Teacher Learning of Technology-Enhanced Formative Assessment (TLT)

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I've been very pleased with [TEFA] as a way of diagnosing preconceptions or misconceptions. And I like it very much for that.

Project Description

Overview

TLT is a five-year project studying how secondary science teachers learn to use an electronic "classroom response system" (CRS) to implement continuous real-time formative assessment. For the project's professional development (PD) strand, we teach them a specific CRS-based pedagogical approach called *Technology-Enhanced Formative Assessment* (TEFA). For its research strand, we monitor their learning and study how they implement the techniques in their own practice.

Project goals

1. to better understand teacher learning of TEFA pedagogy;
2. to better understand effective and efficient methods of teacher PD, especially in TEFA; and
3. to develop tools and techniques for the evaluation of teachers' TEFA mastery, of suitable design and quality for use in a controlled, randomized, IERI-style "scaling study" of the effects of TEFA on student learning.

TEFA combines FA techniques with CRS technology.

Prior research demonstrates conclusively that formative assessment (FA) can be highly effective at improving student achievement. However, FA is difficult for many teachers to implement well. A CRS helps make FA more efficient and also helps make the classroom more student-centered and interactive.

Current status

The first year of PD for the first cadre and the baseline year for the second cadre of teachers ended in June 2007. The four-day kick-off workshop for cadre 2 was conducted in August 2007. Weekly PD meetings for the second cadre start September 12.

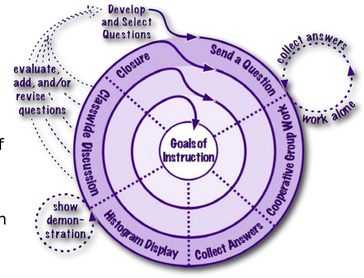
The TEFA Pedagogical Model

TEFA is designed around four pedagogical "pillars".

1. question-driven instruction (QDI),
2. dialogical discourse (DD),
3. formative assessment (FA), and
4. meta-level communication (MC).

TEFA structures classroom learning using a "question cycle".

1. present a question;
2. allow individual thinking or small-group work;
3. collect responses;
4. display a histogram of the responses;
5. elicit and discuss the reasoning behind each response;
6. continue discussing ideas, related situations, etc.; and
7. provide wrap-up or closure (summary, mini-lecture, segue to another question, etc.).



A "classroom response system" (CRS) facilitates interaction with students and supports the question cycle.

1. Students enter responses into radio-frequency "clickers";
2. a radio-frequency receiver communicates with clickers;
3. software aggregates the responses and presents a histogram of class-wide response choices; and
4. additional features support review, diagnosis, etc.

Professional Development

Overview

PD is sustained: a 3-year program for each cadre.

- PD begins with a 4-day implementation workshop in August,
- continues with weekly meetings during the first academic year,
- followed by monthly meetings during years 2 and 3.
- Collaborative action research enhances and sustains PD.

All teachers in each cadre are from the same school.

- All PD activities are on-site, soon after the school day ends.

PD taught by project PIs, using & modeling TEFA pedagogy

Participating Teachers

- Each cadre contains about 10 teachers, from
- both high & middle school, math & science (mostly HS science).
- There will be 3 cadres: 2 so far, one more starting next January.

Typical Weekly PD Lesson & Homework

Checking in

Teachers talk about how they are doing (with technology, with question design, with managing discussion, etc.), what they have been trying, and what is on their minds.

Sample question cycle

Instructors model how a typical PRS question/discussion/closure cycle might look, and introduce new question styles.

Theoretical underpinnings

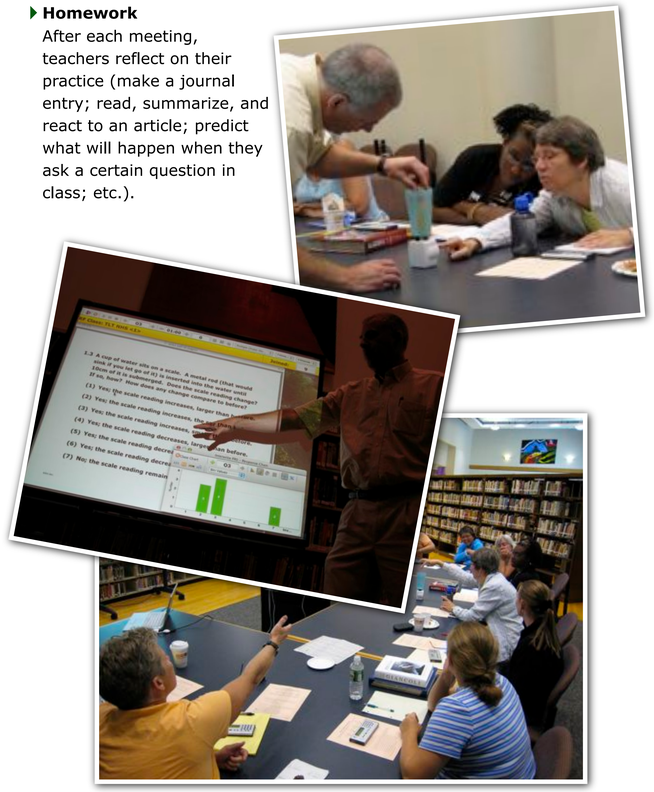
Instructors provide some structure and pedagogical theory to help teachers understand TEFA pedagogy and apply it consistently.

Working on new questions

Teachers collaborate in small groups to develop questions for their own use during the upcoming week, and to get feedback on them.

Homework

After each meeting, teachers reflect on their practice (make a journal entry; read, summarize, and react to an article; predict what will happen when they ask a certain question in class; etc.).



