HEART
HEALTH & EDUCATION ADVICE & RESOURCE TEAM

Helpdesk Report: Infrastructure and Basic Facilities

Date: 01.11.13

Query: **Infrastructure & basic facilities: What elements of school infrastructure (e.g. classroom, desk, latrine, library, computer lab, roof, doors, electricity, security) are associated with improvements in learning achievement?**

These helpdesks were designed to enable an extensive search for evidence on various methods for improving learning. There are a series of six similar reports, each is based on an edit of a literature search for their chosen method. After the initial search had been done the search fields were expanded to include further search engines and search methods, for more information please see the search strategy section of the report.

The list of methods searched in the series are: textbooks, teacher training, infrastructure and basic facilities, school leadership, school governance and student performance data.

Enquirer: **DFID**

Content

1. Screened results from search strategy

A total of 10 documents were assessed as potentially relevant.

Necessary but Not Sufficient: Challenges to (Implicit) Theories of Educational Change--Reform in Nepal's Primary Education System.
Thirth Khaniya and James H Williams (2004)
International Journal of Educational Development, 24(3): 315-328.
Available from http://www.sciencedirect.com/science/article/pii/S0738059304000069
This report is also included in the textbooks, teacher training and leadership reports.

Educational quality reforms are undertaken in hopes that students in a higher quality education system will acquire more of the curriculum. However, the authors argue, there is no necessary connection between investments in educational quality and improved learning outcomes. A national assessment of grade 3 students in Nepal found few differences in learning competencies before and after a multi-year reform project involving improvements in classrooms, curriculum, textbook distribution, teacher training packages, administration and supervision system, school management, and community involvement in school

management. The article explores the implications for educational reform initiatives and theories of educational change.

Methods
Primary and empirical
Quasi-experimental

School Resources and Academic Performance in Sub-Saharan Africa.
Valerie Lee and Tia Linda Zuze (2011)
Comparative Education Review, 55(3): 369-397.
Available from
http://www.jstor.org/discover/10.1086/660157?uid=28262&uid=3738032&uid=2&uid=3&uid=5910784&uid=67&uid=28260&uid=62&sid=21102750024827
This paper is also included in the textbooks report.

This paper investigates the links between students' achievement and several resource inputs in African primary schools, using data from the 2000 Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ-II). The authors focused on four sub-Saharan countries that had in place legislation mandating free and universal primary schooling: Botswana, Malawi, Namibia, and Uganda. Using multilevel modelling (hierarchical linear models), strong links were found between material and human resources and grade 6 students' achievement in reading and mathematics. Structural features such as school shifts and school size were negatively associated with achievement, although effects varied across countries. We discuss policy implications of our findings within each country's educational context.

Methods
Primary and empirical
Non-experimental

Which In- and Out-of-School Factors Explain Variations in Learning across Different Socio Economic Groups? Findings from South Africa.
Michelle C. Smith (2011)
Comparative Education, 47(1): 79-102.
Abstract available from:
http://www.tandfonline.com/doi/abs/10.1080/03050068.2011.541678#.UnOfF3DwmSo

Previous studies on the role of the school in influencing attainment in South African schools have concluded that the inequalities which are known to exist in these are still largely due to the legacy of the Apartheid system. More recently, policy focus has been on narrowing the gap between the attainment of different socio-economic groups by addressing the inequality in school resource levels and facilities. The work presented here investigates which pupil background, school context and school resource (human and physical) factors affect individual academic attainment by developing separate multilevel models for individual learners of similar socio-economic status. This approach allows for the possibility that different in- and out-of-school factors combine to explain the differences in attained mathematics and reading scores of Grade 6 pupils participating in the SACMEQ II survey in 2000, and that this could be dependent on the socio-economic status of the individual learner. It is argued that policy focus should be wider than just resourcing levels. The evidence points to the need to additionally target deprived, mainly rural, neighbourhoods and develop interventions and alternative strategies to overcome some of the acute social disadvantages that pupils, especially from the lowest socio-economic status, bring with them into school. These include poor nutrition, lower fluency levels in the language of instruction used in schools and higher chances of living away from home in order to be schooled.

