COST-EFFECTIVENESS CONSIDERATIONS FOR SCALING TEACHER PROFESSIONAL DEVELOPMENT

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TPD@SCALE BRIEFING NOTE

Cost-effectiveness: Considerations for scaling teacher professional development

Susy Ndaruhutse
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Executive Summary

- Any evaluation of cost-effectiveness within teacher professional development programs, particularly those that are mediated by technology, must ensure that it looks not only at the costs of a pilot program, but also at how the program's costs may reduce substantially as the program scales.
- A variety of issues need to be considered when costing programs such as course design and development, language of instruction, technology competence of teachers, access to devices and connectivity, and capacity of the system to support scaling.
- Trade-offs need to be considered so that an appropriate balance can be achieved in quality, equity, and efficiency, especially when considering how to reach disadvantaged or marginalized teachers who may require additional support to achieve the same outcomes.
- Measuring cost-effectiveness requires programs to collect accurate and comprehensive costing and outcome data from the outset of the program, building this into the program's monitoring and evaluation framework.

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Acronyms

ABC	activity-based costing
CBA	cost-benefit analysis
CEA	cost-effectiveness analysis
CUA	cost-utility analysis
CFA	cost-feasibility analysis
DepEd	Department of Education (Philippines)
DFID	Department for International Development (United Kingdom)
ELLN	Early Language, Literacy and Numeracy
FIT-ED	Foundation for Information Technology Education and Development
GEEAP	Global Education Evidence Advisory Panel
ICT	information and communications technology
LAC	Learning Action Cell
LAYS	Learning Adjusted Years of Schooling
LMICs	low- and middle-income countries
OER	open educational resources
RoI	return on investment
SECT	Standardized Early Childhood Development Costing Tool
TaRL	Teaching at the Right Level
TDABC	time-driven activity-based costing
TPD	teacher professional development
UNESCO	United Nations Educational, Scientific and Cultural Organization
VfM	value for money

Boxes, Figure, and Table

Introduction

Teachers are the biggest cost input to most education systems. In the Global South, an analysis by Crawfurd (2020) found that teacher wage bills make up around 10% of the national budget. This equates to over 50% of governments' annual recurrent education budget, and in some countries, a much higher amount. Ensuring that teachers have the appropriate skills and competencies to enable learners to attain their potential is thus critical to demonstrating that this significant recurrent investment provides value for money. This becomes even more urgent in light of the Education Commission's (2016) projection that low-income countries will need twice as many teachers as 2015 levels by 2030. Teacher professional development (TPD), both pre-service and in-service, is therefore crucial for ensuring that teachers' skills and competencies are developed and remain relevant and up-to-date.

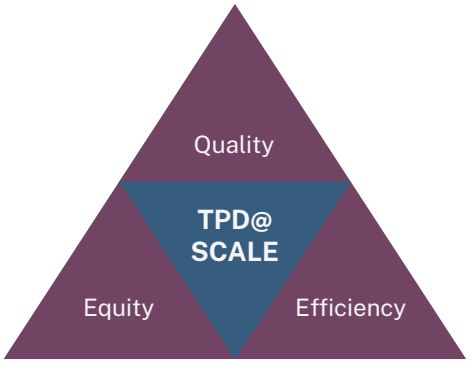
Cascade models of face-to-face training that require teachers to travel to centralized locations and remain residential for blocks of time are costly and only occasionally effective. With advances in technology and connectivity coupled with the need for more teachers to progress universal education of a high quality for all children and young people, digital technology has the potential to support the delivery of TPD at scale, if appropriately designed. However, it is important to demonstrate that any TPD program has both pedagogical impact on learning outcomes, and is cost-effective in comparison to other alternative programs.

This briefing note provides an overview of some of the approaches, questions to consider when establishing the cost-effectiveness of TPD programs, and challenges in measuring cost-effectiveness. Four broad challenges are outlined which include (i) the lack of data and research on cost, educational impact, and cost-effectiveness; (ii) the lack of clarity on real costs of TPD and economies of scale; (iii) political will; and (iv) the wider enabling (or disabling) environment.

The briefing note focuses on the efficiency triangle (i.e., optimization of inputs to achieve desired outputs; cost-effectiveness) in the TPD@Scale Framework, while ensuring that efficiency is balanced with ensuring quality and equity.

