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# WHITE PAPER SERIES

Centers for Excellence in Teacher Training (CETT) Program

## Paper Two: Testing and Assessment

### FINAL REPORT

June 2012

This final report was prepared for the United States Agency for International Development (USAID), Bureau for Latin America and the Caribbean, Office of Regional Sustainable Development, Education and Human Resources Team, under the Evaluation and Technical Support to LAC/RSD/EHR Contract AFP-M-00-06-00047-00. It was prepared by the Aguirre Division of JBS International, Inc. Its primary authors are Gilbert Valverde, Richard Wolfe, and Renzo Roncagliolo.

## CETT WHITE PAPER SERIES

This document is one in a series of white papers discussing the implementation and outcomes of the Centers for Excellence in Teacher Training (CETT) program. The CETT program was implemented by USAID's Bureau for Latin America and the Caribbean, Office of Regional Sustainable Development, Education and Human Resources Team from 2002–2009. CETT was based on a Presidential Initiative derived from commitments made by the U.S. Government at the Summit of the Americas in 2001 and operated in twenty-one countries in the regions of Central and South America, as well as the Caribbean.

The purpose of this CETT white paper series is to highlight the legacy of the initiative and to provide future program designers with some of the most important lessons learned and best practices developed within the long-term implementation of the CETT program.

The CETT white paper series includes five publications by theme:

**Paper One: Regional Nature**

*This white paper discusses the challenges, successes, and lessons learned implementing a regional model for teacher training. The regional nature of CETT differentiated this program from other, strictly national, teacher professional development efforts undertaken by USAID. Three CETTs in the Caribbean, Central and South America underwent a significant process of compromise and cooperation to arrive at their regional models and this paper documents the initiatives taken.*

**Paper Two: Testing and Assessment**

*This white paper discusses the challenges and lessons learned in the process of creating a cross-country testing initiative. The three CETTs carried out testing initiatives to track student performance toward literacy benchmarks, with the goal of showing valid and reliable results. An extremely challenging endeavor, student assessment is further complicated when using tests across countries.*

**Paper Three: Sustainability**

*This white paper discusses the lessons learned while anticipating the challenges of sustaining the CETT program after the end of USAID funding. The CETTs worked closely with USAID to prepare for the continuation of the program at the regional, national, and local levels. The paper examines the political, financial, institutional, and social sustainability dimensions of these efforts.*

**Paper Four: Paradigm Shift**

*This white paper discusses the systemic change in the behaviors and attitudes of CETT stakeholder groups, including school administrators, teacher trainers, teachers, parents, and students. CETT's teacher training model stressed the inclusion of stakeholders at all levels to promote the importance of reading and writing. Achievement of the program's intended effects depended on the willingness of the institutions and individuals involved to change their behaviors. This paper highlights the lessons learned and best practices in promoting this change.*

**Paper Five: Cost Effectiveness**

*This white paper presents lessons learned from a cost effectiveness study linking financial inputs and CETT program outcomes. While the data was insufficient to provide a full cost effectiveness analysis, the paper identifies lessons learned and presents guidelines for future program design and cost effectiveness analysis.*

# WHITE PAPER SERIES

## Centers for Excellence in Teacher Training (CETT) Program

### **Paper Two: Testing and Assessment**

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The authors' views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.



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## **Acronyms**

CA-RD	Central America and Dominican Republic
CARICOM	Caribbean Community
C-CETT	Caribbean CETT
CETT	Centers for Excellence in Teacher Training
CRSAT	Caribbean Reading Standards Achievement Test
ICT	Information and Communication Technologies
IRT	Item Response Theory
LAC	Latin America and the Caribbean
USAID	United States Agency for International Development



## Introduction and Methodology

The Centers for Excellence in Teacher Training (CETT) program was a Presidential Initiative to improve the pedagogical skills of teachers in the first, second, and third grades in economically disadvantaged communities of Latin America and the Caribbean (LAC). The hemisphere-wide program—announced in 2001 and implemented by the U.S. Agency for International Development (USAID)—created three regional<sup>1</sup> CETTs that began implementation in 13 countries, referred to in this study as:

1. C-CETT (beginning in the Caribbean countries of Jamaica, St. Vincent and the Grenadines, St. Lucia, Guyana, and Belize);<sup>2</sup>
2. Centro Andino (Ecuador, Peru, and Bolivia in South America); and
3. CETT CA-RD (in the Central American countries of El Salvador, Guatemala, Honduras, and Nicaragua; and in the Dominican Republic).

The Cooperative Agreements for USAID assistance to the CETT program ended in December 2009 after over seven years of technical support. (Two CETTs were issued a no-cost extension until early 2010.) As a result of the program, 35,095 teachers and administrators received training in interactive methods of literacy instruction. The program reached over 799,000 students in 21 countries.

CETT provided in-service training to teachers and administrators located in disadvantaged rural and urban areas that did not benefit from other donor programming. The program promoted the development of skills and adoption of active-learning strategies for teaching reading by aligning existing pedagogical practice with research-based best practices. The program had five core components:

1. **Teacher training** in effective reading methodologies and classroom management techniques
2. **Materials** for teachers to use to improve their reading instruction
3. **Diagnostic tools** to enable teachers to identify and address students' weaknesses and needs
4. **Applied research** to ensure the efficacy of the training, tools, and materials provided
5. **Information and communications technologies (ICTs)** to broaden access to the program

In addition, the CETTs also focused on sustainability efforts to ensure continuance of the program after the end of USAID funding. Within the parameters of these components, each CETT had the flexibility to manage and implement the program based on its regional context and needs. As a result, the CETTs developed with slight differences in each region.

CETT training *content* was related to seven literacy skills: reading comprehension, phonological awareness, phonics, fluency, oral expression, written expression, and vocabulary. Knowledge of these skills provided the foundation for integrated and effective reading instruction.

<sup>1</sup> In this study, “regional” refers to one of the three CETT areas: the Caribbean, South America, or Central America and the Dominican Republic. “Hemispheric” refers to all three CETTs as a single unit.

<sup>2</sup> By the end of the program in 2009, many more islands in the Caribbean had adopted CETT. Jamaica, St. Lucia, St. Vincent and the Grenadines, Belize, Guyana, and the Commonwealth of Dominica implemented CETT with USAID funding. After learning of the experiences and results of other countries, the governments of Trinidad and Tobago and Grenada approached C-CETT to join, fully financing their own implementation and purchasing C-CETT’s technical support. In 2009, five additional countries signed Memoranda of Understanding (MOUs) to expand CETT implementation to St. Kitts and Nevis, Antigua and Barbuda, Anguilla, Montserrat, and the British Virgin Islands.