Methods
Primary and empirical
Experimental

Factors Associated with Differential School Performance in the Gucha District of Kenya
Henry Onderi and Paul Kroll (2008)
Research in Education, 80(1)
Available from: http://manchester.metapress.com/content/d7820j41571k7263/

The article reports a study of factors associated with different levels of examination performance among thirty secondary schools in a district of Kenya. There are very limited data on school effectiveness in developing countries but there is some evidence that resource levels and aspects of teacher quality may be important. The research found considerable differences between the examination results in English and mathematics across the thirty schools. These differences were strongly correlated with differences in the quality of the infrastructure of the schools. They were also correlated, although less strongly, with measures of teacher quality, especially in the case of mathematics. Provincial schools had better examination results and, in particular, better infrastructure than District schools, but the association between infrastructure and attainment was independent of this relationship.

Methods
Primary and empirical
Quasi-experimental

The Succeed Project: Challenging Early School Failure in Bangladesh.
Frances E.Aboud , Kamal Hossein and Chloe O'Gara (2008)
Research in Comparative and International Education, 3(3): 295-307.
Available from: http://www.wwwords.co.uk/rss/abstract.asp?j=rcie&aid=3314

This evaluation research compares the first-grade competencies of two cohorts of Bangladesh children who attended "Succeed" preschools, with a control group who did not attend preschool. Testing of these groups occurred in 2006, 2007, and 2005, respectively. The Succeed program aims to improve children's learning and children's school success by developing and testing an affordable, sustainable preschool model that can be implemented in school, community and home settings. Researchers assessed the quality of school- and home-based preschool environments using the Early Childhood Environment Rating Scale (ECERS) plus two curricular subscales that tap program quality. An independently developed test based on government-defined competencies assessed school achievement of Grade 1 children. Results showed that children who attended Succeed preschools performed better in four of the five competencies relating to reading, writing, and oral math, compared with children without any preschool experience. Better quality preschool environments were positively associated with children's competencies in Grade 1. There were no statistically significant differences in first-grade performance between children from home-based preschools compared with school-based preschools, both using the same Succeed program.

Methods
Primary and empirical
Quasi-experimental

One Mouse per Child: interpersonal computer for individual arithmetic practice.
Alcoholado, C., M. Nussbaum, et al. (2012)
Journal of Computer Assisted Learning, 28(4): 295-309.
Abstract available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2729.2011.00438.x/abstract

Single Display Groupware (SDG) allows multiple people in the same physical space to interact simultaneously over a single communal display through individual input devices that work on the same machine. The aim of this paper is to show how SDG can be used to improve the way resources are used in schools, allowing students to work simultaneously on individual problems at a shared display, and achieve personalized learning with individual feedback within different cultural contexts. We used computational fluency to apply our concept of One Mouse per Child. It consists of a participatory approach that makes use of personal feedback on an interpersonal computer for the whole classroom. This allows for N simultaneous intelligent tutoring systems, where each child advances at his or her own pace, both within a lecture and throughout the curricular units. Each student must solve a series of mathematical exercises, generated according to his or her performance through a set of pedagogical rules incorporated into the system. In this process, the teacher has an active mediating role, intervening when students require attention. Two exploratory studies were performed. The first study was a multicultural experience between two such distanced socio-economic realities as Chile and India. It showed us that even in different environmental conditions, it is possible to implement this technology with minimal equipment (i.e. a computer, a projector, and one mouse per child). The second study was carried out in a third grade class in a low-income school in Santiago de Chile. The students were asked to solve mainly addition exercises. We established statistically relevant results and observed that the software proved most beneficial for the students with the lowest initial results. This happens because the system adapts to the students' needs, reinforcing the content they most need to work on, thus generating a personalized learning process.

Methods
Primary and empirical
Quasi-experimental

Effects of special e-learning program on hearing-impaired learner's achievement and perceptions of basic geometry in lower primary mathematics.
Kiboss, J. K. (2012)
Journal of Educational Computing Research, 46(1)
Abstract available from: http://eric.ed.gov/?id=EJ965346

Achievement in mathematics is an issue of great concern not only to students and parents but also to employers and researchers in Kenya. This is because the Kenya National Examination Council (KNEC) has continuously reported dismal results in this area, and especially in geometry. Also, KNEC indicates that it presents difficulties to both the teachers and learners during instructional sessions. In an extension of research demonstrating causal effects of electronic learning environments on special education learners' achievement and perceptions of mathematics instruction, the present study experimentally examined the effectiveness of a special electronic learning program (SELP) to improve hearing-impaired learners' achievement of basic geometry and their perception of the Geometry learning environment. Sixty-six hearing-impaired learners from four special education schools situated in Rift Valley province were sampled purposively on the basis of the school's accessibility to participate in the study. The study employed the Solomon-Four Group Design research method. The specific dependent measures were the learners' achievement in geometry and their perception of the classroom learning environment. Measurement of achievement and perception were conducted using two instruments: (i) the Geometry Achievement Test (GAT),

and (ii) the Special Learners Classroom Environment Questionnaire (SLCEQ). GAT's reliability was computed using K-R20 formula yielding a reliability of 0.78. On the other hand, SLCEQ reliability was determined using Cronbach alpha yielding a reliability coefficient of 0.82. The study established that SELP was modestly effective in improving the achievement of hearing-impaired learners on geometry and their perception of the classroom environment. The study concludes that teachers can arrest the special learners' problem of poor performance in geometry through the use of electronic learning programs.