With governments and development partners having finite financial resources to spend on TPD, cost analysis is important to ensure that public resources and taxpayers' money are not wasted on programs that could deliver the same outcomes at a lower cost. It is also helpful when advocating for innovative new approaches that have the potential to scale faster and at lower cost than traditional approaches.

Figure 1. TPD@Scale Framework



Source: TPD@Scale Coalition for the Global South (2019)

Definitions

Before looking at the different methods for measuring and analyzing costs, it is important to be clear about terminology. Hoosen and Butcher (2017, pp. 186-187) provide definitions of cost-efficiency and cost-effectiveness to differentiate between the two:

> **Cost-efficiency** refers to the extent to which an institution or program maintains a particular level of production with fewer resources or increases the level of products or services it produces with a less than proportionate increase in the resources used. It thus refers to the "cheapness" of educational provision.
>
> **Cost-effectiveness** refers to the extent to which an institution or program produces outputs (which are concrete and measurable) or outcomes (which may not always be measurable). It represents striking the optimal balance between cost, student (teacher) numbers, and educational quality, a balance that changes according to educational context.

For both cost-efficiency and cost-effectiveness, the value of the data is only in comparing performance across different programs to consider which is more efficient or effective (Walls et al., 2020). Given that TPD programs exist in most contexts, when thinking about cost-effectiveness for TPD at scale, it will usually encompass comparing the costs of a new program with existing provisions.

Another term that is commonly used, particularly among some funders, is value for money (VfM). DFID (2011) and UKAid Direct (n.d.) offer the definition below:

> **Value for money** refers to maximizing the impact of each unit of currency spent in order to develop a better understanding of costs and results so that choices of programs can be informed by evidence. This requires an understanding of the expected costs of a program and of its expected results.

VfM analysis includes a combination of cost-economy, cost-efficiency, and cost-effectiveness analysis (Walls et al., 2020), which is captured in DFID's approach to VfM. This approach, in turn, uses the 3Es framework to look at overall cost-effectiveness:

- **Economy** – Is the program using the appropriate quality of inputs at the right price?
- **Efficiency** – Is the program using these inputs in an optimal way to produce outputs?
- **Effectiveness** – Is the program's outputs achieving the desired outcomes in teachers' ICT skills and ways in which technology can act as an enabler for enhanced professional learning for all teachers?

An important consideration that cuts across the 3Es framework pertains to **equity**. As outlined in TPD@Scale Coalition for the Global South (2021), there is a balancing act to be done when looking at the economy, efficiency, and effectiveness of TPD programs with an equity lens. This is likely to involve trade-offs particularly when scaling. As an example, when teachers are working with marginalized or disadvantaged groups to ensure greater equity, this may require additional time and higher cost interventions (e.g., translating materials into local languages) to ensure the same quality, but this is less economical in order to remain effective. This highlights the need to design for scale but localize for inclusion.

Cost drivers

When considering the use of digital learning approaches to support TPD, Trucano (2005, p. 22) posed a fundamental question: *"Can you reach the same education goals and objectives in a different manner at less cost without using ICT?"* In information and communications technology (ICT)-mediated approaches, several factors can drive costs up or down (Meyer, 2006; Meyer, 2014; Laurillard, 2007; and Rumble, 1997). These include:

- the proportion of face-to-face time (blended approach or fully online);
- the need for physical space (buildings and associated travel and residential costs) and what might be substituted with virtual space through technology;
- the extent to which the program is adapting existing materials versus developing all materials from scratch;
- the organization of the course development process (activities, inputs, types of staff used, etc.);
- the extent to which there has been effective public investment in digital infrastructure (telecommunication antennae, cabling, network hardware, etc.);
- the extent to which teachers have access to existing technological and digital infrastructure and devices (either at school or personally) rather than have a need to purchase computers, tablets, and smartphones for TPD; and
- the extent to which technology (e.g., online modules, self-paced learning, and automated grading) can automate some tasks otherwise done using high-cost labor.

Decisions on these factors need to be made in a way that is rooted in the local context, draws on effective training approaches, and does not reduce the quality of learning outcomes in the attempt to drive down costs. Boxes 1 and 2 showcase examples of how virtual coaching in Brazil and South Africa proved to be more cost-effective than onsite or other TPD modalities.

