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PROJECTING THE GLOBAL DEMAND FOR TEACHERS:
Meeting the Goal of Universal Primary Education by 2015

PROJECTING THE GLOBAL DEMAND FOR TEACHERS:

Meeting the Goal of Universal Primary Education by 2015

UNESCO

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1. Introduction

As government policies in developing countries move from an emphasis on the expansion of the quantity of primary education towards the improvement of quality provision, teachers are recognised for their central role in ensuring learning achievement for all. The shortage of primary teachers is an issue in all parts of the world – amongst poor and rich countries alike. But, it is recognised as a particular obstacle for many less-developed countries seeking to achieve Education for All (EFA) and the time-bound goal of providing universal primary education (UPE) by 2015.

Education Ministers from around the world, in drafting the communiqué for the High-Level Group meeting on EFA, recognised the importance of teachers in meeting national education goals:

Without adequate numbers of professionally qualified teachers, including female teachers, who are deployed in the right places, well-remunerated and motivated, adequately supported and proficient in local languages, we cannot offer the world's children quality education.

UNESCO, 2008

Projections of teacher supply and demand are one way to anticipate prospective teacher shortages and surpluses. While projections can provide a global picture, they can also be used to identify specific countries with inadequate numbers of primary teachers, especially in the context of meeting their own education goals.

In 2006, the UNESCO Institute for Statistics (UIS) introduced projections to quantify the primary teacher gap and to assess the scope of the challenges facing countries (UIS, 2006). This report provides an update on the 2006 projections in order to serve as a foundation for ongoing monitoring. The purpose is to provide a transparent description of the model used to project the global need for primary teachers between 2007 and 2015, the end-year of the time-bound goals.

There are challenges in elaborating global projections that take into account national specificities. For example, attrition rates depend on the distribution of the teaching force by age and other factors that can change from year to year. To address this, this paper provides three different country-level scenarios, while reporting the medium scenario globally. The model's assumptions about concurrent improvements in the quality and efficiency of the education system so that existing primary teachers are deployed more effectively may be unrealistic for countries with extremely high pupil-teacher ratios or with pupils who often repeat primary grades.

It is important to note limitations in interpretation of the projections at the national level where, for example, the efficient deployment of teachers is a key issue. While there may not seem to be inadequate numbers of teachers at the national level, there may be severe shortages in particular regions or shortages of teachers with subject-matter expertise, specific linguistic skills and understanding of local culture. In other words, while national indicators are important, attention should also be paid to what happens below the surface.

Finally, projections are a useful starting point, but they do not provide insight into the critical issue of teacher quality. Even if there are adequate numbers of teachers, it does not necessarily translate into high-quality education provision. In this area, the UIS continues to develop, pilot and collect comparable indicators that can provide a more accurate global picture of the quality of teachers and teaching.

1.1 How to use the projections

The UIS has calculated a series of projections related to teacher needs in order to assist national and international policymakers to identify and evaluate the recruitment challenges and budgetary implications associated with the goal of achieving UPE by 2015. The projections do not indicate what will happen, but what should happen as consequence of committing to the international goal. Therefore, they are intended to serve as a guide to set realistic goals by indicating the required resources.

It is important to note that not all countries need to expand their teaching forces. Many could actually have fewer teachers in classrooms in 2015 than in 2007. To draw attention to these differences, the UIS has divided countries into those facing a gap and those that are not. Regional totals are calculated separately for each group in order to reduce the risk of misinterpretation.

Section 2 presents the findings of UIS projections for teacher needs between 2007 and 2015. Section 3 serves as a user's guide to the projection model. It presents the concepts, assumptions and calculation techniques of the forecasting model. Further technical information is provided in **Appendix I** and statistical tables are provided in **Appendix II**.

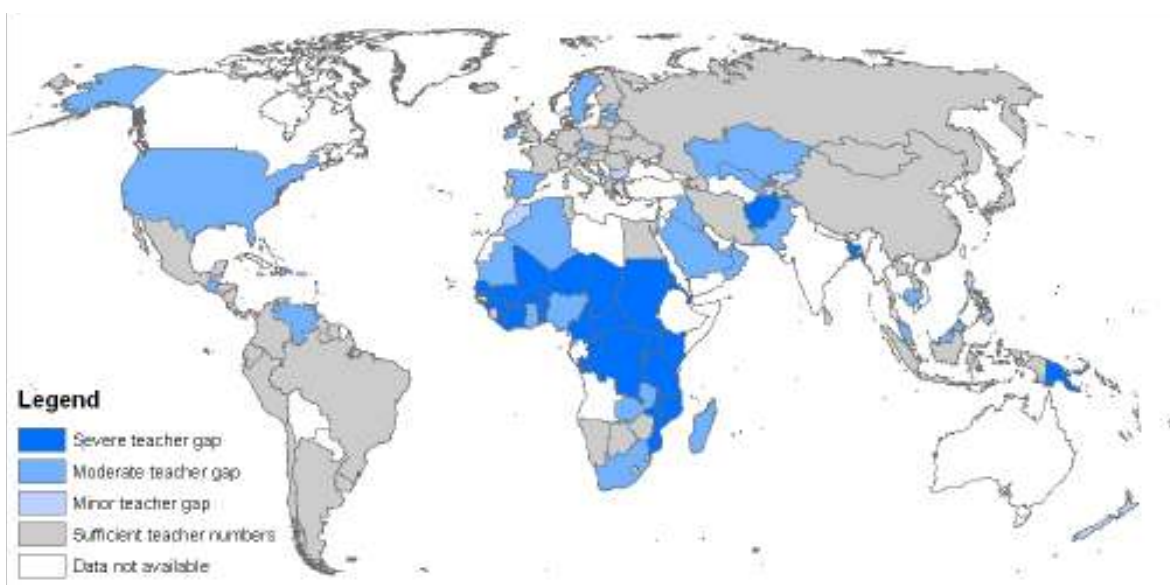
2. Results of UIS projections

2.1 How big is the teacher gap?

Approximately one-half of the world's countries, 96 out of 195¹, need to expand their teaching forces in order to be able to enrol all primary school-age children by 2015, according to UIS calculations (see **Figure 1** and **Table 1**).

In total, these 96 countries will need at least 1.9 million more teachers in classrooms by 2015 than in 2007 to provide UPE of good quality.

Figure 1. Level of teacher gaps by country



Source: UNESCO Institute for Statistics, Statistical Table 2.

Sub-Saharan Africa has by far the greatest need for additional teachers, as presented in **Figure 2**. Three out of four countries (27 out of 45 countries) in the region face a teacher gap. In these 27 countries, 2.6 million teachers were employed in 2007. The number of primary teachers must grow to 3.7 million in the eight years remaining to fulfil the EFA commitment, indicating a gap of 1.2 million. For every two teachers teaching in 2007, there must be three in 2015. Budgets for teacher salaries will have to grow by 50%, according to levels reported in 2007.

¹ The projection is based on data for the reference period 2007. The UIS has publishable data for 150 countries for the reference period. The data were complemented by non-publishable estimates for another 45 countries, most of which are based on estimates from previous publishable data.

Table 1. The teacher gap

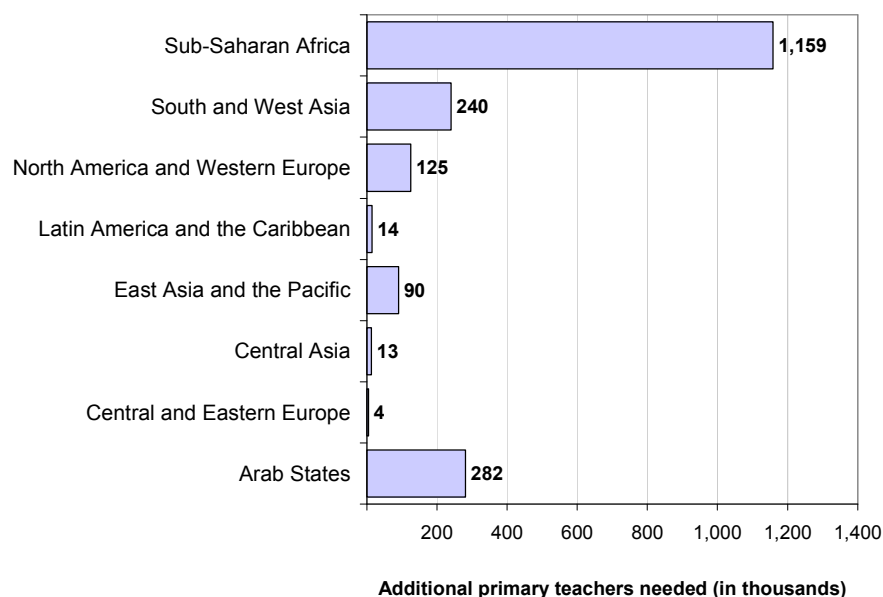
Current and projected teacher stock and increases needed by 2015, by region

Region	All countries		Countries that need to expand				
	Current teacher stock 2007 (in thousands)	Number of countries	Current teacher stock 2007 (in thousands)	Projected teacher stocks required to meet goal by 2015	Difference in teacher stocks (in thousands)	Number of countries with moderate or minor teacher gap	Number of countries with severe teacher gap
Arab States	1,959	20	1,503	1,785	282	11	4
Central and Eastern Europe	1,214	20	399	403	4	7	0
Central Asia	318	9	206	219	13	4	0
East Asia and the Pacific	9,961	29	1,032	1,122	90	10	4
Latin America and the Caribbean	2,905	39	435	450	14	11	0
North America and Western Europe	3,718	24	2,132	2,257	125	7	0
South and West Asia	4,949	9	925	1,165	240	1	2
Sub-Saharan Africa	2,822	45	2,573	3,732	1,159	8	27
World	27,847	195	9,205	11,133	1,928	59	37

Source: UNESCO Institute for Statistics.

Figure 2. Teacher shortages

Increase in teacher stocks needed by 2015, by region

**Note:** Only countries with teacher shortages are considered.

Source: UNESCO Institute for Statistics, Statistical Table 3.

The Arab States, as well as South and West Asia, also face primary teacher gaps. The Arab States region will need 282,000 additional primary teachers in classrooms, while countries in South and West Asia will require 240,000. Yet, considering the current size of the teaching forces in these regions, the gaps are moderate in comparison to sub-Saharan Africa.

The remaining regions account for a total teacher gap of below 200,000. However, it is important to note that regional averages can mask more extreme situations in individual countries. As shown in **Table 2**, ten countries outside of the sub-Saharan African region must dramatically expand their teaching forces.

Table 2. Countries with moderate or severe teacher gaps, by region

	Teacher gap	
	Moderate (0.25%-2.9%)	Severe (3%-18%)
Arab States	Algeria, Iraq, Jordan, Mauritania, Oman, Qatar, Saudi Arabia, Syrian Arab Republic and United Arab Emirates	Djibouti, Palestinian Autonomous Territories, Sudan and Yemen
Central and Eastern Europe	Czech Republic, Estonia, Latvia and Serbia	-
Central Asia	Kazakhstan and Uzbekistan	-
East Asia and the Pacific	Brunei Darussalam, Cambodia, Malaysia, Solomon Islands and Vanuatu	Cook Islands, Nauru, Papua New Guinea and Timor-Leste
Latin America and the Caribbean	Anguilla, Guatemala, Saint Kitts and Nevis, and Trinidad and Tobago	-
North America and Western Europe	Andorra, Cyprus, Ireland, Spain, Sweden and United States of America	-
South and West Asia	Pakistan	Afghanistan and Bangladesh
Sub-Saharan Africa	Cape Verde, Equatorial Guinea, Ghana, Madagascar, Nigeria, South Africa and Zambia	Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Kenya, Liberia, Malawi, Mali, Mozambique, Niger, Rwanda, Senegal, Somalia, Tanzania, Togo and Uganda

Source: UNESCO Institute for Statistics, Statistical Table 2.

