VALIDATION OF A MULTI-PHASE SCALE UP DESIGN FOR A KNOWLEDGE-BASED INTERVENTION IN SCIENCE AND READING COMPREHENSION

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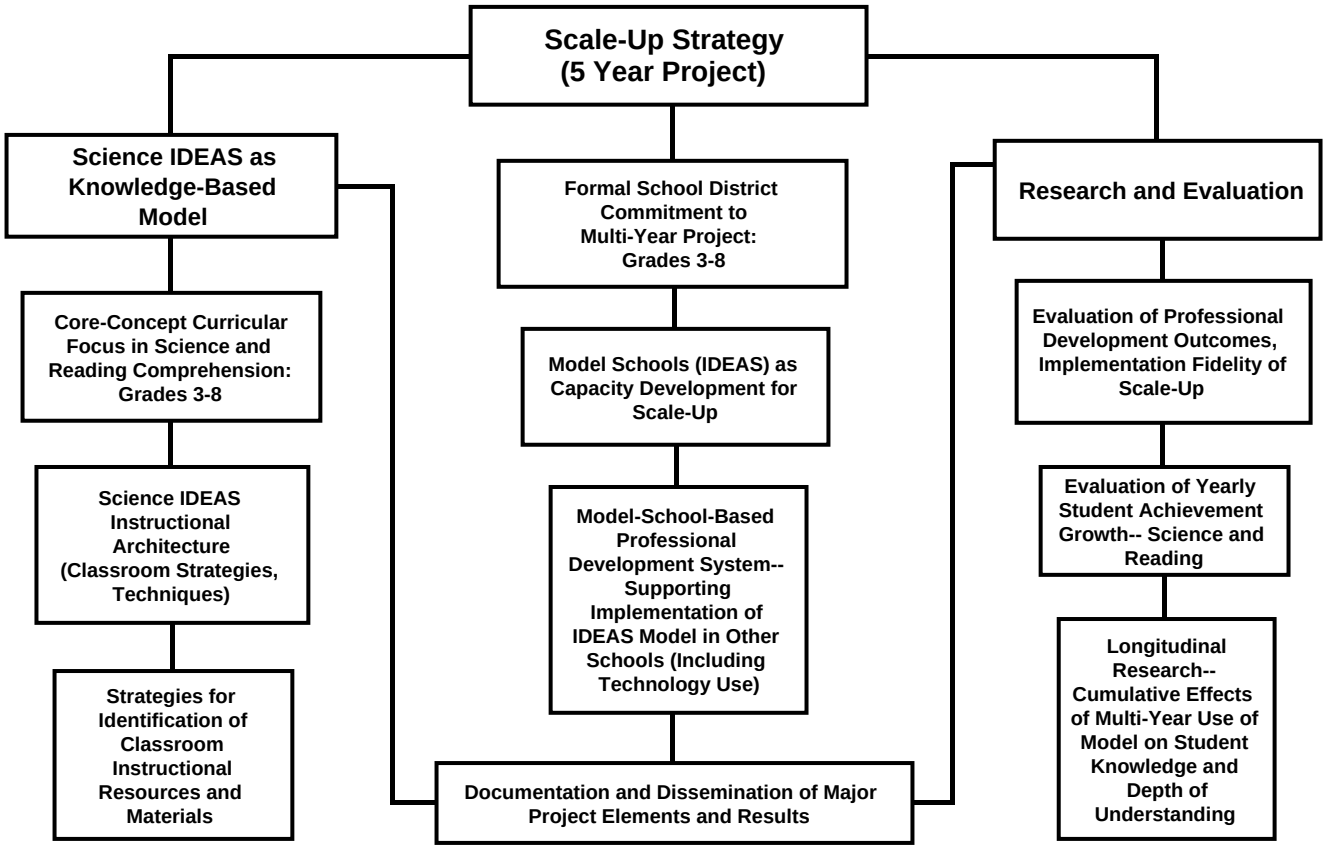
IERI Reverse Site Visit Presentation
Project REC 0228353
May 25, 2004

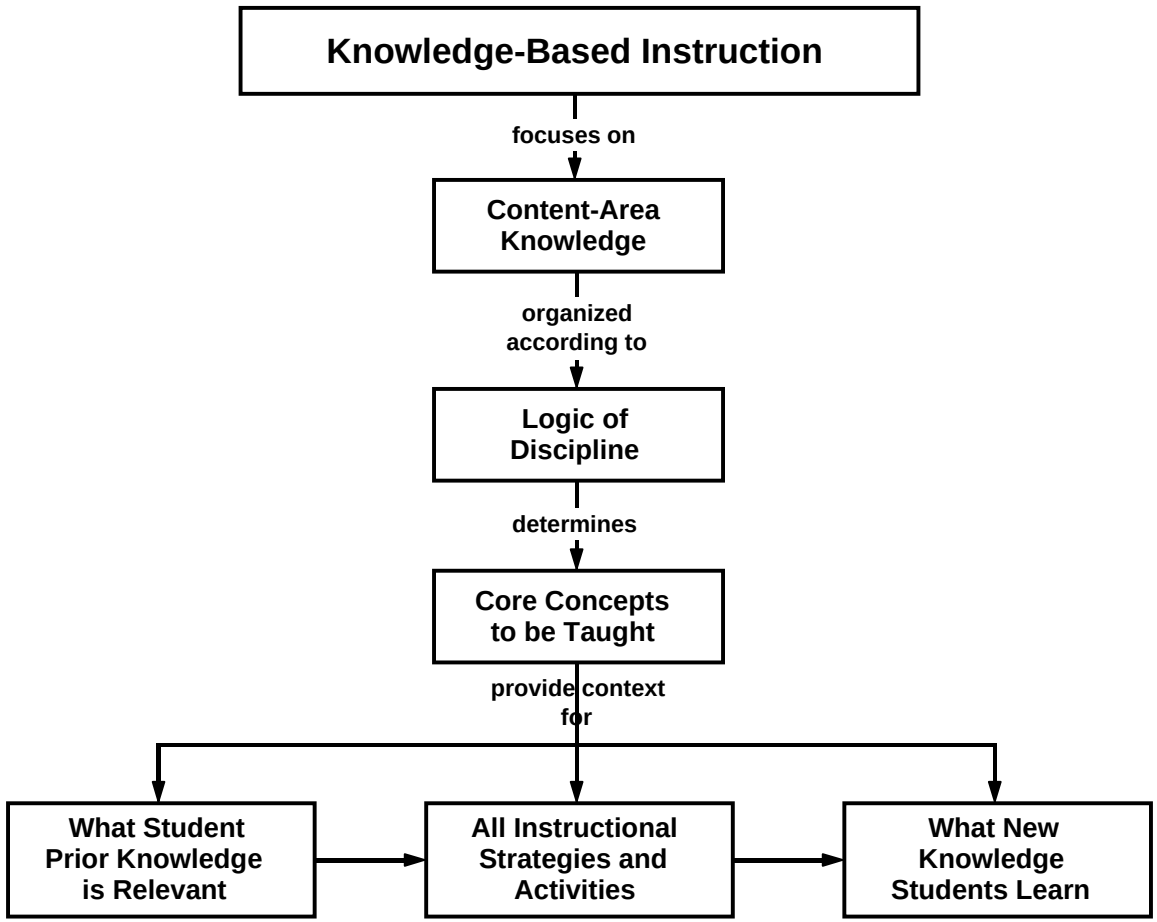
Presentation Overview…

- Project Overview (15 min.)
  - Science IDEAS Intervention
  - Multi-Phase Scale-Up Design
- Responses to General Questions (45 min.)
- Responses to Project-Specific Questions (15 min.)
- Open Q and A (40 min.)
- Wrap/Up/Next Steps (10 min.)