The CETT teacher training model introduced innovative *techniques* such as continuous teacher training throughout the school year and follow-up support in the classroom. Teacher trainers visited CETT classrooms where they observed teachers and provided feedback and recommendations. Teacher circles gave teachers the opportunity to share their experiences with peers. Each CETT also emphasized the role of parents and the greater community in embracing a “culture of literacy” to support the importance of reading in the early grades.

The program was implemented in two phases: Phase One (2002–2006) and Phase Two (2006–2009). Phase One launched the initial CETT program design and development. Lead implementing institutions in Jamaica, Honduras, and Peru signed Cooperative Agreements with USAID. Phase Two supported a continuation of the CETTs following USAID’s emergent consensus that five years were not sufficient to fully implement the program and achieve the desired results. Each lead organization of the three regional CETTs continued its ongoing relationships with the same partner institutions throughout both phases. Broad outcomes of the program include reaching over 35,000 teachers and administrators with interactive methods of literacy instruction, the creation of new curricular and supplemental materials for early-grade reading, and the development of a cadre of experienced master trainers with expertise in teaching reading.

## **Purpose**

This white paper examines the experience of CETT in designing and developing a student assessment system. The study is part of the CETT white paper series, a compilation of five research papers on key topics related to CETT: regional nature, testing and assessment, sustainability, paradigm shift, and cost effectiveness. Each of the white papers examines the three CETTs through a selection of lenses and analyzes the research findings to bring significant and specific lessons learned with respect to CETT activities into focus. This research gives form to the legacy of the Presidential Initiative and provides future program designers with some of the most important lessons learned during the long-term implementation of the CETT program.

The focus of this study is to look at what we can learn from the efforts to integrate the use of student achievement testing into the CETT program as a tool for monitoring progress and evaluating program impact on learning. The study investigates the challenges faced and the lessons learned from the cross-country student testing effort. The CETT experience is compared also with international best practices in the use of student testing for program evaluation in order to draw recommendations for similar program initiatives in the future.

The first section of the paper provides a general description of program evaluation in CETT, which encompassed a number of activities, including the testing initiative that is the focus of this paper. The second section presents the three fundamental challenges to the evaluation design given the monitoring and evaluation efforts of the CETTs, and how these challenges affected the testing initiative. The third section documents the lessons learned and the innovative techniques that the CETTs used in designing the student tests, and in analyzing the test results. In the final section, the research team proposes a framework for action in the form of recommendations based on the CETT experience that can inform testing initiatives within program evaluation of future USAID interventions. The overall results of the CETT program are not presented in further detail here, but specific results are described as illustrations of the methodological approaches used.

## Research Questions

The basic assumption guiding this white paper is that the use of testing helped develop practices and improve program outcomes while building local capacity in the area of monitoring and evaluation. The research team, led by expert consultants Dr. Gilbert Valverde and Dr. Richard Wolfe, set out to investigate several research questions about what went well and what was overlooked in the CETT testing initiative:

1. For each region and overall, to what extent was the testing initiative successful in building regional testing capacity and assessments that accurately show outcomes resulting from the CETT interventions?
2. What were the advantages and synergies of the regional approach to the CETT testing effort that are noteworthy for future programming? What were the limitations in the process of developing these?
3. As each CETT developed its testing approach and methodology, what differences developed among them? What strengths and weaknesses did each approach have? How could they have been improved?
4. In what ways/to what extent did the CETTs meet the challenge of fielding evaluations adhering to acceptable standards of accuracy, feasibility, and utility? To what extent did the testing systems established by each CETT contribute to a meaningful and valid evaluation of program impact?
5. Given the questions above, what are the lessons learned regarding best practices in program evaluation involving student testing? How is this related to the development of project-specific or more general testing and evaluation systems?

The authors of this report drafted these questions with all stakeholder groups in mind, and with the understanding that information would come from several different sources.

## Methodology

This white paper is based on a review of documents and notes developed by the consultants to the CETTs and authors of this study, Dr. Gilbert Valverde and Dr. Richard Wolfe. Dr. Valverde and Dr. Wolfe provided technical assistance on assessment design and student testing to the CETT program from 2005–2009 and were also extensively involved in assisting some of the countries with analysis of the test data.

The authors reexamined their notes from former interviews and meetings, aides-mémoires, technical reports, and independent analyses to categorize the challenges faced in developing student performance tests in the three regional programs: C-CETT, Centro Andino, and CETT CA-RD. Additionally, the analyses of test data were reviewed and categorized to highlight examples that illustrate the fundamental, cross-cutting lessons learned in CETT, with the most important implications for future efforts.

## Limitations of the Study

The research team identified several limitations of this study:

- An inherent limitation is that information was taken from previous reports, discussions, interviews, and through the long-standing working relationships that the authors had with all three CETTs. As noted, the consultants who led this study provided technical assistance on

testing to CETT over the course of four years and were able to provide in-depth insight as to the inner workings of the testing initiative. At the same time, their close involvement with the program made it more difficult to analyze the program from an outsider's perspective. No new data were collected for this study.

- Although the research team provided technical assistance to all three CETTs, the level of involvement varied. The team was most involved with Centro Andino and CETT CA-RD. Although efforts were made to review documentation, data, and data analysis across the three regions, the team's experience and access to documentation in some regions contributed to a more detailed analysis of those CETTs.

## Program Evaluation in CETT

A number of overviews of the assessment priorities of programs in Latin America and the Caribbean have stressed the importance of effective monitoring and evaluation systems to measure program impact.<sup>3</sup> Moreover, the development of indicators of program impact has been among the highest priorities of the strategic objectives in education of the LAC bureau at USAID, the implementers of the CETT program.<sup>4</sup> In CETT, the monitoring and evaluation systems developed were intended to gather evidence of program progress and impact through quantitative and qualitative indicators, including changes in student performance. The analysis of the data collected over those years has been presented in several evaluation reports, which focused largely on teacher learning and performance.<sup>5</sup> This section outlines the design of the monitoring and evaluation system in CETT specifically related to student performance tests.