2.2 Which countries face the greatest challenges?

It is possible to categorize countries by the relative size of their primary teacher gaps. Countries facing a minor gap need to increase the number of teachers in the classroom by less than 0.25% in order to achieve UPE by 2015. This is the case for 13 countries. Another 46 countries face a moderate gap, requiring an annual growth of 0.25 to 3%.

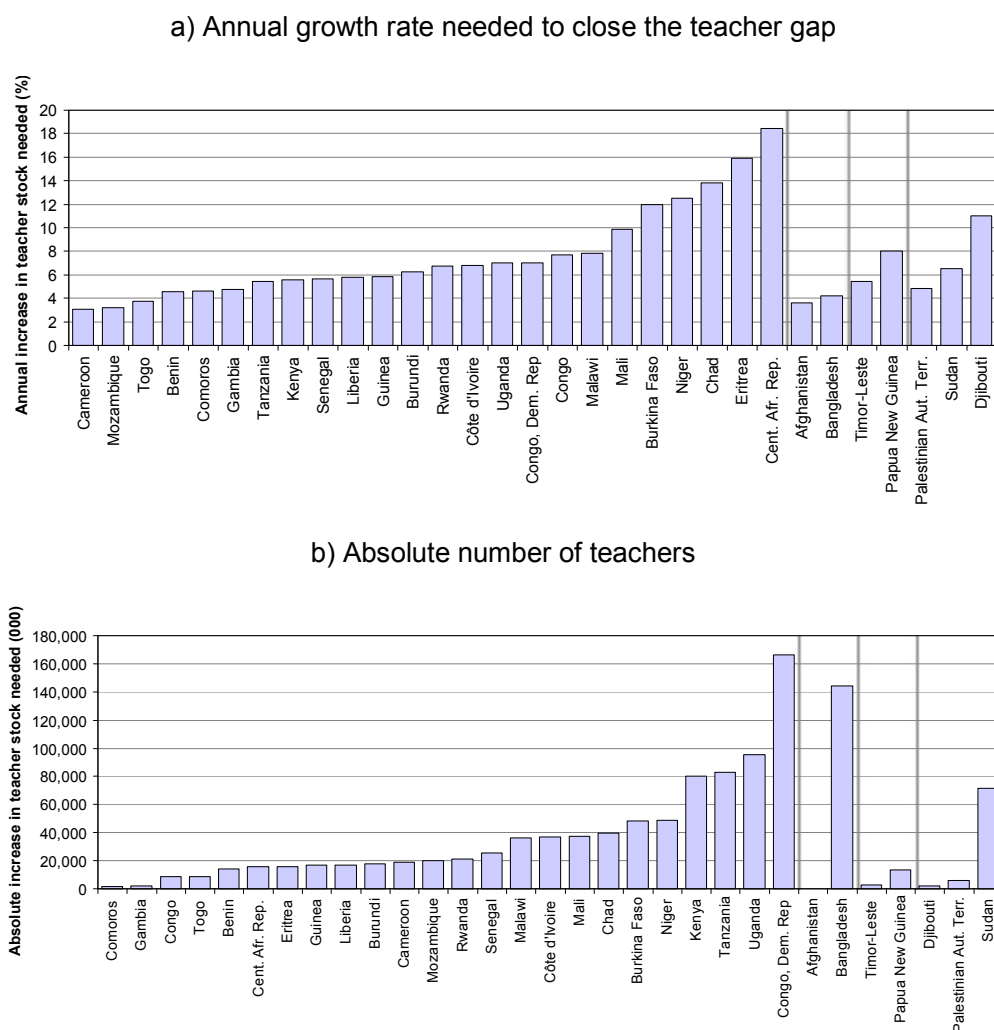
Finally, 37 countries are faced with severe primary teacher gaps (*see Table 2*). They need to expand the number of teachers in classrooms every year by 3% to 18% in order to meet the goal of UPE. This does not include the regular recruitment to compensate for attrition (due to teacher retirement, for example). Assuming 5% attrition, this group of countries would have to annually recruit the equivalent of 8% to 23% of their current teaching force.

More than two-thirds of the world's countries with severe teacher gaps are in sub-Saharan Africa. They include the Central African Republic, which needs to expand its teacher stock by 18.5% each year to achieve UPE (not including attrition) by 2015, followed by Eritrea (15.9%), Chad (13.8%), Niger (12.5%) and Burkina Faso (12.0%).

In absolute numbers, Tanzania will need the most additional teachers (238,000) by 2015, followed by the Democratic Republic of the Congo (166,000), Uganda (95,000), Burkina Faso (81,000) and Kenya (80,000) (see **Figure 3**).

Ten countries have severe teaching gaps in the Arab States, East Asia and the Pacific, as well as South and West Asia. In order to reach UPE by 2015, primary teaching forces must expand by 11% every year in Djibouti, followed by Papua New Guinea (7.8%), Sudan (6.5%) and Timor-Leste (5.4%).

Figure 3. Countries with severe teacher gaps



Source: UNESCO Institute for Statistics, Statistical Table 2.

2.3 Can the gaps be filled?

Is it feasible for countries to bridge these severe gaps? To evaluate the challenges, it is useful to consider progress that has been made since the EFA Summit in Dakar in 2000.

The good news is that several countries have been able to expand their teaching forces between 1999 and 2007 at an even higher rate than required to achieve the

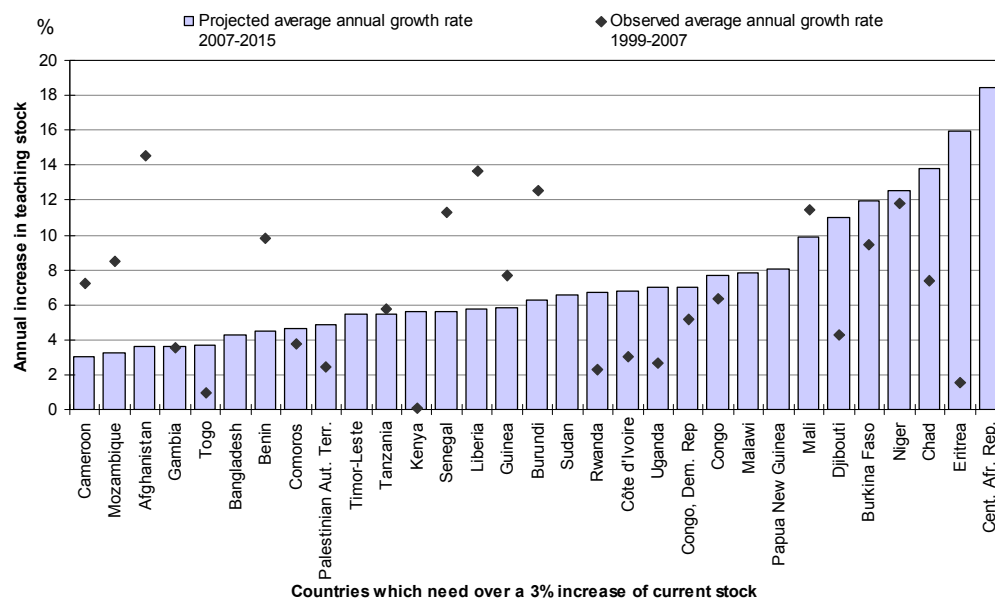
UPE goal. They include: Afghanistan, Benin, Burundi, Cameroon, Congo, the Democratic Republic of the Congo, Guinea, Mozambique, Senegal and Tanzania.

However, most of the countries with severe gaps will fall short of the goal if current trends continue (see **Figure 4**). It is important to note that some of these countries have clearly made remarkable efforts to close the gap. Burkina Faso, Chad and Djibouti managed to expand their teaching forces by 5% to 12% annually since 1999. Yet, these rates are not enough to meet UPE by 2015. Furthermore, it will presumably become increasingly difficult to sustain this pace.

Even more problematic is that a number of countries have clearly fallen behind in the aim to attain the UPE goal. Between 1999 and 2007, the expansion rates for primary teaching forces in Côte d'Ivoire, Eritrea and Uganda were not even one-third of what is required to achieve UPE by 2015.

By looking at trends since Dakar, it becomes clear that it is possible for countries to dramatically expand their teaching forces over a relatively short period of time. However, little information is available on the training of these new teachers. Many countries that succeed in employing sufficient numbers of teachers by 2015 will most likely need to expand their training programmes to ensure quality education.

Figure 4. Comparison of projected and past annual growth rates in the expansion of teaching forces



Source: UNESCO Institute for Statistics, Statistical Tables 1 and 2.

Turning from the 37 countries that face severe teacher gaps, a more positive perspective emerges when considering the 59 countries that are experiencing minor or moderate shortfalls in the primary teacher stock. This group should be able to bridge the gaps. To do so, the respective numbers of teachers need to increase annually by less than 3%, which is in general less than growth rates since 1999. Moreover, most countries with moderate gaps managed to expand their teaching forces even faster than would have been expected since 1999. If the political will and international commitment continue, two-thirds of these countries should not face major problems in expanding their teaching forces to ensure that there are enough teachers in classrooms to achieve UPE by 2015.

2.4 What is projected for countries without a teacher gap?

Approximately one-half of the world's countries (99 countries) face stable or potentially decreasing numbers of primary education students. Most of them have already achieved UPE or are close to doing so. Moreover, many can expect declining school-age populations. It is, therefore, feasible to expect that these countries can succeed by improving school efficiency.

In total, there will be 2.6 million fewer primary teachers in classrooms in these 99 countries in 2015 compared to 2007 (see **Table 3**). However, this figure could change if countries decide to lower pupil-teacher ratios, for example. The potential decline in teacher numbers would be relatively slow and, generally, the result of natural fluctuations in teaching forces (i.e. vacant posts are not filled).

According to UIS projections, the steepest fall in teacher numbers would occur in 15 countries in East Asia and the Pacific. In 2015, there could be 1.6 million less primary teachers than in 2007 (7.2 million versus 8.9 million in 2007). Many countries in Latin America and the Caribbean, as well as South and West Asia, will also need fewer teachers. There could be about 300,000 fewer teachers in each of these regions between 2007 and 2015.

Table 3. Current and projected teacher stock for countries needing fewer teachers in 2015 than in 2007, by region

Region	Countries needing fewer teachers in 2015			All countries
	Current teacher stock (in thousands)	Projected teacher stocks required to meet UPE by 2015 (in thousands)	Difference in teacher stocks (in thousands)	
Arab States	456	412	-44	4
Central and Eastern Europe	816	729	-87	13
Central Asia	112	95	-17	5
East Asia and the Pacific	8,929	7,284	-1,645	15
Latin America and the Caribbean	2,469	2,145	-324	28
North America and Western Europe	1,587	1,495	-91	17
South and West Asia	4,025	3,679	-345	6
Sub-Saharan Africa	249	212	-37	11
World	18,642	16,051	-2,591	99

Source: UNESCO Institute for Statistics, Statistical Table 3.

2.5 How many teachers need to be recruited between 2007 and 2015 to meet the needs of UPE and to compensate for attrition?

The number of teachers needed in classrooms by 2015 is referred to as the "stock" of teachers. But when planning to expand or maintain teacher stocks, policymakers must also consider the number of teachers leaving the profession. Teachers retire, change professions, switch education levels or leave the classroom to assume administrative duties. To fully evaluate future needs for teachers and the challenges to mobilize sufficient numbers of motivated and trained recruits, policymakers must examine the projected flows in and out of the profession.

For the purposes of projections presented in this report, three different scenarios were used: low scenario with an annual attrition rate of 3.5%; medium scenario with a 5% rate; and high scenario of 6.5%. The medium scenario is used in this section.

According to the medium scenario of 5% attrition, 1.3 million teachers will need to be recruited every year between 2007 and 2015, amounting to a global total of 10.3 million over the eight-year period. These figures are based on the needs associated with attrition and UPE-related expansion in countries that have not yet achieved the goal and those that have. Recruitment needs in the latter are solely linked to attrition.

The global figures will inevitably decrease over time as they are calculated for a specific reference period (the years remaining until 2015). For example, the global figure of 10.3 million recruits is projected to fall to 9.1 million beginning in 2008 and down to 6.7 million in 2010, when only five years will remain to the target year of 2015. Given the limitation in this figure, the UIS suggests focusing more specifically on expansion rates and changes in the stock of primary teachers needed for planning and advocacy purposes.