Box 1. Cost-effectiveness through virtual coaching in Brazil

A TPD intervention in Ceará state of Brazil had four components:

1. Performance feedback on teacher practice (from classroom observations undertaken at the end of the previous school year)
2. Self-help materials
3. Face-to-face interaction with high-skill coaches
4. Expert coaching support provided through Skype

The treatment group of 156 schools in the randomized controlled trial had a 0.05 to 0.09 standard deviation higher performance on the state test and a 0.04 to 0.06 standard deviation higher performance on the national test. The expert coaching support provided through Skype kept the costs of the program at $2.40 per student and produced cost-effective impacts on learning compared to other rigorously evaluated TPD interventions that have cost data (Bruns et al., 2017).

Box 2. Cost-effectiveness through virtual coaching in South Africa

A randomized controlled trial that looked at different delivery models of structured learning programs in a pilot in South Africa found that on-site coaching is more cost-effective (0.41 standard deviation increase in test scores per US$100) than centralized training workshops (0.23 standard deviation increase in test scores per US$100) and short coaching interventions (no significant impact).

Given the challenge to scale on-site coaching, a variation of the program was tested using virtual coaching. The results after a year showed that this variation had the same effectiveness as on-site coaching in improving teacher instruction practice and the literacy outcomes of children. The cost of the virtual coaching was US$41 per learner whereas the on-site model cost US$48 per learner (Kotze et al., 2019).

Laurillard (2007) argues that with digital learning, the biggest cost driver is not necessarily hardware or infrastructure such as laptops or Internet access, but time for teachers and other specialist staff to design and support learning. However, it is important to consider the local context including the extent to which schools and teachers have ICT equipment and technology that they can access to support their training. This may vary substantially between countries, within countries, and across schools and teachers.

When looking at a particular intervention, the number of teachers to be trained over time as the intervention scales is a key consideration as this will impact the overall cost and the cost of each teacher trained. With ICT-mediated programs, there are high upfront fixed costs (technology and course design). Costs of delivery per teacher trained vary, depending on the scale of delivery. These variable costs include access to technology, digital materials, and virtual instruction. With traditional programs, there are lower upfront fixed costs (course design) and then a standard cost of delivery per teacher trained that remains the same whether you train ten teachers or one million teachers. These include costs to produce print-based materials, face-to-face instruction, a physical venue for the training, and transport/residential costs for trainees.

Therefore, taking a long-term view of costs and the likely reach of the program is critical when comparing the cost-effectiveness of an ICT-mediated TPD program with a face-to-face program. A hypothetical example is given in Table 1.

Table 1. Hypothetical example of relative costs of ICT-mediated versus traditional program when scaling

Program beneficiaries	100 teachers (Pilot)		1,000 teachers (First stage of scaling)		10,000 teachers (Scaling further)		1 million teachers (Very large scale)	
Cost/delivery mode	**ICT**	**Traditional**	**ICT**	**Traditional**	**ICT**	**Traditional**	**ICT**	**Traditional**
Up front fixed costs per teacher trained	$10,000	$2,500	$1,000	$250	$100	$25	$1	$0.25
Delivery costs per teacher trained	$20	$150	$20	$150	$20	$150	$20	$150
Total cost per teacher trained	$10,020	$2,650	$1,020	$400	$120	$175	$21	$150.25
Full cost of program	$1,002,000	$265,000	$1,020,000	$400,000	$1,200,000	$1,750,000	$21,000,000	$150,250,000

ICT-mediated program: upfront fixed cost of design is $1 million; delivery cost per teacher trained is $20
Traditional program: upfront fixed cost of delivery is $250,000; delivery cost per teacher trained is $150

These figures illustrate that for the small-scale hypothetical pilot (e.g., 100 teachers), the ICT-mediated program is likely to cost much more than a traditional program for each teacher trained, which makes it appear as not being cost-effective. However, if a longer term time horizon is considered, therefore looking at costing with scaling in mind, it can be seen that when the same program is scaled to several thousand and more, the unit cost of training each additional teacher (i.e., delivery cost) reduces significantly. As a result, the ICT-mediated program becomes substantially cheaper to deliver both for each additional teacher trained and when looking at the full cost of the program. This is because the long-term driver for reducing costs is delivery at scale. The exact point at which the ICT-mediated program becomes cheaper than the traditional program will vary depending on the relative proportion of upfront fixed costs versus delivery costs. When looking at the national scale or state-level scale for large federal systems, the numbers are likely to range between 50,000 and several million teachers.

