Analysis of Teacher Stock versus Flow in Primary Education in East Asia and the Pacific Middle-Income Countries

A Simple Model and Results from Simulation between 2020 and 2030

Nobuyuki Tanaka
Lars Sondergaard
Abstract

Too many children are not learning to read in the East Asia and Pacific region’s middle-income countries. In some countries in the region, such as the Lao People’s Democratic Republic and the Philippines, more than 90 percent of 10-year-olds cannot read and understand an age-appropriate text. To accelerate learning in these countries, better teaching will be needed. To improve teacher quality in the next 10 years, where should countries focus their attention? On improving the teaching skills and content knowledge of their existing stock of teachers, on recruiting and better training new teachers, or on doing both? This paper contributes to this discussion by addressing two policy questions: (i) will East Asia and Pacific’s middle-income countries need more or fewer teachers in the coming decade, and (ii) quantitatively, how important will the newly recruited teachers be (the flow) relative to the teaching workforce who have already been recruited (the stock)? To answer these questions, the paper uses a simple model that projects the required number of primary school teachers in each of the East Asia and Pacific region’s 22 middle-income countries. The model is based on several factors, such as: (i) the size of future cohorts of children, (ii) the proportion of those cohorts who end up in school, (iii) the pupil-to-teacher ratio, and (iv) teacher attrition. Two key messages emerge with an important policy implication. First, significant heterogeneity exists across the 22 countries, with seven countries projected to need fewer teachers overall in the next 10 years relative to the teacher stock in 2020, while the rest will need to expand their teacher workforce. Second, despite this heterogeneity, in every East Asia and Pacific country, teachers who are already “in the system” are expected to constitute the majority of teachers still employed in 2030. In some countries, teachers who have already been recruited will constitute more than 70 percent of those who will be in schools in 2030. The findings has an important policy implication, namely: if countries want to improve the quality of teaching in schools, their primary focus in the next 10 years should be on improving the stock, that is, the quality of their current teacher workforce (through more and better teacher professional development).
Analysis of Teacher Stock versus Flow in Primary Education in East Asia and the Pacific Middle-Income Countries: A Simple Model and Results from Simulation between 2020 and 2030\textsuperscript{1,2}

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The World Bank

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\textsuperscript{2} We simulated primary school teachers’ stock and flow up to 2040 and examined the situation as of 2030 (SDG4 target year).
I. Introduction

Too many children are not learning to read in the East Asia and Pacific (EAP) region’s middle-income countries (MICs). In some EAP countries, such as the Lao People’s Democratic Republic and the Philippines, more than 90 percent of 10-year-olds cannot read and understand an age-appropriate text (World Bank et al. 2022a). To accelerate learning in these countries, better teaching will be needed. But to improve the quality of teachers in the next 10 years, where should these countries focus their attention? On improving the teaching skills and content knowledge of their existing stock of teachers, on recruiting and better training new teachers, or on doing both? This paper contributes to this discussion by answering two policy questions: (i) will EAP’s MICs need more or fewer teachers in the coming decade, and (ii) quantitatively, how important will the newly recruited teachers be (the flow) relative to the teaching workforce who have already been recruited (the stock)? Two key messages emerge: first, significant heterogeneity exists across the 22 countries, with 7 countries – mainly in East Asia – projected to need fewer teachers overall in the next 10 years relative to the teacher stock in 2020, while most others will need to expand their teacher workforce (especially in the Pacific Islands). Second, despite this heterogeneity, in every EAP country, teachers who are already “in the system” are expected to constitute the majority of teachers still employed in 2030. In some countries, teachers who have already been recruited will constitute more than 70 percent of those who will be in schools in 2030.

II. Large needs for more and better primary teachers

Globally, more teachers will be needed. Teacher shortages are a global problem, with an estimated need for 69 million more teachers to meet SDG4 by 2030. This includes a need for 24% more primary teachers. The need for primary teachers varies by region, with Sub-Saharan Africa and South Asia accounting for the majority of the need in developing countries. In 2016, Southeast Asia and Oceania were estimated to need 3 million and 43,000 more primary teachers, respectively (Sources: UIS 2016, International Task Force on Teachers for Education 2030, 2021). The main driver behind the need for additional teachers is the rapid growth in student numbers, as well as countries’ desire to avoid having large class sizes with detrimental impacts on student learning (e.g. see Finn and Achilles 1999).

