Overview of Pedagogy, Learning & Technology in the 21st Century

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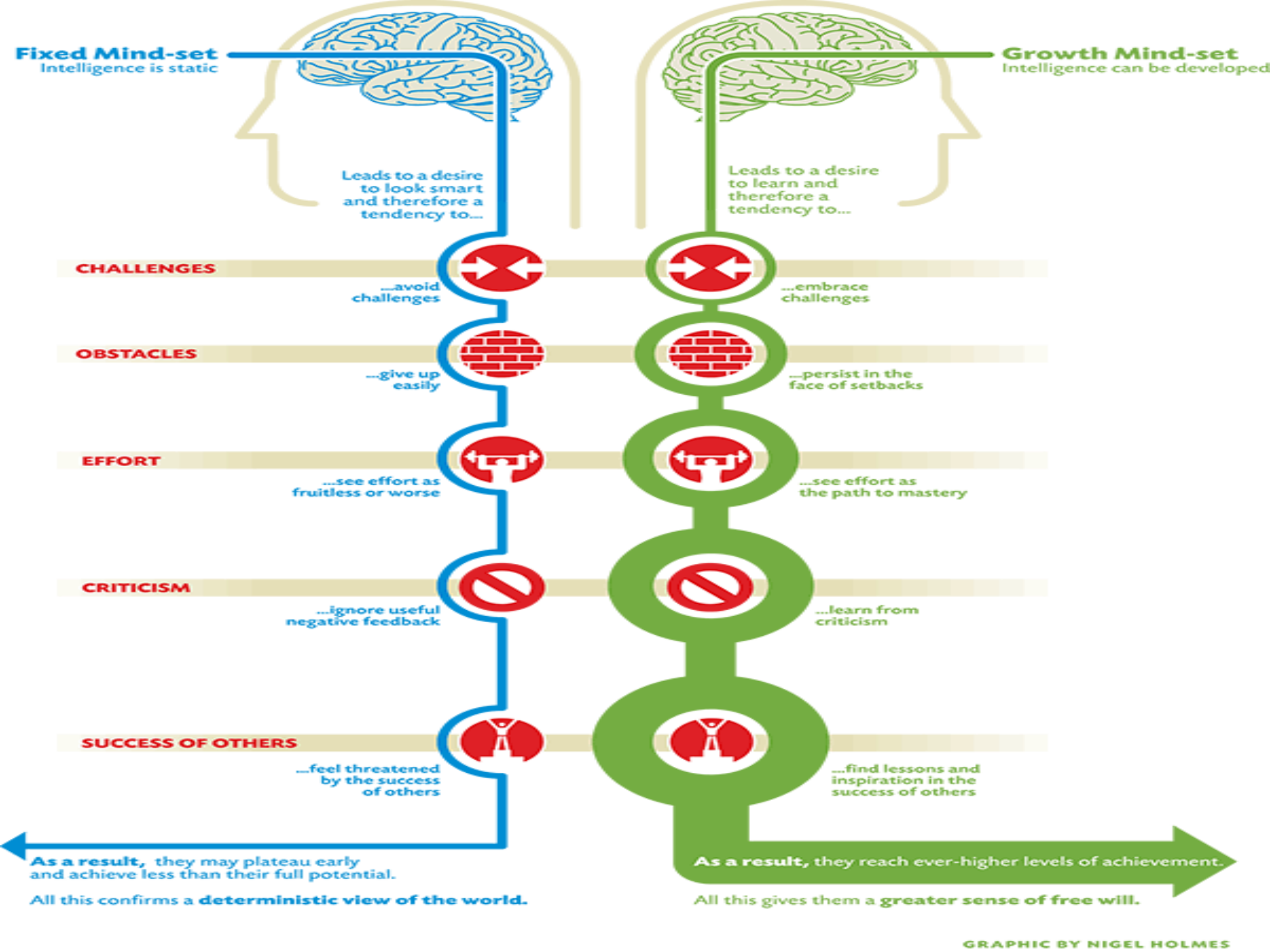
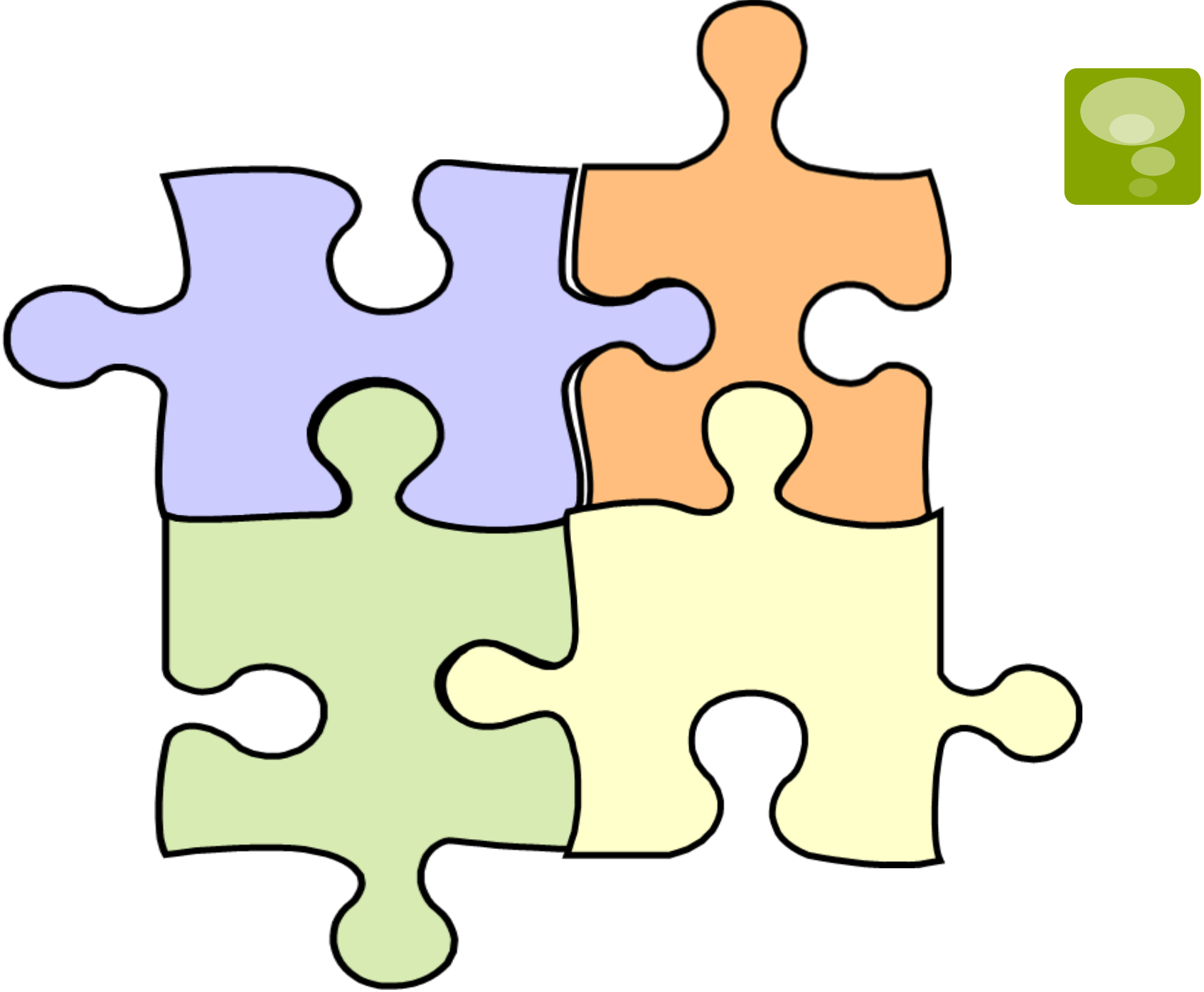
Even Geniuses Work Hard

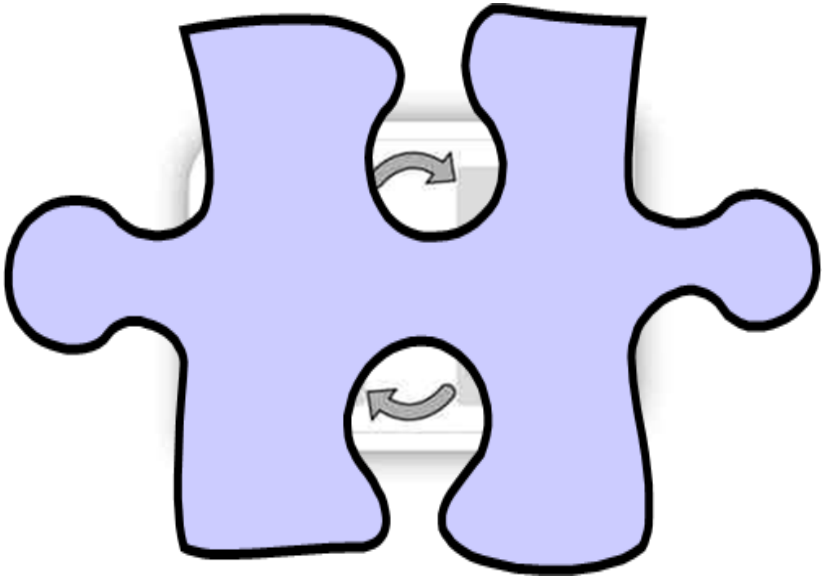
Carol S. Dweck (1999, 2007)

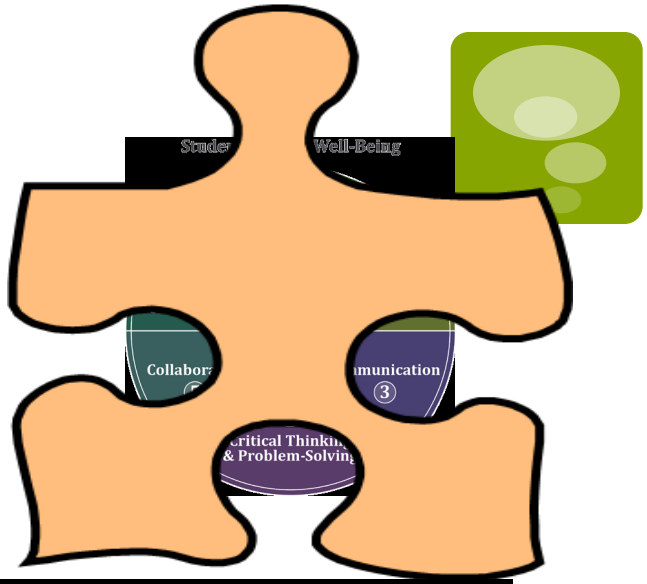
Teachers who strive to design challenging, meaningful learning tasks may find that their students respond differently depending on the students' assumptions about intelligence. Students with a growing mindset may tackle such work with learning tasks that require them to stretch or take risks.

To prepare students to benefit from meaningful work, therefore, teachers need to create a growth-mindset culture in the classroom.


Fixed Mind-set
Intelligence is static
Growth Mind-set
Intelligence can be developed
Leads to a desire to look smart and therefore a tendency to...
Leads to a desire to learn and therefore a tendency to...
CHALLENGES
...avoid challenges
...embrace challenges
OBSTACLES
...give up easily
...persist in the face of setbacks
EFFORT
...see effort as fruitless or worse
...see effort as the path to mastery
CRITICISM
...ignore useful negative feedback
...learn from criticism
SUCCESS OF OTHERS
...feel threatened by the success of others
...find lessons and inspiration in the success of others
As a result, they may plateau early and achieve less than their full potential.
All this confirms a deterministic view of the world.
As a result, they reach ever-higher levels of achievement.
All this gives them a greater sense of free will.
