group (with institutions)</b>	Katie Chapman and Alison Girdwood, DFID policy leads Max Gasteen, DFID	
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# 1. Background

## 1.1 Aims and rationale for review

Investing in human capital is considered to have a whole array of benefits to the individual, society and the economy as a whole. Academics in many fields of social science point to the benefits of education in terms of personal health, crime and environmental protection. The benefits to education are also demonstrated in interviews with street children in African countries, who when asked what they would like often report 'going to school'. Education and skills are considered to be one of the key determinants of economic growth and development. These widely-held views and perceptions tie in with the focus of policy on the Millennium Development Goal of a full course of primary education for all. Achievement of this goal is regarded as key factor in sustained economic development (UN 2000).

Given this widely accepted belief that education and skill development is good for individual, society and the economy, the long-standing interest of academics and policy-makers in understanding the causes and consequences of education has acquired a new dynamism. The research effort across social sciences has led to a voluminous literature, using an array of quantitative and qualitative methods and leading to as many unanswered questions as those answered. Even focusing on the topic of this systematic review - the relationship between education, skills and economic growth - a wealth of material has been produced in economics, social policy, education and sociology with methods as diverse as cross-country regressions to individual cases studies of specific education interventions

The empirical evidence of the relationship between education, skills and economic growth can be divided into three main approaches: (1) wage equations undertaken in labour economics consider the rate of return to education using individual level data; (2) growth accounting where the estimation attempts to split the growth of an economy into the contributions of various inputs, labour, capital, quality adjusted labour etc.; and (3) growth regressions which uses cross-country comparisons to understand the relationship between education and growth (Temple (2001)). Regardless of the approach taken, the empirical evidence is mixed on the importance of education and skills in explaining economic growth - and this leads to an often confusing picture for policy-makers looking for evidence to support policy (Patrino and Psacharopoulos (2002), Krueger and Lindahl (2010), Bosworth and Collins (2003) and Pritchett (2001)).

However, diversity of the studies in terms of methodology, data quality, result and country groupings, coupled with the increasing volume of the literature on the human capital-growth relationship, call for a systematic synthesis of the existing evidence for two reasons. First, a systematic synthesis of the evidence is necessary to provide policymakers with verifiable and comparable estimates of the empirical relationship between education, skills and economic growth, with a special focus on low-income countries. Secondly, a systematic review is also necessary to uncover the potential for new research avenues in terms of theory, methodology and data quality.

This systematic review aims to address these needs by: (a) synthesizing the **empirical evidence** on the empirical link between education and economic growth with a view to support evidence-based policy making; and (b) identifying potential avenues for further analytical and empirical research on the human capital-growth relationship. These avenues are likely to include labour productivity, innovation and labour market participation. In doing this, the systematic review will pay special attention to the synthesis of the empirical evidence on the human capital-growth relationship with respect to **low-income countries**.

Unlike healthcare, education or social policy research, where systematic reviews constitute a well-established method of synthesizing micro-level research findings, systematic reviews on the macro-level outcomes of education are a new development. In addition, the issues here do not necessarily lend themselves to systematic review questions suitable for randomised control trials (RCTs) or cross-sectional studies in which the intervention and the reference standard are performed on similar samples. Studies considering the link between education, skills and economic growth in the economics literature may draw on cross-national studies with or without a time dimension or on panel data where the impacts of the relevant variables and the time trend may be mixed. In addition, the sample, the estimated model, the methodology for data analysis, and the quality of the data may differ from one study to the other. These aspects constitute additional challenges for systematic reviews on macro-level outcomes of education in general and for the proposed systematic review in particular.

The proposed review will address these challenges and maximise the reliability of the synthesis by:

- a. Drawing on theoretical/analytical studies for informing data collection from empirical studies and building the theoretical framework on the relationship between education, skills and economic growth;
- b. Conducting a **meta-analysis** of the evidence from *all* empirical studies to be selected in accordance with pre-specified criteria;
- c. Providing a meta-synthesis of the findings in all empirical studies, plus sub-sets of the studies that will be clustered on the basis of a common characteristic such as model used, country composition, and the channel through which education and skills are assumed to affect economic growth;
- d. Relating the synthesized empirical evidence to the theoretical framework with a view to highlight the channels through which education and skills impact on growth and evaluate the progress made in the literature and the scope for new research avenues in the area of education, skills and growth relationship.

Conducting the meta-analysis on the basis of study clusters sharing a common characteristic will enable us to control for methods, samples and channels through which education interacts with growth. On the other hand, locating the empirical synthesis with the theoretical/analytical framework will enable us to identify the scope/need for further

research. In this exercise, we will draw on the mixed methodology proposed by Harden and Thomas (2005).

## **1.2 Definitional and conceptual issues**

Definitions and conceptual issues vary between the three main approaches taken in the literature that consider the empirical evidence of the relationship between education, skills (i.e., human capital) and economic growth. . The wage equation approach often undertaken by labour economists provides the opportunity to focus in more detail on the link between different types of education and skills and wages/income. Whilst this large body of research would enable us to consider a wide range of questions regarding heterogeneity in the returns to education of different types or of particular skills, it would not necessarily address the question of the relationship between education and economic growth as these studies often focus more on the private return to education in terms of higher wages or the social return in terms of higher tax revenues. As a consequence, and in order to assess the relationship between education, skills (i.e., human capital) and economic growth we will focus on the macroeconomic approaches of growth accounting and growth regressions. Whilst, as documented below, this macroeconomic focus may reduce our options of considering the heterogeneity in the return to education, this focus will enable us to answer the research question more directly.

Krueger and Lindahl (2001) summarise and reconcile the findings from these two strands of the empirical work. They find that whilst the wage equation approach provides good evidence on the personal benefits of education, in terms of the private return to education, it is less clear when looking at the evidence on the social returns to education. They find that the growth regression approach provides evidence of the importance of the stock of education and the change in education in the growth of the economy, conditional on measurement error concerns in the education variable (average years of schooling). Therefore we shall need to consider both the role of the stock of human capital and its change in terms of the effect on economic growth.

Bosworth and Collins (2003) state that growth accounting and growth regression approaches have much to say to policy makers if they are used appropriately. They note that although both methods have developed empirically beyond the economic theories they have originated from due to the availability of data and computer capacity they have many useful findings worth using by policy makers. Since the focus of the review question is on economic growth rather than the personal income we shall focus on the body of evidence produced using growth regression and growth accounting papers rather than wage equations papers. One weakness of this choice is that they are likely to be few papers on skills. Even in the rate of return literature the number of skills papers based in developing countries is limited (Glewwe 2002). At the macroeconomic level it is likely that there are very few papers linking aggregate levels of skills to economic growth beyond papers using literacy and numeracy rates which could be considered as measures of basic skills in the economy. If the search results and included studies demonstrate that this is the case, the lack of evidence on skills will be reported and its implications for further research will be

identified. Nevertheless, the absence of studies focusing on skills may be compensated by studies focusing on different measures of human capital, some of which may include proxies for skills.

### **1.2.1 Education and Skills in macroeconomic models: definition and measurement**

The terms education and skills are very broad terms however the focus on macroeconomic growth papers helps in the definition and measurement of education and skills. In this context education and skills are seen as the way of measuring the stock of human capital in the economy and the change in that stock over time. Human capital is one of the inputs in the economy which together with physical capital and natural resources combine to create the output or national income of the economy, often measured by GDP. The change in national income is economic growth.