Teachers with better skills and knowledge will be needed. Different data sources suggest wide differences in the qualifications that primary teachers have. For instance, surveys conducted in six East Asian countries (Cambodia, Lao PDR, Malaysia, Myanmar, the Philippines, and Vietnam) reveal that the academic credentials of primary education teachers (Grade 5) range widely. All or the majority of children in the Philippines (100 percent), Malaysia (89 percent), and Myanmar (88 percent) had a teacher with at least a bachelor’s degree from a university, while this figure was 68 percent in Vietnam. However, in Lao PDR, on average less than 1 percent of children had a teacher who held this academic credential, and the majority of its students were taught by teachers with a post-secondary level credential, but not a bachelor’s degree. In Cambodia, approximately 60 percent of students had a teacher with secondary education or lower academic credentials. This situation reflects national policies that have lower requirements for teacher

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3 Covered countries (alphabetical order in each subregion): Cambodia, China, Indonesia, Lao PDR, Malaysia, Mongolia, Myanmar, the Philippines, Thailand, Timor-Leste, and Vietnam in East Asia; Fiji, Kiribati, Marshall Islands, Micronesia (Fed, Stats), Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu in the Pacific Islands.
qualifications, and the survey report notes that estimates of teacher academic credentials also reflect the impact of policies implemented more than a decade ago (UNICEF 2022).

This difference in teachers’ qualifications is confirmed by data supplied by Ministries of Education to UNESCO Institute of Statistics (UIS). In these data, countries report on the percentage of their teachers who have met their country’s “minimum required qualifications”. The data shows that in East Asian countries, almost all primary education teachers have met the minimum qualifications required to enter the profession, with a few exceptions. However, many Pacific Island countries have a significant shortage of qualified primary teachers (again, as defined by countries’ own definition of what are these qualifications). For instance, in the Solomon Islands, around 25% of primary teachers do not have the minimum qualifications, while in Micronesia, two-thirds of teachers lack the necessary requirements.

Figure 1. Share of teachers with minimum required qualifications in primary education, 2015–2019, median, %

Source: Authors’ calculation using UNESCO Institute of Statistics database.
Note: Blue: East Asian countries; Yellow: Pacific Island countries.

Taken together, many countries face the dual challenge of (i) upgrading the qualifications of existing teachers (to at least meet minimum requirements); and (ii) improving the quality of the preservice teacher training provided (to a growing number of teachers) to ensure that all future teachers meet minimum

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4 Specifically, the indicator shows: “Percentage of teachers by level of education taught (pre-primary, primary, lower secondary and upper secondary education) who have received at least the minimum organized pedagogical teacher training pre-service and in-service required for teaching at the relevant level in a given country, in a given academic year.”
requirements before entering the teaching profession. Regarding the former, to upgrade existing teachers’ skills and qualifications, teachers will need continuous support. This is needed to increase the efficiency of their instruction and to build their practical pedagogical and digital skills, which are critical domains for learning recovery and acceleration (World Bank et al. 2022b).

In the case of the EAP region, what is the relative importance of these two challenges: the need to upgrade the skills of the existing stock of teachers versus the importance of hiring more (and better preparing) the flow of new teachers? Using a simulation described below, this paper tries to quantify the relative importance of the two.

III. Simulation: Teacher stock and flow in primary education in East Asia and Pacific middle-income countries, 2021–2030

A simple model to forecast the relative importance of the stock versus the flow of teachers

As mentioned above, there are already estimates of how many teachers will be needed in the future. These estimates are based on simulation models. To our knowledge, in these modeling exercises, there has been less focus on the importance of the existing stock of teachers. Our paper helps fill this gap in a simple and, we hope, intuitive way.

The model is based on several factors, such as: (i) the size of future cohorts of children (which are exogenous to the education sector); (ii) the proportion of those cohorts who will end up in school (for which we make assumptions about net enrollment rates); (iii) the pupil-to-teacher ratio (PTR, a policy variable); and (iv) teacher attrition (for which we use historical data where available).

We hope this paper will be a useful input for policy makers’ and development partners’ deliberations on how to improve teaching quality.

Box 1. Simulation model: Steps, assumptions, and robustness check

<table>
<thead>
<tr>
<th>A. Seven steps</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1. Estimate total population in EAP MICs</strong></td>
</tr>
<tr>
<td>• Access World Population Prospects 2022 estimates for each country up to 2040 (<a href="https://population.un.org/wpp/">https://population.un.org/wpp/</a>)</td>
</tr>
<tr>
<td>• Use the indicator “population by 1-year age groups and sex”</td>
</tr>
<tr>
<td><strong>Step 2. Estimate primary school-age population in EAP MICs</strong></td>
</tr>
<tr>
<td>• Confirm education system for each country using indicators “official entrance age to primary education (years)” and “theoretical duration of primary education (years)” from World Bank EdStats (<a href="https://datatopics.worldbank.org/education/">https://datatopics.worldbank.org/education/</a>)</td>
</tr>
<tr>
<td>• Estimate primary school-age populations using data retrieved from World Population Prospects 2022 data</td>
</tr>
<tr>
<td><strong>Step 3. Estimate student enrollment in primary schools in EAP MICs</strong></td>
</tr>
<tr>
<td>• Estimate student enrollment in primary schools</td>
</tr>
<tr>
<td>• Use the indicator “total net enrollment rate, primary, both sexes (%)” from World Bank EdStats</td>
</tr>
<tr>
<td><strong>Step 4. Estimate teacher position needs per pupil-to-teacher ratio (PTR) in EAP MICs</strong></td>
</tr>
<tr>
<td>• Use the indicator “pupil-qualified teacher ratio in primary education (headcount basis)” to estimate the number of teachers needed for primary education</td>
</tr>
</tbody>
</table>