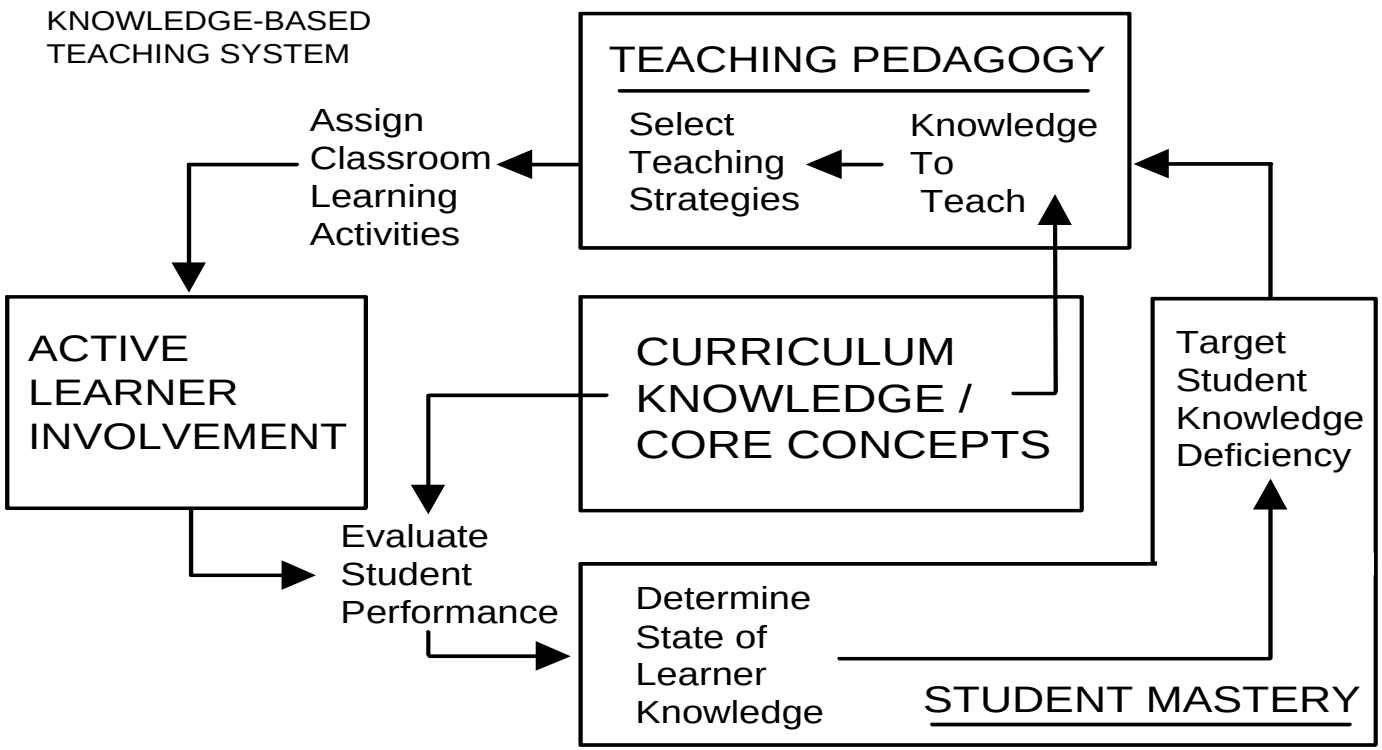
Project Overview (15 Min.)



