What is TEFA?

A high-level introduction to the pedagogical approach called "Technology-Enhanced Formative Assessment"

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Technology-Enhanced Formative Assessment (TEFA) is a pedagogical approach for using classroom response technology to conduct effective, interactive, student-centered instruction in classes with anywhere from a dozen to hundreds of students. It has been tested in multiple science disciplines, and to a lesser extent in mathematics and social sciences, at both university and secondary-school levels.[1]

TEFA honors four key values: *question-driven instruction*, *dialogical discourse*, *formative assessment*, and *meta-level communication*. Separately, each of these is of well-established value to science instruction.[2] Integrated into an interlocking whole as TEFA, they provide a powerful, flexible instructional approach.

Honoring *question-driven instruction* means having students wrestle with rich, meaty, meaningful questions and problems as a context for sense-making and a vehicle for learning, not just as assessments. Honoring *dialogical discourse* means involving students in extensive discussions in which multiple points of view and ways of thinking, including ones not anticipated by the teacher, are sought, explored, and compared; it also means helping students practice speaking the "social language" of the discipline being taught rather than focusing exclu-

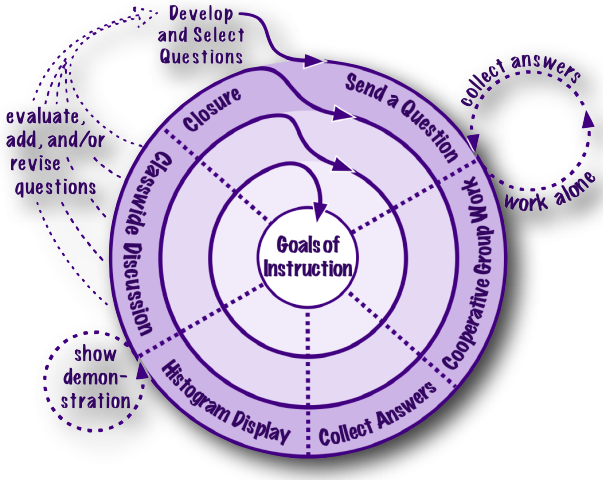
TEFA's Origins

From 1994-1997, the UMass Physics Education Research Group spearheaded a research project called *TTECCS: Transforming Technical Education with a Classroom Communication System* (funded by the U.S. National Science Foundation through grant DUE-9453881). In collaboration with Better Education Inc., we worked to refine, test, and develop curriculum and pedagogical methods for Classtalk, the first modern classroom response system.

As we discovered ways that Classtalk could be used to support sound science instruction consonant with educational research findings, the first outlines of TEFA emerged. This pedagogical approach matured through our subsequent teaching, mentoring other UMass instructors, and our work with high school phys-

sively on content. Honoring *formative assessment* means continually probing and modeling students' knowledge and thinking, adjusting instruction accordingly, and providing students with individualized, prescriptive feedback to guide their learning efforts. Honoring *meta-level communication* means explicitly and implicitly addressing and discussing instructional communication, thinking and learning, and the instructional narrative (along with course content) in order to help students re-frame their learning activities and participate more productively and consciously in the learning process.

TEFA implements question-driven instruction, dialogical discourse, and formative assessment by structuring large chunks of class time around an iterative *question cycle*, a pattern that can be altered and embellished as required. The basic cycle consists of posing a question to the class; allowing students a few minutes to ponder it alone or in small groups; collecting students' answers; presenting a summary of the answers; eliciting students' justifications for their choices; moderating a class discussion to develop, challenge, compare, contrast, and integrate the ideas raised; and providing appropriate wrap-up or closure. In a typical hour-long class, three or four related question cycles might be used to develop students' understanding of a set of related concepts.



A *classroom response system* (CRS) facilitates the TEFA question cycle. Although the fundamentals of TEFA can be practiced without technological aid, using a CRS makes a surprising difference to the quality of the results.[3]

TEFA's Origins (cont'd.)

ics teachers as part of *A2L: Assessing-to-Learn Physics* (NSF grant ESI-9730438).

We continue to formally articulate and flesh out TEFA as part of our current project, *Teacher Learning of Technology-Enhanced Formative Assessment* (TLT).

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