In this context human capital is measured using aggregate measures such as average years of schooling (Krueger and Lindhal 2001), enrolment rates (Bils and Klenow 2000), education expenditure (Baldacci et al 2008, Ranis et al 2000, Oketch 2006), Literacy and Numeracy Rates (Vinod and Kaushik 2007) and National test scores (Pritchett 2001, Hanushek and Kimko 2000). The first challenge for this systematic review will be how to compare the results of these various measures of human capital. It is highly likely that estimated coefficients for the relationship between education and economic growth will differ between studies mainly due to differences in the type of data used. The second challenge will be to consider the potential for measurement error bias in these measures. It is likely that different measures will be liable to different measurement errors. For example it is possible that enrolment rates have more measurement error than education expenditure measure. To address such anomalies, we will use the type of education measure as a criterion for clustering studies together for conducting meta-regression analysis and generating Funnel plots.

The third issue is one of school quality. Work by Hanushek and Woessmann (2007) suggests that the lack of school quality data in many of the studies considering the relationship between education, skills and growth may be the single biggest challenge in this area of research. The key concern here is whether the use of an aggregate measure like average years of education really captures the human capital development that has been undertaken. That is: is a year of education the same for all people in all settings? This is especially a concern for cross-country studies where differences in educational experience are likely to be larger than a cross-sectional study within a country or within a region for example. This is a key concern in the literature at the moment. One solution is to focus on the educational and skill outcome measures such as literary rates or test scores rather than measures of the size of the education sector in the economy. In terms of the systematic review we shall acknowledge this concern in the field and will address it by having education measurement used as a common theme for clustering studies. The cluster-based meta-syntheses will be compared with the meta-synthesis of all studies; and this will provide a better picture of the size and significance of the estimated parameters. This may be less

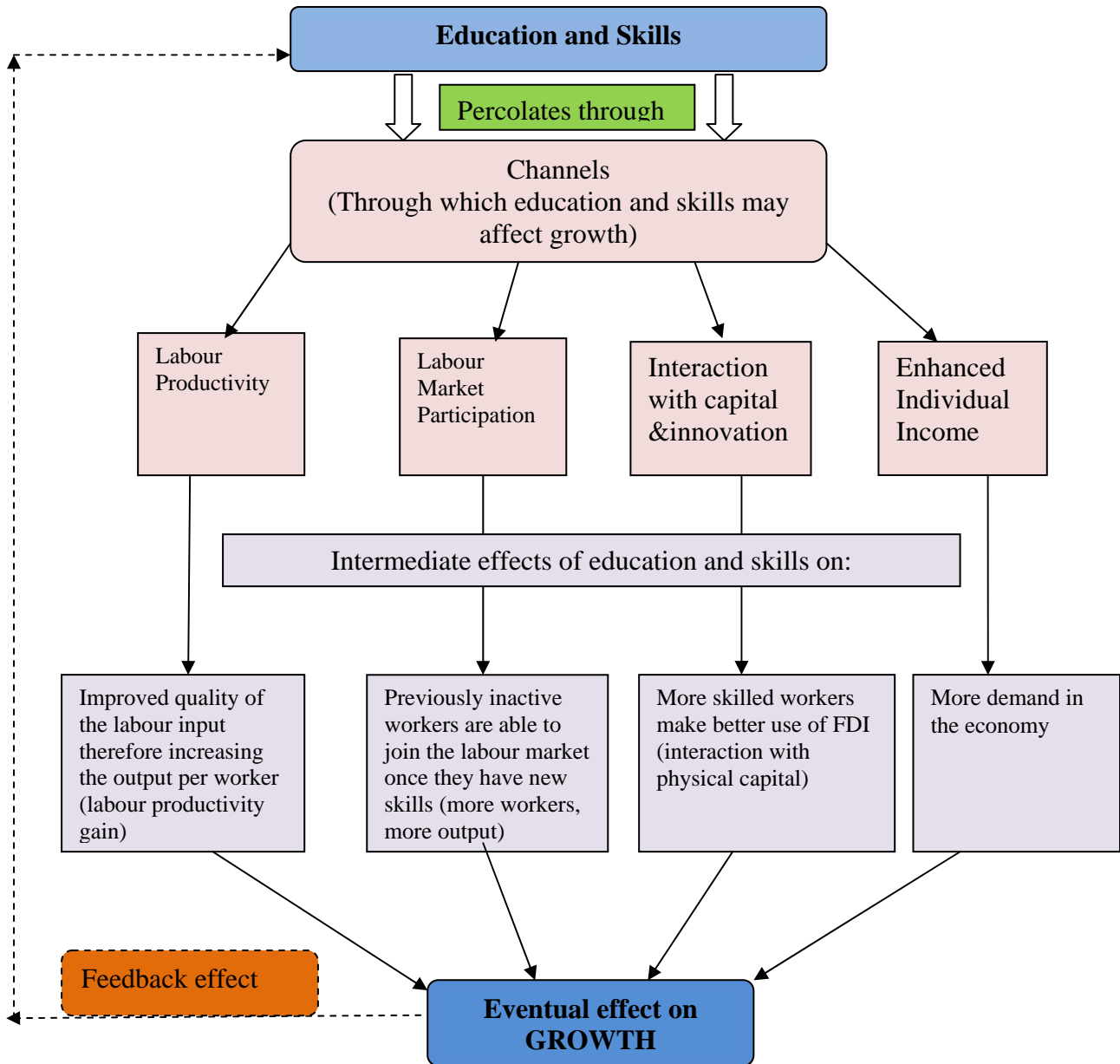
'neat' compared to a single meta-synthesis usually reported in healthcare studies, but it will be more objective and verifiable than the syntheses reported in conventional literature reviews. It will also provide policy-makers and researchers alike with a clear view about the contingent nature of the evidence and about the need/scope for further research.

Given these findings, we are confident that a systematic review of the empirical research findings on the human capital-growth relationship would be both feasible and meaningful. The way in which we conceptualise this systematic review (meta analysis of the evidence from aggregate and clustered studies with a common characteristic in terms of data, methodology and channel) will enable us to address the issues discussed above, and to apply a critical appraisal/quality assessment of the studies in a manner informed by the theory and method of investigating the human capital-growth relationship. In addition this will also enable us to identify possible gaps in the research, most likely to be around the skills part of the review.

### ***1.2.2 The human capital-growth relationship: channels and causal mechanisms***

The link between education, skills and economic growth is unlikely to be a direct one. Figure 1.2.2 shows diagrammatically our conceptual framework as to the channels by which education and skills are transmitted to growth. This is based on the existing literature on the possible causal mechanisms. The conceptual framework attempts to build in both the notion of the stock of human capital found in the economy at any one point in time and the change in education. The prior belief in economics is that education should have a positive impact on economic growth although how this is transmitted differs between papers. Therefore in addition to documenting the relationship between economic growth and human capital using meta-analysis this review will also attempt to document the key pathways (causal mechanisms) through which education and skills are suggested to impact economic growth, drawing on theoretical/analytical papers. This is an important part of the systematic review as identifying pathways will help to identify how to ensure that education funding is most effective in low-income countries. If the Millennium Development Goal of a complete primary education for all is to be obtained it is important that the pathways are identified so that governments obtain as big a return on their investment in education and skills as possible. Identifying the pathways may help policy makers understand better where previous human capital expenditures have gone in the economy. (Oreopoulos and Salvanes 2009, Pritchett 2001)

Figure 1.2.2: Channels through which education and skills may affect economic growth



The first key pathway to consider is the link between human capital and labour productivity (Hanushek and Kimko 2000, Oketch 2006, Bils and Klenow 2000, Temple 2001). This pathway grows from the rate of return literature and labour economic theory. The idea is that a worker is paid a wage equal to his/her marginal revenue product of labour. If this is the case, standard wage equations should establish a positive relationship between the level of education however it is measured and the level earnings. This positive relationship between education and earnings implies that educated workers have higher marginal revenue product of labour that because they are more productive. When aggregated at the macro-economic level, it can be established that higher levels of education and skills (however they are measured) are conducive to higher productivity and the latter is conducive to higher output in the economy. Clearly the strength and weakness of this proposed pathway is whether education and skills actually do lead to a more productive workforce, or whether they are just means of signalling. This is the old-standing debate in theory of human capital. If education merely serves as a signalling device then positive relationship between the level of education and skills and output growth will not hold. Therefore, theoretically, there is no a priori reason to assume that higher levels of education and skills are conducive to higher levels of growth: this relationship must be established empirically.