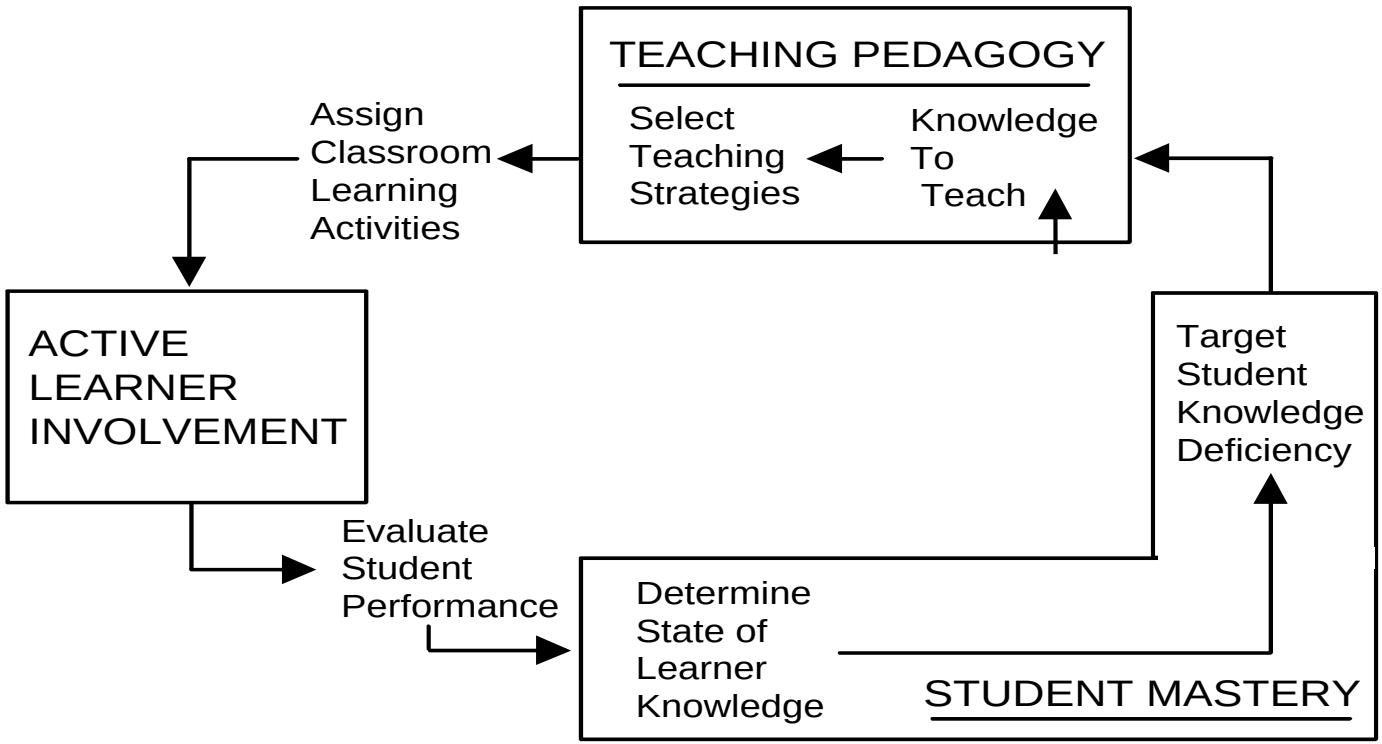
Knowledge-Based Instruction



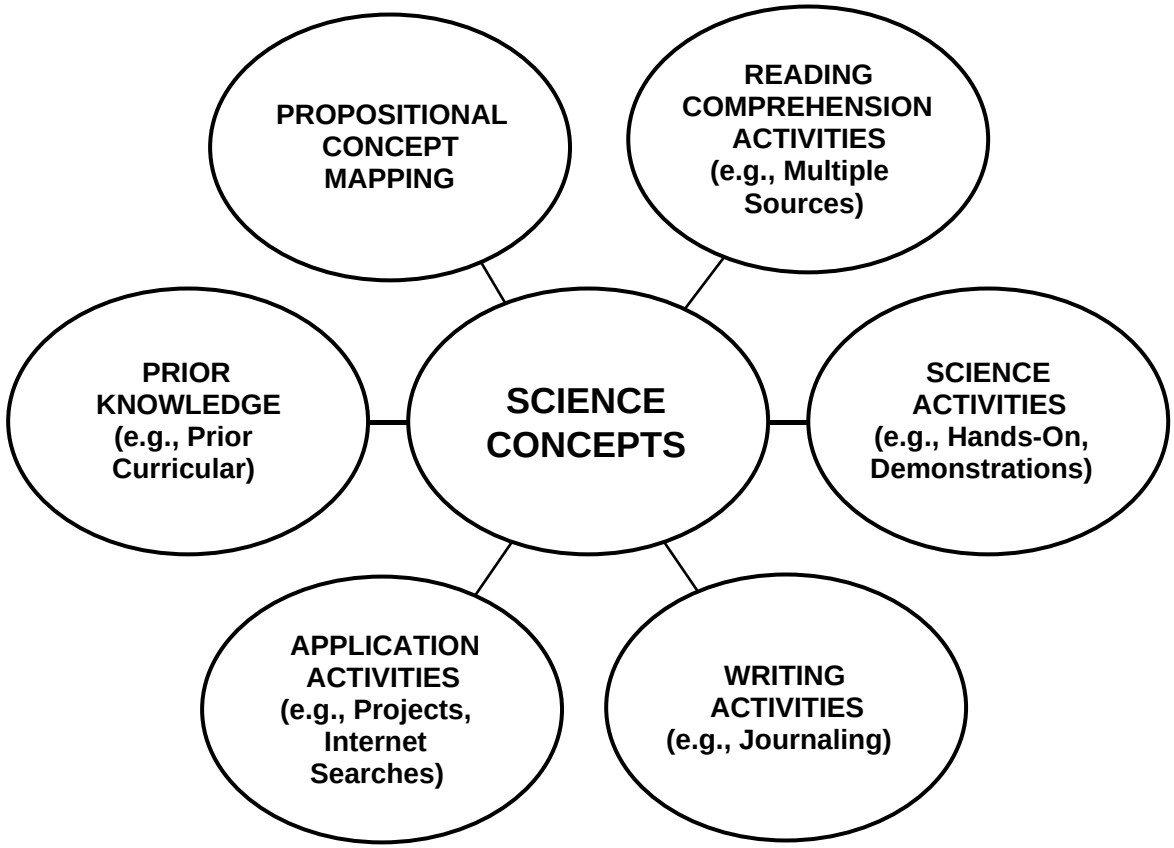
ITS Architecture as Knowledge-Based Instruction



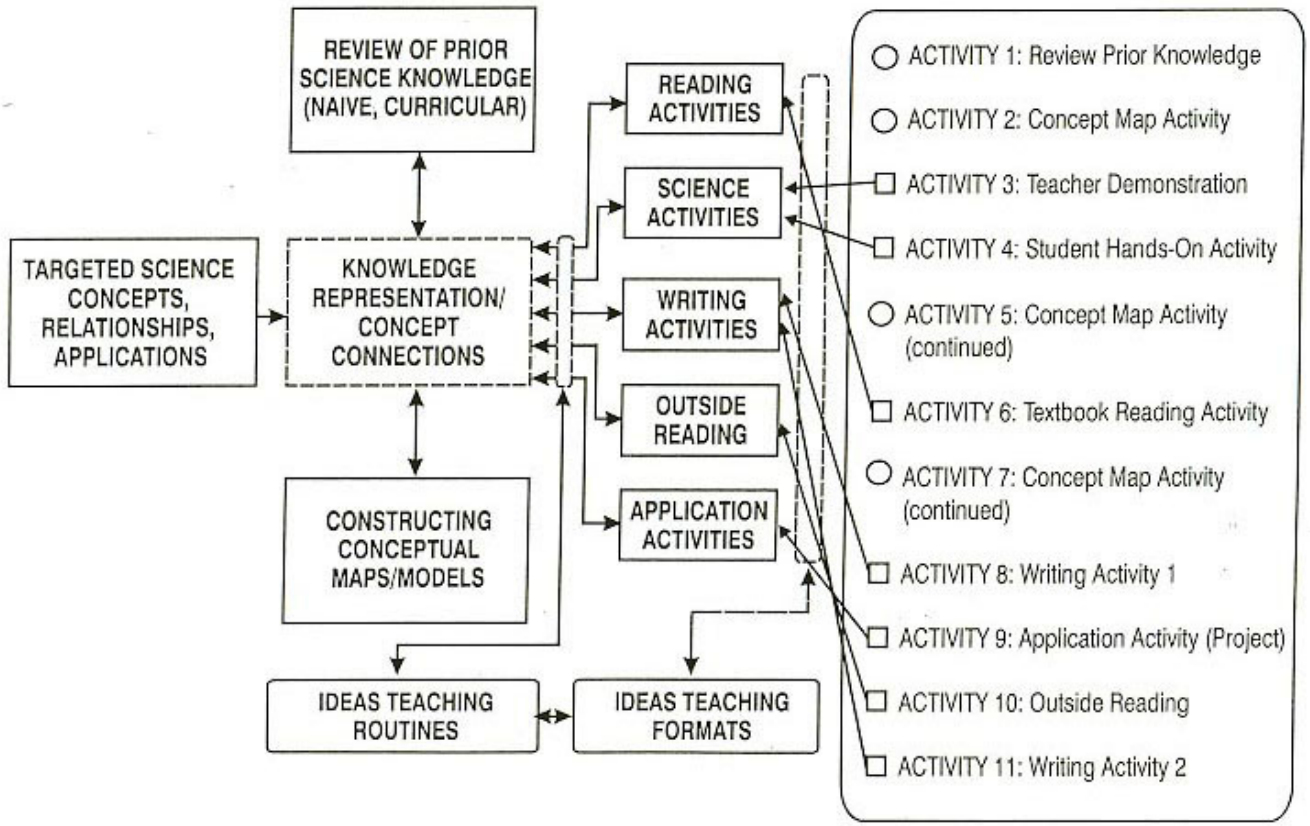
ITS Architecture Without Knowledge Component