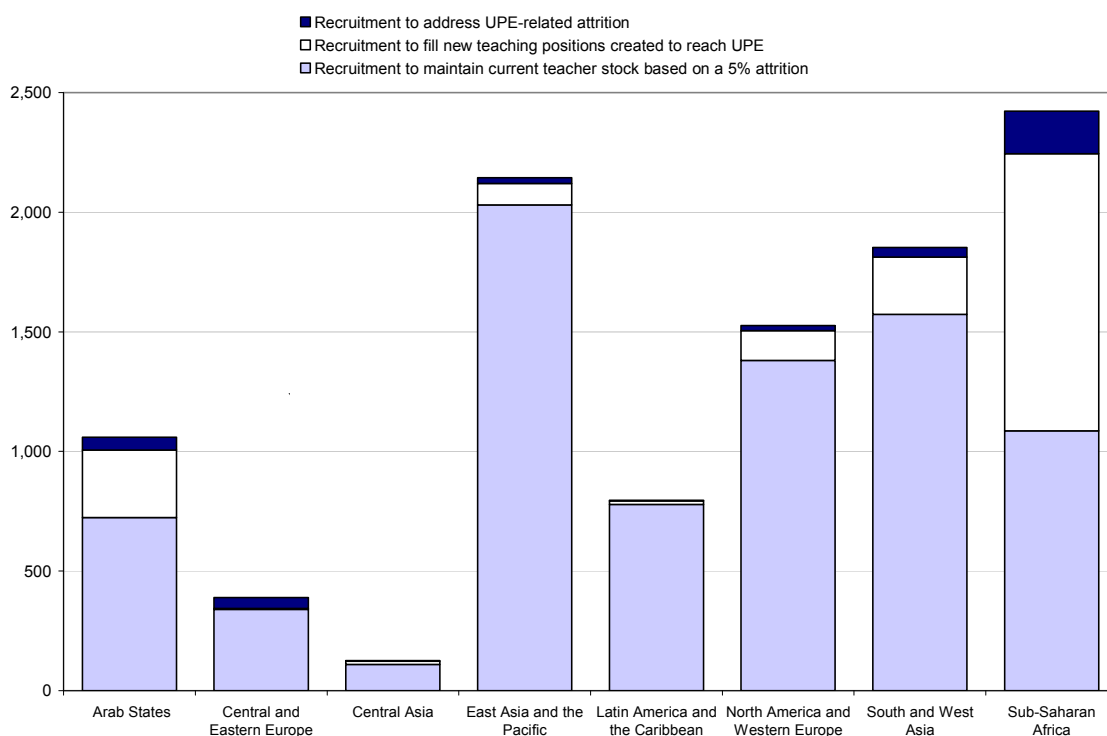
Figure 5 shows the extent to which regions will require different inflows of primary teachers. Sub-Saharan Africa will need the largest inflow – 2.4 million teachers. This enormous projected demand is mainly driven by efforts needed to achieve UPE: 1.2 million primary teachers are needed to fill new posts and another 178,000 recruits to compensate for attrition related to this expansion in teacher stocks.

East Asia and the Pacific will need the second largest inflow, mainly to compensate for attrition. The absolute number for the region appears to be impressive but is relatively small in proportion to the population size. Furthermore, it is important to remember that many education systems across the region are actually going to decline in size. Overall, 3.5 million primary teachers are expected to leave the profession between 2007 and 2015. However, 1.5 million positions could remain vacant and still meet the goal of UPE so that the total inflow of new teachers would amount to about 2 million.

The Arab States will also require significant inflows, but this will be largely due to the creation of new UPE-related teaching posts. A total of about 1.06 million teachers should be recruited between 2007 and 2015 – of which 336,000 would fill new posts. Thus, in order to achieve UPE, recruitment over this period will have to be 50% higher than that associated with regular attrition.

Other regions, namely South and West Asia, North America and Western Europe, will also need to recruit substantial numbers of primary teachers. However, this recruitment is primarily due to the regular replacement of teachers who will leave the system.

Figure 5. Number of primary teachers that need to be recruited between 2007 and 2015, by region



Note: Recruitment to address UPE-related attrition also uses a 5% attrition rate.

Source: UNESCO Institute for Statistics, Statistical Table 3.

2.6 How much of the projected need for teacher recruitment is attributed to meeting the goal of UPE?

Figure 5 provides a breakdown of the factors driving projected recruitment needs. Of the 10.3 million teachers needed, 8.1 million will be deployed to maintain the current capacity of education systems (i.e. compensate for attrition). About 2.2 million recruits will be needed to expand education systems in order to achieve UPE (1.9 million for new posts and about 300,000 for associated attrition) between 2007 and 2015. In other words, one in five teachers that need to be hired by 2015 will be part of global efforts towards EFA. This reflects the massive investment which is required by governments.

This perspective highlights the dramatic burden for sub-Saharan Africa. The region needs to recruit and train about 1.1 million teachers to maintain the current situation in the classroom, which already falls short in terms of education quality. But to attain UPE, these countries must recruit an additional 1.3 million teachers, bringing the total to 2.4 million. In short, they will need to recruit almost as many teachers in just eight years as are currently teaching in classrooms across the region.

3. How to forecast teacher needs: User guide to the UIS projection model

In order to draw conclusions and lessons from the projections presented in this report, readers must clearly understand the underlying assumptions of the UIS forecasting model. This section presents the assumptions and model used for the UIS teacher projections. It is important to stress that the underlying assumptions, such as benchmarks used for pupil-teacher ratios, are subject to discussion. The use of such assumptions should not be confused as a standard set by UNESCO.

Teacher projections are primarily driven by two central questions. First, what are the financial implications? Decision makers need reliable estimates of teacher stocks in order to mobilize and allocate the required budgetary resources.

The second question relates to the challenges of training and recruiting sufficient numbers of teachers. How many new posts need to be created and are there enough professionals flowing into the workforce to compensate for annual attrition?

3.1 Projecting teacher stocks in 2015

The first step is to determine how many primary teachers are needed in classrooms in 2015 (i.e. teacher stock). The UIS scenario is based on the conviction that progress towards UPE cannot be achieved by simply increasing resources. Policy measures targeting school efficiency and education quality are also needed. The projection model, therefore, assumes that primary education systems:

- i) reach universal primary enrolment and completion, i.e. NERs of 100%;
- ii) increase efficiency by reduction of repetition, i.e. repetition rates fall by one-half and do not exceed 10%, and consequently, GERs are between 100% and 110%;
- iii) maintain or improve pupil-teacher ratios to ensure minimum quality standards, i.e. countries with PTRs above 40 to 1 recruit sufficient teachers to reach this standard;
- iv) experience population growth as projected by the United Nations Population Division; and
- v) maintain current levels for other indicators unchanged between 2007 and 2015.

The following paragraphs discuss in detail the assumptions and illustrate their application for selected countries.

Assumption 1 – Universal primary enrolment and completion

For universal primary enrolment and completion, it is assumed that all children of primary school age are enrolled in school and complete the full cycle of primary education. This would imply an adjusted net enrolment rate (NER) of 100%, with the number of pupils at least as high as the number of children of primary school age. Adjusted NER includes primary school-age children enrolled in secondary education. Children may repeat grades but do not drop out.

An implicit assumption in the model is that systems will successfully reduce late entry into school. This would mean that the difference between the NER and gross enrolment ratio (GER), which is currently substantial in many countries, would be largely due to the effect of repetition.

Table 4 summarizes by region the adjusted NER levels in 2007. Of 165 countries with available data, just 52 reported rates above 95% (indicating that they have or are close to achieving UPE). In particular, 33 countries need to increase their rates by more than 20 percentage points, 17 of which are located in sub-Saharan Africa.

Table 4. Number of countries by adjusted NER ranges and region, most recent year available between 2005 and 2008

Adjusted NER	<80%	80%-90%	90%-95%	>95%	No data available
Arab States	4	5	3	7	2
Central and Eastern Europe	0	1	10	7	4
Central Asia	0	0	4	4	1
East Asia and the Pacific	5	3	5	9	13
Latin America and the Caribbean	2	5	12	18	4
North America and Western Europe	0	2	5	18	5
South and West Asia	2	3	2	3	1
Sub-Saharan Africa	17	9	3	6	10
World	30	28	44	72	40

Note: Adjusted NER includes primary school-age children enrolled in secondary education in the enrolment figures. Adjusted NER is slightly higher than NER.

Source: UNESCO-UIS, 2009

Assumption 2 – Efficiency and repetition

Most governments do not have the resources to reach the goal of UPE by just expanding their school systems. Considerable gains can also be made by improving the efficiency of systems, notably by reducing repetition. The UIS model assumes that countries will reduce the number of repeaters by one-half, or, when the percentage of repeaters in 2007 exceeds 20%, then repetition is assumed to be 10% in 2015. As such, the enrolment target is the equivalent of the school-age population plus the percentage of repeaters projected for 2015. In other terms, the GER in 2015 is assumed to be between 100% and 110%, depending on the percentages of repeaters. The efficiency assumption applies to all countries, regardless of whether they reached UPE or not.

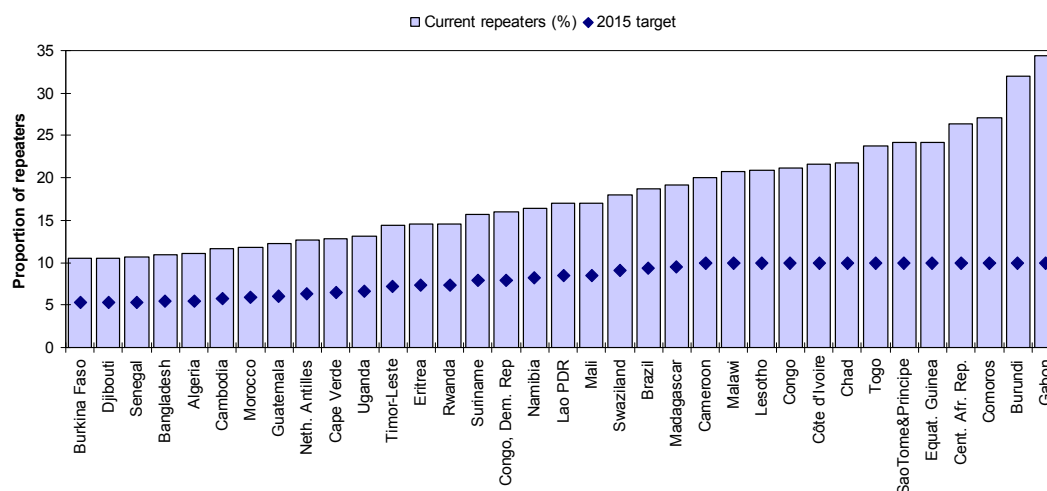
Table 5 summarizes repetition levels by region. Of the 181 countries with recent data available, 73 countries have primary repetition rates below 2% and another 42 countries are in the range of 2% to 5%. However, in 54 countries, between 5% and 20% of primary pupils currently repeat grades. Moreover, repetition rates exceed 20% in the following countries: Burundi, Cameroon, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Equatorial Guinea, Lesotho, Malawi, Sao Tome and Principe, and Togo (see **Figure 6**). To reach the efficiency assumption used in the UIS model, repetition rates would have to fall by more than one-half within the next seven years, which represents an enormous challenge.