The second link is between human capital and labour market participation (Glewwe 2002 and Klasen 2002). In this case the investment in human capital may increase the probability of the person actually finding a job and entering the labour market. Therefore an increase in the amount of the labour input will increase the output of the economy and therefore the economic growth. This link is likely to be especially important for the females in the economy as they may be more likely to look for employment if they are educated than if they are not.

The third link is between human capital and investment/innovation (Oketch 2006, Nelson and Phelps 1966, Engelbrecht 2003). It can be argued that a more skilled workforce is more able to make effective use of the FDI that a developing country may attract. This interaction with physical capital and the generation of R&D makes a potentially powerful effect on the rate of growth of the economy, assuming that capital is attracted there in the first place. However the development of a stock of more productive workers should make the attraction of FDI easier.

The fourth link here is through the accelerator effect of investment. Investment in human capital should lead to not just more aggregate supply in the economy due to the increase in the quality of the workforce but also to the aggregate demand in the economy as the more skilled workers earn more and therefore consume more. Finally it is likely that the pathways by which education and skills affect economic growth are likely to change overtime and across countries. We will be mindful of this as we develop our narrative synthesis.



### **1.3 Policy and practice background**

The Millennium Development Goals have focused education policy in recent years on the universal provision of primary education and especially for girls. This focus on primary education in low-income countries is not without its critics (Bennell 1996) however it is also clear that primary education plays an important role in providing pupils with the basic skills required for further study and employment. The effectiveness of the focus on primary education is strongly linked to the view of how education impacts growth. Whilst focuses on the labour market and human capital suggest primary education is important, studies that consider the interaction between education and innovation suggest that primary education is a necessary but not sufficient condition for economic growth.

The focus on the low income countries could produce some interesting effects both in terms of the magnitude of the education effects and on the key pathways identified. This systematic review will attempt to allow the existing literature to inform us of the main effect of education on economic growth and the possible pathways within low-income countries.

### **1.4 Research background**

#### ***1.4.1: Theoretical and empirical research on human capital - growth relationship: an overview***

The theoretical basis consists of either the exogenous growth tradition (Solow 1956) or the more contemporary endogenous growth models (Aghion and Howitt 1998). However with the availability of larger and more detailed data sources as well as the computer power to analyze them many of the more recent empirical papers have evolved beyond the growth theories they were once testing. Their results therefore build on and add to other applied econometric papers rather than providing a direct test of the more traditional economic growth and development theories. This development in the area of applied econometrics means that many of the newer theories in this field have originated not from a theoretical model but from the empirical models or the data itself. This evolution has also meant that the focus in the more recent papers has been on the rather econometrically-focused problems of endogeneity and model specification.

Despite a large body of work identified on the link between education, skills and economic growth a relatively small proportion of that work is focused exclusively on developing countries. Most of the published papers find a positive association between education and economic growth although the unpublished literature may have more insignificant results. Although there are likely to be few papers considering skills and economic growth directly at the macroeconomic level we think that it is possible to make some contribution here too when focusing on the measures of education such as the literacy rates (basic skills).

#### ***1.4.2: Reviews of the human capital-growth literature: few and far in between***

There do not appear to be any systematic reviews in this field as they are not very common in economics. Non-systematic literature reviews have not focused exclusively on low-income countries. Key reviews in this field include: Aghion (2009) which reviews the theoretical background to the education and growth literature but is largely focused on developed countries and higher education, Temple (2001) which reviews the empirical literature for the OECD countries, Griliches (1997) whose literature review focused on the empirical work for the USA and Krueger and Lindahl (2001) in their attempt to reconcile the labour and macroeconomic literatures have some developing country examples. Therefore, by paying a special attention to literature on low-income countries, this systematic review will make a significant contribution to this area.

Exclusive reviews for the developing countries at the macro-level are few and far between. Brook – Utne (2002) reviews the works published in the *International Review of Education* from 1931-2001. This review focuses on the role of aid in the provision of education and some key aspects of the delivery of education, such as the language of instruction. Therefore this systematic review is well placed to be a good summary of the literature for link between education, skills and economic growth available at this time. It will also be able to identify the gaps in the field.

#### ***1.4.3: The rationale for a systematic review: intellectual and policy relevance***

To our knowledge, the less than handful reviews mentioned above are the only reviews of the empirical literature on the human capital-growth relationship. Of course, this does not mean to suggest that existing studies do not provide brief reviews of the existing work relevant to their research questions. However, such reviews are limited in scope/coverage and selective by design. Therefore, a systematic review of the empirical literature on the human capital-growth relationship will be a timely exercise from a policy as well as intellectual perspective.

A systematic review will be policy-relevant for two reasons. First, it can address the need for reliable and verifiable evidence as an input into the policy-making process. Secondly, the large and increasing volume of the empirical literature, and the varied and sometimes conflict nature of the reported findings, complicates the task of policy makers seeking reliable and verifiable evidence. The proposed systematic review, the first on the topic of human capital-growth relationship, will square the circle of needs and means by synthesizing the empirical evidence and mapping this evidence with theoretical explanations. As such, it will provide policy-makers with reliable and verifiable information on how education and skills may affect economic growth and by how much.

The intellectual relevance of the proposed systematic review stems from the need to take a systematic stock of the literature as a basis for identifying gaps and further research avenues. The development of the empirical literature beyond the growth theories from where they originated may have raised new findings which could add to policy makers understanding of the human capital – growth relationship as well as for economic growth

theorists who may be able to develop the theory further in light of these empirical results. The proposed systematic review will provide a comprehensive summary of the progress made and the scope for new research avenues in the area of human capital-growth relationship.

### **1.5 Objectives, Scope and Milestones**

This systematic review addresses the following question: ***What is the empirical evidence of the relationship between education, skills and economic growth in low-income countries?***

It aims to synthesize the empirical findings on the effect of education and skills on economic growth, which is usually measured as growth in gross domestic product (GDP) or per-capita GDP growth. As indicated in Sections 1.1 and 1.2 above, the topic of this review (the human capital-growth relationship) has been examined theoretically and empirically. The brief review in Section 1.4 above provides summary information on the theoretical debate and empirical findings as well as the case for a systematic review in terms of policy and intellectual relevance.

The focus of the review will be the empirical evidence on the human capital-growth relationship in developing countries, with a special attention to the evidence on low-income countries. The existing literature suggests that education and skills may affect growth in different ways in different contexts; and as such, it points out the need to classify and synthesize these effects and the channels through which they unfold. Therefore, the proposed systematic review will consist of three sections:

- a. A section that develops the theoretical/analytical framework within which the relationship between education, skills and growth is examined and informs the collection of data from empirical studies;
- b. A section that synthesizes the empirical evidence on human capital-growth relationship – using meta-analysis methodology that draws on earlier work in economics, such as Mitchell et al (2005); Doucouliagos and Paldam (2009); Stanley and Jarell (1989); and Stanley and Doucouliagos (2007);
- c. An overall conclusion that maps the meta-synthesis with the theoretical/analytical framework and identifies the scope/need for further research.