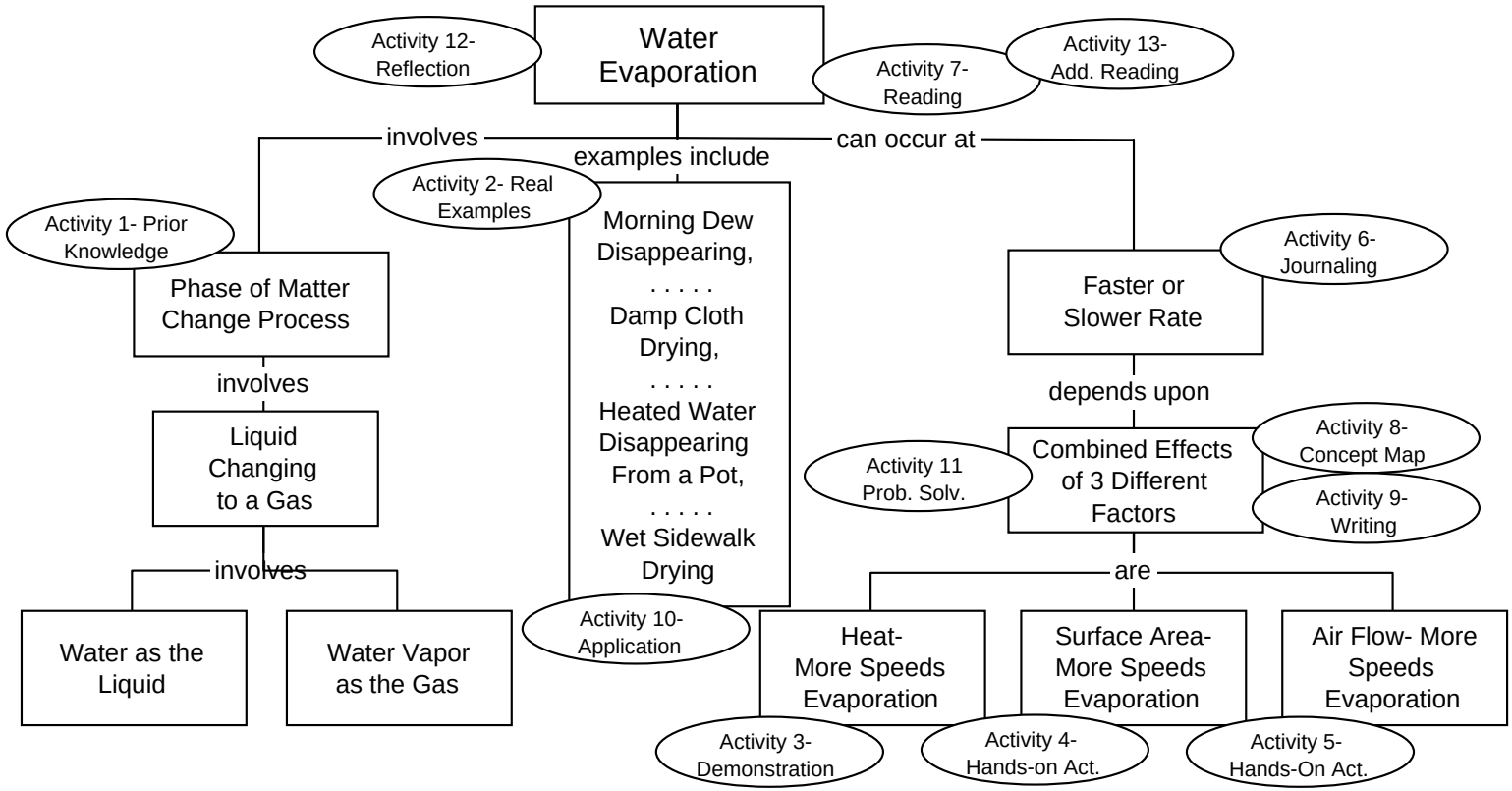
Science IDEAS as a Knowledge-Based Model