Methods
Primary and empirical
Quasi-experimental

Impact Evaluation of Burkina Faso's BRIGHT Program. Final Report
D. Levy, M. Sloan, L. Linden, H. Kazianga (2009)
Mathematica Policy Research
Available from: http://www.mathematica-mpr.com/publications/PDFs/international/burkina_BRIGHT.pdf

The BRIGHT program was designed to improve the educational outcomes of children in Burkina Faso. It focused on girls in particular and was implemented in 132 rural villages throughout the 10 provinces of the country in which girls' enrolment rates were lowest. It consisted of constructing primary schools with three classrooms and implementing a set of complementary interventions. This report documents the main findings from the impact evaluation of the BRIGHT program. The evaluation design involved comparing children in the 132 BRIGHT villages (participant group) with children in 161 similar villages that had applied to participate in BRIGHT but were not chosen (comparison group). In general, the main conclusions are that BRIGHT had about a 20 percentage point positive impact on girls' primary school enrolment, and had positive impacts on Math and French test scores for both girls and boys. Although the magnitude of BRIGHT's estimated impacts is larger than that observed in typical education interventions in developing countries, a cost-effectiveness analysis would be needed to assess whether the effects are large on a per-dollar basis. In particular, it would be useful to know whether building a less expensive school of the sort typically built in Burkina Faso would have generated similar impacts. While this evaluation cannot answer this question definitively, the authors found suggestive evidence indicating that part of the impact of BRIGHT came from having built a school in villages in which no school would have been available, and part from having built a school with a better infrastructure and add-on components than the typical school that would have been available without BRIGHT.

Methods
Primary and empirical
Experimental

The Impact of School Design on Academic Achievement in the Palestinian Territories: An Empirical Study
CELE Exchange (2012)
Available from: http://www.oecd.org/education/innovation-education/centreforeffectivelearningenvironmentscele/44708225.pdf
This article outlines a research project that aimed to gather first-hand data from school users (pupils, teachers, school principals), as well as academic performance data from pupils. The project compared data obtained from users of "new and site-specific" and "standard" schools in order to show whether more attractive and site-specific designs have a positive effect on learning.

Methods
Primary and empirical
Experimental

Factors Determining the Effectiveness of Secondary Schools in Nigeria
I. A. Ajayi, H. T Ekundayo (2011)
Anthropologist 13: (1) 33-38
Available from: http://www.krepublishers.com/02-Journals/T-Anth/Anth-13-0-000-11-Web/Anth-13-1-000-11-Abst-Pdf/Anth-13-1-033-11-630-Ekundayo%20H-T/Anth-13-1-033-11-630-Ekundayo%20H-T-Tt.pdf

The study examined the factors determining the effectiveness of secondary schools in Nigeria. The study was a descriptive research design of the survey type. The population comprised all the teachers, principals as well as parents of students in public secondary schools in south - west Nigeria. The sample comprised 1200 teachers, 300 parents and 60 principals from 60 secondary schools. Multi-stage random sampling technique was used to select the sample. Three sets of instruments were used to collect the data for the study. The data collected were analysed using frequency counts, percentage scores and multiple regression analysis. The study revealed that the secondary schools were effective in the affective and the psychomotor domains but not effective in the cognitive domain. The study further revealed that learning environment, monitoring of students' progress, school facilities and teachers' quality made significant contributions to school effectiveness. Learning environment was the best predictor of school effectiveness. It was therefore recommended that the government and school administrations should intensify efforts towards improving the level of cognitive achievement while more emphasis should be placed on institutional factors such as teachers' quality, learning environment, school facilities and monitoring of students' progress in order to improve the effectiveness of schools.

Methods
Primary and empirical
Experimental

2. Additional resources

The following resources were identified through other helpdesk reports and Google scholar.