In this design, the meta-synthesis of the empirical evidence (Section b) constitutes the major component/task that addresses the immediate aim specified in the review question – namely the synthesis of the empirical evidence on the human capital-growth relationship. Sections (a) and (c) will play a complementary role, but will add value by providing a systematic assessment of the existing ‘knowledge’ on the human capital -growth relationship. As such, it can be considered as an innovative element that reflects the fact that the review is the first systematic review in the area of education, skills and growth in developing countries.

As many of the studies for the developing countries are likely to come from cross-country studies we will try to control for income level of countries in two ways. First, we will report the meta-synthesis of the evidence that control for low-income countries explicitly. Secondly, we will report the meta-synthesis of the panel-data regressions that are based on a random-effects estimation. As opposed to fixed-effects estimation, which can only support inference about the actual cases (countries) in the sample, the random-effects estimation supports inference about the population (i.e., all countries in the world) from which the sample is drawn. In other words, the meta-synthesis of the random-effects regression evidence can be used for inference about low-income countries as well as other countries – with an associated confidence interval. To ensure that data used in primary studies includes low-income countries and uses random-effect regressions, we will use ‘low-income country’ and ‘random effect’ criteria among the criteria for selection/inclusion at the quality assessment/critical appraisal stage of the systematic review. Finally, we will also provide the meta-synthesis of the empirical evidence reported in *all* included studies separately. To provide a visual picture of the relationship between the estimates and their precision in these study types, we will use Funnel plots as proposed in Doucouliagos and Paldam (2009).

**Table 1.5.1: Milestones in the review process**

<b>Time-frame</b>	<b>Tasks to be completed</b>
14 October 2010	<ul style="list-style-type: none"> <li>• Protocol completed in the light of reviewers’ comments, approved by DFID.</li> </ul>
18 – 29 October 2010	<ul style="list-style-type: none"> <li>• Complete the search and store search results on EndNote</li> </ul>
1–12 November 2010	<ul style="list-style-type: none"> <li>• Upload search results on to EPPI Reviewer</li> <li>• Apply selection Criteria on the basis of title/abstract information</li> <li>• Code selected studies (S) and de-selected studies (D)</li> <li>• Document the initial selection process.</li> </ul>
15-30 November 2010	<ul style="list-style-type: none"> <li>• Retrieve included studies.</li> </ul>
1 December 2010 – 7 January 2011	<ul style="list-style-type: none"> <li>• Carry out evaluation/critical appraisal</li> <li>• Apply inclusion/exclusion criteria, code included studies as ‘I’ and excluded studies as ‘X’</li> <li>• Carry out manual search and evaluate, using the same inclusion/exclusion criteria</li> <li>• Document included and excluded studies</li> <li>• Code study characteristics (e.g. estimation method, publication type, etc.)</li> <li>• Fill in data/information extraction forms for each included study</li> </ul>
10 – 31 January 2011	<ul style="list-style-type: none"> <li>• Conduct meta-analysis of reported empirical estimates</li> <li>• Conduct narrative synthesis of theoretical/analytical explanations</li> <li>• Map meta synthesis with narrative synthesis</li> <li>• Write the Review and submit to referees</li> </ul>

## **2. REVIEW METHODOLOGY AND PROCEDURES**

### **2.1 User involvement**

Our starting point in the process of identifying the potential users of the review has been the review specifications spelled out by DFID and the consultations we have had with the policy leads at DFID. As a result, we now have the necessary information about DFID's expectations of the review. These expectations include: (i) possible use of the systematic review as an evidence base for policy development; (ii) identifying possible gaps in the theoretical and empirical literature; and (iii) identifying new research questions that may inform both new research and/or new systematic reviews of the existing research.

We aim to expand the range and composition of the potential users by following a two-pronged strategy. On the one hand, we draw on the University of Greenwich's research and publicity infrastructure to disseminate the review findings through press releases, Greenwich-based workshop presentations, and web presence on the University of Greenwich website. On the other hand, we will liaise with the University of Greenwich Director for International Partnerships, who works closely with higher education institutions in developing countries, including India, Bangladesh, and Ethiopia. The aim here is to present the findings of the review and elicit debate through workshops open to the faculty of partner institutions, civil society organisations, and local/national policy-makers in the host country. We aim to organise 2 overseas workshops – one in India and one in Ethiopia.

Finally, we will revise and update the review in the light of the feedback given and comments raised in the workshops – with a view to publish it as a journal article. We think such an outcome will make the review available to a wider range of readers. In addition, we expect the journal publication to instigate scholarly interest in and debate on how systematic reviews can add value to the conventional literature reviews that are the dominant form of reviews in economics in general and development economics in particular.

### **2.2 Review Stages and Methodology: The Pre-Analysis Phase**

In this section, we explain the methods and procedures that will guide the first 4 steps in the review process. These are:

1. Searching for studies and search criteria;
2. Initial screening on the basis of title/abstract information;
3. Evaluation/critical appraisal on the basis of full-text information; and
4. Extraction of information/data

The final phase, which consists of the synthesis and writing up, and the synthesis methods to be used are explained in Section 2.3 below.

## **STEP 1: SEARCHING FOR STUDIES and SEARCH CRITERIA**

Our search strategy consists of 2 components:

- a. Database selection; and
- b. Concept/keyword specification, searching and storing/documenting the search results.

### **2.2.1(a): Database selection**

Databases that will be searched for studies on the human capital-growth relationship consist of a comprehensive list, drawn on the basis of our research experience and referee comments/recommendations received on the draft Protocol. The databases are grouped under 3 categories, reflecting 3 publications types: Published studies, working papers and reports, and theses.

#### ***(i) Databases for published studies***

We will search for **journal articles, books and book chapters** in the **following databases**:

- 1. EBSCO:** International Bibliography of the Social Sciences (IBSS) - economics, politics, sociology, anthropology and Economics)

<http://www.csa.com/htbin/dbrng.cgi?username=greenwichuni&access=welcome>

- 2. EBSCO:** Business and Economics Databases

<http://search.ebscohost.com/Community.aspx?authtype=ip&ugt=723731563C8635473786350632853E8223E365D36013609369E328E336133503&return=y&IsMobile=N>

- 3. SCIEDIRECT** – All sciences and humanities

[http://www.sciencedirect.com/science?\\_ob=HomePageURL&\\_method=userHomePage&\\_btn=Y&\\_acct=C000027518&\\_version=1&\\_urlVersion=0&\\_userid=634187&md5=0afa29013cc300e420d26fa98ae36c3c](http://www.sciencedirect.com/science?_ob=HomePageURL&_method=userHomePage&_btn=Y&_acct=C000027518&_version=1&_urlVersion=0&_userid=634187&md5=0afa29013cc300e420d26fa98ae36c3c)

- 4. WEB OF KNOWLEDGE** – All sciences and humanities

[http://apps.isiknowledge.com/UA\\_GeneralSearch\\_input.do?product=UA&search\\_mode=GeneralSearch&SID=T2e6Bncg9ABckBdGfdc&preferencesSaved=](http://apps.isiknowledge.com/UA_GeneralSearch_input.do?product=UA&search_mode=GeneralSearch&SID=T2e6Bncg9ABckBdGfdc&preferencesSaved=)

- 5. JSTOR** – Social sciences

<http://www.jstor.org/action/showBasicSearch>

## 6. ECONLIT

Available on ScienceDirect.