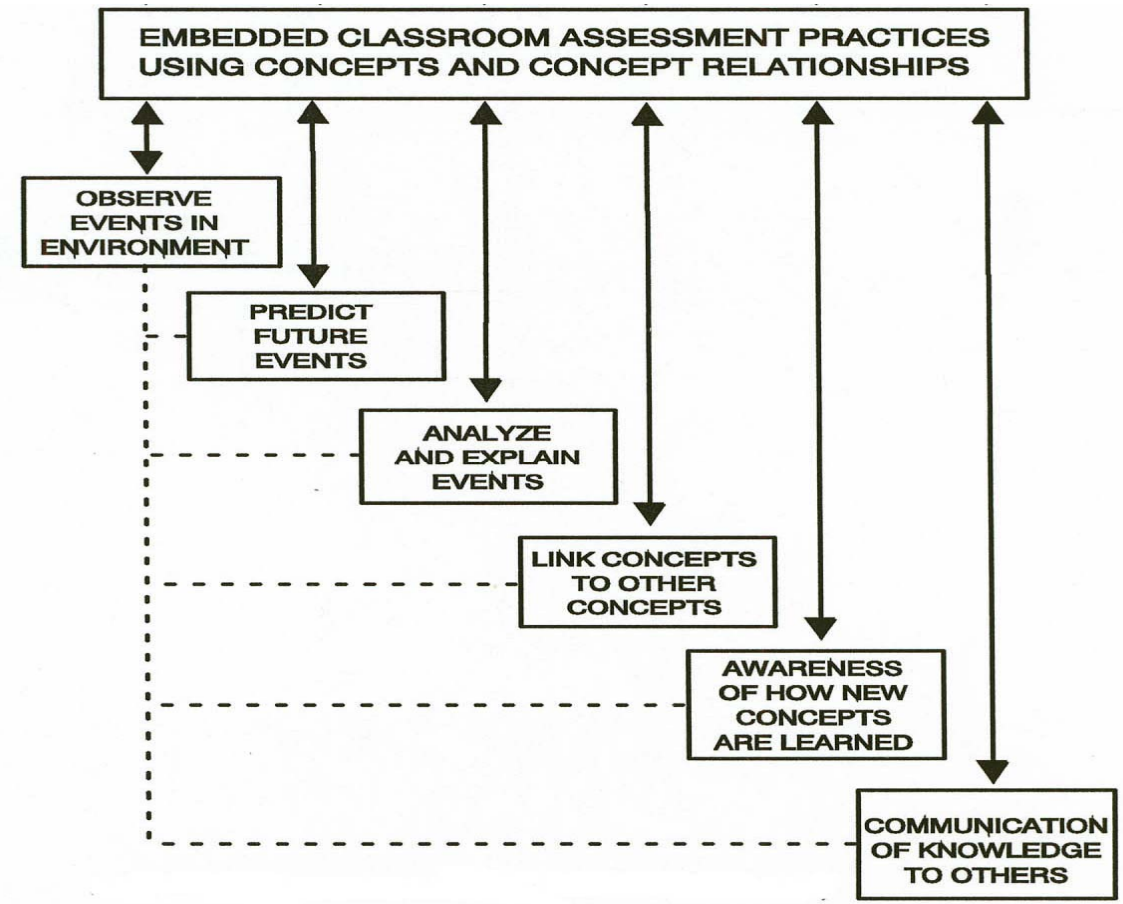
Science IDEAS Architecture



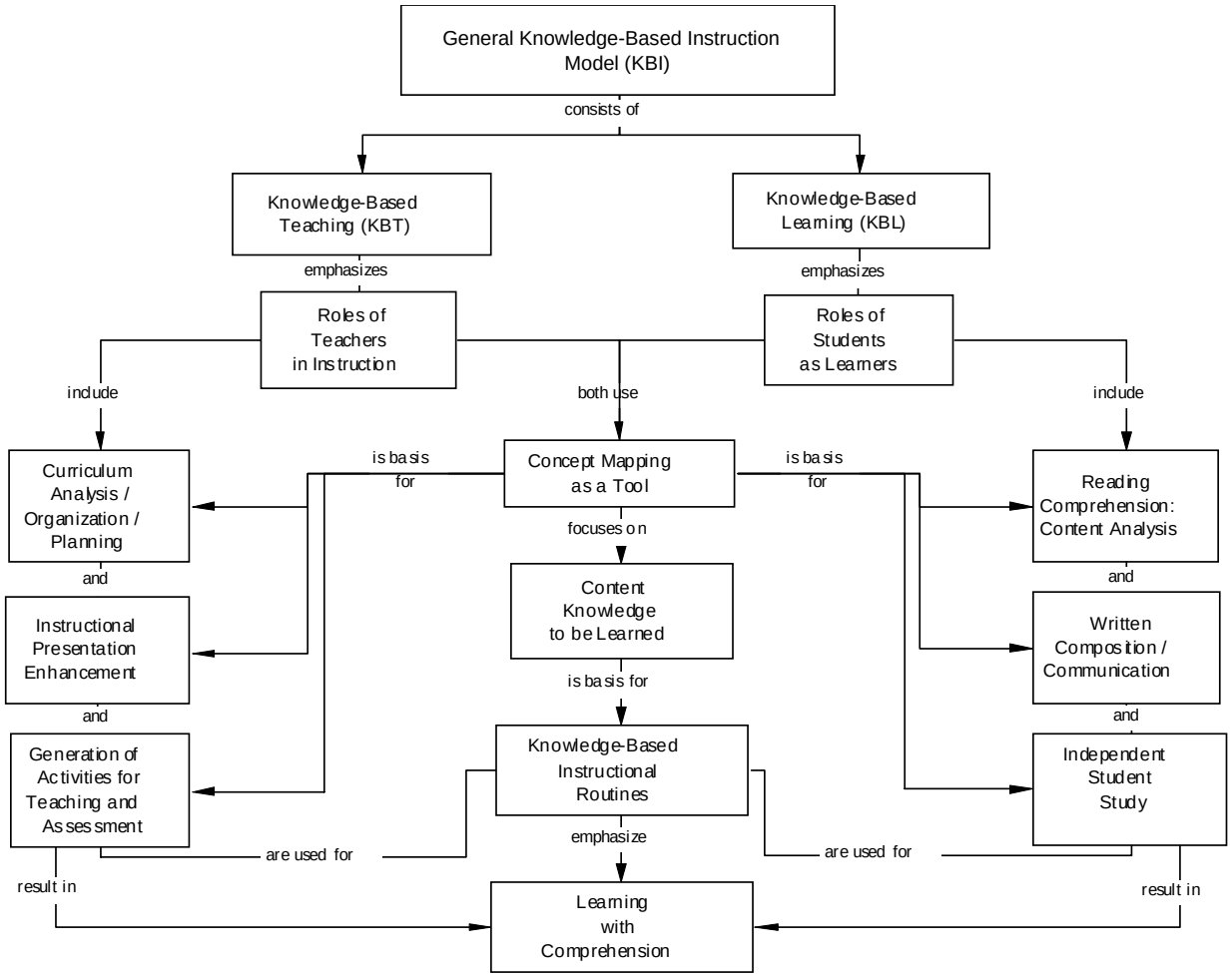
Science IDEAS as Knowledge-Based Instruction: An Illustration…



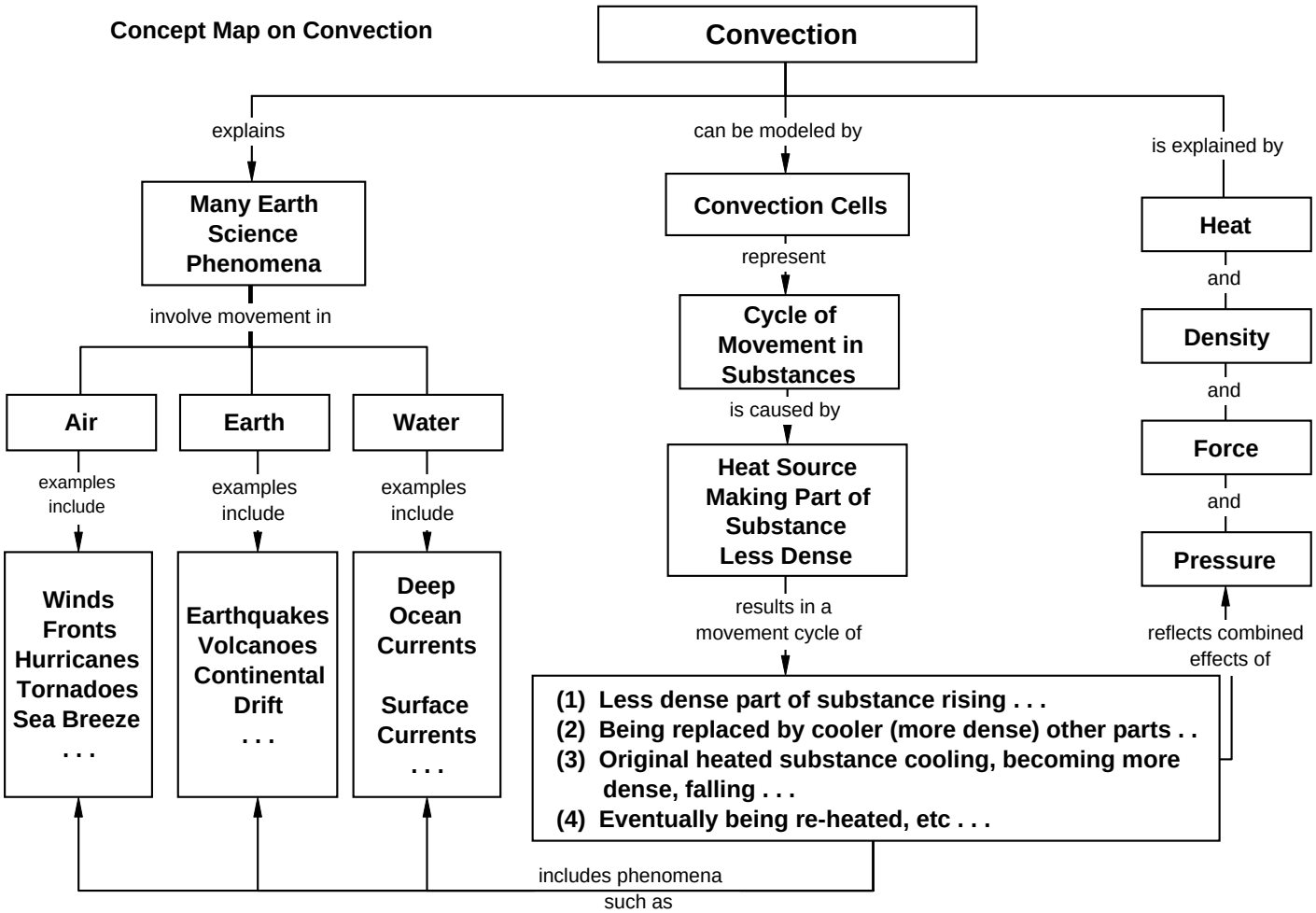
Science IDEAS: Categories of Knowledge-Based Performance Outcomes



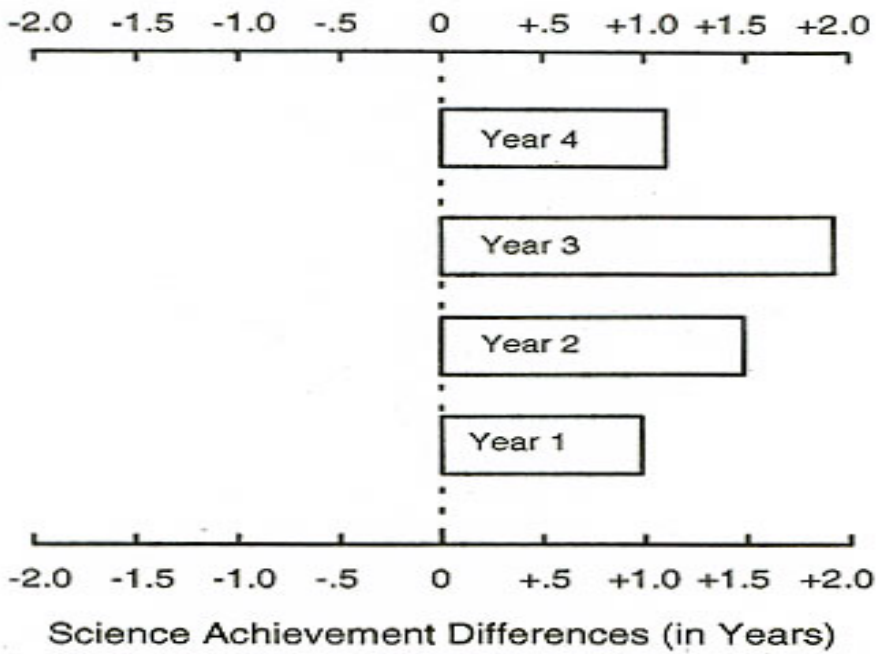
Generalizing the Knowledge-Based Instructional Framework for Science IDEAS