5 For instance, see International Task Force on Teachers for Education 2030 2021, UIS 2009 or UIS and EFA-GMR 2014.

6 Original data source is UIS.
Using these teachers’ numbers, estimate the number of teacher positions needed in future to maintain the target PTR. Calculate how many more or fewer teachers are needed per calculated required teacher positions versus the current number of teachers as of 2020.

**Step 5. Estimate teacher replacement needs due to teacher attrition in EAP MICs**
- Use the indicator “teacher attrition rate from primary education, both sexes (%)” to estimate how many teachers will need to be replaced annually, from World Bank EdStats or data obtained from countries.

**Step 6. Estimate total teacher recruitment needs in EAP MICs**
- Estimate total teacher recruitment needs by considering the increase/decrease in teacher positions and teacher replacement due to attrition in the year 2030 (a target year of SDG4).

**Step 7. Conduct robustness checks under different scenarios**
- Conduct robustness checks under two scenarios:
  - i) **High 2020 Teacher Stock Scenario** “more teachers who are already in teaching workforce in 2020 remain teaching in 2030”
  - ii) **Low 2020 Teacher Stock Scenario** “fewer teachers who are already in teaching workforce in 2020 remain in teaching force in 2030”

### B. Robustness check

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Base Scenario</th>
<th>High 2020 Teacher Stock Scenario – lower attrition</th>
<th>Low 2020 Teacher Stock Scenario – higher attrition and higher PTR</th>
</tr>
</thead>
</table>
| Teacher attrition rate for projection period (up to 2040) | 1. Countries with data for at least one year between 2015 and 2019.  
  -> Use country data (median of 2015 to 2019), except Malaysia (use 2%).  
  2. Countries without data between 2015 and 2020.  
  -> Use 2.38% (median of available data for EAP region, excluding Myanmar, between 2015 and 2019). | 1. Use 0.4 for all countries (0.4 is the lowest rate observed in the region between 2015 and 2019). | 1. Countries with data for at least one year between 2015 and 2019.  
  -> Use country data (median of 2015 to 2019) + 1%.  
  2. Countries without data between 2015 and 2020.  
  -> Use 3.4% (higher than base by 1%), except for Indonesia. Use 7.9% (6.9% + 1%) for Indonesia. |
| PTR in 2040                                      | 25 or lower                                        | 25 or lower                                       | 30 or lower                                                      |

IV. Main findings from the simulation: Stock and flow of primary teachers in EAP MICs in 2030

A. Projected changes in teacher position needs vary widely across the region

Significant heterogeneity exists across the 22 EAP countries with respect to primary education teacher position needs by 2030. Only six countries – mainly in East Asia – are projected to need fewer teachers overall in the next 10 years, while most countries will need to expand their teacher workforce (especially

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7 For UIS data, teacher attrition rate is calculated as “the number of leavers is estimated by subtracting the number of teachers in year t from those in year t-1 and adding the number of new entrants to the teaching workforce in year t. The attrition rate is the number of leavers expressed as a percentage of the total number of teachers in year t-1.” UIS website ([http://uis.unesco.org/en/glossary-term/teacher-attrition-rate-education-level](http://uis.unesco.org/en/glossary-term/teacher-attrition-rate-education-level)).
in the Pacific Islands). For instance, teacher position needs are expected to increase by 41.7 percent in Papua New Guinea and by 38.4 percent in Vanuatu by 2030, whereas Thailand and China’s needs are expected to decrease by 18.5 percent and 32.3 percent, respectively. However, this does not mean that those countries do not need any new teachers. Countries need to fill vacant positions for the teachers who leave the profession. Thus, all countries will need to recruit new teachers over the next decade, and in some countries, teacher recruitment will be significant; hence improved selection and recruitment will still be important (Figure 2).

Figure 2. Projected percentage change in the number of primary school teacher positions between 2020 and 2030, by country

Source: Authors’ projections.
Note: Blue: East Asian countries; Yellow: Pacific Island countries.