## 7. ISI – WEB OF KNOWLEDGE

[http://apps.isiknowledge.com/UA\\_GeneralSearch\\_input.do?product=UA&search\\_mode=GeneralSearch&SID=R1Be7P8B6KIJ2O@OONg&preferencesSaved=](http://apps.isiknowledge.com/UA_GeneralSearch_input.do?product=UA&search_mode=GeneralSearch&SID=R1Be7P8B6KIJ2O@OONg&preferencesSaved=)

*(ii) Databases for working papers, reports, etc.*

For scholarly **working papers, reports, and forthcoming papers**, we will search in the following databases:

## 8. SOCIAL SCIENCE RESEARCH NETWORK (SSRN)

<http://papers.ssrn.com/sol3/DisplayAbstractSearch.cfm>

## 9. NBER WORKING PAPERS

<http://www.nber.org/papers>

## 10. RESEARCH PAPERS IN ECONOMICS (REPEC)

<http://econpapers.repec.org/scripts/search/search.asp?pg=-1>

## 11. CENTRE FOR INTERNATIONAL DEVELOPMENT OF HARVARD UNIVERSITY

<http://www.hks.harvard.edu/centers/cid/publications>

## 12. WORLD BANK – Working papers, reports

<http://publications.worldbank.org/e-commerce/>

## 13. IMF - Working papers, reports

<http://www.imf.org/external/pubind.htm>

## 14. UNDP – Research papers, reports

<http://www.twinside.org.sg/pos.htm>

## 15. UNESCO – Research papers, reports

<http://cms01.unesco.org/en/literacy/resources/papers-and-reports/>

## 16. ILO – Working papers, reports

<http://www.ilo.org/public/english/dialogue/sector/papers/index.htm>

### ***(iii) Databases for Theses***

For **PhD Theses**, we will search in the following databases:

**17 ECONLIT** – contains indexes of PhD thesis submitted world wide

Available on ScienceDirect.

**18. INDEX TO THESES** – contains all theses submitted in Great Britain and Ireland universities.

<http://www.theses.com/>

### ***(iv) Google Scholar search***

**19. Google Scholar**

<http://scholar.google.co.uk/>

In addition to the databases listed above, we will search in **Google Scholar**, using the same search criteria.

### ***(v) Manual search***

In addition to the publication types to be searched in 3 types of databases and Google Scholar, we will conduct manual search after completing the evaluation/critical appraisal of the selected studies. The manual search aims to locate unpublished studies, grey literature not indexed on commercial databases, and to identify any study that may not be captured by the search above. Our manual search will be guided by the recommendations of JBI (2008) and CRD (2009), which include:

- Manual search in the reference lists of studies included in the final sample;
- Citation search to identify studies that precede recent studies
- Contacting governmental and inter-governmental agencies and relevant think-tanks not included in the list above; and
- Contacting the top 5 authors (in terms of publication number) whose work is included in the final sample.

The results from these searches will be subject to the same selection and inclusion/exclusion criteria used for determining the final sample of studies obtained through the normal search procedure.



### **2.2.1(b): Search criteria, database searches and storing search results**

Searches in databases will be conducted as 'Title', 'Abstract', 'Keyword', and 'Text' searches. The search procedures are based on recommendations provided in the **EPPI Workshop** held at DFID and the text mining method suggested in CRD (2009); and will be driven by the following specifications:

**Keyword 1: Education**

Synonyms: **Schooling, Training, Qualifications, Skills, Human capital**  
**(For 'Title' 'Abstract' and 'Keyword' search)**

**Keyword 2: Growth**

Synonyms: **development, economic performance, investment, labour productivity, capital, innovation, labour market participation**  
**(For 'Title' 'Abstract' and 'Keyword' search)**

**Keyword 3: Low-income countries**

Synonyms: **Less developed countries, LDC, developing countries, Africa, Asia, Latin America, Middle East, World Bank list of low-income countries (country by country)**  
**(For 'Keyword' and Text' search)**

#### **Time period:**

**January 1980 – July 2010:** for published journal articles, reports, and book chapters; and

**January 1980 – July 2010:** for working papers, policy research papers, discussion papers, and theses.

#### **Language:** Open

Initially, we will search in 'Title', 'Abstract' and 'Keyword' for Keywords 1 and 2, and their synonyms. Then, we will carry out a 'Keyword' and Text' search, using the 'Low-income countries' (Keyword 3) and its synonyms. Finally, we will use the 'Combine' command to combine the search results. This exercise will yield studies that have all specified keywords and their synonyms in 'Title', 'Abstract', 'Keyword' or 'Text'.

The search will be conducted by a research assistant, who is trained in search methodology and in use of the *EPPI Reviewer*. The research assistant will compile the search results in *EndNote* and upload the *EndNote* files to *EPPI Reviewer*.

The two reviewers (M. Ugur and D. Hawkes) will check the combined results for any duplication, and clean the duplicated studies manually to make sure that the study with the URL link to the full-text study remains in *EndNote*.

We will provide a search summary for each round of the search process described above. The summary will be obtained automatically from the 'Search' facility of each Database. A sample of the search summary is presented in Appendix 2.1, Table 2.1.A1.

## STEP 2: INITIAL SCREENING ON THE BASIS OF TITLE/ABSTRACT INFORMATION

At this stage of the review process, we will transfer the combined search results from *EndNote* to *EPPI Reviewer* – the data management software developed by the Institute of Education to help with systematic reviews.

The titles and abstracts of all transferred search results will be screened to ensure that the studies are appropriate/relevant for the review question. During screening, we will use only **one criterion** to select the relevant studies: **relevance** of the study for the systematic review at hand.

The **relevance** criterion will be made operational and specific by interrogating each search result with the following 2 questions:

1. ***Does the study ANALYSE the relationship between education, skills and growth? Yes or No?***
2. ***Does the study ESTIMATE the relationship between education, skills and growth? Yes or No?***

Studies that SCORE 1 ‘yes’ will be selected for the next stage – i.e., for the critical evaluation and inclusion/exclusion stage.

If the selected study ANALYSES the education, skills and growth relationship, it will be **coded** as **TA**

If the selected study ESTIMATES the education, skills and growth relationship, it will be **coded** as **EM**

If the selected study ANALYSES AND ESTIMATES the education, skills and growth relationship, it will be **coded** as **EM2**

Studies that do not satisfy the relevance criterion will be coded as D and will be de-selected.

We have adopted this relevance criterion instead of a more elaborate set of criteria upon recommendations we have received from the reviewers. The single criterion for selection will reduce the risk of missing relevant studies, but it will require more rigorous appraisal in the next stage, where studies will be evaluated on the basis of full-text information.

Given this review’s focus on the ‘empirical evidence on the relationship between education, skills and growth’, we will include only SA studies that are essential for the provide a comprehensive analysis of the relationship between

Two reviewers (M. Ugur and D. Hawkes) will apply these criteria to the search results independently. However, before independent screening, we will conduct a pilot of 10 studies listed in search results. The aim here is to test whether the **relevance** criterion is interpreted and applied reliably and consistently in selection or de-selection of studies. Any discrepancies between reviewer decisions will be discussed, and both the discussion and the basis of *ex-post* agreement will be documented. This is in line with the best practice recommended by CRD (2008: 24) for screening studies and it verifiable/reproducible by third parties, if necessary.