GRAPHIC BY NIGEL HOLMES







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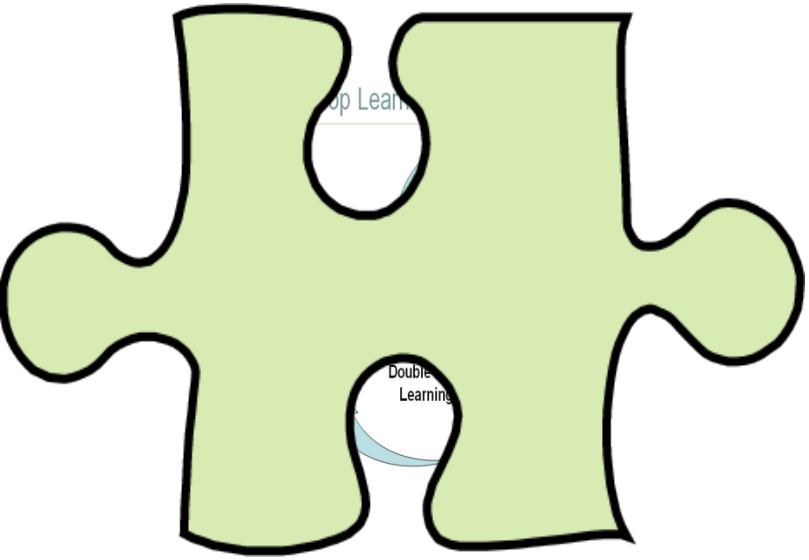
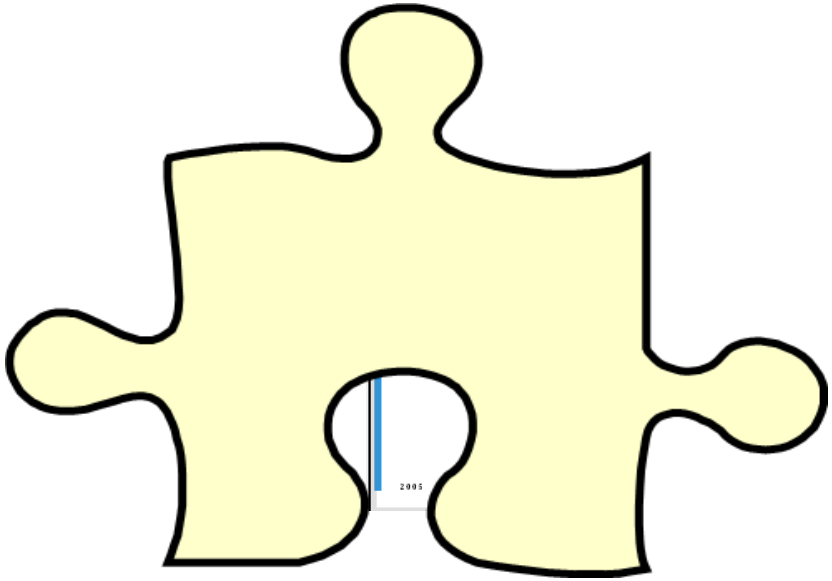