Box 3 illustrates how the demonstrated success of a digital literacy program for teaching in the Philippines resulted in its eventual scale up

Box 3. Cost-effectiveness through blended learning in the Philippines

In 2015, the Foundation for Information Technology Education and Development (FIT-ED) developed and piloted the Early Language, Literacy and Numeracy Digital (ELLN Digital) for K-3 Teachers in the Philippines as an alternative to the Department of Education's (DepEd's) traditional cascade model (10-day face-to-face workshop).

ELLN Digital uses a blended approach combining self-learning with classroom practice, co-learning with peers in a school-based professional learning community, and offline, interactive, multimedia modules. Plan-Do-Study-Act cycles help to improve the design, impact, and sustainability of the program through communities of practice known as Learning Action Cells (LACs). The pilot, which aimed to develop a more cost-effective and sustainable approach to provide at scale in-service teacher training, included 240 primary schools and over 4,000 teachers.

An evaluation of the pilot that focused on literacy teaching found that there were statistically significant improvements in the pedagogical and content knowledge of participating teachers, particularly those in rural schools. While the evaluation did not review cost-effectiveness, in 2019, the program started to scale nationally with a plan to reach over 250,000 teachers in three years due to the success of the pilot and its outcomes compared to DepEd's traditional cascade model (Oakley et al., 2018).

Approaches to measuring cost and effectiveness

Several methods are used to analyze cost-effectiveness. These include:

- Cost-benefit analysis (CBA)
- Cost-effectiveness analysis (CEA)
- Cost-feasibility analysis (CFA)
- Cost-utility analysis (CUA)

Appendix A provides further information on the definitions, uses, requirements, and challenges particular to each method.

Although still in its infancy, CEA is most used in education, despite challenges especially in relation to data available from the Global South. CEA compares the costs of programs relative

to their outcomes and is often measured by a ratio of the effect a program achieves for a given amount of cost. When considering TPD, CEA can be used to compare a new program with the status quo.

In order to undertake CEA, activity-based costing (ABC) is needed. This approach attempts to cost a program based on the resources it consumes, making visible the increased cost of a higher quality service (e.g., bespoke tailoring of teacher training versus off-the-shelf package) recognizing the extra time it takes to produce it. More information on different approaches to costing can be found in Appendix B along with some tools that are available to support cost-effectiveness analysis.

Questions and considerations when designing, delivering, and evaluating TPD programs

In this section, we outline a set of overarching questions to pose prior to designing any TPD program. We also present some specific considerations for the design, delivery, and evaluation of TPD programs in order to better capture costs and trade-offs to ensure efficient and effective use of resources.

A OVERARCHING QUESTIONS FOR TPD PROGRAM DESIGN

- What are the program's expected educational outputs and outcomes? How can these be captured in full, including personal, psychosocial, and environmental benefits (e.g., focus not only on improved academic learning outcomes in a short timeframe, but also on outcomes like greater collaboration between teachers and across schools potentially leading to increased school effectiveness in the longer term; increased teacher professionalism; spillover effects of teachers' access to technology for their own status as well as financial and emotional well-being; and reduction in the need to travel for residential training sessions)?
- Does the program have a strong theory of change to make clear links between inputs, activities, outputs, and outcomes?
- What is the added value of technology (low-, medium-, or high-tech) in supporting TPD in different contexts?
- Can the same results be achieved more effectively without ICT?
- Has some initial analysis been done to estimate the cost of any pilot?
- What assumptions are being made about the appropriate scale for the program and how this will impact cost over time?
- What access do teachers and schools have to ICT infrastructure and technology that can potentially reduce the need for significant upfront infrastructure investment in phones, tablets, etc.?
- Are human, technological, and financial resources available for scaling the program?
- Is there sufficient capacity within the education system to support scaling?