At the end of the screening stage, we will document the selection / de-selection decisions given. This information will be provided in a table that summarises:

- The total number of **selected** studies
- A Breakdown of the **selected** studies, based on the number of 'yes' scores it has secured;
- The total number of **de-selected** studies

### **STEP 3: CRITICAL APPRAISAL AND INCLUSION/EXCLUSION ON THE BASIS OF FULL-TEXT INFORMATION**

#### **Step 3.1. The critical appraisal framework**

At this stage, full text of all studies in the selected sample will be read independently by two reviewers (M. Ugur and D. Hawkes). We will conduct a pilot of 10 studies selected in the previous stage. The aim here is to ensure as much consistency as possible between the reviewers' inclusion/exclusion decisions. Any discrepancies between reviewer decisions at the pilot or inclusion/exclusion stage will be discussed and resolved by consensus. Both the discussion and the basis of *ex-post* agreement will be documented.

The aim of the critical appraisal at this stage is to ensure that we include studies that satisfy 3 criteria: **validity, reliability and applicability**. In this context, **validity** refers to the extent to which the study employs a methodology that would minimise the risk of bias (Cochrane 2010); and **reliability** refers to the extent to which the findings of the study are reproducible. (Reynolds and Trinder, 2000; Booth and Price, 2004). **Applicability**, on the other hand, refers to the extent to which the findings of the study can be generalised/applied to low-income countries.

To ensure **validity, reliability and applicability (VRA)**, we will use the **PIOS** framework, which is derived from the PICOS framework recommended by the Centre for Reviews and Dissemination (CRD) of the University of York (CRD, 2009). Although PICOS has been developed for systematic reviews in health care, the framework can be adopted to this systematic review.

The PICOS framework requires screening of search results with respect to: (i) **P**opulation; (ii) **I**nterventions; (iii) **C**omparators; (iv) **O**utcomes; and (v) **S**tudy design. We revise this framework by dropping the 'Comparator' criteria as the research on education, skills and growth relationship is not based controlled trials data, and by renaming the intervention as 'Independent variable' that is assumed to influence the outcome. The resulting framework can be abbreviated as **PIOS**, consisting of the four criteria below:

**Population:** the cases in the study should include 'low-income countries' or its synonyms as defined above in the search strategy.

Independent variable: the study should be examining **'education'** or its synonyms as an 'intervention' or as a 'state variable' that differs between countries and/or over time.

Outcome: the study should be examining the **change in 'growth'** or its synonyms, as defined in the search criteria above.

Study design – for theoretical/analytical (**TA**) studies: the study should be based on an **explicit theoretical/analytical model**, constructed and brought to a conclusion verbally or mathematically, with a view to **analyse** the impact of education or its synonyms on growth or its synonyms.

**OR**

Study design – for purely empirical (**EM**) or mixed (**EM2**) studies: the study should be based on a **clearly-specified regression model and an estimation methodology** appropriate for **estimating** the impact of education or its synonyms on growth or its synonyms.

The critical appraisal of the full-text studies will be carried out by interrogating each study with a consistent and reproducible set of questions. These questions are derived by merging the **validity-reliability-applicability (VRA)** requirements with the **PIOS framework**, as demonstrated in Table 2.2.3.1 (for TA studies) and Table 2.2.3.2 (for EM and EM2 studies) below. As can be seen in these tables, for theoretical/analytical (TA) studies, we define 4 inclusion/exclusion criteria applied through 4 questions (Table 2.2.3.1). For theoretical / analytical (TA) studies, we define 5 inclusion/exclusion criteria applied through 5 questions (Table 2.2.3.2).

The classification of studies into TA, EM or EM2 takes place at screening stage (step 2, p. 17). However, this classification/coding may change when full-text studies are read and more information becomes available about the type of the study. If this proves to be the case, the change will be recorded and reported in the review documentation. To reiterate, the study type classification/coding will be based on the following definitions:

- An empirical study (EM) is a study that **utilises a valid regression model** for estimating the human capital-growth relationship;
- A mixed study (EM2) is a study that **analyses the impact of human capital on growth through a mathematically-derived model and uses empirical evidence to verify the model's predictive quality.**
- A theoretical/analytical study (TA) is a study that **analyses the impact of human capital on growth through mathematically- or diagrammatically- or verbally-derived models.** The main aim of TA studies is to develop models/explanations of the human capital-growth relationship rather than estimate the magnitude of the growth impact of education and skills.

Both reviewers will compare their study type coding decisions and resolve any disagreement by consensus.

**Step 3.2: Applying inclusion/exclusion criteria to ensure validity, reliability and applicability of included studies**

We will evaluate each theoretical/analytical study (coded as TA) with respect to 4 inclusion/exclusion criteria. The criteria and the questions to be used to interrogate the studies are given in Table 2.2.3.1 below.

**Table 2.2.3.1: Inclusion/Exclusion Criteria for Theoretical/Analytical (TA) Studies: Merging the PIOS Framework with Validity, Reliability and Applicability Requirements**

PIOS Heading	Inclusion/Exclusion Criteria	Question	Decision
<b>Population</b>	<b>1. Model/analysis is of universal applicability</b>	1. Is the analysis <b>applicable</b> in a low-income country context?	Yes -Include No -Exclude
<b>Independent Variable</b>	<b>2. Education and Skills are essential concepts /variables in the analysis</b>	2. Is education/skills a <b>central state factor/variable</b> in the analysis of the study?	Yes -Include No –Exclude
<b>Outcome</b>	<b>3. Change in growth performance is central to the analysis</b>	3. Does the study relate the <b>change in growth performance</b> to education/skills directly or indirectly?	Yes -Include No –Exclude
<b>Study Design</b>	<b>4. Substantial/original analysis</b>	4. Does the study go beyond background/review information by providing a <b>substantial analysis</b> of the human capital -growth relationship?	Yes–Include No –Exclude

**Decision rule: Include if TA study scores 4 ‘yes’, exclude otherwise. If excluded, indicate the number of the criteria that study had failed (1 to 4).**

For empirical (EM) and mixed (EM2) studies, we apply 5 inclusion/exclusion criteria. The criteria cover the validity, reliability and applicability (VRA) requirements and are compatible with the PIOS framework. However, these criteria differ from the inclusion/exclusion criteria used with theoretical/analytical (TA) studies. The difference is due to the shift in the evaluation towards the nature of the empirical data used, its quality, and the quality of the estimation/testing methods used in the study. The list of the criteria and the interrogation questions they imply are given in Table 2.2.3.2 below.

**Table 2.2.3.2: Inclusion/Exclusion Criteria for Empirical (EM) and Mixed (EM2) Studies: Merging the PIOS Framework with Validity, Reliability and Applicability Requirements**

PIOS Heading	Inclusion/Exclusion Criteria	Question	Decision
<u>Population</u>	<b>1. Data including low-income countries</b>	1. Does the study use <b>data including ‘low-income countries’</b> or its synonyms?	Yes -Include No -Exclude
<u>Independent Variable</u>	<b>2. Is an appropriate measure of education/skills used?</b>	2. Does the study use a recognised measure of <b>education/skills for example educational attainment, educational qualifications, educational expenditure, completion rates?</b>	Yes -Include No –Exclude
<u>Outcome</u>	<b>3. Originality of findings on the education-growth relationship</b>	3. Does the study report <b>original findings</b> – and NOT report, summarise or interpret existing findings only?	Yes -Include No –Exclude
<u>Study Design</u>	<b>4. Valid study design</b>  <b>5. Robustness check for causality</b>	4. Does the study <b>use a valid design</b> using time-series data, cross-section data, panel data OR simulation?  5. Does the study conduct <b>causality tests</b> or use <b>instrumental variables</b> to address endogeneity and/or reverse causality?	Yes–Include and code No –Exclude  Yes–Include No -Exclude

**Decision rule: Include if EM and EM2 studies score 5 ‘yes’, exclude otherwise. If excluded, indicate the number of the criteria that the study had failed (1 to 5).**

The fifth criterion for empirical (EM) and mixed (EM2) studies is introduced to capture empirical studies that go beyond estimating **only the association** between human capital and growth to find out whether a causal relationship can be established and the causality runs from human capital on to growth. This is in line with the review question, which focuses on the ‘growth impacts of education and skills’.