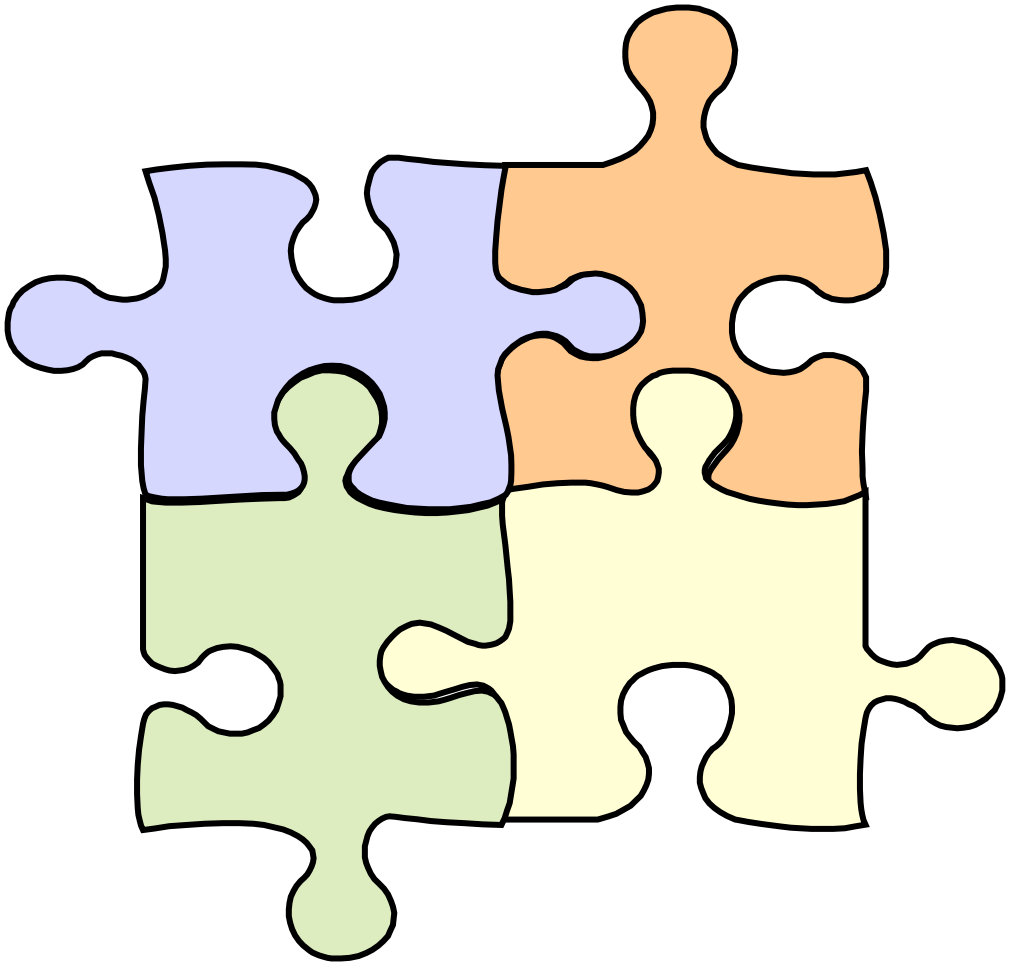


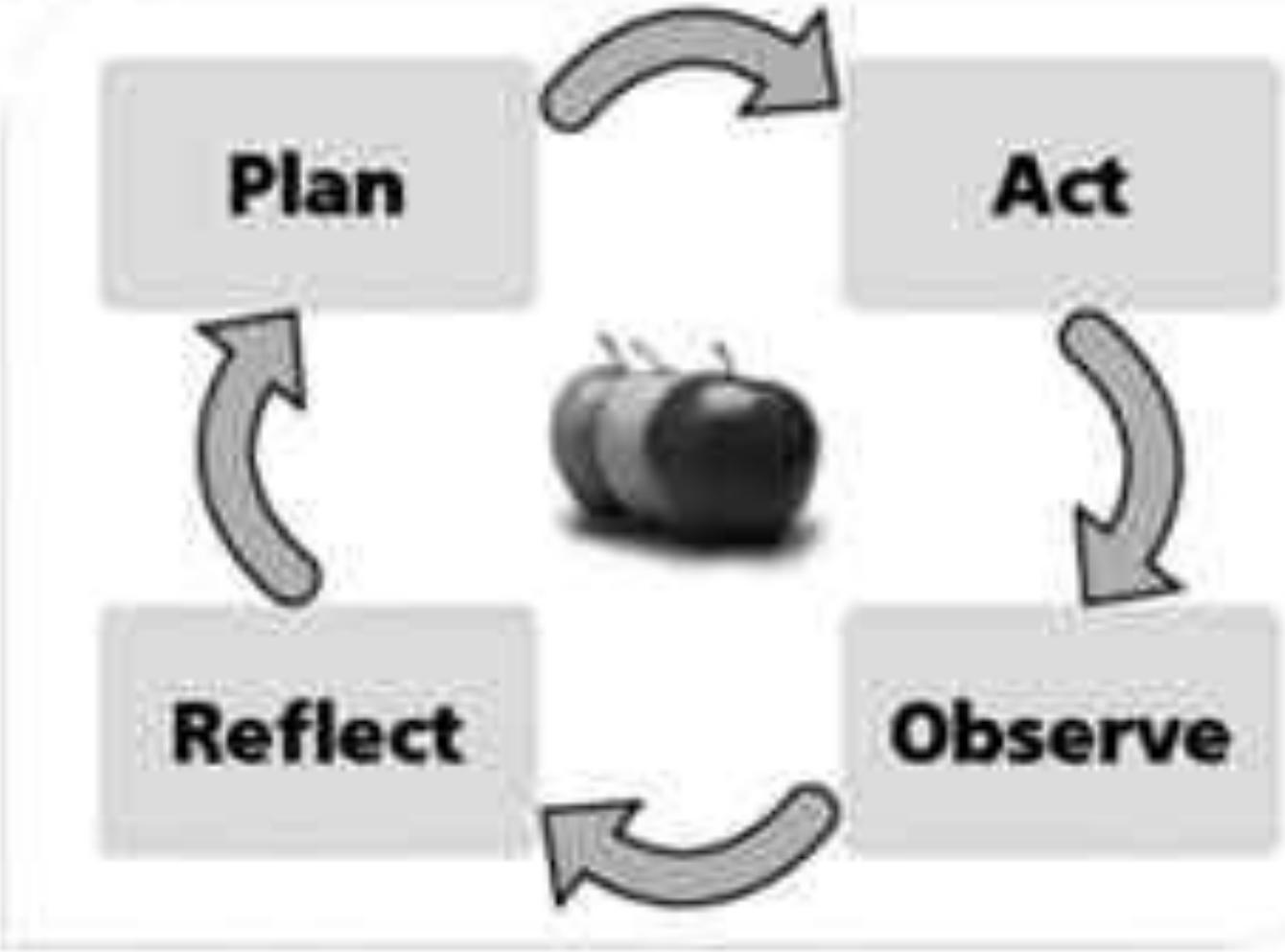
Katherine Bielaczyc and Allan Collins

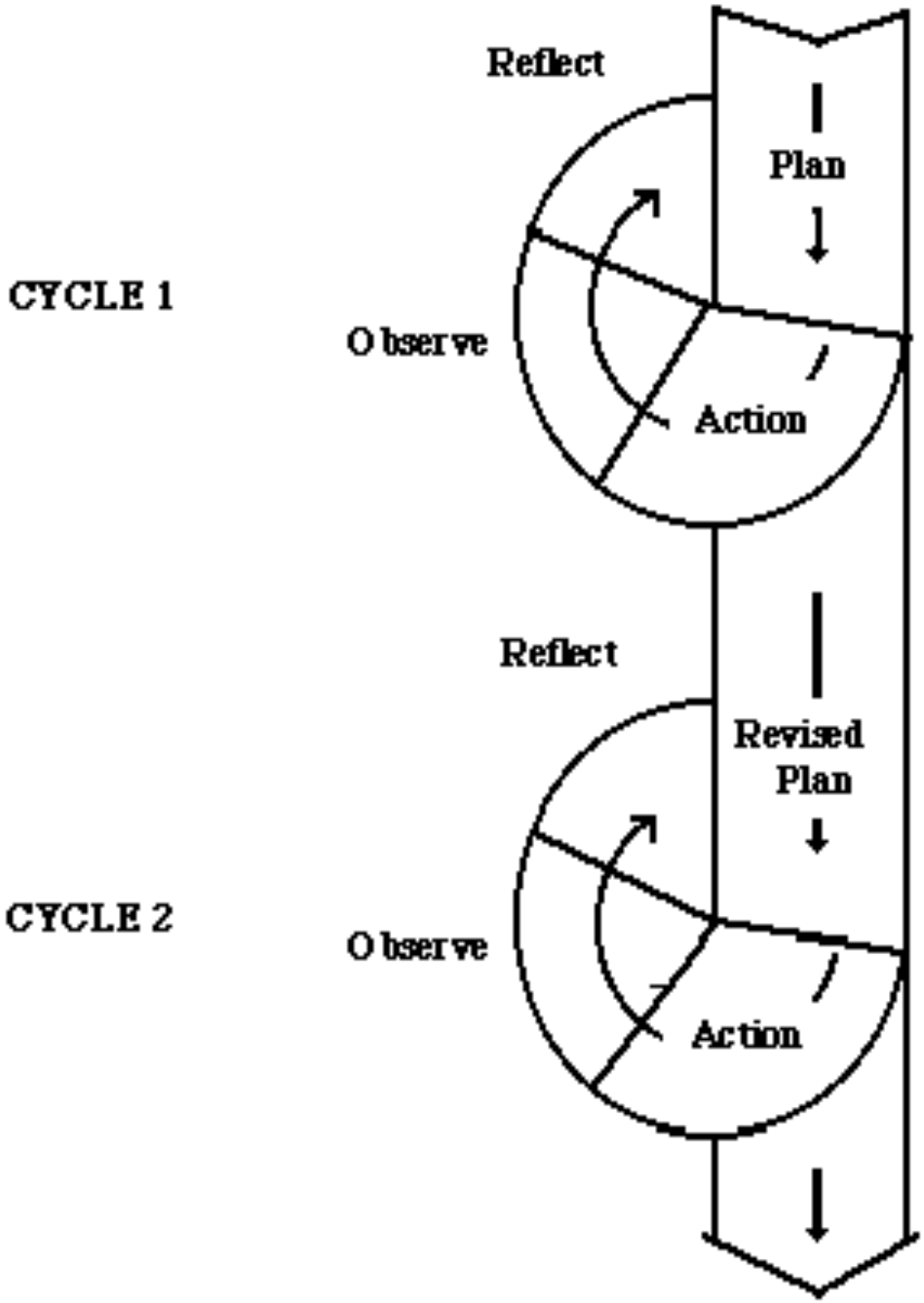