How Propositional Concept Maps Represent Big Ideas for Teachers and Students

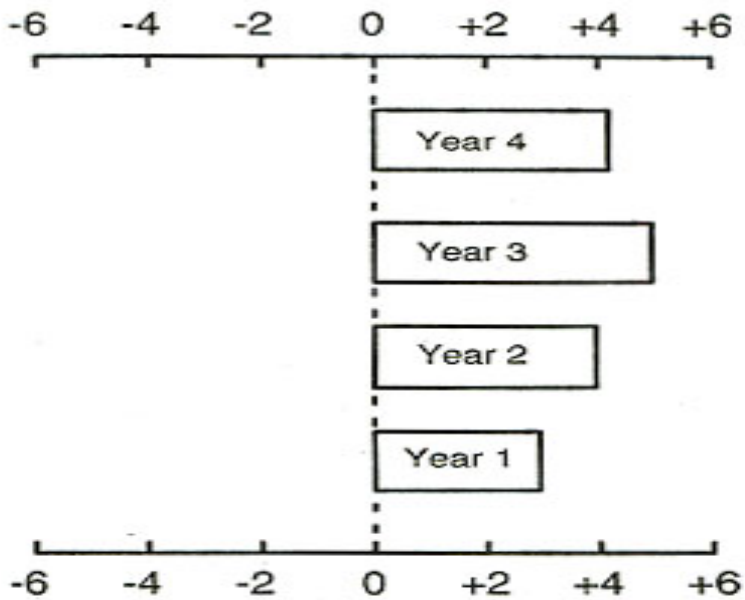


Science IDEAS: Research-Based Evidence



Note-- Year 1 students = grade 4; average/above average
Year 2 students = grade 4; average/above average
Year 3 students = grades 4,5; at-risk
Year 4 students = grades 4,5; average/above average/at-risk

Science IDEAS: Research-Based Evidence



Note-- Year 1 students = grade 4; average/above average
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Year 4 students = grades 4,5; average/above average/at-risk

Science IDEAS: Phases of Implementation for Grades 3-5

Phase 1 (Year 1) Initial Implementation

1.A Teaching science concepts *2 hrs./day with variety of activities* (e.g., reading, hands-on, journaling, concept mapping, writing) via multi-day lessons

1.B Emphasis on *learning more about what is being learned*

1.C Cumulative classroom displays of student work

Phase 2 (Year 1) Adding Science IDEAS Teaching Routines

2.A Prior Knowledge Routine

2.B Reading Comprehension Routine

2.C Propositional Concept Mapping Routine

2.D. Writing From Concept Maps Routine

2.E Combining Reading Comprehension with Concept Mapping

Science IDEAS: Phases of Implementation for Grades 3-5 [Continued…]

Phase 3 (Year 2) Expanding Lesson Scope

- 3.A Consistently *referencing all specific concepts taught to superordinate (core) concepts*
- 3.B Displaying and *referencing core concept maps* as learning and memory organization guides

Phase 4 (Year 3) Adding KBI Advanced Teaching Routines

- 4.A Assessment Routine
- 4.B Concept Teaching Routine
- 4.C Student Motivation Routine

Phase 5 (Year 3) Focusing Instruction on Core Science Concepts

- 5.A Develop *core concept maps as curriculum guides*
- 5.B *Integrate all Phase 1 2 3 4 components* within core concept map frameworks

Science IDEAS: Phases of Implementation for Grades 6-8

Phase 1 (Year 1) Initial Implementation

1.A *Teaching science concepts*- science course setting emphasizing understanding concepts in earth, physical, life sciences mapping, demonstrations, hands-on activities

1.B Emphasis on *learning more about what is being learned* (via additional reading materials, Internet sources, projects)

1.C Consistently *referencing all specific concepts taught to superordinate concepts*, emphasizing concept relationships, linkage of concepts to observations

1.D. *Display and reference propositional concept maps* for students as learning and memory organization guides

1.E Cumulative *classroom displays* of student work

Science IDEAS: Phases of Implementation for Grades 6-8 [Continued…]

Phase 2 (Year 1) Adding Science IDEAS/KBI Teaching Routines

- 2.A Prior Knowledge Routine
- 2.B Reading Comprehension Routine
- 2.C Propositional Concept Mapping Routine
- 2.D Combined Reading Comprehension with Concept Mapping Routine
- 2.E Writing From Concept Maps Routine
- 2.F Student Use of Concept Maps for Study and Review

Phase 3 (Year 2) Adding Advanced KBI Teaching Routines

- 3.A Assessment Routine
- 3.B Concept Teaching Routine
- 3.C Student Motivation Routine

Science IDEAS: Phases of Implementation for Grades 6-8 [Continued…]

Phase 4 (Year 3) Adding Advanced Teaching Routines

5.A Develop *core concept maps as curriculum guides*

5.B *Integrate all Phase 1 2 3 components* within core concept map frameworks

Elements of Project
Multi-Phase Scale Up Design

- Intervention Phase
  - Focus at classroom level
  - Initially supported by project staff
- Implementation Phase
  - Collaborative involvement of district personnel
  - Capacity development of district personnel
- Transfer of Responsibility Phase

Dynamics of Project
Multi-Phase Scale Up Design

- Evolution of Different Project Components through Different Phases (Int., Imp., Transfer)
- Multi-Faceted Criteria for Scale Up Success as Project Evolves through Phases
  - Maintenance of Strong Fidelity
  - Maintenance of Performance Outcomes
  - Documentation of Scale Up Process in Form that Facilitates Other Applications and Research

Responses to General Project Questions (45 Min.)

General Project Questions

Project Definition of Scaling…

- Functional Success Criteria for Scaling
  - Implementation Fidelity
  - Performance Outcomes
- Three Perspectives on Scaling
  - *Perspective 1*: Multi-faceted Implementation Process
  - *Perspective 2*: Transformational (Multi-Phase) Process Emphasizing Capacity Development)
  - *Perspective 3*: Using scaling *Perspectives 1 and 2* as framework for scaling applications and research

General Project Questions

Project Definition of Scaling…

Perspective 1: Scaling success considered as a multifaceted process that requires:

- *Condition 1*: An internal capacity/infrastructure for sustainability
- *Condition 2*: Given *Condition 1*- An internal capacity/infrastructure for expansion to new sites (scale up)
- *Condition 3*: Given *Conditions 1 and 2*- An internal infrastructure for systemic administrative dynamics that provide the impetus for sustainability and scale up

General Project Questions

Project Definition of Scaling…

Perspective 2: Scaling as a transformational process accomplished through a multi-phase scale up design