As stated in Section 1 of the protocol above, the empirical measures of human capital may be influenced by economic growth/development and there may be reverse causality between education/skills and growth - both theoretically and empirically. For example, high-growth may lead to higher investment in education/skills and higher levels of development may enable countries to invest in better-quality educational institutions. Given these complications, we aim to focus on studies that use causality tests or instrumental variables that are widely used in the literature to control for reverse causality or endogeneity problems.<sup>1</sup>

The application of the inclusion/exclusion criteria will be conducted independently by two reviewers (M. Ugur and D. Hawkes). The reviewers will first conduct a pilot study consisting of 10 studies selected randomly. The decisions on the pilot sample will be compared and convergent/divergent decisions will be noted. Agreement on divergent decisions will be sought through consensus based on prior discussion.

### **Presentation of inclusion/exclusion decisions**

Information from *EPPI Reviewer* will be retrieved to provide a tabular summary of all included and excluded studies. In the table, included studies will be classified into 2 categories:

- i. ***Theoretical/Analytical Studies (TA)*** – which will be used to inform the conceptual framework.
- ii. ***Empirical Studies (EM and EM2)*** – which will be used for the ***meta-synthesis*** in the synthesis stage.

**Excluded studies** will have failed to satisfy at least one inclusion criteria. They will be coded such that they can be reported with how many inclusion criteria they failed to satisfy and what these criteria are. For example, an excluded study may have failed to satisfy 2 criteria in Table 2.2.3.2 above and these criteria may have been criteria no. 1 and 3. Then, this study will be coded as 2 (1, 3).

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<sup>1</sup> **Note:** *The inclusion/exclusion criterion no. 5 (robustness checks) may be relaxed and we may include studies that do not control for endogeneity and reverse causality problems. This may be the case if the number of studies in the final sample remains low. If this proves to be the case, the empirical studies that are included despite failing criterion no. 5 will be analysed as a separate group – and their findings will be synthesised as evidence of association/correlation between human capital and growth – rather than as estimates of the growth impact of human capital.*

#### STEP 4: DATA/INFORMATION EXTRACTION

Data extraction is the process through which we obtain the information about study characteristics and findings from included studies. Data extraction will be linked with the evaluation/critical appraisal process, and we will follow the methodology proposed by CRD (2009).

One issue in the design of the extraction method is whether or not blinding is necessary for review quality. Although some studies recommend blinding, CRD (2009: 30) reports that blinding does not alter the results of a systematic review despite its high cost in terms of time. Nevertheless, and to be on the safe side, data extraction will be conducted by two reviewers (D. Hawkes and M. Ugur) independently. We will first conduct a pilot of 10 studies, using the data/information extraction form, a sample of which is presented as **Table 2.2.A1 in Appendix 2.2** below. At the end of the pilot study, information on data/information forms will be compared and convergent/divergent information will be noted. Agreement on divergent information will be sought through consulting the relevant original studies together and establishing a consensus between the reviewers on that basis. The aim of the pilot is to minimise the occurrence of divergence between the reviewers when they work independently and fill in the data/information extractions forms for all included studies.

The data/information extraction form will be generated from information in the **study record** created in EPPI Reviewer. The study record should be thought of as a list of study

The data/information extraction form will include the following information:

- a. Bibliographical information about the study: including record no. in EPPI Reviewer, author(s), title, and citation.
- b. Study characteristics information: including study design, study type, type of data used (time-series, cross-country or panel data), and units of measurement for dependent (outcome) and independent variables.
- c. Analytical/estimation methods used: including type of analysis (mathematical/verbal) for study type TA or TA2, method of estimation for study type E or EM (including fixed- or random-effects regression, linear or non-linear modelling, interaction terms, etc), and number of countries/years in the sample.
- d. Outcomes/results reported: theoretical/analytical conclusions about casual mechanisms and channels in the human capital-growth relationship (for TA and TA2 studies), estimated parameters for all independent variables including interaction terms (for E and EM studies), standard errors of estimated parameters (for E and EM studies), causality/endogeneity test results (for E and EM studies), etc.

The data/information extraction forms will not be filled in manually. Instead, each of the data/information forms will be generated from data/information entered into relevant columns in **EPPI Reviewer** for each included study. As can be seen from **Table 2.2.A1 in**



**Appendix 2.2**, there will be 14 columns into which data/information will be entered for each included study. Once this data is entered, a data/information extraction form for each study can be generated by pooling together the information in relevant columns. The information in the 14 columns, together with some of the information on **study control variables** in **Table 2.2.A2** in **Appendix 2.2**, will be used for conducting the meta-analysis and carrying out various tests for potential bias in the final stage of the review. As can be seen in **Table 2.2.A2** in **Appendix 2.2**, we will enter information for 22 study control variables, ranging from study and publication type through estimation type to the type of interaction terms used in estimations. As indicated above, this information, together with that on the data/information extraction form, will enable us to: (a) pool together sub-sets of studies into various clusters; (b) test for similarities/differences in the empirical findings across clusters and between each cluster and the full study set; and (c) test for bias that may be induced by study type, publication type, or type of modelling.

## **STEP 5: SYNTHESIS**

According to CRD (2009: 45), synthesis involves the ‘collation, combination and summary of the findings of individual studies included in the systematic review.’

Methods of synthesis can be classified into 2 broad categories: methods for synthesizing quantitative/empirical evidence such as meta-analysis; and methods for synthesizing qualitative evidence, such as narrative synthesis.

As far as meta-analysis is concerned, the method yields meaningful and reliable results if the evidence reported in studies is based on randomised control trials (RCTs). If the reported evidence is not based on RCT data, meta-analysis is not recommended (Sauerbrei, 2005).

One limitation of the meta-analysis is that it cannot be used to falsify a theory as it does not generate ‘new’ evidence based on double-blind and controlled trials. In other words, it is mainly a statistical examination of ‘scientific studies’. Secondly, the reliability of meta-analysis regressions depends on the quality of included studies: a good meta-analysis of badly-designed studies generates a ‘bad’ statistic (Slavin, 1995).

Nevertheless, meta-analysis has certain advantages over conventional literature reviews and/or descriptive summaries of research findings. One advantage is that current meta-analysis methods enable reviewers to establish the extent to which model specification errors exist in empirical studies and how these errors affect the variation among reported evidence. Another advantage is that meta-analysis provides tools for checking for publication bias by clustering studies on the basis of publication type and then plotting Funnel diagrams and conducting Funnel Asymmetry Tests (FAT). Thirdly, meta-analysis, despite its shortcomings, is an objective and systematic method for synthesising diverse and often conflicting empirical findings in the literature. In fact, Doucouliagos and Stanley (2007)

report that meta-analysis results contradict the verdicts of conventional literature reviews and inform more verifiable conclusions.