Table 5. Number of countries by repetition ranges and region, most recent year available between 2005 and 2008

Countries need to reduce repetition:	... by one-half				...by more than one-half	No data available
	<2%	2%-5%	5%-10%	10%-20%	>20%	
Arab States	6	6	4	3	n	1
Central and Eastern Europe	14	4	n	n	n	3
Central Asia	8	n	n	n	n	1
East Asia and the Pacific	13	4	3	3	n	11
Latin America and the Caribbean	9	16	11	3	n	2
North America and Western Europe	19	5	n	1	n	4
South and West Asia	2	3	2	2	n	0
Sub-Saharan Africa	2	4	11	11	12	17
World	73	42	31	23	12	39

Source: UNESCO-UIS, 2009

Figure 6. Countries with the highest percentage of repeaters in 2007 and assumed percentage for 2015



Source: UNESCO-UIS, 2009

Table 6 shows that in 2007 most countries had already reached the required level of GER, and many exceeded it substantially. Only 65 countries report a GER below 100% and certainly need to increase enrolment ratios to reach UPE. Almost all other countries could achieve UPE with efficient use of current resources and consequently would not need to increase the teaching force, assuming efficiency gains and a sufficient pupil-teacher ratio.

Table 6. Number of countries by level of GER and region, most recent year available between 2005 and 2008

Region	<90%	90%-100%	100%-110%	110%-120%	>120%	No data available
Arab States	4	5	7	1	0	3
Central and Eastern Europe	0	13	4	0	0	4
Central Asia	0	5	2	1	0	1
East Asia and the Pacific	2	5	10	4	0	13
Latin America and the Caribbean	4	4	13	14	2	4
North America and Western Europe	1	7	13	3	0	5
South and West Asia	1	1	0	4	1	2
Sub-Saharan Africa	8	5	9	8	4	11
World	20	45	58	35	7	43

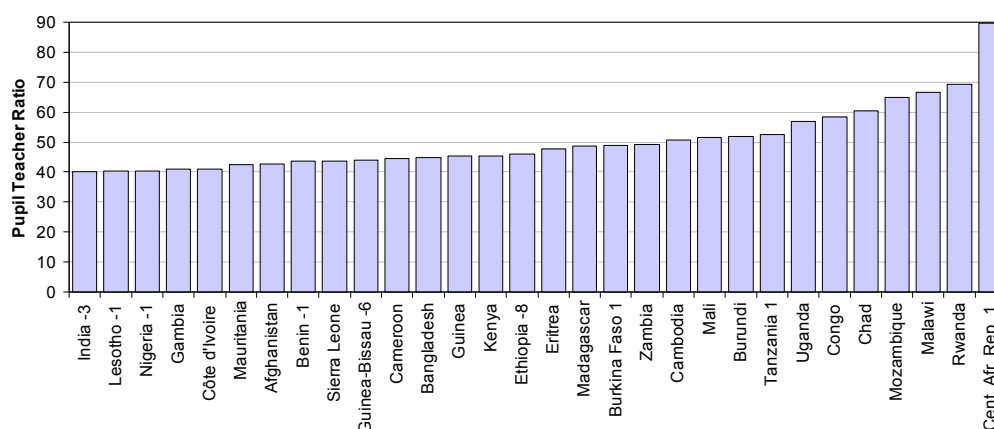
Source: UNESCO-UIS, 2009

Assumption 3 – Standards for pupil-teacher ratios

The pupil-teacher ratio (PTR) is an important policy variable when planning education systems. A low PTR comes at a high cost: more teachers are needed and larger budgets to cover their salaries. Yet, high ratios mean larger class sizes which can compromise education quality. The Education for All Fast Track Initiative (EFA-FTI) framework recommends a reference value of 40 pupils per teacher at the primary education level.

The UIS model uses the current primary-level PTR for countries where there are less than 40 pupils per teacher. However, **Figure 7** shows that there are 30 countries (25 of which are in sub-Saharan Africa) with current PTRs exceeding this standard. For these countries, it is assumed that the PTR will be reduced to 40:1 by 2015. In particular, the ratios need to fall by more than 10 points in the following countries: Burundi, Cambodia, Central African Republic, Chad, Congo, Malawi, Mali, Mozambique, Rwanda, Tanzania and Uganda.

Figure 7. Countries with current PTR exceeding the model assumption of 40:1

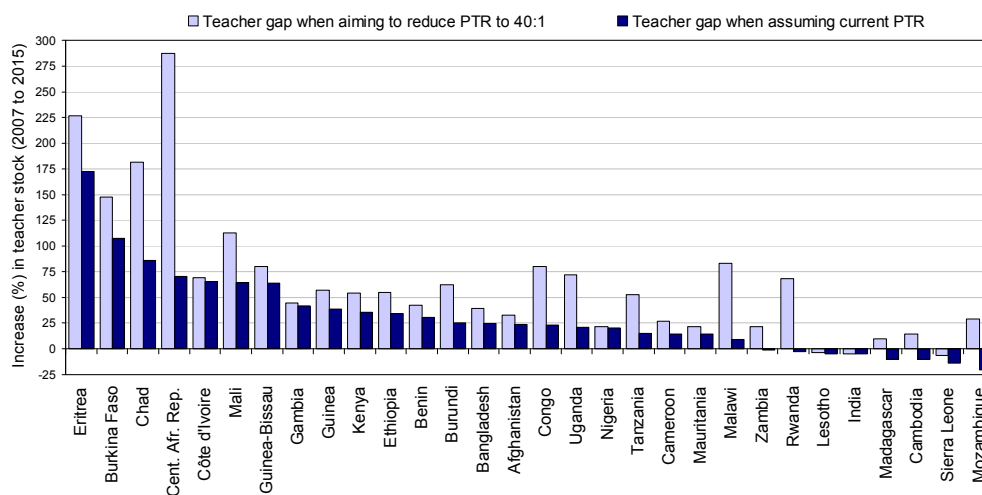


Note: ⁺¹ Data refer to 2008; ⁻¹ Data refer to 2006; ⁻³ Data refer to 2004; ⁻⁶ Data refer to 2001; ⁻⁸ Data refer to 1999.

Source: UNESCO-UIS, 2009

The assumption concerning education quality and PTRs has a dramatic impact when estimating teacher gaps. **Figure 8** illustrates the projected differences between current teacher stocks and required stocks for 2015 with and without the assumption that PTRs are reduced to 40:1. For example, if the Central African Republic managed to achieve UPE by expanding enrolment figures but did not reduce the PTR which currently stands at 91:1, then the country would need 70% more teachers in classrooms by 2015 compared to 2007. However, if the PTR was reduced to 40:1, the teacher stock would have to increase by 287%. In total, the difference between these two projections amounts to close to 500,000 teachers.

Figure 8. Teacher gaps with and without reduction of PTR



Source: UNESCO Institute for Statistics, Statistical Table 2.

Assumption 4 – Population growth

Population growth is another key factor affecting UIS projections. In the model, the school-age population for the academic year 2015 is based on estimated projections released in 2008 by the United Nations Population Division. It is assumed that the theoretical starting age and duration of primary education will not change.

Assumption 5 – Other indicators

The model assumes that all other relevant factors in the education systems remain unchanged between 2007 and 2015. For example, calculations for PTRs and teacher numbers are based on teacher headcount figures as opposed to full-time equivalents. Teacher headcount numbers could be affected by changes in the percentages of part-time teachers. However, for modelling purposes, it is essential to limit projections to a set of key indicators.

Estimation method for teacher stock

The teacher stock required for the year 2015 is calculated using a simple two-step model based on the key assumptions. First, the number of children enrolled is estimated. Based on assumptions 1, 2 and 4, this is between 100% and 110% of the school-age population projected for 2015. In the second step, the number of teachers is calculated by dividing projected enrolment numbers by the PTR (which can never exceed 40:1).

3.2 Projected teacher flows between 2007 and 2015

UIS estimates for primary teacher recruitment needs are based on a flow model that takes into account the number of teachers entering and leaving the workforce.

Assumption 6 – Average attrition rates

This approach requires assumptions about the average rate at which teachers leave the workforce. Attrition refers to the number of teachers that leave the profession permanently in a given year. There are many reasons for attrition, including retirement, resignation and dismissal or other reasons, such as illness or death. The attrition rate is this number divided by the total number in the teaching force.

Which attrition rate would reasonably capture the diversity of contexts, education systems and teaching forces around the world? Unfortunately, apart from a handful of countries that are able to closely monitor teacher flows, the evidence base is limited and uneven.

One can consider this question from a theoretical perspective. For example, attrition rates can also be expressed in terms of the average duration of teaching careers (see **Table 7**)

For example, if 5% of teachers leave the profession every year, the average teaching career would last 20 years. This figure seems to be valid for many education systems.

Table 7. Attrition rates and the theoretical duration of teaching careers

Attrition	
Rate	Average duration of teaching career
2%	50 years
3%	33 years
5%	20 years
8%	12 years
10%	10 years

At the same time, there are very few cases where teaching careers might last, on average, as high as 50 years, suggesting that very low attrition rates of 2% to 3% are only temporary or occur within very particular contexts. The same is true of high attrition rates of 10%. Some of the factors associated with the level of attrition rates include the age profile of the teaching force, the competitiveness of the labour market, existing public health risks and education system governance (see **Table 8**).

Table 8. Factors associated with attrition rate levels

Lower rates of attrition	Higher rates of attrition
Youthful teacher age profile	Higher proportion of older teachers
Few opportunities in the labour market for those with secondary or post-secondary qualifications	Many opportunities - competitive labour markets
Low public health risks for the adult population	High public health risks for the adult population (e.g. malaria, HIV-AIDS, etc.)
Mainly public provision of education in which teachers are civil servants	Private provision and contract teachers

It is difficult to draw firm conclusions from observed measures of primary attrition, other than a relatively broad range of rates between 3% and 9%. In developing countries, this is partly due to limitations in existing information systems. Moreover, it is further complicated by the lack of metadata on the methods used to derive existing estimates.

A recent study by *Pôle de Dakar* (2009) cites attrition rates for nine sub-Saharan African countries and the territory of Zanzibar (United Republic of Tanzania). These rates range from as low as 2% in Eritrea and Liberia to 9% in Zambia. Given the high rate of HIV/AIDS prevalence in Zambia, estimated attrition rates range from 5% to 9% (UIS, 2005; Education International, 2007).

Another study by Bennell and Akyeamong (2007) found high attrition rates in Ghana (8.0%) and Zambia (8.4%), but relatively low rates in Tanzania (2.8%) and Malawi (3.7%).

One of the highest attrition rates has been reported in Lesotho (12.4%) for primary education in 2004 (Urwick et al., 2005), while subsequent estimates have shown a lower rate of approximately 3% to 4% annually (*Pôle de Dakar*, 2009; Education International, 2007). The case of Lesotho illustrates one of the difficulties in measuring attrition – inaccurate or imprecise records on teachers. Apparently teachers in Lesotho must resign in order to change schools (instead of via official transfer) or to go on study leave. As a result, they may be mistakenly counted as having left the profession (Urwick et al., 2005).

Estimated attrition rates for other developing countries include 2.9% in India (Bennell and Akyeamong, 2007) and 3.1% in Jamaica (Morgan et al., 2006). The OECD (2005) published data on teacher attrition based on ranges for 13 OECD countries. Three countries reported low rates (below 3%); six reported middle rates (3% to 6%); and four reported high (above 6%) rates of attrition.

Some estimates take into account factors noted in Table 8. For example, *Pôle de Dakar* (2009) estimates for sub-Saharan Africa depend upon the prevalence of HIV/AIDS. For countries with an HIV rate below 5%, the estimated attrition rate is 3%. Attrition rates rise to 6% for countries with HIV rates exceeding 15%.

To project teacher needs, the UIS considered three attrition estimates – 3.5%, 5% and 6.5%. For the most recent estimates, it was decided to focus on the middle scenario of 5%. The rationale for choosing 5% as the middle scenario in the current estimates is largely based on the validity of a theoretical duration of 20 years for teaching careers (based on a 5% attrition rate) and existing observed data from developed and less-developed countries. Further study is needed to test this assumption across a wide range of development contexts.

Estimation method for teacher flows

When calculating teacher flows (and stocks), it is important to distinguish between countries where teacher numbers are expected to decrease and increase. Outflows (leading to falling numbers) are defined primarily by annual attrition. The inflow to the system is driven by the recruitment of new teachers.