### Background

The aim of the Summit of the Americas Initiative, which was the conceptual basis for the CETT program, was to "improve teacher and school administrator quality and to improve the quality of reading instruction in the classroom throughout the hemisphere, with special emphasis on poorer countries and teachers who work in disadvantaged communities."<sup>6</sup> For each of the five core components outlined in the Introduction, USAID identified specific expected results. For example, three major expected results were identified for the teacher training component:<sup>7</sup>

- Teachers are more skilled, knowledgeable, motivated, self-confident, and better equipped to teach reading.
- Fewer students are reading below grade level.
- Networks of teachers and reading organizations are established and exchange best practices, lessons learned, and materials to improve reading instruction within their countries and across the hemisphere.

With these and other results in mind, each regional CETT was charged with developing the CETT components based on the context of that region. In addition, according to the milestones set for the first year of implementation, the CETTs were to develop monitoring and evaluation plans within three months of signing the Cooperative Agreements with USAID.<sup>8</sup> In order to support this process, an external consulting firm, Aguirre International, was contracted. A core part of the work of this

<sup>3</sup> World Bank. (1998). *Assessing Aid: A World Bank Policy Research Report*. New York, NY: Oxford University Press; Navarro, J. C., Taylor, C., Bernasconi, A., & Tyler, L. (Eds.). (2000). *Perspectivas sobre la reforma educativa: América Central en el contexto de políticas de educación en las Américas*. Washington, D.C.: U.S. Agency for International Development; Development Assistance Committee. (1999). *Criteria for Donor Agencies' Self-Assessment in Capacity Development*. Paris, France: Organisation for Economic Co-operation and Development.

<sup>4</sup> U.S. Agency for International Development, LAC Regional Office. (2002). *LAC Regional Education and Training Improvement Program Data Sheet*. Washington, D.C.: U.S. Agency for International Development.

<sup>5</sup> U.S. Agency for International Development, LAC Regional Office. (2011). *Centers for Excellence in Teacher Training (CETT) : Two-Year Impact Study Report (2008-2009)*. Washington, D.C.: U.S. Agency for International Development; U.S. Agency for International Development, LAC Regional Office. (2006). *Centers Of Excellence For Teacher Training (CETT): Professional Development Review*. Washington, D.C.: U.S. Agency for International Development. (2004). *A Reflective Study Of Teacher Professional Development in the Latin American and Caribbean Regional Centers of Excellence for Teacher Training*. Washington, D.C.: U.S. Agency for International Development.

<sup>6</sup> U.S. Department of State. (2003). *Centers of Excellence for Teacher Training in the Americas* [Press Release]. Retrieved from <http://www.america.gov/st/washfile-english/2003/August/20030801114640nesnom0.254513.html>

<sup>7</sup> U.S. Agency for International Development. (2002). *Centers for Excellence in Teaching Training: A Summit of the Americas Initiative Information Packet*. Retrieved from [http://pdf.usaid.gov/pdf\\_docs/PNACY696.pdf](http://pdf.usaid.gov/pdf_docs/PNACY696.pdf)

<sup>8</sup> Ibid.

consulting firm was to provide technical assistance to the CETTs to develop their monitoring and evaluation capacity, which in the second phase of the work was grouped in five areas:

1. **Performance Assessment:** Collaborate with USAID and the CETTs to develop a plan for monitoring key inputs, milestones, and program outcomes.
2. **Evaluation Research:** Assist with indicator development, data collection and reporting, and trends analysis, drawing on the extensive work done in indicator development both by Aguirre International and other stakeholders for USAID in the arena of education in recent years.
3. **Planning:** Work with CETTs to develop a methodology of “performance improvement” to develop and refine process, outcome and impact indicators, and to develop methods and strategies for appropriate data collection.
4. **Reporting and Dissemination:** Assist the CETTs in creating the means to report efficiently the wide range of information of their activities.
5. **Training in M&E:** Develop workshops and conferences to work with CETT partners to provide performance monitoring and evaluation training.

It is evident that monitoring and evaluation was emphasized from the inception of the program, as resources were provided by USAID to support the CETTs in their development of performance measures. However, USAID and the CETTs soon found that developing valid and reliable measurement tools was a complex enterprise that required careful design and execution, and the complexity of evaluation would require a significant level of effort and time. Moreover, as discussed in other white papers in this series (see paper one: regional nature), the development of the CETT components themselves, such as the teacher training models, materials, and diagnostic tools, took a longer time than anticipated.

### **Measurement Indicators and Demonstrating Program Impact**

In the first two years of the program, the CETTs experienced substantial pressure to begin implementing the program and to demonstrate results quickly. They focused on measurement indicators related to the number of teachers and school administrators trained and the relative number of students affected by the program. Although these outcome measures were necessary, more focus was put on getting the program up and running before other pieces, such as performance evaluation, could be developed more fully.

It should also be noted that over the seven years in which the program was implemented, the focus for assessment and evaluation changed. Initially, USAID sought to evaluate whether the program was having an impact on teachers, who were the direct beneficiaries of this teacher training program. Thus, the first assessment tools created focused mainly on measuring *teacher* performance. In fact, two cross-regional qualitative studies of teacher professional development were carried out in Phase One (2004 and 2006, cited above). In subsequent years, the focus shifted to not only assessing teacher performance, but also to creating instruments for measuring student performance in reading. This shift was in line with an increased interest by USAID—and other international development organizations—in linking quality to learning and measuring the impact of program interventions on student learning. This came out of the growing perception of many working in international education that the rapid expansion of access - a considerable achievement internationally – was nevertheless diluted by the fact that the education offered was of low quality.

Towards the end of Phase One, the CETTs began to develop evaluation models that included student testing in order to measure impact at the program level. Each regional CETT developed common tests

for use by the member countries in each region. It took several years of hard work on the part of the CETT teams, guided by technical advice from Drs. Valverde and Wolfe, to produce the first comparative test results in 2007.

The C-CETT designed the Caribbean Reading Standards Achievement Test (CRSAT), a set of student achievement tests that measured growth in six key literacy areas. The CRSAT was based on the Caribbean Standards for Reading and Writing, which were developed and implemented by C-CETT. These standards were later endorsed by the Caribbean Community (CARICOM) and are currently used throughout primary schools of the English-speaking Caribbean.<sup>9</sup> The tests were administered to grade one to three students in C-CETT schools in Caribbean member countries annually.