Research

Overview

TLT uses a longitudinal, delayed-intervention, mixed-methods research design to illuminate teacher learning.

- One semester of baseline data is collected for each teacher before PD begins, as a basis for comparison.
- Each cadre is followed for 3 post-baseline years (throughout PD).
- Qualitative (classroom video, interviews, free-response questionnaires) and quantitative (multiple-choice questionnaires, student surveys) data is collected.

Instrumentation Developed or Under Development

(in collaboration with SRI International, a project subcontractor)

TCOP: TEFA Classroom Observation Protocol

We are working on a live observation protocol aimed at capturing key indicators of TEFA skill and of primary pedagogical practices. Meanwhile, we visit and videotape complete TEFA-using classes for subsequent coding and analysis. Short pre- and post-observation interviews accompany each visit/observation.

TVBI: TEFA Video-Based Interview

In this semi-structured interview protocol, a teacher is shown select five-minute clips from different videotapes of their own teaching, and asked to reflect upon how and why their practice has evolved.

TIL: TEFA Implementation Log

This short, simple paper form documents one day's use (or not) of TEFA in each class and the teacher's perceptions of how it went.

TMRS: TEFA Monthly Reflection Survey

This web-based survey uses multiple-choice and free-response questions to probe teachers' TEFA use, their self-perceived skills and learning, and factors that have helped or hindered them.

TPPI: TEFA Pedagogical Perspectives Interview

This two-part semi-structured interview (one hour per part) probes a teacher's outlook and beliefs on pedagogy, general aspects of classroom practice, and classroom roles.

TPPS: TEFA Pedagogical Perspectives Survey

This web-based multiple-choice survey also probes aspects of teachers' views on pedagogy and classroom practice, but in a more scalable way. Large portions were drawn from published instruments, for validity and comparison with other studies.

TCFS: TEFA Contextual Factors Survey

This web-based survey of multiple-choice and free-response questions solicits a teacher's perceptions of aspects of their teaching context (technological, administrative, logistical, and social) that might help or hinder attempts to implement TEFA.

TLPI: TEFA Lesson Planning Interview (abandoned)

This one-hour, artifact-based, semi-structured interview probes a teacher's lesson planning practices, considerations, and priorities, aimed at surfacing instructional priorities and orientation.

TPBS: TEFA Professional Background Survey

This web-based survey captures a teacher's professional preparation and background, to support case studies.

TSS: TEFA Student Survey

This optically-scanned paper survey is for students in teachers' classes, eliciting their perceptions of the learning environment.

Data Collection

Data about teachers' pedagogical beliefs and views

TPPI (yearly), TPPS (yearly), TLPI (2x/year, discontinued)

Data about teachers' practice and TEFA implementation

TCOP (4x/year), TIL (daily), TSS (2x/year)

Data about teachers' reflections on their own learning

TMRS (monthly), TVBI (yearly)

Data about teachers' backgrounds and context

TCFS, (yearly), TPBS (once)

Preliminary Findings

When example content is used in PD, teachers tend to focus overly on superficial features.

Teachers seem to have surprising difficulty separating the intended pedagogic message from the context in which it is presented. Many become distressed if too many examples are given in a subject they care little about, or if they perceive the level to be too high for their students. The math teachers say there is too much science, and the science teachers say there is too much math. Few seem to understand that the questions modeled during PD are designed for them, not necessarily for their students.

Technology can be an impediment to FA practice.

CRS technology is intended to enhance practice of FA, but initially, using it presents a barrier. Further, teachers' initial facility with the hardware and software significantly impacts their learning curve for question development and implementation of the TEFA approach.

[I've been most focused on] getting the technology to work. Check TV, program, pass out clickers, check if everybody's unit is working then ask a question. Talking with kids is easy.

Teachers follow a predictable general trajectory of skills development and focus of attention.

Teachers concentrate on technology first, then progress to question design. Next, they work on managing whole-class discussion, and eventually on interpreting student responses. Integrating TEFA with other constraints and aspects of teaching is another area of focus that develops later in the "trajectory".

The toughest part for me is designing questions… I think the course is definitely addressing the issue…

Individual teachers choose widely different details of TEFA practice to focus on.

Two teachers became very attentive to the amount of time they waited after asking a question. One became interested in the nature of questions. Another invented new ways of managing the classroom discussion. Yet another wrestled with tension between structure and control vs. unstructured discussion.

There's always that moment of ta-da! And you look at it and you think 'Wow!'… And on the fly, mentally, you say 'well now how do I handle this?'

In student surveys, some teachers have improved and some have not, but overall ratings have stayed about the same.

Based on three rounds of student surveys of cadre 1, teachers vary widely in how they have changed during the first year of PD. Early results suggest that the classroom environment created by this cadre of teachers has not changed significantly yet — but they are not controlled for student population, subject, course level, etc.

Middle school teachers have lower expectations for students than high school teachers, hindering TEFA adoption.

The teachers in cadre 1 include middle and high school math and science teachers. In general, the middle school teachers had much lower expectations for their students' ability to participate in TEFA and engage in quality discussions.

Reflection leads to improvement.

The teachers who were most successful with the approach during the first year seem to be those who were most self-reflective. When TEFA wasn't working as well as they'd hoped, they focused on their own beliefs and actions, and on what they could do differently. Those who were less successful with TEFA tended to blame students' abilities and attitudes, parents' attitudes, etc.

[Participation in the PD] does make me more reflective… I do reflect more often [about] what I'm doing and how well it connects with the kids, without a doubt it does force me to look at myself more closely.

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