B COSTING CONSIDERATIONS FOR TPD PROGRAM DESIGN AND DELIVERY

TPD course design and development. TPD is most likely to be effective when it focuses on practical training, classroom practice, and reinforcement over time (GEEAP, 2020). Several factors impact the costs of TPD course design and development, and potentially the effectiveness of a program. These include:

- the level and model of instructional design;
- the requirements for video and multimedia production;
- the extent to which the course content draws on open educational resources (OERs), requires payment of a license fee for any curriculum used or adapted or is developed from scratch;
- the number, type, and experience of staff who work on developing the course (generalist versus specialist), the time taken to do this, and the relative cost of in-house versus freelance support;
- the extent to which existing face-to-face content is being adapted for blended training (no or very limited instructional design) or the need to design a fully bespoke course;
- whether any software, applications, and platforms that are used to host resources are free to access or require payment; and
- the amount of interactivity planned during teacher training, including the mix of synchronous and asynchronous learning.

Understanding which of these add the most value both pedagogically and in relation to a specific country context, and where trade-offs can be made that have minimal or no negative effect on learning outcomes, is critical to ensuring cost-effectiveness.

Language of instruction. In some countries, there are many indigenous languages used alongside the official or main national language. This can result in teachers having a range of competencies (from poor to very good) in the language(s) of instruction. Understanding the language competency of teachers and their students is an important consideration in the design and costing of any TPD program to ensure that it is likely to produce the required outcomes. Where competencies are poor, there will need to be a core focus on improving language competency in any TPD program in addition to instructional and pedagogical approaches and content. An element of language training will need to be costed into the program.

Fixed and variable costs. When considering digital learning as part of a large-scale TPD program, consider how to transfer more of the variable costs into fixed costs without reducing the effectiveness of the program, in order to increase productivity. Fixed costs will be spread across a large group of teachers as the program scales, providing economies of scale and more sustainable costs *(see Table 1)*. An example may be looking at producing written guidance and checklists for teachers during the design phase (fixed cost) to reduce the need for providing bespoke individualized support to teachers during (variable cost).

Digital technology training for teachers. Trainers along with teachers who are part of any training using a blended or fully digital approach will require training on the use of any hardware, software, or application that is used as part of delivery as they may not be familiar with this. This will need to be planned and costed into the program.

Cost variations between and within countries. While a common framework can be used, the cost of different activities will vary across (and sometimes within) countries due to differences in salaries, multimedia production costs, network/internet access, and other inputs. This requires any costing framework to use local costs that might vary according to context and may require a rural or remote cost weighting (Butcher & Hoosen, 2020).

In-kind costs. Some costs may be provided in-kind (e.g., teachers' time in peer-to-peer support groups or communities of practice; teachers using their own devices). If such in-kind contribution cannot be guaranteed, it should ideally be monetized to ensure full costs are captured for the future financial sustainability of the program.

Negotiating bulk discounts. If looking to scale, it may be possible to negotiate discounts on equipment or connectivity with telecommunications providers or to ask them to include technology training as part of any bundle. Discounts or subsidized connectivity was a key feature of COVID-19 education response in different countries. This could help to reduce the costs of scaling.

Scaling up after a pilot. The cost of any pilot should also include an indication of whether the pilot group being trained is broadly representative of the typical teacher, or whether the pilot has focused on higher performers in an urban location meaning that further roll out is likely to cost more per teacher to achieve the same quality outcome. The Education Scalability Checklist (VVOB et al., 2021) is a useful tool to help consider scaling in a holistic way.

Trade-offs for equity. Building on the point above, there may need to be trade-offs over time between cost-efficiency (lowest cost) and cost-effectiveness (lowest cost for the same outcomes) to ensure equity. This might require higher costs of training for some groups in order for them to attain the same level of quality. As Chuang et al. (2021) emphasize, it is important to ask for whom any initiative is cost-effective.

Capacity of the system to support scaling. Careful consideration needs to be given not only to the costs of scaling, but also to the system capacity to support scaling (VVOB, 2021). Particularly for blended approaches that require some face-to-face or personalized virtual support for the teachers being trained, it is important to consider a sustainable speed and timeframe for scaling to ensure that there are enough trainers to provide trainee teachers with the same quality of support (*see McLean et al., 2020 for a discussion of how this was a challenge in scaling COVID-19 health response*).