In Centro Andino, grade three students in schools participating in CETT for three years were tested in all three countries at the beginning and end of the school year. The achievement tests were developed by the Project Implementation Unit at the Universidad Cayetano Heredia with technical assistance from Aguirre International. In Peru alone, the scores of these third graders were compared to the scores of third grade students in a chosen sample of comparison schools.

The CETT CA-RD student achievement tests were developed by the CETT team at the Universidad del Valle in Guatemala, who served as the technical specialists in assessment for the CETT CA-RD. They adopted a pre-test / post-test design, in which CETT students of grades one to three were tested at the start and end of the school year. The structure and student outcomes of the student performance tests designed by each CETT are described in detail in the fifth white paper of the series on cost effectiveness.

It is important to highlight that the testing initiative examined in this paper is only one part of CETT's monitoring and evaluation strategy. Other components of the monitoring and evaluation strategy included the external evaluations carried out by Aguirre International (e.g., qualitative professional development studies, impact study, and other studies, see footnote #5), and each CETT's internal monitoring and evaluation system. The internal monitoring system included, to varying degrees and forms in the different CETTs, tools to monitor the performance of teachers and trainers, diagnostic tools to map out students' levels at the start of the school year, and formative tests to evaluate students' progress during the school year. Where developed, a number of the tools first became available in the last years of program implementation, some as late as 2008.

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<sup>9</sup> The Caribbean Community (CARICOM) is an association of 15 nations and dependencies throughout the Caribbean whose purpose is to promote economic integration and free trade among member states, and the coordination of labor, industrial, social, and foreign policies. CARICOM was established in 1973 by the Treaty of Chaguaramas ([http://www.caricom.org/jsp/community/revised\\_treaty-text.pdf](http://www.caricom.org/jsp/community/revised_treaty-text.pdf)).



## A Fundamental Challenge: Evaluation Design

In all regions, implementation of CETT began without a program-level evaluation design in place and thus no specific design for student testing. This was largely due to USAID's intention that each of the three regional host institutions – centered in regional universities selected through an assessment process – should have the latitude to develop its own program using national and regional experts, without a prescribed vision of how each CETT would evolve. On the other hand, all three CETTs were aware that the funding came through a Presidential Initiative, and thus there would be great interest at high levels in showing rapid results. The need to get teachers trained rapidly for reporting purposes, the challenges in each region to working across national boundaries in this new, collaborative, form, and the commitment to each region's relative independence to develop its own program, undermined the creation of a unified evaluation plan, and this proved to be a fundamental challenge throughout the program's existence. Not surprisingly given these realities, the testing initiatives created by the CETTs varied in their approach. Each regional assessment team interpreted the broad imperative to assess "impact" according to its own understanding. This section notes three specific evaluation design challenges that affected CETT at the program level: 1) measuring program impact; 2) disaggregating the impact of program components; and 3) implementation of student testing.

### ***Design Challenge 1: Measuring Program Impact***

CETT was primarily an initiative seeking to innovate in the area of teacher training. Much effort was put into developing an in-service teacher training model that would promote the use of effective teaching practices in literacy instruction, with the assumption that improved teaching practices would result in enhanced learning opportunities for children. The following key assumptions of the model suggested a set of causal mechanisms – that is, a particular progression of changes in behavior that would lead to the final goal of improved student learning in reading and writing:

- Trainers help teachers acquire new pedagogical knowledge and skills through in-service training.
- Teachers use new teaching proficiencies acquired in training to improve instruction, with the additional support of supervision and new instructional materials.
- Improved instruction leads to better opportunities for students to learn.
- Students take advantage of better opportunities to learn and acquire greater proficiencies in reading and writing than their peers in classrooms in which teachers did not receive CETT services.

The final step in this progression – the link between opportunities to learn and greater proficiency among students— required a comparative judgment. In order to substantiate a claim of program impact on classroom learning, the CETTs had to demonstrate that the students participating in the program had become more proficient in reading and writing than they would have without the CETT investments

In order to accomplish this goal, the ideal approach would have been to identify the population of schools to which the CETT experience was intended to be generalizable, and then assign schools randomly to treatment or comparison groups. An experimental design was not part of the CETT program, however. The testing initiative started after program implementation had already begun, and it was not feasible to expand to an additional set of schools for experimental purposes. Comparison schools were identified after program implementation had begun rather than selected at program startup. As a result, data was not available to measure any initial differences between schools, teachers or students, and conclusions regarding program impact were more difficult to substantiate. Many of the

subsequent efforts to improve the testing design were directed at compensating for this initial design weakness.

### ***Design Challenge 2: The Impact of Program Components***

A second design challenge was the CETTs' ability to measure the relative impact of each program component, as several components (teacher training, didactic and student materials, diagnostic assessment, etc.) made up the CETT package. The CETT schools received component interventions as soon as practicable, so teacher training, teacher and student materials, in-class coaching, and formative assessments were introduced as soon as they became available. Monitoring and evaluation efforts provided crucial formative feedback to improve implementation, and efforts were made to refine the model, especially in Phase Two. However, CETT did not test the different components of the program by experimenting with different mixes, and thus did not have a chance to refine the model by looking at the relative effectiveness of each component in comparison to the others.

### ***Design Challenge 3: The Implementation of Testing***

A third challenge of the overall CETT design was that monitoring and evaluation activities were largely carried out by the implementing parties themselves, which has implications for the actual and perceived reliability of the findings. The technical assistance USAID provided through Aguirre International helped compensate for this difficulty, in particular by providing expert advice and guidance in evaluation and testing design. Nevertheless, testing was in the hands of teams that had an important stake in the result of the evaluation efforts. As CETT evolved, considerations of data quality, professional standards in evaluation, and standards for reporting and communicating results became more salient. This expanding focus on monitoring and evaluation resulted in targeted support to the regional programs in their efforts to respond to these increasingly more explicit concerns. The next section provides some of the lessons learned and innovative techniques that the CETTs implemented in order to measure student performance given these design challenges.

## Lessons Learned and Innovative Techniques in CETT Testing

In Phase Two of the program, a Reference Standards document<sup>10</sup> developed by Valverde et. al., (2007) laid out in considerable detail all the steps and requirements for student testing, from test design to sampling, implementation, analysis, and reporting. The CETT teams used the Reference Standards to address deficiencies in their test designs and to build knowledge about effective testing standards. The increased attention to internationally accepted standards in test design and implementation in CETT became an example of testing across national boundaries and a model for integration as an important aspect of results reporting.