Given these advantages, meta analysis of economic research findings has been used in several studies as new techniques have been developed to test for the significance of the reported results. For example, Mitchell et al (2005) uses meta-analysis to synthesize research evidence on the relationship between economic development and human rights. Doucouliagos and Paldam (2009) conduct a meta-analysis of the relationship between international aid and population size of the recipient countries, and whether this relationship between multilateral and bilateral donors. Havranek and Irsova (2009) examine the relationship between firm characteristics and the extent of vertical technology spillovers generated by foreign direct investment (FDI). (For further studies, see Meta Analysis of Economic Research (MAER) Network website at <http://www.hendrix.edu/maer-network/default.aspx?id=15088> ).

Against this background, we will draw on meta analysis techniques to synthesize the empirical evidence on the human capital-growth relationship in a number of ways.

First, we will generate Funnel plots capturing the relationship between the reported estimates and their precision. The clusters for country types, model specification, publication type, country grouping, etc. will be generated from the 'study control variables' listed in Table 2.2.A2 in Appendix 2.2.

- For the whole set of included studies – to capture the tendency of the funnel as precision increases;
- For 2 publication types: journal articles and the rest – to detect whether publication type affects the funnel
- For model specifications (depending on models used) – to detect whether model type affects the funnel;
- For sample/panel sizes – to detect whether sample/panel size affects the funnel; and
- For country groupings (low-income, middle-income, developed countries) – to detect whether country type affects the funnel.

Secondly, we will run meta regressions to test:

- For funnel asymmetry caused by publication (Funnel Asymmetry Test - FAT]
- For genuine empirical effect, regardless of publication selection (Precision Effect Test - PET]

As proposed by Stanely (2008).

Thirdly, we will run meta-regressions to estimate the meta estimates of the human capital coefficient and the coefficients of the control variables capturing publication type, model type, and sample/panel size, and country type.

In addition, we will provide a narrative synthesis of the theoretical explanations for the causal mechanisms and channels through which education and skills may affect growth. For this, we will draw on the narrative synthesis methodology proposed by Popay et al (2006) and Rogers et al (2009). Finally, we will map the findings of the meta-analysis with those of the narrative synthesis, with a view to identify the scope/need for further research. In this exercise, we will draw on the 'mixed methods synthesis' proposed by Harden and Thomas (2005)

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## **Appendices**

### **Appendix 1.1: Authorship of this report**

Details of Advisory Group membership:

Katie Chapman and Alison Girdwood, DFID policy leads

Max Gasteen, DFID

Details of Review Group membership:

Dr Denise Hawkes, University of Greenwich

Dr Mehmet Ugur, University of Greenwich

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**Table 1.2.A1: World Bank List of Low Income Countries**

Afghanistan	Guinea-Bissau	Rwanda
Bangladesh	Haiti	Senegal
Benin	Kenya	Sierra Leone
Burkina Faso	Korea, Dem Rep.	Somalia
Burundi	Kyrgyz Republic	Tajikistan
Cambodia	Lao PDR	Tanzania
Central African Republic	Liberia	Togo
Chad	Madagascar	Uganda
Comoros	Malawi	Uzbekistan
Congo, Dem. Rep	Mali	Vietnam
Eritrea	Mauritania	Yemen, Rep.
Ethiopia	Mozambique	Zambia
Gambia, The	Myanmar	Zimbabwe
Ghana	Nepal	
Guinea	Niger	

[http://data.worldbank.org/about/country-classifications/country-and-lending-groups#Low\\_income](http://data.worldbank.org/about/country-classifications/country-and-lending-groups#Low_income)

## Appendix 2.1: Documentation of search results

The search results for each database and the combined search results will be documented through the search report generated by the database. A trial sample is given below.

**Table 2.1.A1: Samples of search result summary**

Database / Platform	Date	String	Hits
EBSCO – Business/Economics Databases	10 August 2010	SU ( low-income countries OR less developed countries OR LDC OR developing countries ) or TX ( low-income countries OR less developed countries OR LDC OR developing countries ) AND TI ( growth OR development OR economic performance ) or AB ( growth OR development OR economic performance ) or SU ( growth OR development OR economic performance ) AND TI ( education OR skills OR qualifications OR training OR schooling OR human capital ) or AB ( education OR skills OR qualifications OR training OR schooling OR human capital ) or SU ( education OR skills OR qualifications OR training OR schooling OR human capital )	1738
Science Direct	10 August 2010	(pub-date > 1979 and TITLE-ABSTR-KEY(education OR skills OR qualifications OR training OR schooling OR human capital ) and TITLE-ABSTR-KEY(growth OR development OR economic performance )) and low-income countries OR less developed countries OR LDC OR developing countries	90
JSTOR	10 August 2010	<< (((ti:(education OR skills OR qualifications OR training OR schooling OR human capital) OR ab:(education OR skills OR qualifications OR training OR schooling OR human capital)) OR ca:(education OR skills OR qualifications OR training OR schooling OR human capital)) AND (year:[1980 TO 3000])) AND (((ti:(growth OR development OR economic performance) OR ab:(growth OR development OR economic performance)) OR ca:(growth OR development OR economic performance)) AND (year:[1980 TO 3000])) AND (low-income countries OR less developed countries OR LDC OR developing countries) >>	868



**Appendix 2.2: Documentation of data and information extraction**

**Table 2.2.A1: Sample of Information/Data Extraction Form**

Information/Data Required	Components (to be coded in <i>EPPI Reviewer</i> )
Bibliographical information	<ol style="list-style-type: none"> <li>1. Record no. in EPPI Reviewer</li> <li>2. Author(s)</li> <li>3. Title and citation</li> </ol>
Study characteristics	<ol style="list-style-type: none"> <li>4. Study type (TA, TA2, E, EM2)</li> <li>5. Publication type (journal articles, book chapter, working paper, thesis, report, etc.)</li> <li>6. Type of data used (time-series, cross-country or panel data)</li> <li>7. Units of measurement for dependent (outcome) and independent variables</li> </ol>
Analytical/estimation methods	<ol style="list-style-type: none"> <li>8. Type of analysis (mathematical/verbal) for study type TA or TA2</li> <li>9. Method of estimation for study type E or EM (including fixed- or random-effects regression, linear or non-linear modelling, interaction terms, etc)</li> <li>10. Number of countries/years in the sample</li> </ol>
Outcomes/results reported	<ol style="list-style-type: none"> <li>11. Theoretical/analytical conclusions about casual mechanisms and channels in the human capital-growth relationship (for TA and TA2 studies)</li> <li>12. Estimated parameters for all independent variables including interaction terms (for E and EM studies)</li> <li>13. Standard errors of estimated parameters (for E and EM studies)</li> <li>14. Causality/endogeneity test results (for E and EM studies)</li> </ol>

**Table 2.2.A2: Study Control Variables and Codes**

<b>Study control variable</b>	<b>Code</b>
<b>A. Publication type</b>	
Theoretical analytical	1. TA or TA2
Purely empirical	2. E
Empirical - mixed	3. EM2
Journal article	4. J
Book chapter	5. BC
Book	6. B
Report	7. R
Thesis	8. Th
<b>B. Type of data</b>	
Time series	9. Ts
Cross-country (no time dimension)	10. CC
Panel	11. P
Sample/panel size	12. Number
<b>C. Type of estimation</b>	
Linear regression	13. LR
Non-linear regression	14. NLR
Fixed effect panel data regression	15. FE
Random effect panel regression	16. RE
Number of control variables	17. Number
<b>D. Interaction terms/impact channels</b>	
Human capital and country type/level of development	18. HCCT
Human Capital and Physical Capital/Innovation	19. HCPC
Human Capital and Labour Productivity	20. HCLP
Human Capital and Labour Market Participation	21. HCLM
Human Capital and Enhanced Individual Income	22. HCEI