Feedback and learning loops. Understanding the learning experience of teachers during the delivery of a program (e.g., what is useful and what is less useful) can help to ensure that adjustments are made to ensure that the program can be adapted to maximize impact and use resources efficiently.

Monitoring and evaluation during delivery. Any program will benefit from being designed in a way that requires the collection of cost and performance data as part of its monitoring and evaluation framework, in order to calculate accurate cost-effectiveness data.

Challenges in measuring cost and cost-effectiveness

A number of challenges exist when measuring cost-effectiveness.

CHALLENGE 1: LACK OF DATA AND RESEARCH ON COST, EDUCATIONAL IMPACT, AND COST-EFFECTIVENESS

> *"The evidence base on costs is much thinner than that on benefits, with a tiny fraction of studies examining both." (World Bank, 2018, p. 110)*

- There is very little rigorous research available on the cost-effectiveness of educational interventions in the Global South, and even less data available on cost-effectiveness of TPD (GEEAP, 2020; Butcher & Hoosen, 2020; Vrasidas, 2020). This is due to limited availability of consistent and comparable cost and effectiveness data across programs in the Global South (Butcher & Hoosen, 2020) as well as a lack of expertise and experience of programs gathering and showcasing these data.
- When looking at digital learning, there is a widespread belief that investing in ICT is cost-effective and that the cost of technology (hardware, software, and connectivity) is decreasing. However, the full cost of digitally-supported education (which also includes maintenance, upgrading, skills, and development) is still high. This makes it very difficult to ascertain whether digital learning is cost-effective (Trucano, 2005; Butcher & Hoosen, 2020).

CHALLENGE 2: LACK OF CLARITY ON REAL COSTS OF TPD AND ECONOMIES OF SCALE

> *"For a program to scale, a cost analysis needs to show that the program can expand, adapt, and sustain itself over time." (Kennedy, 2020, p. 2)*

- TPD includes (i) upfront fixed developmental costs (capital costs) of the training resources and tools used; and (ii) variable costs of delivery (recurrent costs) of teacher support from trainers and technicians that will increase in proportion to the number of teachers benefitting from the program but depend on its size and scale (Laurillard, 2007).
- Pilots are likely to be more expensive per teacher trained than scaling, especially when digital learning is part of the delivery approach. However, pilots often take place in capital cities with better performing teachers, meaning that their costs are not truly representative.
- Scaling up digitally supported TPD programs may reduce the marginal cost (the cost of training each additional teacher) and the overall unit cost, creating economies of

scale. However, it may increase the marginal cost and the overall unit cost if there are higher levels of attrition of teachers on the program as it scales, or if some teachers need greater support or are harder to reach (i.e., to ensure equity, some teachers may need additional support that is more expensive to deliver).

- A lot will depend on the assumptions about scaling and how these assumptions impact the relative costs of the development and the delivery of the training as well as the specific country contexts.

CHALLENGE 3: POLITICAL WILL

> *"Scaling up programs requires deep understanding of the challenges of managing change, reform, and distributed leadership across multiple levels and contexts." (Vrasidas, 2020. p. 18)*

- Deciding on which programs to prioritize is a political process that includes value judgments around what to measure, evaluate and compare that are not always evidence-informed.
- Politicians have short-term time horizons and incentives to make visible investments in technology initiatives that largely focus on the distribution of devices with little forward planning and budgeting of the recurrent costs of using these devices (such as training in how to use them, electricity supply, connectivity, and maintenance). As a result, these initiatives may not be cost-effective to support improved teaching and learning.
- Short-term horizons create a disincentive for political decision-makers to commission research on the cost-effectiveness of digital learning initiatives, and this contributes to the continuing lack of reliable evidence.

CHALLENGE 4: WIDER ENABLING (OR DISABLING) ENVIRONMENT

- All TPD programs take place in a wider enabling (or disabling) environment that includes existing national technology infrastructure, whether it is provided through public or private investment, and the extent to which it reaches remote and rural areas; as well as national approaches to language of instruction, curriculum, pre-service teacher training, pedagogy, and assessment that may help or hinder the goal of improving learning outcomes for students.
- This might result in significant variations in the cost-effectiveness of the same program in different contexts.