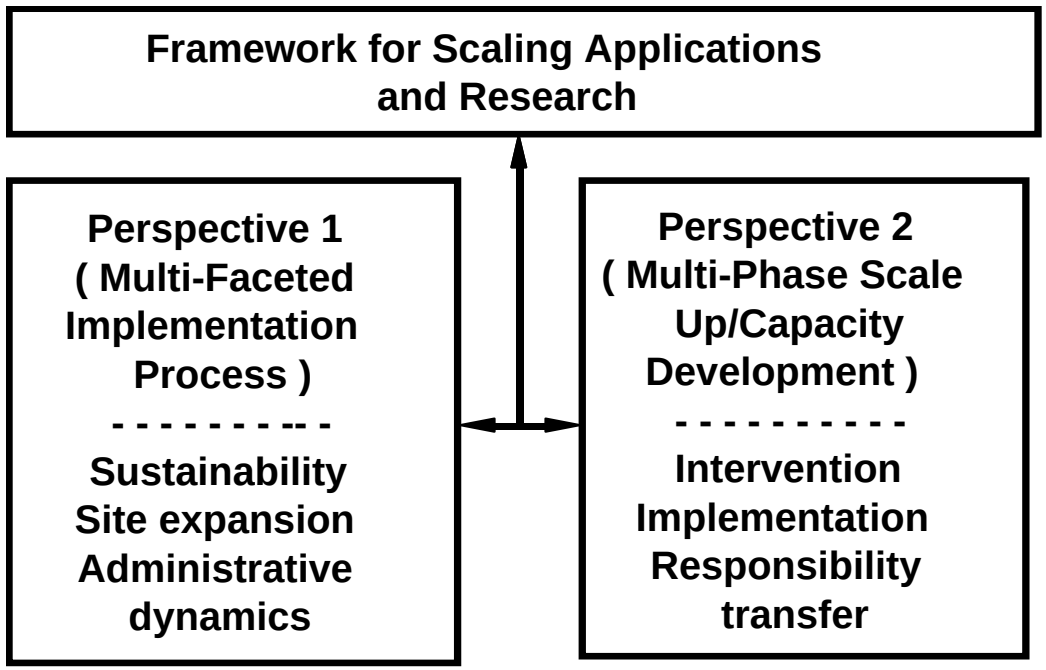
(re: Sustainability, Site expansion, Administrative dynamics)

- *Intervention Phase*: Project-supported classroom intervention
- *Implementation Phase:* Collaborative development of capacity of district (personnel/ infrastructure)
- *Transfer of Responsibility Phase*: Elements of implementation assumed by district

General Project Questions

Project Definition of Scaling…

Perspective 3: Using scaling *Perspectives 1 and 2* as framework for scaling applications and research



General Project Questions

Evidence That Project is Conducting Scaling…

Elementary Schools (Grades 3-5)

Initial Scale Up Schools (2 in Palm Beach, 2 in Broward)

- *Intervention evidence*: (a) prof. development/school support, (b) implementation fidelity, (c) student performance outcomes
- *Collaborative involvement with principals*: (a) involvement in fidelity process, (b) grade level curriculum planning, (c) instructional planning (e.g., scheduling, pull-outs, resources)
- *Capacity development of lead teachers*: (a) model classrooms, (b) in school mentor support, (c) prof. development for teachers in new schools

General Project Questions

Evidence That Project is Conducting Scaling…

<u>Elementary Schools (Grades 3-5)</u> [Continued…]

Initial Scale Up Schools (2 in Palm Beach, 2 in Broward)

- *Sharing Success Seminars*: (a) teacher sharing, (b) networking
- *Ongoing communication with district administrators*: (a) instructional characteristics, (b) benefits to students, (c) implications for future
- *Identification of project enhancements*: (a) modification of fidelity process, (b) more implementation structure for principals, (c) formal school volunteer scale up process

General Project Questions

Evidence That Project is Conducting Scaling…

<u>Elementary Schools (Grades 3-5)</u> [Continued…]

Scale Up Addition of new Elementary Schools (4 in Palm Beach, 3 in Broward to Initial 4 Scale Up Schools: Total=11)

- Use of comprehensive schoolwide process for identifying new schools for scale up
- Collaborative implementation with project leadership teachers of start-up 2-week professional development for teachers in new scale up schools (June, 2004)
- Formal scheduling commitment of principals in new sites to fidelity monitoring process and grade level curriculum planning

General Project Questions

Evidence That Project is Conducting Scaling…

<u>Middle Schools (Grades 6-8)</u>

Initial Scale Up Schools (2 in Broward) (Fall, 2003)

- Selection of middle schools linked as feeders to project elementary schools
- Initial development of grade 6-8 model as extension of grade 3-5 Science IDEAS model (in grades 6-8 teachers specialize in science)
- *Intervention evidence*: (a) effectiveness prof. development, (b) clinical monitoring of fidelity, (c) student performance outcomes

General Project Questions

Evidence That Project is Conducting Scaling…

<u>Middle Schools (Grades 6-8)</u> [Continued…]

Initial Scale Up Schools (2 in Broward) (Fall, 2003)

- Final refinement/adaptation of elementary fidelity monitoring process for middle school

Scale Up Addition of 2 new Middle Schools (1 in Palm Beach, 1 in Broward: Total = 4) (Fall, 2004)

- Use of comprehensive schoolwide process for identifying new schools for scale up
- Formal commitment of principals in all sites to fidelity monitoring and in scheduling grade level curriculum planning for science teachers

General Project Questions

Methods Re: Direct Investigation of Research Questions…

Coherent chain of reasoning: theory- research questions – data-analysis – evidence – theory

- *For Substantive Science IDEAS intervention…*
  - *Original Data*: Replicated series of controlled studies
  - *Concurrent Theory*: Recent developments in interdisciplinary research in support of original data
  - *Evidence/Substantive Analysis*: Interdependent implications from original data and concurrent interdisciplinary theory to focus and expand Science IDEAS intervention for scale up: Grades 3-8
  - *Project Research Questions*: Longitudinal effects of cumulative, in-depth knowledge on science and reading comprehension (Continuation of chain: data →evidence→ theory)

General Project Questions

Methods Re: Direct Investigation of Research Questions…

Coherent chain of reasoning: theory- research questions – data-analysis – evidence – theory

- *For Research on Scale Up…*
  - *Preliminary analysis to frame problem to be studied*: Educational R&D Perspective (ER&D)
    - Instructional systems design (ISD) principles for product development and validation
      - Replicated empirical evidence of validation (as "scientific evidence")
      - Engineered so that implementation requirements can be met application contexts (as meeting requirements for "sustainability" and "scale up")
      - ER&D addresses scalability through advance engineering

General Project Questions

Methods Re: Direct Investigation of Research Questions…

Coherent chain of reasoning: theory- research questions – data-analysis – evidence – theory

- *For Research on Scale Up…*
  - *Preliminary analysis to frame problem to be studied*: Educational R&D Perspective (ER&D) [Continued…]
    - Scalability of research-based intervention is more complex process than ISD
      - Original implementation methodology requires adaptation and development for use in applied setting by practitioners
      - Significant development of the capacity of school system is required to accomplish initial implementation with fidelity, sustainability, and expansion to new sites (scale up)

General Project Questions

Methods Re: Direct Investigation of Research Questions…

Description of research design…

- Overall longitudinal design that combines group-oriented and multiple baseline methodology
- Focus is on establishment of generalizability of the intervention through intra-study replication (school interventions across time)
- Design will focus on the following combined effects:
  - Performance comparisons between participating and comparison schools
  - Changes in performance trends prior to and after intervention
  - Changes in performance and fidelity trends- re: years of experience of participants, sequential project scale up cycles
  - Development of grade 3-8 achievement trajectories as means of establishing student performance expectations

General Project Questions

Methods Re: Direct Investigation of Research Questions…

Description of research design… [Continued…]

- Qualitative (i.e., descriptive) documentation of all major project "scale up" components
  - in a procedural form
  - In a technologically accessible (for practitioner use)
- Development/maintenance of longitudinal project database
  - used for all statistical analysis
  - Documented/maintained in form that it can be shared with other researchers