For countries where teacher stocks are projected to fall, outflows and inflows are calculated as follows. The outflow – or the number of teachers leaving the profession – is based on the assumed attrition rate of 5% per year. To calculate the inflow, the first step lies in estimating the annual rate at which the stock of teachers

could be reduced while maintaining UPE. The difference between the attrition rate and the reduction rate for teacher stock is used to calculate the required inflow of new recruits. For each year, these percentage rates are then multiplied by the teacher stock to calculate the absolute number of teachers who are either leaving or joining the system. These annual totals are then added together to calculate the total number of teachers entering and leaving the profession between 2007 and 2015.

For countries that need to expand their stock, there are three types of teacher flows to consider. First, new teachers are needed to maintain the current system and account for the assumed attrition rate of 5%. This annual flow amounts to the following: 5% of the teachers in the system in 2007 multiplied by 8 (i.e. the years remaining to 2015).

Second, additional posts need to be created to ensure that there are enough teachers in classrooms to achieve UPE. This inflow is simply the difference between the number of teachers employed in 2007 and the number needed in 2015, i.e. increased stock.

A third flow is required to compensate for attrition associated with the UPE-related positions. Some of these newly-recruited teachers may leave the profession before 2015 and must be replaced. Thus, for each year in the projection period, the UIS estimates the total number of UPE-related posts created since 2007 and then applies the attrition rate of 5%. The sum of these numbers for 2007 to 2015 amount to the total number of new recruits associated with UPE-related attrition.

4. Comparison of the UIS model with other projection studies

Since the 1990 World Conference on Education for All in Jomtien, Thailand, many simulation models have projected the number of school places and the teacher stock needed to reach UPE or similar goals. In particular, Colclough and Lewin (1993), Mehrotra and Buckland (1998), Brossard and Gacougnolle (2001), Bruns, Mingat and Rakotomalala (2003), UNESCO BREDAs, World Bank and UNESCO-UIS (2005) and UNESCO-UIS (2006) have designed simulation models to measure the costs of reaching UPE (see **Table 9**).

The first step in projecting future teacher needs lies in estimating the number of school places that are required to enrol all children of primary school age by 2015. As previously explained, the UIS model defined the target value using a primary NER of 100% plus a minimum value between one-half of the current percentage of repeaters in primary education and 10%. The calculation concerning repeaters was also used by Bruns, Mingat and Rakotomalala (2003) and UNESCO BREDAs, World Bank and UNESCO-UIS (2005). Both of these models use 100% universal primary completion, which is, in practice, the same as the UIS approach, because they both assume universal coverage of the primary school-age population. The UIS projection of pupil numbers is based on expected changes in the size of the population cohort and in the coverage of primary education. Pôle de Dakar (2009) deviates from the other projections with respect to the target year. The target years have been adapted to the individual countries according to the current status of their education systems: while the Dakar goal is to achieve UPE by 2015, it is obvious that some African countries will reach this goal sooner and that others are still too far for it to be realistic for the 2015 horizon.

Second, the UIS model also factors in concerns for quality education, notably by setting a benchmark PTR of 40:1. The UIS model uses the minimum value between the current PTR and the benchmark of 40:1. All of the models mentioned above relied upon this benchmark, with the exception of Colclough and Lewin (1993) and Brossard and Gacougnolle (2001), whose models employed respectively 85% and 90% of the current PTR. An important aspect of this approach is that it also allows countries to let the ratio rise to 40:1. Most of the countries with PTRs below the benchmark have far less than 40 pupils per teacher. The UIS model is based on the assumption that it is not credible to suggest that these countries further reduce ratios or allow them to expand to the level of 40:1 in the interest of education quality.

The UIS model differs from its predecessors in other key aspects as well. Three of the models made assumptions about the share of pupils enrolled in private education, because their final goal was to examine public costs to reach UPE. Others excluded private education altogether. The UIS model does not make this distinction, because it focuses on total demand for primary teachers, regardless of governance or financing of the schools in which they are employed.

The UIS projections also estimate the number of additional teachers, or inflow, required to compensate for attrition rates in order to assess potential training needs. Therefore, three scenarios are based on different attrition rates: low (3.5%), medium (5%) and high (6.5%). This report presents figures from the medium scenario. The results of all three scenarios, at the national level, are presented in the Statistical Tables. The Pôle de Dakar (2009) model takes into account a rate of teacher attrition that varies depending upon the country's characteristics and especially the prevalence of HIV/AIDS, in the absence of data on teachers actually leaving the system or data on other high-morbidity or high-mortality diseases such as malaria.

Table 9. Comparing underlying assumptions of teacher projection models

	Colclough and Lewin, 1993	Mehrotra and Buckland, 1998	Brossard and Gacougnolle, 2001	Bruns, Mingat and Rakotomalala, 2003	UNESCO BREDIA, World Bank and UNESCO-UIS, 2005	UNESCO Institute for Statistics, 2006	Pôle de Dakar, 2009	UNESCO Institute for Statistics, 2009
Coverage	97 countries	Global	Global	47 countries	52 countries	Global	41 countries	Global
Base year	1990	1994	1998	2000	2003	2004	Between 2004 and 2007*	2007
Overall target	GER=100%	NER=100% & GER=100%	NER=100%	Primary completion rate = 100%	Primary completion rate = 100%	NER=100%	GIR = 100% and primary completion rate is 100* Target year is also flexible, ranging from 2010 to 2020	NER=100%
Repetition	0.25 * base repetition rate	No assumption made	Implicit assumption based on past trends	Current if <10% otherwise 10%	Current if <10% otherwise 10%	10% or 0.5 * country specific rate	Current if <10% otherwise 10%	10% or 0.5 * country specific rate
Pupil teacher ratio (PTR)	0.85 * base PTR by year 2000	Current, 40:1 and 30:1	Current, 0.90 * base	PTR by year 2015 40:1	Current if <40:1 otherwise 40:1	Current if ≤ 40:1 otherwise 40:1	Current value if ≤ 40:1; 40 if current between 40 and 60; 50 if current is over 60	Current if ≤ 40:1 otherwise 40:1
Private education	Reach 10% by year 2000	Included	Included	10%	Current if =0% or <10% otherwise 10%	Included	Current value if > 10%; 10% if current between 5% and 10%; 5% if current is below 5% and 0 if current is nil.	Included
Source of population data	World Bank estimates	Does not take into account population growth	UN Population Division, 1998 revision	World Bank estimates	United Nations Population Division, 2002 revision	UNPD estimates, 2004 revision	UNPD estimates, 2006 revision	UNPD estimates, 2006 revision
Attrition	National rate	No assumption made	No assumption made	No assumption made	No assumption made	5.0/6.5/8.0	Minimum of 3%; 3% for countries where the incidence of HIV is below 5%; 3.5% for HIV incidence between 5% and 10%; 4% for HIV incidence between 10% and 15%; 6% for countries where the incidence of HIV is over 15%	3.5/5.0/6.5
Deployment	Double-shifting to reach PTR=0.85 * base PTR by year 2000	No assumption made	No assumption made	No assumption made	No assumption made	No assumption made	No assumption made	No assumption made

5. Comparison with previous UIS projections

Caution is required when comparing the updated UIS estimates on teacher gaps with those from 2006 – notably those published in the report entitled *Teachers and Educational Quality: Monitoring Global Needs for 2015* (UIS, 2006). In this report, the UIS estimated that about 18 million teachers would need to be recruited globally to achieve UPE and to compensate for teacher attrition between 2004 and 2015.

In the current projections, this figure has been revised to 10.3 million primary teachers needed for the period between 2007 and 2015. The change in the number is mainly due to two factors: more recent evidence has led to a revised assumption of annual teacher attrition (from 6.5% to 5%) and the shorter time period to reach the target date of 2015 (from 2004-2015 to 2007-2015).

For the updated 2009 projections, the UIS revised its assumptions regarding attrition rates. This does not reflect an observed change in actual attrition figures but rather a more conservative interpretation of the sparse data available. In calculating its projections, the UIS presents three scenarios based on low, middle and high attrition rates to provide greater scope for interpretation of national and regional figures. For the previous estimates (2004 to 2015), the attrition rates used for the low, middle and high scenarios were: 5%, 6.5% and 8%. The UIS released projections for the middle scenario (6.5%). For the current estimates (2007 to 2015), the scenarios were modified to: 3.5% (low), 5% (medium) and 6.5% (high), and a new middle scenario of 5% is reported.

The change in the medium scenario from 6.5% to 5% accounts for a difference of 3.3 million in the global number of primary teachers to be recruited to compensate for attrition between 2007 and 2015.

The change in global estimates is also linked to the shorter reference period. The previous UIS projections were based on the period 2004 to 2015 – or three years more than the current timeframe. This difference accounts for an estimated 3 million (at 5% attrition) to 4.2 million (at 6.5% attrition) recruits that would no longer be counted for the 2007 to 2015 period.

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Appendix I

Technical specifications

1. Who is a teacher?

A teacher is a person officially employed (part-time or full-time) in an educational institution to guide and direct the learning experience of students, irrespective of qualifications (trained or not) or the delivery mechanism (i.e. in person or distance learning). This definition excludes educational personnel without active teaching duties (e.g. principals who do not teach) and persons who work occasionally or on a voluntary basis in educational institutions.

2. How to calculate how many teachers are needed?

The number of teachers in a country is not static – many factors influence the expected teacher needs. The main contributor to the calculation of the expected number of teachers is the number of children enrolled in school. Indeed, as the universal primary education (UPE) target is 100% of the school-age population, a country has to plan to have enough teachers to meet this demand, while also taking into account the potential repeaters who need to stay at the same grade for an extra year. For ease of reading, the base year is noted as b , the target year as t , and any year in between is y .

5.1 A two-step model

This model calculates the number of teachers in two steps: generating the stock of teachers needed by 2015 and estimating the number of teachers needed to compensate for flow between the base (b) and target (t) years, by single year (y).

Step 1: Teacher stock

The number of teachers needed by the target date of 2015 can be computed by using the projected school-age population (SP) of pupils (including repeaters – REP) and dividing it by the expected pupil-teacher ratio (PTR) as conversion factor.

$$\text{Teacher}_{(t)} = \frac{\text{SP}_{(t)} + (\text{SP}_{(t)} * \min[(\text{REP}_{(b)}/2), 0.10])}{\min(40 : 1, \text{PTR}_{(b)})}$$

Step 2: Flow

The calculation for teacher stock does not capture the movement within the teacher population between base and target years: between those two points in time, many new teachers will enter the profession while others will leave, generating a replacement rate combined with an attrition rate scenario (RR(AR)). The first operation is to calculate the flow of teachers if all other indicators are unchanged, and the second operation is to add the number of teachers needed if there is an additional attrition between years.

Additional teachers needed by the target year by countries with growing school-age populations =

$$\sum_{b+1}^t [\text{Teacher}_{(b)} * (\frac{\text{RR}(\text{AR})}{100})] + \sum_{y=b+1}^t [(\text{Teacher}_{(y)} - \text{Teacher}_{(b)}) * (\frac{\text{RR}(\text{AR})}{100})]$$

Hence, total teachers needed to meet UPE by 2015 =

$$\frac{\text{SP}_{(t)} + (\text{SP}_{(t)} * \min[(\text{REP}_{(b)}/2), 0.10])}{\min(40:1, \text{PTR}_{(b)})} + \sum_{b+1}^t [\text{Teacher}_{(b)} * (\frac{\text{RR}(\text{AR})}{100})] + \sum_{y=b+1}^t [(\text{Teacher}_{(y)} - \text{Teacher}_{(b)}) * (\frac{\text{RR}(\text{AR})}{100})]$$

In summary, the number of teachers needed by 2015 is calculated by the current stock of teachers today, added to the flow of additional teachers needed to replace those who leave the profession (attrition) during the reference period, in addition to the additional teachers needed to meet the demand of an increasing pupil population, while maintaining current standards of pupil-teacher ratios.

3. How to interpret regional figures?

The projected demand for primary teachers is calculated at the country level, which result in positive (national population expanding) and negative (national population decreasing) numbers of teachers. While the sum of the demand for teachers at the global level can provide information on overall requirements, this number is not applicable to national policy use. Indeed, as extra teachers from Germany are not a commodity easily transferable to the classrooms of Yemen, analyses should be based at the country level or disaggregated by type of need, e.g. countries needing to expand in comparison to those facing reductions in their teaching force.