Government versus private primary schools in India: An assessment of physical infrastructure, schooling costs and performance
Jitendra Gouda, Kailash Chandra Das, Srinivas Goli, Ladumai Maikho Apollo Pou, (2013).
International Journal of Sociology and Social Policy, 33:11/12 pp.708 - 724
Abstract available from:
http://www.emeraldinsight.com/journals.htm?articleid=17094372&show=abstract

This paper is an effort to identify the difference between government and private primary schools in terms of physical infrastructure, schooling costs and student's performance. Further, the paper assessed the role of physical infrastructure and schooling costs on the performance of students. The paper aims to discuss these issues.
Design/methodology/approach – This study used India Human Development Survey (IHDS) data. Bivariate, trivariate, $?^2$ and ANOVA test, factor analyses and Theil index are used as methods of analyses. *Findings* – The results present a distinct picture of government and private primary school education in India in terms of physical infrastructure standards, schooling cost and performance of students. In all the three selected indicators, private primary schools remained a forerunner or outperform the government primary schools in India. Besides this, the physical infrastructure and schooling cost found to have effect on

performance of students both in private and public schools. *Practical implications* – Since government primary schools hold more than 70 percent of total students, there is an urgent need to improve the standards of primary education in these schools. Further, efforts are needed to reduce the gaps between private and public schools in terms of its basic physical facilities and performance of students in the country. *Originality/value* – The paper used the IHDS to examine the existing differentials between government and private primary schools. The analysis is purely an original work.

Methods
Primary and empirical
Non-experimental

Quality of Primary Education Inputs in Urban Schools: Evidence From Nairobi
Moses W. Ngware, Moses Oketch, Alex C. Ezeh (2011). Education and Urban Society 43:1 91-116
Available from: http://eus.sagepub.com/content/43/1/91.short

This article examines the quality of primary school inputs in urban settlements with a view to understand how it sheds light on benchmarks of education quality indicators in Kenya. Data from a school survey that involved 83 primary schools collected in 2005 were used. The data set contains information on school quality characteristics of various types of schools in Nairobi. On the basis of the national benchmarks, the quality of education provided in government schools was shown to be "better" with regard to infrastructure, teacher qualifications, and textbook provision than that provided in all the nongovernment-owned schools. However, nongovernment schools have smaller class sizes and lower pupil—teacher ratio (PTR). The bad news is that government schools have large class sizes and higher PTR and hence low levels of teacher—pupil interaction. Nongovernment schools had poor classroom structures and a higher pupil—textbook ratio, particularly private individually owned schools and community-owned schools. It also emerges that although in the government schools, student learning space is constrained by the class size, the student learning space in nongovernment schools is constrained by the classroom size. Meeting quality benchmarks in primary schooling, therefore, remains a challenge among urban populations.

Methods
Primary and empirical
Non-experimental

Quality education for all children? What works in developing countries
Shari Krishnaratne, Howard White and Ella Carpenter (2013)
International Initiative for Impact Evaluation (3ie) Working paper 20
Available from http://www.3ieimpact.org/media/filer/2013/09/10/wp_20.pdf

Better infrastructure building has a positive impact on school attendance and enrolment and on maths and language test scores. Providing materials, either through new chalkboards and flip charts, new computers or new teachers, has some positive impact on test scores, but no effects are seen on school enrolment, attendance and progression. One targeted dropout programme did have positive, significant impacts on dropout rates, but this is an isolated case.

Methods
Primary and empirical
Non-experimental

School Resources and Educational Outcomes in Developing Countries: A Review of the Literature from 1990 to 2010
Paul W. Glewwe, Eric A. Hanushek, Sarah D. Humpage, Renato Ravina (2011)
NBER Working Paper No. 17554
Available from: http://www.nber.org/papers/w17554
This paper is also included in the textbooks report.

Developing countries spend hundreds of billions of dollars each year on schools, educational materials and teachers, but relatively little is known about how effective these expenditures are at increasing students' years of completed schooling and, more importantly, the skills that they learn while in school. This paper examines studies published between 1990 and 2010, in both the education literature and the economics literature, to investigate which specific school and teacher characteristics, if any, appear to have strong positive impacts on learning and time in school. Starting with over 9,000 studies, 79 are selected as being of sufficient quality. Then an even higher bar is set in terms of econometric methods used, leaving 43 "high quality" studies. Finally, results are also shown separately for 13 randomized trials. The estimated impacts on time in school and learning of most school and teacher characteristics are statistically insignificant, especially when the evidence is limited to the "high quality" studies. The few variables that do have significant effects – e.g. availability of desks, teacher knowledge of the subjects they teach, and teacher absence – are not particularly surprising and thus provide little guidance for future policies and programs.