Much can be learned from the complexities and challenges of the CETT testing initiative. Considerable efforts were made to go beyond the types of perfunctory and superficial “evaluations” towards a more rigorous approach to evidence regarding program impact using student performance tests. The most noteworthy characteristics of CETT evaluation efforts included:

1. **Use of pre- and post- measurement.** In order to measure program impact, Centro Andino and CETT CA-RD tested students in program and comparison schools over time. Because the schools were not chosen randomly into intervention and control schools prior to the program implementation, comparison schools with similar characteristics as the CETT cohorts were identified. By using pre- and post-test measurements at two points in time, the CETT testing teams could then measure the amount of change in the outcome or performance variables, or “value added”.
2. **Vertical scaling across grades.** Vertical scaling, a methodology used to link assessments across grades in order to describe student growth over time, further strengthened the choice of pre-post measurement design in Centro Andino and CETT CA-RD. Growth and learning are fundamental assumptions of education. The premise is that school children progress in their learning over time and across the grades. Despite the centrality of this philosophy and its acceptance by most educational system actors, few efforts in program evaluation incorporate this perspective in their evaluation design. CETT took up the challenge of mapping and locating students along a learning continuum from grade one to grade three.
3. **Multi-year tracking of teachers and students, to look at incremental effects of training and instruction.** As the evaluation efforts in CETT were refined, extended, and strengthened, efforts were made to further enhance the learning progressions perspective. Thus, some of the same students and teachers were tracked and studied over time in order to gauge the progressive impact of the implementation of the CETT model. This resulted in a true longitudinal study, not simply a succession of independently sampled groups over time.
4. **Test developments that were aimed at studying reading achievement through the lens of the program objectives.** Although tests in CETT, with the possible exception of C-CETT, were essentially norm-referenced,<sup>11</sup> there were noteworthy efforts to design measures aligned with the learning goals that served as the objectives of the program. Alignment was sometimes problematic, both because consensus on the program’s pedagogical models was achieved over time and because it was evolving simultaneously with early efforts in test design. However, analysis and reporting emphasized the use of program objectives.

<sup>10</sup> Valverde, Gilbert, Renzo Roncagliolo Jones, and Richard Wolfe. (2007) *Reference Standards for Evaluation Reporting*. Produced with funding from USAID by Aguirre Division of JBS International, Washington, DC.

<sup>11</sup> In everyday language, “norm-referenced” testing is often thought of as “grading against a curve.”

5. **Interpretation of item and sub-domain results for diagnosis.** In addition to producing general measures of achievement in reading comprehension and early reading skills, CETT analyzed student performance on individual items or sub-scales of items within the larger domain of reading comprehension. Thus, it was possible for CETT, especially in the final analyses conducted, not only to gauge overall levels of proficiency, but also to identify areas of weakness and strength at the group level, which could be used for diagnostic and implementation purposes.
6. **Collection and analysis of associated variables for students, teachers, and schools.** Evaluations in CETT attempted to account for the effects of demographic, social, and other contextual factors on what students learned. Analytical models used in CETT evaluation were therefore capable of accounting for these associated variables, which allowed them to isolate the impact of other external factors affecting outcomes.

### **Innovative Techniques in Instrumentation**

The area that received perhaps the most attention in CETT was instrument development, specifically the development of student achievement tests. This was the area in which the largest number of CETT personnel participated, and the one that required the greatest efforts to coordinate across units. Initial designs were refined over the years, and there was an increasingly rigorous use of pilot data. Although external feedback and coaching on test development was limited, as were efforts made to set cut scores or achievement levels as outcome goals, the CETTs developed increasingly stronger technical understandings of the attributes of good test items and some procedures for assessing and validating the quality of the items.

#### ***Test Development and Matrix Sampling***

The construction and interpretation of student achievement tests used in the context of program evaluation is often oversimplified. If the questions on a test are *about* the content of the target instruction and learning, then one may make the conclusion that one test will be as good as another. However, this kind of thinking has negative consequences for making inferences about program quality:

1. If a test does not provide *comprehensive* measurement of the target content, then it will be difficult to determine the overall effect of the program. For example, if a test used in the evaluation of a reading program measures only decoding skills, one will have little information about the impact of the program on student reading comprehension and inference.
2. If a test does not provide *differentiated* information about student achievement across the target content, then there will be no specific diagnostic information for improving the skills of individual students and no formative indications for improving the instruction and the program.
3. If a test does not provide information that is *referenced* to criterion standards of achievements, then it will be difficult to judge whether a program has succeeded. For example, in the analysis of reading comprehension, one should want to know whether students can adequately understand and use the texts found in specific populations of reading materials, such as schoolbooks.

In the case of reading in early grades, the domain for testing can be analyzed in various ways. One may ask what skills students have (decoding, vocabulary, finding explicit information, making inferences, making connections); try to measure the reading experiences of students and the interests they show; and inquire about what students can do with the reading activity, such as discuss, write, and communicate the main ideas.

However, all these considerations lead to a crucial methodological problem: if the content domain is large and complex, then the tests used to evaluate student achievement in the domain must be comparably long and detailed. A test with complete, detailed coverage of a content domain would be much too long for one student to take in a reasonable testing session. One way to overcome this problem is to use matrix sampling. In matrix sampling, all of the test items are randomly divided to create different tests. Then alternate tests are distributed randomly. Having multiple forms also makes it practical to administer effectively the same test at two points in time, such as at pre-test and post-test, since the situation of having students see the same items twice can be minimized or discounted. The text box below includes more detailed information on matrix sampling.

#### **Technical Example: Matrix Sampling**

A methodologically sound way to overcome the problem of too much information to be included in one student exam is matrix sampling, where the pool of items necessary to provide full coverage of the content domain is divided into a number of alternate test forms, each containing a stratified random sample of the pool. At each critical point in a study (e.g., pre-test, post-test), the alternate forms are distributed randomly, one to each student across classes and schools.

The statistical situation is then:

- (a) Each student has taken a sample of questions that is representative of the total pool—that is, of the content domain—so the student’s score estimates the student’s performance in the domain. The scores may not be very precise, because an individual’s sample is small, but they are unbiased, so correlations with external variables will be correct (after correction for the sampling).
- (b) The aggregate scores over the students in a classroom, or a school, or a treatment condition (e.g., experimental and control) also estimate performance in the total domain. They are quite accurate because they are determined by averaging over all students and therefore over all forms and all items, and the sampling errors in the test forms of individual students cancel out.
- (c) At the level of individual student, there is likely insufficient information (too few items) to form analyzable scores for sub-domains. But between students, sub-domain scores are determined by different items due to forms-level sampling. Consequently, once aggregated over the students in a class, or school, or treatment condition, sub-domain scores can be quite accurate.