4. What is still missing from the model?

This exercise has limitations and its results should be interpreted with care. Little is still known on country-specific attrition rates or teacher deployment. Equally, PTRs can also be considered as a vague approximation of what is acceptable for a quality education, considering that they are based on headcounts and not full-time equivalents.

This model does not cover the need for teachers at other levels of education and, therefore, cannot account for the attrition of teachers who would be promoted from one level of education (i.e. primary) to another (i.e. secondary).

Finally, the projection does not capture teacher quality, late entry or completion of pupils.

5. Main simulation model: Reaching UPE by 2015

The simulation model presented in this report is based on a time-bound target. Therefore, it is different from projection models that predict a future situation based on the current situation or pattern. Instead, this simulation defines a fixed target, which is described in terms of indicators, and applies a model to quantify the minimum requirements to reach the desired goal.

Elements of the model

The teacher stock needed to reach UPE

Stock data refer to the total number of teachers in the reference school year.

Target school year (t)

The school year 2015 is defined as the academic year ending in 2015. In countries where the school year crosses two calendar years, this corresponds to the school year 2014/15. For other countries, it is 2015.

School-age population (SP)

The school-age population for the academic year 2015 is projected using the 2006 revision of population projections estimated by the United Nations Population Division. It is assumed that the nationally-defined typical starting age and duration of primary education will not change.

SP_(t): The school-age population for 2015 is defined as the population of primary school age in the target year, using the population data closest to the start of the school year. If the school year 2015 refers to 2014/15, then the school-age population would reflect the year 2014. For small island countries that have no population estimations for 2015, 2007 data are used. For Anguilla, data for 2007 were not available, thus 2006 population data were applied.

Enrolment (ENRL)

The target of the model is for countries to reach UPE by 2015. This implies that every child is enrolled for the full cycle of primary education and completes it. Typically UPE is associated with a net enrolment rate (NER) of 100% or, alternatively, a primary completion rate (PCR) of 100%. Yet, to project teacher numbers, assumptions on the enrolment stock are needed, which cannot be directly derived from the PCR. On the other hand, an NER of 100% can be insufficient to reach a PCR of 100% if repetition occurs.

For this model, the enrolment stock needed to reach UPE is defined as that needed to reach 100% NER plus an additional enrolment needed to allow for repetition. Since the target of quality education precludes high repetition rates, the model assumes that the number of repeaters should not exceed 10%.

Future improvements in efficiency are assumed for all countries, including those with already low repetition rates, since the model is designed to calculate the minimum number of teachers and enrolment. The repetition target is set to a maximum of 10% or one-half of the country's current percentage. For countries exceeding 20%, the model factors in an efficiency gain or reduction by more than one-half. Therefore, the enrolment target is the equivalent of the school-age population plus 10% or one-half of the current rate of repetition. When the percentage of repeaters was not available at the country level, the regional average was used.

$REP_{(b)}$ = Observed percentage of repeaters in the base year (divided by 100) or the latest year available

$$REP_{(t)} = \min\left(\frac{REP_{(b)}}{2}, 0.10\right)$$

$$ENRL_{(t)} = SP_{(t)} + (SP_{(t)} * REP_{(t)})$$

Note: The enrolment assumption does not consider a potential additional enrolment due to a backlog of students.

Teachers

The number of teachers needed is provided by the projected enrolment and the benchmark PTR for 2015. A PTR of 40:1 is widely accepted as sufficient to provide quality instruction. Countries with PTRs exceeding this threshold are modelled to reach it by 2015. However, the model does not factor in any decline in the ratio for those countries that already have PTRs of 40:1 or below.

$PTR_{(b)}$ = Observed PTR for the base year or the latest year available.

$$Teacher_{(t)} = \frac{ENRL_{(t)}}{PTR_{(t)}}$$

$$Teacher_{(t)} = \frac{SP_{(t)} + (SP_{(t)} * \min[(REP_{(b)}/2), 0.10])}{\min(40:1, PTR_{(b)})}$$

Flow of teachers from base year +1 to target year

Flow data refer to teachers who join the teaching force during the reference period and teachers who leave the teaching force during the reference period. The flow of teachers is determined by changes in the size of the teacher population and turnover due to attrition. Since the current stock is observed in the base year (b), the first year considered is b+1 and the last year is the academic school year 2015 (t).

Increase in teacher stock

The total change in stock is defined as the difference between the base year, $Teacher_{(b)}$, and the stock to be reached in 2015, $Teacher_{(t)}$. In most cases the base year (b) with the latest data available refers to the current year, yet for some countries earlier years are used.

The change is expressed in different ways:

C: Absolute change in teaching stock: $Teacher_{(t)} - Teacher_{(b)}$

PC: Percentage change in teaching stock: $\left(\frac{Teacher_{(t)}}{Teacher_{(b)}}\right) * 100$

The average annual change in stock for the period y to 2015 is calculated as a geometric growth rate for the period between the year with the latest data available and 2015:

$$AC = \left\{ \exp\left[\ln(Teacher_{(t)} / Teacher_{(b)}) / (t - y) \right] - 1 \right\} * 100$$

Attrition and teacher replacement

The simulation provides four scenarios for attrition rates set at 3.5%, 5% and 6.5%. A rate of 5% indicates that every year 5% of the teaching force leaves the profession, either due to retirement, career changes or other reasons.

AR: Annual attrition rate set to 3.5%, 5% and 6.5%

The model distinguishes between attrition and the rate of teacher replacement. For example, countries with a projected decrease in teaching stocks do not need to replace all newly vacant posts.

RR(AR) for countries with shrinking stock: AR + AC

Note: AC itself is negative when stocks are declining and is included in RR.

RR(AR) for countries with growing stock: AR (AC is taken into account in the new hires below).

The total number of teachers to be hired to replace those who have left is the sum of teachers hired in the period from b+1 to 2015. Since the stock for y is given, the first increase in stock and hire for replacement (for teachers leaving in y) is assumed for b+1.

HR_(y) is the number of teachers to be hired for replacement in the year y.

$$HR(y) : Teacher_{(y-1)} * \left(\frac{RR(AR)}{100} \right)$$

Teacher_(y-1) is the stock of teachers in the year y-1: Teacher_(y) * AC_{((y-1)-y)}

THR is the total hire for replacement y+1 to t: Sum of HR_(y+1) to HR_(t)

The projected teacher demand for UPE must take into account the fact that initial increases in the teaching stock will lead to increases in attrition later in the period of y+1 to 2015 (i.e. the newly created posts become vacant and need to be filled again). The model assumes the same average attrition rate for existing and newly created posts.

For countries with a growing teacher stock, the increased demand for teachers to replace vacant posts can be calculated separately from the regular attrition that would occur if the stock did not increase.

HR_(y) can be expressed as HRr_(y) for the regular attrition and HRa_(y) for the increased attrition due to growth towards UPE. The sum of HRa_(y) for y+1 to 2015 needs to be considered as additional demand for teachers towards UPE.

$$HRr_{(y)} : Teacher_{(b)} * (RR(AR) / 100).$$

$$HRa_{(y)} : (Teacher_{(y-1)} - Teacher_{(b)}) * (RR(AR) / 100).$$

The sum of HRa_(y) for b+1 to t needs to be considered as the additional demand for teachers towards UPE.

Total flow of teachers needed for replacement =

$$\sum_{b+1}^t [Teacher_{(b)} * \left(\frac{RR(AR)}{100} \right)] + \sum_{y=b+1}^t [(Teacher_{(y)} - Teacher_{(b)}) * \left(\frac{RR(AR)}{100} \right)]$$

Hence, total teachers needed to meet UPE by 2015 =

$$\frac{ENRL_{(t)}}{PTR_{(t)}} + \sum_{b+1}^t [Teacher_{(b)} * \left(\frac{RR(AR)}{100} \right)] + \sum_{y=b+1}^t [(Teacher_{(y)} - Teacher_{(b)}) * \left(\frac{RR(AR)}{100} \right)]$$

Appendix II

Statistical tables

Statistical table 1. Country data and indicators, 2007 or latest year available

Country	Reference year	School-age population (in thousands)	Teacher stock	Pupil-teacher ratio	Repetition rate (%)	Gross enrolment ratio (GER)	Observed average annual growth 1999-2007
Afghanistan	2007	4,600	110,312	43	n	102.6	14.5
Algeria	2007	3,720	170,207	24	11	110	0.0
Argentina	2006	4,092	283,367	16	7	114	2.7
Armenia	2007	116	6,606	19	0	110	...
Aruba	2007	9	594	17	8	114	2.9
Austria	2007	344	29,274	12	1	101	0.1
Azerbaijan	2007	443	44,106	12	0	116	2.4
Bahamas	2007	36	2,685	14	n	103	2.2
Bangladesh	2007	17,842	364,494	45	11	91	...
Barbados	2007	21	1,553	15	a	105	1.6
Belarus	2007	372	22,640	16	0	97	-5.2
Belgium	2007	713	65,378	11	3	103	0.2
Belize	2007	42	2,268	23	9	123	2.4
Benin	2006	1,452	32,513	44	8	96	9.8
Bhutan	2006	98	3,431	29	7	102	9.2
Botswana	2005	303	13,526	24	a	107	2.1
Brazil	2007	13,885	754,291	24	19	130	-1.1
Brunei Darussalam	2007	44	3,628	13	2	106	1.3
Bulgaria	2007	265	16,790	16	2	101	-4.6
Burkina Faso	2007	2,391	32,760	48	12	65	9.4
Burundi	2007	1,303	28,671	52	32	114	12.6
Cambodia	2007	2,080	48,736	51	12	119	1.2
Cameroon	2007	2,846	70,230	44	20	110	7.2
Cape Verde	2007	78	3,170	25	13	101	-0.1
Central African Republic	2007	700	5,436	91	27	71	...
Chad	2007	1,790	21,933	60	22	74	7.4
Chile	2007	1,589	66,862	25	2	106	2.6
China	2007	95,607	6,073,666	18	0	112	...
Colombia	2007	4,554	187,821	28	4	116	-0.7

Country	Reference year	School-age population (in thousands)	Teacher stock	Pupil-teacher ratio	Repetition rate (%)	Gross enrolment ratio (GER)	Observed average annual growth 1999-2007
Comoros	2005	132	3,340	35	27	85	3.8
Congo	2007	587	10,631	58	21	106	6.3
Costa Rica	2007	487	27,518	19	8	110	3.2
Côte d'Ivoire	2007	3,022	53,161	41	22	72	3.0
Croatia	2007	193	11,423	17	0	99	1.1
Cuba	2007	870	91,530	10	1	102	0.1
Cyprus	2007	56	3,697	16	0	102	0.3
Czech Republic	2007	460	24,713	19	1	101	-6.0
Dem. Rep. of the Congo	2007	10,383	230,834	38	16	85	5.1
Djibouti	2007	122	1,597	35	9	47	4.3
Dominican Republic	2007	1,268	56,744	24	6	107	...
Ecuador	2007	1,721	90,366	23	1	118	1.3
Egypt	2007	9,544	368,785	27	3	105	0.9
El Salvador	2007	912	27,098	40	7	118	...
Equatorial Guinea	2007	65	2,936	28	24	124	8.2
Eritrea	2007	604	6,933	48	15	55	1.5
Estonia	2007	77	5,927	13	n	99	-5.2
Fiji	2005	110	3,946	28	2	94	-0.2
Finland	2007	374	24,272	15	0	98	0.6
France	2007	3,723	216,654	19	1	110	0.6
Gambia	2007	253	5,341	41	5.8	86.4	3.5
Germany	2007	3,177	242,969	14	1	104	0.2
Ghana	2007	3,446	105,257	32	6	98	4.8
Greece	2007	631	62,114	10	1	101	3.7
Grenada	2007	17	871	16	2	81	1.3
Guatemala	2007	2,159	80,418	30	12	113	4.6
Guinea	2007	1,451	29,049	45	9	91	7.6
Guyana	2007	97	4,173	26	1	112	0.1
Honduras	2006	1,096	45,725	28	7	119	6.3
Hungary	2007	417	39,706	10	2	96	-2.3
Iceland	2006	31	2,893	10	n	97	0.2
Indonesia	2007	25,412	1,583,589	19	3	117	3.4
Iran, Islamic Republic of	2007	5,917	372,859	19	2	121	2.3
Iraq	2005	4,612	222,600	21	8	99	4.9
Ireland	2007	456	29,852	16	1	104	5.3
Israel	2007	746	61,640	13	1	111	1.7
Italy	2007	2,695	273,113	10	0	105	0.8