As the Global Education Evidence Advisory Panel (GEEAP) emphasizes:

> *"One major element of systemic reform, so comprehensive that it is hard to evaluate rigorously, is realigning the curriculum, assessment, and examinations – and the overall orientation of the system – away from elite students, and toward the actual skill distribution in the entire student population… if there is political appetite for systemic change, addressing the curriculum and learning standards head-on could be highly cost-effective (GEEAP, 2020, p. 10)."*

Recommendations for policymakers and practitioners

The overarching recommendation of this briefing note is for policymakers to require program designers (whether in government, the private sector, development partners or practitioner organizations) to design programs from the outset with cost-effectiveness and scale in mind. This will entail:

- Undertaking the activities and inputs required for the program to be effective.
- Breaking these activities and inputs down into developmental costs, delivery costs, and even pilot and rollout costs, where possible.
- Estimating the cost of these activities and inputs as accurately as possible and ideally using common formats for costing program data to enable cost-effectiveness comparisons between programs.
- Building in a learning loop during the design phase so that the program can be adjusted along the way to produce better outcomes if needed; and ensuring that the budget (fixed costs of development as well as any ongoing costs of delivery) is then adjusted accordingly.
- Factoring in whether there are likely to be economies of scale in rolling out the program.
- Factoring in equity considerations and whether there are additional costs of localizing or adapting to enable inclusion, particularly of the most marginalized or disadvantaged.
- Undertaking annual reviews of program costs and outcomes to see if cost-effectiveness estimates are accurate.

Without accurate and comprehensive costing data, it is impossible to measure the cost-effectiveness of a particular intervention or program.

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APPENDIX A: METHODS FOR ANALYZING COSTS

Method	Description	Requirements and challenges
Cost-benefit analysis (CBA)	• Compares costs of programs with the financial benefits they produce. • Sometimes referred to as return on investment (RoI). • Often used in economic appraisals of large infrastructure or transport projects. • Rates of return (private and social) analysis have been the common method of doing CBA in the education sector, but these have generally focused on levels of education (primary, secondary, higher) rather than on specific interventions (Hough, 1993).	• Assigning monetary value to all benefits can be more difficult and requires more data than CEA.
Cost-effectiveness analysis (CEA)	• Compares costs of programs relative to their outcomes and is often measured by a ratio of the effect a program achieves for a given amount of cost. • Often uses the ingredients approach (See Figure A1) detailing all ingredients of a program; working out prices; and then calculating total cost, cost per participant, and cost-effectiveness ratio. • The school effectiveness literature has used this approach (mainly in high-income countries) to examine a variety of inputs going into a school during a year (such as class size, homework, availability of textbooks, teacher certification, and socio-economic status of students' parents) to look at their differing effects on educational outcomes (Hough, 1993).	• Needs both cost and effectiveness data to be collected. • When comparing different programs, both should have similar objectives and outcomes that are clearly defined in a single measure; this includes implementation in similar contexts, at similar scale and with homogenous groups of teachers. • Often costs of programs are additional funds spent over and above existing initiatives, making it difficult to cost accurately. • It can also be difficult to attribute outcomes to that program alone as there may be other factors influencing outcomes.
Cost-feasibility analysis (CFA)	• Conducted in advance of implementing a program and estimates its costs to inform stakeholders and policymakers whether a program is worth investing in.	• For blended learning approaches, costs are likely to vary significantly depending on likely scale of intervention which may make feasibility difficult to estimate without some high-level assumptions about scaling.

Cost-utility analysis (CUA)	• Examines costs and utility/value of a program measured by stakeholder satisfaction. • Widely used in the evaluation of health initiatives. • The recent Learning Adjusted Year of Schooling (LAYS) analysis is an example of this being applied to education (Filmer et al., 2018).	• CUA uses a combination of measures of satisfaction (utility/value) such as Quality-Adjusted Life Years and Disability-Adjusted Life Years, whereas CEA generally uses a single measure.

Note: Draws heavily from Vrasidas (2020) and Walls et al., (2020).

Figure A1. Costing a program using the ingredients method

Note: Adapted from Levin and McEwan (2001).