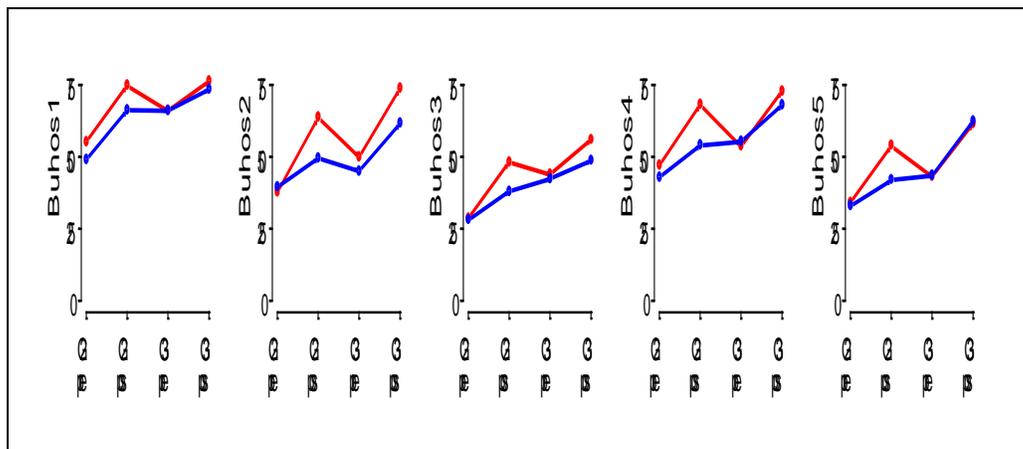
In Centro Andino, matrix sampling was used for testing in the 2008-2009 data collection round. As shown in the following table, the test design comprised four booklets, each divided into two blocks, and each student answered one booklet.

<b>Matrix Sampling in Centro Andino: 2008-2009</b>		
Booklet	Block A	Block B
1	C1a	C1b
2	C2a	C2b
3	C3a	C3b
4	C4a (*)	C4b
* This test was from 2006-2007		

## Vertical Scaling

Other refinements to test design took place as the three CETTs expanded their testing efforts. In CETT CA-RD, for example, the assessment team designed a test to measure vertical scaling on reading comprehension items between grade two and grade three. As seen in Display 2 below, the test given to CETT (red line) and comparison (blue line) schools consisted of a reading passage (called “Buhos”) and five corresponding questions. Since the samples of students were random, the difficulties of the items could be compared across the beginning and end of the school year (shown as “pre” and “pos”). The graphs indicate how the difficulty of each item changed from the pre-test to the post-test in the Dominican Republic. The interest for interpretation lies in the variations in growth patterns. These can be linked to the specific contents of the items.

**Display 2: Vertical scaling of test items in grades two and three: Dominican Republic**



In most cases, the within-year gains in CETT schools were higher (the slopes were greater) than in the comparison schools. While the starting points for CETT and comparison schools were about the same in grade two, the notable result is that there seemed to be a drop in achievement in CETT schools between the end of grade two and the beginning of grade three. This was a similar finding in the CETT impact study (2008-2009), which found that competencies among CETT students decreased during the summer months.<sup>12</sup> However, this dip could also signify a design flaw; as this was a cross-sectional design, the student samples were chosen from two separate grades in the same school year.<sup>13</sup> This last observation points to the challenges of assessment – and, unfortunately, no follow-up assessment has been done to determine whether these findings hold up over time or what may account for the apparent decrease in competencies.

<sup>12</sup> Aguirre Division of JBS International, Inc. (2009). *Centers for Excellence in Teacher Training (CETT): Two-year Impact Study Report (2008 – 2009)*. Produced with funding from USAID. Retrieved from: [http://pdf.usaid.gov/pdf\\_docs/PDACS248.pdf](http://pdf.usaid.gov/pdf_docs/PDACS248.pdf)

<sup>13</sup> Cross-sectional data refers to data collected on subjects (in this case data on students) at the same point in time, or without regard to differences in time; it differs from longitudinal data, which follows the *same* subjects over time.

## Measuring Test Validity

The assessment strategy followed in CETT involved testing students to find out whether they had acquired a number of skills expected of them. The assessment system involved a *written test* with questions that, in the view of the test's authors, demanded that the students use what they learned from CETT-trained teachers in order to answer correctly.

Interpreting the test information correctly and using it properly demands an understanding of the kind of representation of achievement or learning that the tests allow. That in turn means attending to what is known in educational measurement as *validity*. Validity is not intrinsic to the tests, but instead is a property of the interpretations of the information obtained through them and the uses to which that information is put. Hence validity is currently defined as the degree to which empirical evidence support the interpretation of the results of an assessment.<sup>14</sup>

In the case of achievement tests, whether they are norm-referenced, as was the case in CETT, or criterion-referenced, efforts are made to draw conclusions that go beyond the test questions.<sup>15</sup> In other words, in both cases it is acknowledged that the test questions account for only a small sample of all the possible questions that could be asked in an effort to determine if the students have acquired certain abilities. Thus, if students give correct answers to 80 percent of the test questions, they should be able to answer 80 percent of all the questions that could possibly be asked to assess that ability.

The CETT assessments were designed to address the following points:

- **Abilities and skills measured.** In CETT, efforts were made to specify the abilities and skills to be assessed. In C-CETT, a set of common standards was agreed upon as the definition of the learning goals of CETT. These Caribbean Standards for Reading and Writing were used as the referents for the student tests.<sup>16</sup> A contrasting model was followed initially in Centro Andino. In this case, external consultants were asked to put together the first tests, and these were based primarily on test item expertise that these consultants had developed in working on the Peruvian national tests. This resulted in fairly weak connections to the specific programmatic goals of CETT. In CETT CA-RD, a number of test specifications were drawn up with different lists of “competencies” or domains to be assessed, which were vetted by the teams of the participating countries.
- **Consistency between the questions and the abilities or skills to be measured.** This was a weak area across the CETTs, especially in their early efforts. At first, in all cases none of the procedures to ensure consistency were specified, and only as efforts progressed were procedures for rigorous review attempted. However, these efforts at review, in the case of CETT CA-RD for example, took place simultaneously with instrument pilots, so changes, corrections or refinements resulting from these were not piloted, thus substantially constraining their usefulness.