B. The majority of teachers in 2030 were already in the teaching profession in 2020

Despite this heterogeneity, in every EAP country, teachers who are already “in the system” are expected to constitute the majority of those still employed in 2030; in some countries, teachers who have already been recruited (as of 2022) will constitute more than 70 percent of those who will still be in schools in 2030.

This finding is true in all our robustness checks and for virtually all countries (see box 1 for details on robustness checks). That is, even when we assume much higher attrition rates, by 2030, more than half of the teachers employed have already been recruited. The exceptions are Vanuatu, Solomon Islands and Papua New Guinea where, in one robustness scenario, the flow of new teachers appears to be slightly more important than the stock.

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8 By 2030, two out of three East Asian countries are projected to face a declining school-age population versus one out of three Pacific Island countries. Seven out of twelve East Asian countries are projected to face decreasing student enrollment versus one out of four Pacific Island countries.
Figure 3. Percentage of primary school teachers who joined prior to 2020 projected to still be teaching in 2030 (Base scenario: PTR=25 or lower by 2040, with high and low 2020 teacher stock scenarios)

Source: Authors’ projections.
Note: Blue: East Asian countries; Yellow: Pacific Island countries. Myanmar is not presented in this figure because it is difficult to project its future situation due to its current situation and data availability. The vertical line in each country bar chart represents the range of simulation results by different scenarios: the top of the bar is the high teacher stock scenario; the bottom is the low teacher stock scenario (see robustness checks in Box 1).

How could the simulations be strengthened?

As with any model, the projections are only as good as the data available and the assumptions made. This section discusses a number of factors that may affect the results. Specifically, the weakest point of our model is the data and assumption we make on attrition rates, a weakness we have tried to address with robustness checks. Teacher attrition rates are not readily available for our countries of interest: only 8 of the 22 MICs have reported data to UIS for at least one year between 2015 and 2019. However, the data gaps are particularly acute for the Pacific Island countries: Solomon Islands is the only Pacific Island country (out of a total of 12) where data are available between 2015 and 2019. Overall, data availability is better in East Asian countries. However, even when data are reported, the attrition rates fluctuate substantially year by year. For instance, primary teacher attrition rate for Malaysia were 6.7% in 2015, 3.1% in 2016, 2.2% in 2017, no data in 2018, and 3.5% in 2019 (WB Edstats Database).

On the one hand, the projections presented here likely underestimate the proportion of 2030 teachers who have already been recruited, for a number of different reasons. For the countries with dwindling student numbers, these countries will likely struggle to reduce the number of teaching positions (at the rate our
model assumes) as student numbers fall (e.g. see Sondergaard et al. 2012). For the countries with the need to hire more teachers, the government may face challenging in hiring as many additional teachers as our simulations suggest (because of limited government finance, lack of interested candidates, etc.).

On the other hand, our model may be overestimating the importance of the stock. We assumed that the teacher attrition rate is constant for the coming decades in each country. However, counterparts in several Pacific Islands countries report that many of their teachers are leaving the profession, migrating to other countries. Data from one Pacific Island country shows a higher teacher attrition (up to nearly 10 percent) right after the onset of COVID-19, and thereafter, a decline to below 2 percent, which is within the assumption we used in this analysis. Another country presented a relatively modest increase (below 4 percent) after the onset of COVID-19. However, unfortunately, many of the counterparts were unable to quantify how many teachers were leaving the teaching profession annually. If, indeed, attrition rates in Pacific Island countries are higher than assumed (and on an increasing trend), these countries would need to hire more teachers, which, in turn, would imply that their stock of teachers already in the system would be smaller.

The reality is that the higher the rate of attrition, the higher the importance of recruiting and training new teachers (to replace those teachers that leave the system).

We recommend that countries try to fill this knowledge gap, either by analyzing teacher payroll data (to identify the rate at which teachers are leaving the profession) or through surveys.

V. Conclusions

This paper presents a simple approach to estimate the stock and flow of primary school teachers in the future across 22 middle-income countries in the East Asia and Pacific region. It uses selected indicators already in place to monitor progress against the SDG4 target – the net enrollment rate, the pupil-to-teacher ratio, and the teacher attrition rate. To our knowledge, the simulation across all 22 MICs in the EAP region is the first of its kind. We hope it provides useful input for policy makers’ and development partners’ deliberations on how to improve teaching quality, with applicability in regions other than EAP.

The simulation reveals that in every EAP country, teachers who are already “in the system” are expected to constitute the majority of those still employed in 2030, despite significant heterogeneity across the 22 countries regarding projected changes in required teacher positions based on estimated school-age populations and student enrollments in the coming years.

Our finding has an important policy implication, namely: if countries want to improve the quality of teaching in schools, their primary focus in the next 10 years should be on improving the stock – i.e. the quality of their current teacher workforce (through more and better teacher professional development) (Figure 3).
References