Country	Reference year	School-age population (in thousands)	Teacher stock	Pupil-teacher ratio	Repetition rate (%)	Gross enrolment ratio (GER)	Observed average annual growth 1999-2007
Jamaica	2005	339	11,764	28	3	91	3.9
Japan	2007	7,209	390,542	18	3	100	1.0
Kazakhstan	2007	900	57,340	17	0	105	-1.7
Kenya	2007	5,937	146,796	46	6	113	0.1
Kuwait	2007	215	22,016	10	1	98	11.7
Kyrgyzstan	2007	428	16,824	24	0	95	-1.9
Lao PDR	2007	758	29,604	30	17	118	1.0
Latvia	2007	79	6,634	11	3	95	-4.2
Lebanon	2007	472	32,412	14	9	95	2.3
Lesotho	2006	373	10,463	40	21	114	3.4
Liberia	2006	614	29,561	19	6	91	13.7
Lithuania	2007	151	10,843	13	1	95	-2.8
Luxembourg	2007	35	3,218	11	4	102	...
Macao, China	2007	31	1,618	20	6	108	0.4
Madagascar	2007	2,714	78,743	49	19	141	8.0
Malawi	2007	2,526	44,048	67	21	116	...
Malaysia	2006	3,217	198,050	16	a	98	3.9
Maldives	2007	45	3,463	15	5	111	0.9
Mali	2007	2,065	33,230	52	17	83	11.4
Malta	2005	28	2,472	12	3	100	7.5
Mauritania	2007	469	11,379	43	3	103	5.3
Mauritius	2007	118	5,548	22	4	101	1.0
Mexico	2007	12,847	522,733	28	4	114	-0.6
Micronesia (Fed. States of)	2007	17	1,113	17	3	110	...
Mongolia	2007	240	7,572	32	0	100	-0.4
Morocco	2007	3,673	143,846	27	12	107	1.7
Mozambique	2007	4,111	70,389	65	6	111	8.5
Namibia	2007	375	13,675	30	16	109	1.5
Nepal	2007	3,574	112,827	40	21	126	3.5
New Zealand	2007	344	22,257	16	3	102	1.9
Nicaragua	2007	823	31,188	31	9	116	4.1
Niger	2007	2,316	31,131	40	5	53	11.8
Nigeria	2006	24,111	579,530	40	3	97	4.0
Oman	2007	347	21,386	13	1	80	7.9
Pakistan	2007	19,534	450,027	40	5	92	0.9
Palestinian Aut. Territories	2007	477	12,752	30	1	80	2.4
Panama	2007	396	18,183	25	5	113	1.7

Country	Reference year	School-age population (in thousands)	Teacher stock	Pupil-teacher ratio	Repetition rate (%)	Gross enrolment ratio (GER)	Observed average annual growth 1999-2007
Papua New Guinea	2006	988	16,052	36	3	55	-1.0
Peru	2007	3,411	179,743	22	8	117	2.7
Philippines	2007	12,017	390,432	34	2	109	1.0
Poland	2007	2,560	233,612	11	1	97	-3.2
Portugal	2007	655	64,274	12	10	115	0.7
Qatar	2006	69	6,725	11	1	109	6.1
Republic of Korea	2007	3,602	149,945	26	0	107	2.6
Republic of Moldova	2007	170	9,876	16	0	94	-2.8
Romania	2007	877	55,487	17	1	105	-2.0
Russian Federation	2007	5,232	292,639	17	0	96	-2.5
Rwanda	2007	1,459	31,037	69	15	147	2.3
Saint Lucia	2007	20	969	23	3	109	-1.7
Saint Vincent & Grenadines	2007	16	933	17	4	102	-1.4
Samoa	2007	32	1,269	24	1	95	1.2
Sao Tome & Principe	2006	25	1,004	31	26	127	6.3
Saudi Arabia	2007	3,234	282,697	11	3	98	...
Senegal	2007	1,882	45,957	34	11	84	11.3
Sierra Leone	2007	899	30,239	44	10	147	...
Slovakia	2007	226	15,022	15	3	102	-2.2
Slovenia	2007	92	6,111	16	0	104	-1.3
South Africa	2007	7,134	236,032	31	8	103	0.8
Spain	2007	2,418	199,256	13	3	106	1.9
Sri Lanka	2007	1,484	68,114	24	1	109	...
Sudan	2007	5,966	107,933	37	3	66	...
Suriname	2007	55	4,913	13	16	119	...
Swaziland	2007	205	7,169	32	18	113	0.7
Sweden	2007	636	61,310	10	n	94	-0.9
Tajikistan	2007	682	31,482	22	0	100	-0.1
Thailand	2007	5,381	321,930	18	9	106	1.3
The FYR of Macedonia	2007	106	5,519	18	0	95	-0.9
Timor-Leste	2007	191	5,640	31	14	91	...
Togo	2007	1,052	26,103	39	24	97	1.0
Tonga	2006	15	748	22	5	113	0.1
Trinidad & Tobago	2007	130	8,171	16	3	100	0.1
Tunisia	2007	1,021	58,879	18	7	105	-0.5
Uganda	2007	6,489	132,325	57	13	116	2.6
Ukraine	2007	1,651	100,859	16	0	100	-0.5

Country	Reference year	School-age population (in thousands)	Teacher stock	Pupil-teacher ratio	Repetition rate (%)	Gross enrolment ratio (GER)	Observed average annual growth 1999-2007
United Arab Emirates	2007	267	16,523	17	2	107	-0.3
United Kingdom	2006	4,243	248,427	18	n	104	0.1
United Rep. of Tanzania	2007	7,436	156,664	53	4	112	5.7
United States of America	2007	24,730	1,775,357	14	n	99	0.9
Uruguay	2007	315	23,175	16	7	114	4.2
Uzbekistan	2007	2,267	118,676	18	0	95	-0.3
Venezuela	2005	3,320	185,560	19	5	106	...
Zambia	2007	2,346	56,557	49	6	119	6.9
Zimbabwe	2006	2,396	64,325	38	14	101	-0.6

Statistical table 2. Projections for the period 2007-2015

Country	School age population in 2015 (in thousands)	Stock needed in 2015 and change in stock 2007 to 2015			Recruitment due to attrition			Total recruitment needed
		Teacher stock needed in 2015	Absolute change in teacher stock (2007 to 2015)	Average annual growth needed (%)	Teachers to fill vacancies based on a 3.5% attrition	Teachers to fill vacancies based on a 5% attrition	Teachers to fill vacancies based on a 6.5% attrition	
Afghanistan	5,848	146,192	35,880	3.6	30,044	50,073	65,094	85,952
Algeria	3,925	180,152	9,945	0.7	41,824	69,707	90,746	79,651
Argentina	4,073	257,474	-25,893	-1.2	39,347	82,841	115,461	82,841
Armenia	102	5,289	-1,317	-2.7	124	1,085	1,806	1,085
Aruba	9	518	-76	-1.7	59	148	215	148
Austria	321	27,235	-2,039	-0.9	4,770	9,309	12,714	9,309
Azerbaijan	477	41,056	-3,050	-0.9	7,211	14,051	19,182	14,051
Bahamas	33	2,399	-286	-1.4	328	737	1,044	737
Bangladesh	18,493	508,565	144,071	4.3	93,422	155,703	220,270	299,774
Barbados	19	1,471	-82	-0.7	210	448	707	448
Belarus	359	22,502	-138	-0.1	4,555	8,121	11,603	8,121
Belgium	681	61,744	-3,634	-0.7	11,671	21,874	29,527	21,874
Belize	43	1,960	-308	-1.8	203	543	799	543
Benin	1,784	46,354	13,841	4.5	8,862	14,771	19,847	28,612
Bhutan	82	2,903	-527	-2.1	189	696	1,133	696
Botswana	303	13,745	219	0.2	3,126	5,283	7,083	5,502
Brazil	14,395	663,695	-90,596	-1.6	80,693	194,885	280,530	194,885
Brunei Daruss.	46	3,703	75	0.3	879	1,464	1,904	1,540
Bulgaria	268	16,989	199	0.1	4,050	6,750	8,776	6,949
Burkina Faso	2,946	81,021	48,261	12.0	9,358	15,596	26,176	63,857
Burundi	1,696	46,647	17,976	6.3	8,597	14,328	18,627	32,304
Cambodia	2,024	55,672	6,936	1.7	12,407	20,678	26,881	27,613
Cameroon	3,247	89,289	19,059	3.0	18,738	31,230	40,661	50,290
Cape Verde	88	3,894	724	2.6	804	1,340	1,807	2,065
Central African Republic	766	21,066	15,630	18.5	2,012	3,353	5,506	18,982
Chad	2,243	61,680	39,747	13.8	7,073	11,789	18,726	51,536
Chile	1,489	59,987	-6,875	-1.3	8,436	18,643	26,298	18,643
China	84,032	4,758,252	-1,315,414	-3.0	0	873,331	1,529,954	873,331
Colombia	4,269	154,152	-33,669	-2.4	7,742	35,350	56,055	35,350
Comoros	153	4,803	1,463	4.6	861	1,435	2,047	2,898
Congo	697	19,179	8,548	7.7	3,289	5,481	7,259	14,030
Costa Rica	478	25,471	-2,047	-1.0	4,340	8,597	11,790	8,597
Côte d'Ivoire	3,270	89,936	36,775	6.8	13,357	22,262	35,189	59,037

Country	School age population in 2015 (in thousands)	Stock needed in 2015 and change in stock 2007 to 2015			Recruitment due to attrition			Total recruitment needed
		Teacher stock needed in 2015	Absolute change in teacher stock (2007 to 2015)	Average annual growth needed (%)	Teachers to fill vacancies based on a 3.5% attrition	Teachers to fill vacancies based on a 5% attrition	Teachers to fill vacancies based on a 6.5% attrition	
Croatia	164	9,835	-1,588	-1.9	846	2,550	3,981	2,550
Cuba	726	75,472	-16,058	-2.4	4,163	17,643	27,753	17,643
Cyprus	62	3,978	281	0.9	916	1,527	1,985	1,808
Czech Republic	473	25,318	605	0.3	5,994	9,990	12,988	10,596
Dem. Rep. of the Congo	13,832	397,300	166,466	7.0	63,017	105,028	154,068	271,494
Djibouti	125	3,678	2,081	11.0	387	646	1,231	2,727
Dominican Republic	1,323	56,951	207	0.0	13,640	22,734	29,554	22,941
Ecuador	1,664	74,240	-16,126	-2.4	3,807	17,095	27,061	17,095
Egypt	8,757	328,325	-40,460	-1.4	43,708	99,819	141,903	99,819
El Salvador	905	23,558	-3,540	-1.7	2,582	6,663	9,724	6,663
Equat. Guinea	77	3,086	150	0.6	720	1,200	1,560	1,350
Eritrea	823	22,628	15,695	15.9	2,081	3,468	6,402	19,163
Estonia	81	6,280	353	0.7	1,453	2,421	3,162	2,774
Fiji	100	3,604	-341	-1.1	358	951	1,631	951
Finland	350	23,300	-972	-0.5	4,073	7,845	11,427	7,845
France	3,849	204,398	-12,256	-0.7	38,440	72,237	97,585	72,237
Gambia	302	7,757	2,416	3.6	1,401	2,334	65,094	4,750
Germany	2,799	206,545	-36,424	-2.0	17,948	54,196	81,382	54,196
Ghana	3,752	120,757	15,500	1.7	26,228	43,713	58,169	59,212
Greece	627	61,137	-977	-0.2	13,828	23,697	31,100	23,697
Grenada	13	827	-44	-0.6	0	102	399	102
Guatemala	2,488	89,858	9,440	1.4	20,271	33,785	43,920	43,224
Guinea	1,748	45,670	16,621	5.8	8,023	13,372	18,567	29,993
Guyana	79	3,045	-1,128	-3.9	0	333	771	333
Honduras	1,116	41,321	-4,404	-1.3	6,099	13,101	18,352	13,101
Hungary	376	37,754	-1,952	-0.6	5,205	11,279	18,247	11,279
Iceland	30	2,816	-77	-0.3	538	991	1,409	991
Indonesia	25,753	1,391,442	-192,147	-1.6	167,249	406,847	586,546	406,847
Iran, Islamic Republic	6,584	346,726	-26,133	-0.9	60,572	118,375	161,728	118,375
Iraq	4,976	252,036	29,436	1.6	55,551	92,586	122,293	122,021
Ireland	545	34,326	4,474	1.8	7,622	12,703	16,514	17,178
Israel	827	62,122	482	0.1	14,844	24,740	32,162	25,222