<sup>14</sup> For a long time, the most common and extensive concept of validity, and one that dominated academic thinking and assessment practices, was that proposed in 1949 by L. J. Cronbach in his book *Essentials of Psychological Testing* (New York, NY: Harper and Row). Since then, the evolution of the theory and methods of psychological and educational assessments has given rise to a new conceptualization and to its standardization among professionals in these fields. The third edition of *Educational Measurement* by R.L. Linn (1989) presented Samuel Messick's proposal that established the current thinking. Revisions of this proposal led to the meaning of validity as documented in the Standards for Psychological and Educational Measurement.

<sup>15</sup> As noted earlier, “norm-referenced” testing is often thought of as “grading against a curve.” “Criterion-referenced testing” refers to an individual's ability to answer questions posed correctly, e.g., as on a driver's license exam, regardless of how well or how poorly other people being tested perform.

<sup>16</sup> As noted earlier, the standards developed by C-CETT are currently implemented throughout primary schools of the English-speaking Caribbean.

- **Types of questions that demonstrate the abilities mastered.** Discussion of these questions, and developing strong technical answers, were not initially part of the CETT evaluation efforts. As CETT progressed, however, there were efforts to experiment with different types of measures. For example, CETT CA-RD developed items that attempted to measure pre-reading skills, and tested open-ended items to attempt to measure writing/composition skills. There was not enough time to validate these measures given that this came later in the process. In the case of the open-ended questions, a viable analysis plan was never developed and the data were never used.
- **Students' chance of demonstrating what they know is not affected by factors beyond their control.** This aspect of validation showed the most substantial improvement in CETT CA-RD. Using Item Response Theory (IRT) scaling methods, pilot data were used to identify items that showed substantial item-by-country interactions that suggested significant if unintentional bias. Such items were eliminated, resulting in a more widely valid set of measures.

Toward the conclusion of CETT, efforts to use validation activities to improve the assessments were increasingly included as part of the evaluation process, especially by CETT CA-RD.

## Innovative Techniques in Test Analysis

### *The Importance of Scaling and Equating*

In CETT, the assessment designs were based on comparisons over time, especially the growth achieved from one grade to the next and from the beginning of one school year to its end. In some participating countries, the same test was used repeatedly, which made interpretations of results more difficult: improvement could have been due to students' recollection of material they had already seen, and teachers might have used testing materials as part of instruction. A solution to these problems could be to use "parallel" but not identical tests in repeated measurements, as described above. Another solution is to use randomly stratified parallel forms over time, with a different form or set of forms used at each time point. The scores from different times will be comparable, both at the level of individuals and, with much greater accuracy, for classes, schools, and programs. In order to accomplish this more effectively, the following should be considered: (a) A large pool of items is needed to be randomized into the various forms within one time point, and within and across grades; and (b) It must be recognized that the scores from different test forms are not exactly equivalent, but rather differ statistically because of item sampling; and further that the samples are quite small (maybe as few as 20 questions per form).

A more efficient measurement solution is to use Item Response Theory (IRT) programming.<sup>17</sup> When IRT analysis is successfully applied, it provides a comprehensive measurement system for dealing with multiple test forms over time. In addition to having stratified random selections of items over the different forms, one includes blocks of items that are common to forms. For example, in the last CETT CA-RD test design for grades two and three, about 40 percent of the items were common to the different forms and 60 percent were unique to forms. As a consequence, the total item pool was

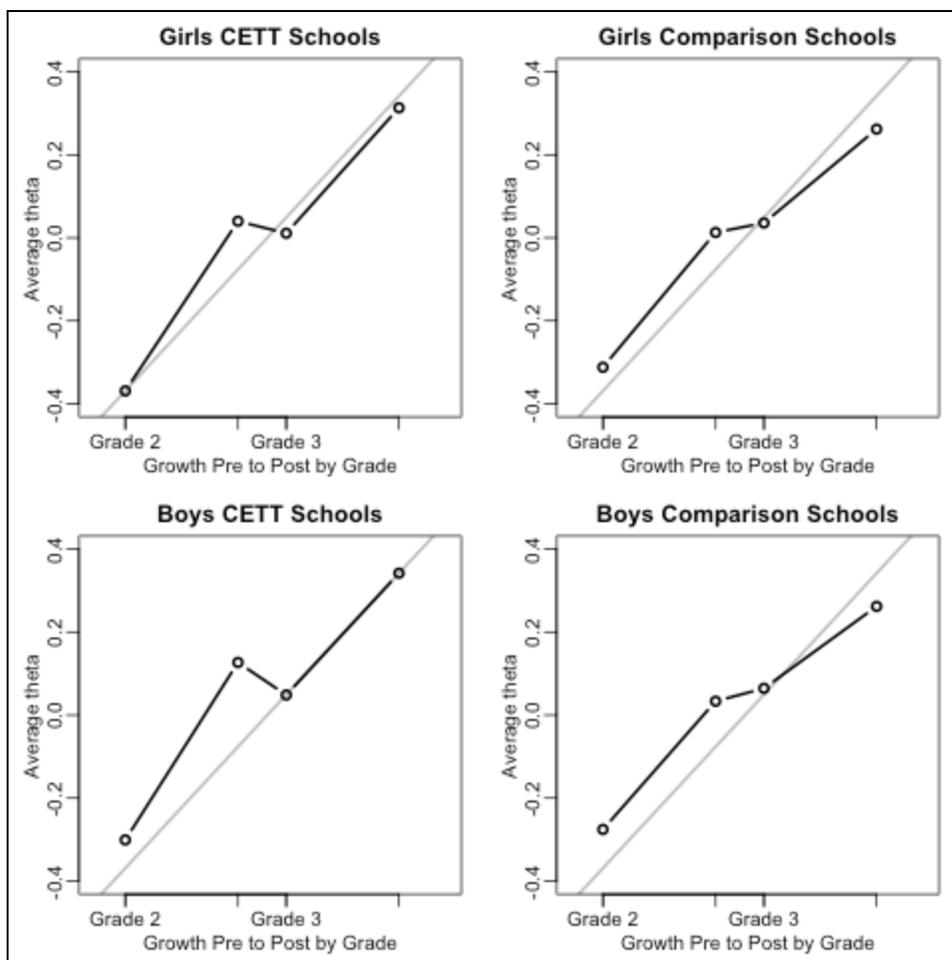
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<sup>17</sup> IRT is a *theory*, one that postulates a single latent trait or ability that differentiates students. Student responses to items are hypothesized to reflect their latent abilities according to particular functions that derive from item characteristics or *parameters* of difficulty and discrimination. Limitations to be noted: If items and patterns of test response do not follow the theory—e.g., if there are multiple factors or if there is a lot of random guessing—then the theory and its calculations can be invalid. Second, the computations for IRT analysis are not simple. They require specialized software and sometimes difficult and sensitive computing steps.

reduced somewhat; but the advantage was that all forms from grades two and three could be scored on a single scale. The common items were used for the IRT equating, and all items contributed information to individual, class, school, and program scores.