APPENDIX B: APPROACHES TO COSTING AND TOOLS TO SUPPORT CEA

Costing approaches	Description of approach	Requirements and challenges
Input-based costing (traditional)	• Attributes direct costs to a service and overheads as a proportion of the direct costs.	• Costing this way does not work in complex environments where multiple activities are being undertaken to provide a service or a group of services making it difficult to single out the cost (and impact) of any one intervention.
Activity-based costing (ABC)	• Attempts to cost a program based on the resources it consumes. • Makes visible the increased cost of a higher quality service (e.g., bespoke tailoring of teacher training versus off-the shelf package), recognizing the extra time it takes to produce it.	• Requires data on the cost of different activities. • Needs to also consider learning benefits of different pedagogical approaches to ensure efficiency of activities and to maintain or improve quality in a financially sustainable way. • Gathering data can be quite complex. • It relies on staff to provide information about time spent on activities which might be difficult to estimate with accuracy and/or face resistance from staff involved in training.
Time-driven ABC (TDABC)	• Builds on the ABC approach and uses a framework with two parameters: • Cost of trainer per hour • Time taken to provide training	• Does not rely on staff filling in timesheets but instead estimates how long each activity takes. • Enables estimates of design time and support time for digital learning.

Note: Draws heavily from Vrasidas (2020).

Which method to use depends on available data, the approach to costing and the type of intervention, though ABC is a more accurate form of costing for CEA.

Some tools that are available to support CEA include:

The Cost Measurement Guidance Note for Donor-Funded Education Programming developed by Building Evidence in Education *(see Walls et. al., 2020)*.
The General Framework for Comparative Cost-Effectiveness Analysis with Applications for Education developed by J-PAL *(see Dhaliwal, et. al., 2012)* along with their Costing Guidelines (see J-PAL, 2016) and Costing Templates in Excel *(see Bhula et al., 2020)*.
The Education Scalability Checklist developed by VVOB et al., 2021.
The Standardized Early Childhood Development Costing Tool (SECT) developed by Brookings *(see Gustafsson-Wright et. al., 2017)*.

Glossary of Terms

Activity-based costing (ABC): Costing a program based on the resources it consumes.

Capital or development budget: One-off upfront developmental costs such as infrastructure purchase, textbook development, or development of a training course.

Cost-benefit analysis (CBA): Compares the cost of an intervention with the financial benefits it is likely to produce. It is sometimes referred to as return on investment (RoI). It is often used in economic appraisals of large infrastructure and transport programs.

Cost-effectiveness: The extent to which an intervention produces outputs (which are concrete and measurable) or outcomes (which may not be measurable). In education, it represents striking the optimal balance between cost, student [teacher] numbers, and educational quality – a balance that changes according to educational context.

Cost-effectiveness analysis (CEA): Compares the cost of an intervention relative to its expected outcomes.

Cost-efficiency: The extent to which an institution or program maintains a particular level of production with fewer resources or increases the level of products or services it produces with a less than proportionate increase in the resources used. It thus refers to the "cheapness" of educational provision.

Cost-feasibility analysis: Conducted in advance of implementing an intervention and estimates its costs to inform decision-makers whether the intervention is worth investing in.

Cost-utility analysis: Examines the costs and utility/value of an intervention to guide procurement or investment decisions. It is commonly used in the health sector as a type of cost-effectiveness analysis and includes a focus on quality of life (utility/value) rather than just financial benefit (focus of cost-benefit analysis).

Economy: Using the right inputs at the lowest costs (getting a good deal).

Effectiveness: Obtaining the expected results/outcomes from the outputs (doing the right things).

Efficiency: Using the inputs in an optimal way to produce the outputs (getting the cheapest deal for the output that you are buying).

Marginal cost: The change in the total cost due to production of each additional unit (e.g., cost of each additional teacher trained).

Recurrent budget: Regular recurring costs of running an education system or program including salaries, staff costs, and operational running costs.

Unit cost: The cost per unit (e.g., cost of each teacher trained) which includes the fixed and variable costs incurred during the process divided by the number of units produced (e.g., teacher trained).

Unit cost = total costs / number of units
Total costs = total fixed costs + total variable costs

Value for money (VfM): Maximizing the impact of each unit of currency spent in order to develop a better understanding of costs and results so that choices of interventions can be informed by evidence. This requires an understanding of the expected costs of an intervention and of its expected results. VfM analysis includes a combination of cost-economy, cost-efficiency, and cost-effectiveness analyses.