Methods
Secondary
Systematic review

Implementing quality education in low income countries: literature review - Ghana
Yaw Ankomah, Janet Koomson, Rosemary Bosu, with George K.T. Oduro (2005)
Institute for Educational Planning & Administration (IEPA) University of Cape Coast
Available from http://r4d.dfid.gov.uk/PDF/Outputs/ImpQuality_RPC/ghanarev.pdf

Quality in education is now crucial in Africa's strategic plans towards catching up with the developed world. While the notion of quality and priority foci may differ from country to country, the term has become a determining factor in facilitating international support for educational expansion and developmental initiatives. Understanding the geographical context of quality in education, what its indicators are within the cultural milieu of particular countries, the challenges associated with implementing quality education are therefore significant. Increasingly successive governments in Ghana have sought and continue to seek strategies for quality delivery of education. Yet, in the country, locally research-based literature on issues related to quality in education is limited.

This document reviews available Ghanaian generated literature that throws light on some quality issues in education. The review also draws on literature from Europe and America and on research and analyses of quality education in other African countries.

Methods
Secondary
Non-systematic review

3. Search strategy

Databases and websites searched:

- Education Resources Information Centre (ERIC)
- British Education Index (BEI)
- Web of Knowledge – limited to Social Sciences Citation Index only
- R4D DfID Research For Development
- Gov.uk: Publications section and DFID evaluation reports
- 3ie Systematic Review Database
- 3ie Database of Impact Evaluations
- The Campbell Library
- EPPI Centre
- Google Scholar

Search strategy concepts

The search strategy was tailored to the functionality of the different databases searched. In searching the academic databases, ERIC, BEI and Web of Science, search strings were developed for the search concepts, school infrastructure, DFID priority countries and Learning Achievement and these were combined. Both keyword and subject heading searches were carried out. Please see Annex C for the full search strategy for these databases. Other databases had more limited search functionality and were searched within topic/ sector areas e.g. Education or using fewer keywords.

The full search strategies for ERIC, BEI and Web of Science are included in Annex B. Please see the following table for summaries of the search strategies and results.

ERIC, BEI and Web of Science

Database and Dates covered	Date searched	Concept search strategy	Hits	Notes	LMIC hits
British Education Index (BEI) 1975 - present	09/10/13	As ERIC but No primary or secondary school limit included	13		
Education Resources Information Centre (ERIC) 1966-present	7-10-13	School Infrastructure and DfID countries and Learning Achievement. Limited to Primary & Secondary Education, yrs 2000-2013	122	Classroom searched in title not ti & ab as too many irrelevant hits when use ab.	~500
Science Citation Index & Social Sciences Citation Index WOS 1900 - present	10-10-13	Added overcrowding concept	74		590

Further detail on the search methods are outlined in Annex C.

4. Screening method

Studies were assessed against the following inclusion criteria:

- Geography: DFID priority countries. A list of priority countries is provided in Annex A. Both Tier 1 and Tier 2 countries were included
- Language: Limited to English language only
- Relevance: Studies which address the thematic research question i.e. **Infrastructure & basic facilities: What elements of school infrastructure (e.g. classroom, desk, latrine, library, computer lab, roof, doors, electricity, security) are associated with improvements in learning achievement?** and which look at **effects** on learning achievement
- Study design: Primary empirical studies (quantitative or qualitative) and secondary analysis (systematic reviews or rigorous literature reviews) which meet the relevance criterion were included. Case studies, theoretical, conceptual and policy papers were excluded.
- Publication date: Within last 10 years

Studies were screened on the basis of the abstract. Where studies were potentially relevant but their adherence to the inclusion criteria could not be fully ascertained from the abstract (for example, evaluation methodology was not stated), they were included in the list, so they can undergo further screening from the full text at a later date.

Study design was described using the DFID How To Note: Assessing the Strength of Evidence:
https://www.gov.uk/government/publications/how-to-note-assessing-the-strength-of-evidence

Authors
This query response was prepared by Geraldine Foster, Judy Wright and Thomas Veale

About Helpdesk reports: The HEART Helpdesk is funded by the DFID Human Development Group. Helpdesk reports are based on 3 days of desk-based research per query and are designed to provide a brief overview of the key issues, and a summary of some of the best literature available. Experts may be contacted during the course of the research, and those able to provide input within the short time-frame are acknowledged.

For any further request or enquiry, contact info@heart-resources.org

HEART Helpdesk reports are published online at www.heart-resources.org