General Project Questions

Methods Re: Direct Investigation of Research Questions…

Description of sampling plan…

- *Original Sampling Design-*
  - Random selection of participating and control elementary schools from volunteer pool
  - Volunteers necessary because of systemic schoolwide impact on school in grades 3-5 (vs. minor enhancement of existing practice)
  - Initial middle school participants linked to project elementary schools through feeder patterns
- *Modification of Original Sampling Design (through 2004-2005)*:
  - Not enough volunteer schools to form sampling pool
  - Ancillary scalability issue for consideration: Would rejection of schools that volunteer for systemic initiative engender backlash that impedes future scale up or create greater interest in participation

General Project Questions

Methods Re: Direct Investigation of Research Questions…

Description of sampling plan… [Continued…]

- *Implications of Modified Sampling Plan-*
  - Random selection is preferable, but focus on project is on establishing generalizability (i.e., replicability, transportability, external validity) of intervention within scalability setting (also intervention previously validated in series of controlled studies)
  - Present sampling design within multiple baseline framework is sufficiently strong to establish "external validity," particularly within project scalability context
  - As volunteer pool expands in future years (which we expect), we will be able to follow original randomized selection methodology
- *Sample attrition*
  - Student-level missing data- HLM methodology allows missing data
  - Schools withdrawing from project- Documentation of reasons and continued tracking the resulting achievement trends in such schools

General Project Questions

Methods Re: Direct Investigation of Research Questions…

Description of Instruments…

- *Externally-Developed and/or Normed*
  - Florida FCAT Science and SAT-9 Reading Comprehension
  - ITBS Science and Reading Comprehension
  - School/Science Appraisal Inventory (SSAI) academic attitude/self confidence re: science, reading
  - Science classroom content assessment (as fidelity measure)- presently identifying measure in process of development/selection
- *Researcher-Developed Instruments* (Major)
  - Implementation Fidelity
  - Professional Development / Support Evaluation

General Project Questions

Methods Re: Direct Investigation of Research Questions…

Analysis plan…

- *Statistical Data Analysis*
  - HLM analysis methodology
  - Longitudinal and year-by-year analyses of data patterns
- *Qualitative/Descriptive Analysis*
  - Documentation of project operations relating to different aspects of scale up
  - Representation of project dynamics in electronically accessable form (work in progress)

Responses to Project-Specific Questions (15 Min.)

Project-Specific Questions

Vision for Science Education…

Perspective 1:	Providing the opportunity for all students to learn science
Perspective 2:	Enhancing the systemic curricular expectations for science in grades 3-8
Perspective 3:	Implementing in-depth science instruction in grades 3-8
Perspective 4:	Developing the systemic capacity of schools to implement in-depth instruction in grades 3-8
Perspective 5:	Pursuit of interdisciplinary research agenda in science education

Project-Specific Questions

Vision for Science Education… [Continued]

Perspective 6: Raising awareness of the importance of in-depth science instruction in grades 3-8 as a significant element of educational reform policy

Perspective 7: Overview and summary of research-based findings and implications reflecting our vision

- Comprehensive science curriculum should include study of both science knowledge and nature of science
- Curriculum focus of science instruction should be on core concepts and concept relationships (consistent with conceptual organization of experts)

Project-Specific Questions

Vision for Science Education… [Continued]

Perspective 7: Overview and summary of research-based findings and implications reflecting our vision [Continued…]

- Overall framework of core concepts and core concept relationships should be articulated across grade levels in a clear and coherent fashion
- All student learning activities, assessment strategies, and teaching strategies should be related to the overall core concept framework
- Students should experience a variety of learning activities for developing meaningful science understanding, including concept mapping as knowledge representation tool

Project-Specific Questions

Vision for Science Education… [Continued]

Perspective 7: Overview and summary of research-based findings and implications reflecting our vision [Continued…]

- Students should engage in variety of applications and problem solving experiences as enhancements of meaningful science understanding
- Cumulative development of science understanding as students progress through school should be accomplished through the elaboration and detailing of core ideas previously introduced (as possible)

Project-Specific Questions

Advantages/Disadvantages from Combining Science and Reading…

- *Advantages* (Argument)
  - Science is an ideal content area for building cumulative meaningful knowledge
    - Foundation for future academic success in science
    - Enhancement of proficiency in reading comprehension
  - Integration of reading within In-depth science instruction is highly feasible
    - Easier for teachers to implement (with adequate support)
    - More inherently motivating for students
    - Has significant systemic implications for educational reform

Project-Specific Questions

Advantages/Disadvantages from Combining Science and Reading…

- *Advantages* (Argument) [Continued…]
  - vs. Research in reading (e.g., Snow/RAND Report)
    - Has not contributed significantly toward content area reading problem (i.e., focus on “skills” vs. “knowledge development”)
    - Emphasis on reading comprehension strategies that are not transferable to content area reading (ecological issue)
- *Disadvantages* (Conclusion)
  - NONE vs. Popular approaches to teaching reading comprehension

Project-Specific Questions

Advantages/Disadvantages from Combining Science and Reading…

- *Potential Negative Side Effects* (Argument)
  - Field of reading in grades 3-5 has re-defined itself as "literature"
  - Integrating reading within science could eliminate literature from grade 3-5 unless:
    - Schools schedule separate instruction for "literature" using time previously used for science (before integration)
    - Integrated science instruction encourages/incorporates fiction when it has science linkage

Project-Specific Questions

Challenges Faced and Addressed in Conducting Research…

Major School/Principal/Teacher Challenges

Challenge 1: Instructional scheduling / time allocations issues

Response: Work with principals and teachers to reduce lack of fidelity

Establish explicit implementation standards for new scale-up schools

Challenge 2: School concurrent commitments that detract from Science IDEAS by overburdening teachers

Response: Continue to work with principals to minimize

Establish explicit standards eliminating this for new scale up schools

Project-Specific Questions

Challenges Faced and Addressed in Conducting Research…

Major School/Principal/Teacher Challenges

Challenge 3: Lack of principal commitment to fidelity monitoring

Response: Modify fidelity process/forms to make more feasible for principals

Involve principals in grade level curriculum planning

Add "principal feedback" loop to school management / fidelity process

Establish standards for fidelity processes for new scale up schools

Project-Specific Questions

Challenges Faced and Addressed in Conducting Research…

Major School/Principal/Teacher Challenges

Challenge 4: Lack of effectiveness of positive project advocacy by principals (and teachers) on schoolwide basis

Response: School display banners
Items in school newspapers (regularly)
Parent "Science Nights"
Encourage/support presentations by principals and teachers at professional conferences
Construct project "talking points" guide

Project-Specific Questions

Challenges Faced and Addressed in Conducting Research…

Other Major Project Challenges

Challenge 5: Lack of personnel resources for potential capacity development in multi-phase scale up implementation phase

Response: Expansion of scope of teacher/leadership cadre as major infrastructure/capacity development component:

- model classrooms
- in-school mentoring
- preparing to offer professional development for teachers in new scale up schools

Project-Specific Questions

Challenges Faced and Addressed in Conducting Research…

Other Major Project Challenges

Challenge 6: Changes in district central administrative staff slows the development of institutional commitment for sustainability, expansion to new sites

Response: Maintain continued communication with district staff in the face of administrative changes as practical (only project option)

Continue pursuit of establishing new institutional "expectations" that would provide long-term support for the project

Presentation: Discussion…

Open Q and A (40 min.)

Wrap/Up/Next Steps (10 min.)

VALIDATION OF A MULTI-PHASE SCALE UP DESIGN FOR A KNOWLEDGE-BASED INTERVENTION IN SCIENCE AND READING COMPREHENSION

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End of Presentation