Country	School age population in 2015 (in thousands)	Stock needed in 2015 and change in stock 2007 to 2015			Recruitment due to attrition			Total recruitment needed
		Teacher stock needed in 2015	Absolute change in teacher stock (2007 to 2015)	Average annual growth needed (%)	Teachers to fill vacancies based on a 3.5% attrition	Teachers to fill vacancies based on a 5% attrition	Teachers to fill vacancies based on a 6.5% attrition	
Italy	2,765	268,086	-5,027	-0.2	59,991	103,336	135,845	103,336
Jamaica	318	11,649	-115	-0.1	1,652	3,459	5,976	3,459
Japan	6,630	364,747	-25,795	-0.9	59,002	119,258	171,343	119,258
Kazakhstan	1,064	64,407	7,067	1.5	14,487	24,146	31,390	31,213
Kenya	8,817	226,859	80,063	5.6	42,954	71,590	93,066	151,653
Kuwait	204	21,325	-691	-0.4	4,059	7,503	10,600	7,503
Kyrgyzstan	412	17,021	197	0.1	3,368	6,017	8,793	6,213
Lao PDR	718	26,213	-3,391	-1.5	3,350	7,844	11,214	7,844
Latvia	81	7,236	602	1.1	1,610	2,683	3,584	3,285
Lebanon	435	32,736	324	0.1	4,941	9,944	16,928	10,269
Lesotho	366	10,072	-391	-0.5	2,079	3,725	4,960	3,725
Liberia	868	46,342	16,782	5.8	8,293	13,822	18,869	30,604
Lithuania	120	9,064	-1,779	-2.2	125	1,697	3,441	1,697
Luxembourg	34	3,171	-47	-0.2	721	1,232	1,616	1,232
Macao, China	22	1,091	-527	-4.8	0	21	185	21
Madagascar	3,135	86,205	7,462	1.1	19,668	32,781	42,615	40,242
Malawi	2,927	80,489	36,441	7.8	13,968	23,280	30,264	59,721
Malaysia	3,295	225,416	27,365	1.6	48,074	80,123	109,061	107,488
Maldives	45	3,182	-281	-1.1	520	1,054	1,455	1,054
Mali	2,567	70,579	37,349	9.9	9,900	16,500	24,588	53,849
Malta	24	2,115	-357	-1.9	176	544	845	544
Mauritania	544	13,823	2,444	2.5	2,978	4,964	6,453	7,408
Mauritius	111	5,269	-279	-0.6	996	1,862	2,542	1,862
Mexico	12,054	438,870	-83,863	-2.2	32,499	110,073	168,254	110,073
Micronesia	16	1,004	-109	-1.3	146	316	444	316
Moldova	163	10,058	182	0.2	1,943	3,495	5,177	3,677
Mongolia	180	5,726	-1,846	-3.4	0	816	1,650	816
Morocco	3,599	144,577	731	0.1	31,322	54,134	74,966	54,865
Mozambique	3,523	90,692	20,303	3.2	18,924	31,540	41,002	51,843
Namibia	344	12,637	-1,038	-1.0	2,034	4,141	5,834	4,141
Nepal	3,679	101,173	-11,654	-1.4	14,176	31,396	44,311	31,396
New Zealand	349	22,622	365	0.2	5,377	8,961	11,656	9,327
Nicaragua	790	27,014	-4,174	-1.8	2,861	7,551	11,068	7,551
Niger	3,095	79,933	48,802	12.5	8,513	14,188	25,356	62,990

Country	School age population in 2015 (in thousands)	Stock needed in 2015 and change in stock 2007 to 2015			Recruitment due to attrition			Total recruitment needed
		Teacher stock needed in 2015	Absolute change in teacher stock (2007 to 2015)	Average annual growth needed (%)	Teachers to fill vacancies based on a 3.5% attrition	Teachers to fill vacancies based on a 5% attrition	Teachers to fill vacancies based on a 6.5% attrition	
Nigeria	27,743	703,597	124,068	2.5	148,781	247,968	328,555	372,036
Oman	331	25,607	4,221	2.3	4,085	7,439	12,048	11,660
Pakistan	19,867	510,348	60,321	1.6	108,809	181,349	247,414	241,670
Palestine	558	18,607	5,855	4.8	3,281	5,469	7,869	11,324
Panama	413	17,283	-900	-0.6	3,368	6,214	8,348	6,214
Papua New Guinea	1,048	29,766	13,713	8.0	3,979	6,632	11,108	20,346
Peru	3,342	156,269	-23,474	-1.7	17,135	44,208	64,512	44,208
Philippines	13,199	396,564	6,132	0.2	94,346	157,243	204,416	163,374
Poland	2,116	199,664	-33,948	-1.9	11,130	45,570	79,579	45,570
Portugal	671	62,956	-1,318	-0.3	13,969	24,160	31,804	24,160
Qatar	79	7,454	729	1.3	1,689	2,815	3,660	3,544
Republic of Korea	2,782	108,697	-41,248	-3.9	0	11,076	26,774	11,076
Romania	829	50,442	-5,045	-1.2	7,733	16,251	22,640	16,251
Russian Fed.	4,409	258,141	-34,498	-1.6	19,190	62,685	109,641	62,685
Rwanda	1,898	52,200	21,163	6.7	9,455	15,759	20,487	36,922
Saint Vincent & Grenadines	16	949	16	0.2	226	376	489	392
Samoa	27	1,128	-141	-1.5	84	272	486	272
Sao Tome & Principe	27	965	-39	-0.5	198	356	474	356
Saudi Arabia	3,514	318,022	35,325	1.5	70,379	117,298	154,861	152,623
Senegal	2,217	71,279	25,322	5.6	11,862	19,770	29,186	45,092
Sierra Leone	1,081	28,378	-1,861	-0.8	5,199	9,905	13,435	9,905
Slovakia	212	13,977	-1,045	-0.9	2,450	4,779	6,526	4,779
Slovenia	71	4,599	-1,512	-3.5	0	653	1,303	653
South Africa	7,175	240,835	4,803	0.3	56,793	94,655	123,825	99,458
Spain	2,845	224,949	25,693	1.5	50,458	84,097	109,325	109,790
Sri Lanka	1,398	58,974	-9,140	-1.8	6,222	16,463	24,144	16,463
St. Lucia	21	949	-20	-0.3	210	364	479	364
Sudan	6,484	179,251	71,318	6.5	26,874	44,789	70,813	116,107
Suriname	51	4,214	-699	-1.9	405	1,141	1,693	1,141
Swaziland	199	6,757	-412	-0.7	1,265	2,383	3,221	2,383
Sweden	617	62,889	1,579	0.3	12,611	22,286	32,239	23,865
Tajikistan	668	30,948	-534	-0.2	6,853	11,846	15,715	11,846

Country	School age population in 2015 (in thousands)	Stock needed in 2015 and change in stock 2007 to 2015			Recruitment due to attrition			Total recruitment needed
		Teacher stock needed in 2015	Absolute change in teacher stock (2007 to 2015)	Average annual growth needed (%)	Teachers to fill vacancies based on a 3.5% attrition	Teachers to fill vacancies based on a 5% attrition	Teachers to fill vacancies based on a 6.5% attrition	
Tanzania	9,379	239,434	82,770	5.4	45,601	76,002	98,802	158,771
Thailand	5,307	313,334	-8,596	-0.3	67,760	118,664	156,842	118,664
The FYR of Macedonia	90	4,924	-595	-1.4	395	1,217	2,137	1,217
Timor-Leste	241	8,610	2,970	5.4	1,502	2,503	3,555	5,473
Togo	1,243	34,937	8,834	3.7	6,747	11,244	15,474	20,078
Tonga	14	660	-88	-1.5	82	196	281	196
Trinidad & Tobago	132	8,377	206	0.3	1,970	3,283	4,296	3,489
Tunisia	997	56,937	-1,942	-0.4	11,983	21,267	28,230	21,267
U.S.A.	25,768	1,867,851	92,494	0.6	433,854	723,089	944,028	815,583
Uganda	8,280	227,701	95,376	7.0	40,758	67,931	88,310	163,307
Ukraine	1,642	100,543	-316	0.0	23,588	39,687	52,058	39,687
United Arab Emirates	343	20,134	3,611	2.5	4,331	7,218	9,383	10,828
United Kingdom	4,289	237,242	-11,186	-0.6	47,252	86,211	115,430	86,211
Uruguay	295	19,703	-3,472	-2.0	1,714	5,172	7,765	5,172
Uzbekistan	2,266	124,246	5,570	0.6	28,429	47,414	62,968	52,984
Venezuela	3,473	190,238	4,678	0.3	45,023	75,039	97,551	79,717
Zambia	2,657	68,594	12,037	2.4	14,792	24,653	32,049	36,690
Zimbabwe	2,327	66,977	2,652	0.5	13,055	23,196	34,048	25,847

Statistical table 3. Regional data

Flow of primary teachers, 2007-2015					
	Recruitment to fill new teacher positions created to reach UPE	Decrease in teachers	Recruitment to maintain current teacher stock based on a 5% attrition	Recruitment to address UPE-related attrition	Total minimum teachers needed (in thousands)
Arab States	281,553	-43,937	723,821	54,636	1,060
Central and Eastern Europe	4,427	-87,013	339,338	44,581	388
Central Asia	13,115	-16,714	109,378	3,175	126
East Asia and the Pacific	90,467	-1,644,969	2,030,815	23,791	2,145
Latin America and the Caribbean	14,497	-324,190	778,360	3,462	796
North America and Western Europe	125,068	-91,268	1,380,094	21,216	1,526
South and West Asia	240,272	-345,294	1,572,932	39,956	1,853
Sub-Saharan Africa	1,158,597	-37,403	1,086,285	177,995	2,423
World	1,927,995	-2,590,788	8,021,023	368,812	10,318

As government policies move from an emphasis on the expansion of primary education towards the improvement of quality provision, teachers are recognised for their central role in ensuring learning achievement for all. The shortage of primary teachers is an issue in all parts of the world, but it is a particular obstacle for many less-developed countries seeking to achieve Education for All (EFA) and the time-bound goal of providing universal primary education (UPE) by 2015.

According to UIS estimates, about one-half of the world's countries will need more primary teachers in classrooms by 2015. Sub-Saharan Africa is faced with the greatest challenge, where the number of teachers must grow from 2.6 million in 2007 to 3.7 million in eight years to meet the UPE goal.

Technical Paper No. 3 presents new global projections by the UNESCO Institute for Statistics (UIS) to quantify the teacher gap in primary education and to assess the scope of the challenges facing countries. It identifies countries that face moderate or severe shortages, and those needing to expand their teaching forces in order to enrol all primary school-age children by 2015. The paper also describes the concepts, assumptions and calculation techniques of the UIS projection model and provides detailed background information in order to allow informed use of the results.



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