Display 3 is an example of the results from CETT CA-RD. The vertical scales are in the IRT metric and labeled “theta.” This represents the estimated latent ability or achievement in a way that is comparable across the two grades. The graphs plot the aggregated growth trajectories for students, divided by sex and program type. The grey diagonal simply marks the potential linear growth from the lowest to the highest mean. It is clear that for both boys and girls, the CETT schools started at a lower score and ended up higher than the comparison schools. Within each grade, the growth for CETT schools was greater. The graphs also showed that the CETT schools dropped in achievement results between the end of grade two and the beginning of grade three.

**Display 3. Longitudinal growth in overall reading from 2008-2009: CETT CA-RD**



### ***Providing Detailed Information about Achievement***

As we have suggested above, it is preferable to use a test design that provides enough items so that many parts of the content domain are represented in the measurement. An additional and important goal is to provide *differentiated* information about sub-constructs within the total content domain and the degrees to which these sub-constructs are learned by different students, in different classrooms. At

the program and group (school, class) level, this is in theory possible, at least for those sub-constructs that have sufficient numbers of items overall represented in the test, especially since it is possible to pool information over all forms. Around 15-20 items are needed to adequately measure a construct, and that is true for each construct examined here.

At the level of individual students, the situation is very different, since with a total of about 20-25 items per student, no sub-construct is going to have a sufficient number of items to justify a sub-score at the individual level. This is not just a matter of the unreliability of estimating an individual's sub-score, but more importantly, the sub-scores would not be consistent between individuals with different forms.

In the case of CETT, not very much attention was given in the CETT analyses to sub-score results. This was likely due to the complexities in the measurement and the analysis methodology, which would have required additional time and technical capacity building, rather than a lack of interest on the part of the CETT implementers.

## Recommendations

Based on the CETT experience, this section puts forth four overall recommendations for designing program evaluation and student testing efforts in future educational programs. The recommendations are intended to advance discussion regarding directions, strategies, and research practices in similar initiatives wishing to measure program impact using student performance tests. It is recognized that accomplishing all of these goals may be a challenge depending on the country context. These recommendations are included as best practices from a research standpoint, and should be taken into account as much as local conditions allow.

***Recommendation 1: Design evaluation components, such as student testing, in advance of program implementation.***

The major conclusion of this paper is that the evaluation design of programs such as CETT ideally should be in place prior to implementation startup. It is recommended that the design include: 1) a complete specification of the evaluation questions under study; 2) identification and justification of methodological strategies for answering these questions; 3) a data collection plan that anticipates and addresses problems that may be encountered; 4) an analysis plan that will ensure that questions are answered appropriately; and 5) a description of the anticipated reports.

The overall design of a testing initiative should be planned in advance for a realistic sense of the size of the intervention (treatment) effects that are likely to be obtained, recognizing that most treatments provide modest but important improvements. Therefore, sample sizes should be carefully considered, especially numbers of teachers and schools, so that the samples will provide sufficient statistical power for demonstrating effects of those magnitudes. Additionally, sufficient time for teachers and schools to learn and adjust to new methods and for students to gain knowledge and skills should be allowed. This usually involves more than one school year. The design should also take full advantage of all sources of variation. For example, if more than one country will serve as an implementation site for the initiative, cross-national comparisons should be made.

To accomplish this under the challenging logistical and organizational realities likely to be encountered in developing countries requires significant coordination and common purpose, especially in multinational contexts as was the case with each CETT. Program implementers should be prepared to negotiate these steps as a high priority among primary stakeholders as they move forward, recognizing that the ability to demonstrate overall program results based on solid evidence will ultimately be viewed as a major product of the program.

***Recommendation 2: Design a scientifically sound plan for how and where the intervention and its comparison are to be implemented, taking into account from the beginning the requirements to ascertain potential program impact.***

One option is to begin to consider educational initiatives as experiments and efforts to test causal hypotheses. In this scenario, impact evaluation strategies are considered along with development of the intervention. The first step would be to identify the population for which results are intended to be generalizable, and then randomly assign intervention and control units. These samples should be appropriately stratified to increase generalizability of results. Ideally, the implementation will also involve replication over time.

It is recommended that all elements of the intervention be evaluated; therefore, different mixes of elements should be tested in different randomly designated intervention sites in sufficient numbers.

Only in this way will a testing team be in a position to determine the relative value of, for example, teacher training and student assessment versus new student textbooks. Each of these elements represents the use of important resources. Overall, evaluation and monitoring systems should be able to determine their relative contributions to desired outcomes, with an eye to optimizing investments in the future.

**Recommendation 3: Specify the design of the measurement of achievement in the evaluation plans. Include the specification of the procedures that will be followed to ensure that such testing measures are valid and reliable and can be used comparably across time and conditions.**

This aspect of evaluation designs should include specification of the procedures that will be followed to include comprehensive coverage of the content domains that are relevant to the instructional goals of the project or program. They should include provisions for vertical alignment of measurements across grades when interventions are for multiple grades. They should also include the plans for the construction and validation of measurement scales that allow repeated measures.

**Recommendation 4: Go beyond investigating causal effects. Design ways of investigating and confirming the quality of the implementation of the project objectives, and assess their relative impact on outcomes.**

Evaluation designs should include laying out procedures for assuring that the content of materials and instructional training are measured in correspondence with program objectives. They should include measures of teacher learning and practices if the program focuses on helping teachers learn new ways to teach. They should also envision measures of opportunities to learn, such as instructional practices, and make provisions to link all of the "process" measures to the measures of student outcomes. These measures should be compared to the control or comparison sites, in order to evaluate program impact.