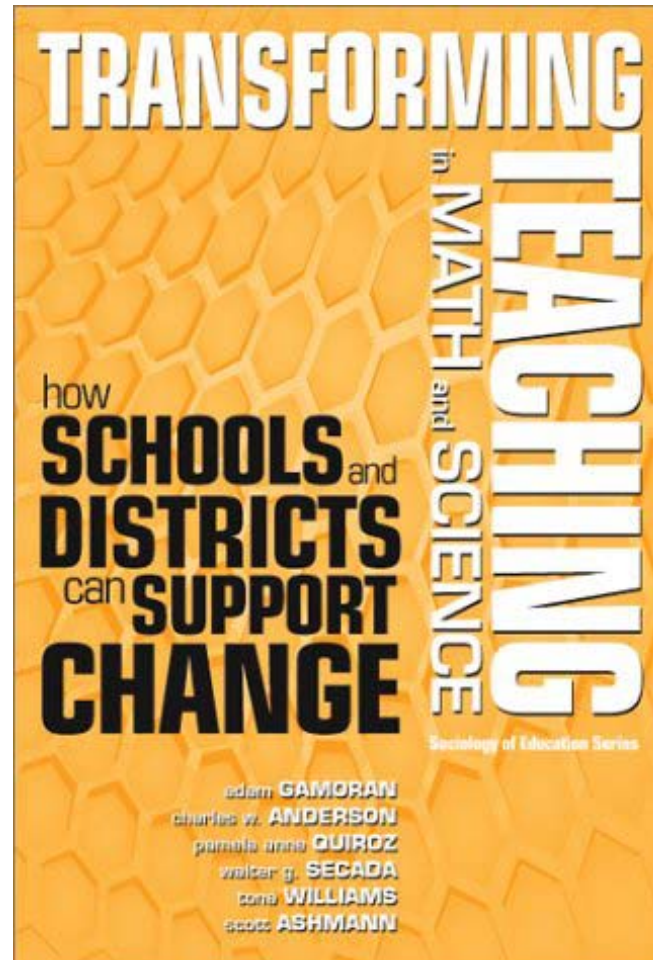


Organizational Conditions that  
Support Inquiry in  
High School Science Instruction

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Draws on our book





## the book is about....

- ✦ What happens when teachers *want* to improve their teaching, and have access to *outside resources* that help them improve, how schools and districts may provide support instead of barriers to change....



# this presentation is about....

- ⚡ How can schools support inquiry-based teaching, particularly in high school science laboratories?



# How Do Schools Support Teaching?

- ✦ Schools are set up to support teaching that follows predictable routines
- ✦ Based on National Academy reports on high school science, laboratory instruction is often routine



# The Problem

- “When done at all, laboratory work can tend more toward verification than problem-solving investigation.” –*Content Panel for Chemistry, p.356*
- “AP laboratory work exercises tend to be ‘cookbook’ rather than inquiry-based.” –*Content Panel for Biology, p.292*

# The Problem

- ✦ But: the Academy reports recommend a more inquiry-based approach to lab instruction
  - “Evidence indicates that traditional ‘cookbook’ methods of laboratory instruction, in which students follow narrowly defined procedures to verify well-known principles, have little effect on students’ conceptual understanding. On the other hand, substantial improvements in understanding are possible through rigorous, interactive laboratory experiences.” –*Content Panel for Physics, p.411*

# Teaching for Understanding

- These panels are recommending “discovery teaching” (Hammer’s term) or “teaching for understanding” (our term)
  - Teaching for understanding enables students to:
    - Construct relationships
    - Articulate ideas
    - Make knowledge their own
  - Teachers use student reasoning as a guide to instruction...
  - About powerful scientific ideas...
  - In equitable classroom communities.



# The Problem

- ✿ School systems are *not* well organized to support teaching for understanding



# The Organizational Challenge of Teaching for Understanding

- ✿ Routine teaching requires...
  - A predictable flow of material resources
  - Preservice training
  - Inservice education to stay abreast of new techniques and accountability demands

- ✿ Teaching for understanding requires...
  - Not only material resources
  - *New human resources: knowledge of content, accountability, and student thinking*
  - Social resources: a forum to work out uncertainties

# David Hammer's Teaching as a Case Study

- ✦ Hammer intends to teach for understanding
- ✦ Barriers:
  - Lack of time
    - Instruction limited to 42-minute blocks 4/5 days
  - Isolation
    - The dark side of autonomy
    - Hammer had the freedom to follow his own approach – but he did so alone

# David Hammer's Teaching as a Case Study

## ✦ Problems of isolation

- **Uncertainty**: Hammer's teaching is *not predictable*
  - Teaching is inherently uncertain
  - Typically teachers avoid uncertainty by following routines
  - Teaching for understanding requires teachers to confront uncertainty
    - Need to follow student thinking
    - No support was evident in Hammer's environment
- Lack of coherence
- Lack of legitimacy

# David Hammer's Teaching as a Case Study

- ✿ Note that Hammer is an unusual teacher!
  - High level of content knowledge and pedagogic content knowledge
  - We cannot expect all teachers to have Hammer's level of expertise
  - Material resources seem to pose no barriers
- ✿ Most teachers would be far less well equipped to respond to the challenges Hammer faced



# Supporting Teaching for Understanding

- What sort of school organization would support the sort of teaching in which Hammer was engaged?



# Supporting Teaching for Understanding

- ✱ Access to material, human, and social resources
- ✱ Resource flows that are *responsive* to teacher initiatives
- ✱ Professional development as the engine of change

# Leadership for Change

## Bureaucratic management

- Resolve uncertainty in teaching through standard routines
- Control teaching through resource allocation

## Organic management

- Respond to uncertainty in teaching through social ties with colleagues
- Provide resources in response to teachers' efforts and initiatives, instead of using resources as constraints

# Leadership for Change

- ✦ Leaders who support teaching for understanding..
  - not only allocate resources, but foster new ways of generating resources
  - procure and distribute not only material resources, but also human and social resources
  - support **distributed leadership**
    - Leadership based on expertise and commitment, not just position



# Sustaining Change

- ✦ A professional community cannot guarantee its own sustainability
- ✦ Need for a continuing flow of organizational resources



# Conditions for Sustainability

- ✿ Integration
- ✿ Linkage
- ✿ Organizational integrity
- ✿ Synergy

(adapted from M. Woolcock in *Theory and Society* 1997)

# The potential for sustainability

## ✦ Oberon High School

- Wisconsin suburb, homogeneous, high test scores
- Integration: A long-established professional community
- Weak linkages with school and district officials
  - Reform confounded by bureaucratic leadership
- Effective organization
- High level of synergy
  - Department-wide vision of science teaching
  - Aligned with state and district standards

# Findings on Sustainability

- ✿ Sustainability depends on interdependence
  - Linkage in addition to integration
  - Synergy in addition to organizational integrity
- ✿ Sustaining reforms is a task for professional communities, not just for individual professionals

# Conclusions

- ✦ Using high school science laboratories for discovery teaching will heighten uncertainties for teachers
- ✦ A strong professional community can help teachers manage uncertainties
- ✦ Ongoing, school-based professional development can contribute to technical knowledge and enhance community