Learning Communities in Classrooms A Reconceptualization of Education

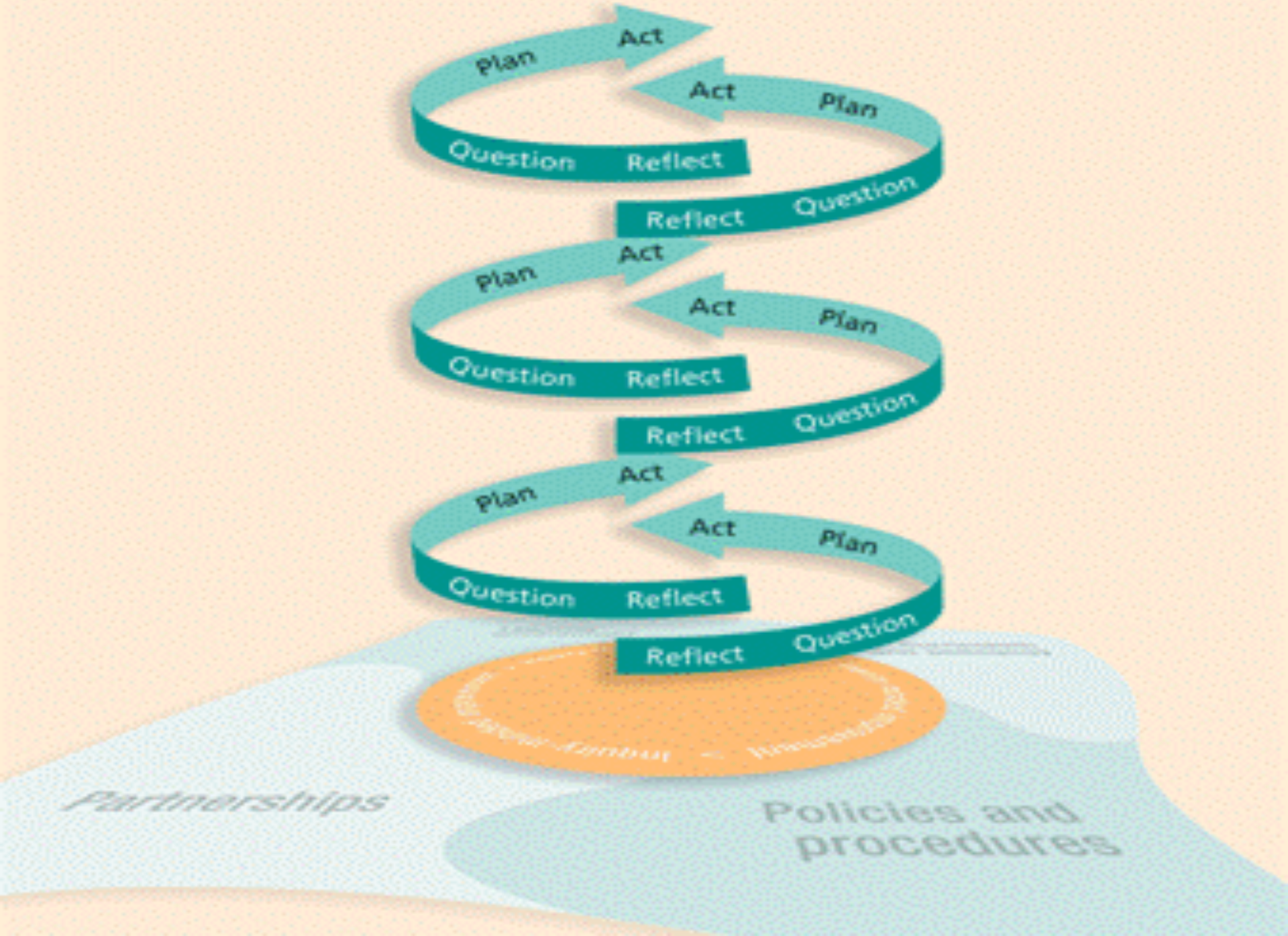
There are four characteristics that such a culture must have:

- (1) diversity of expertise among its members, who are valued for their contributions and given support to develop
- (2) a shared objective of continually advancing the collective knowledge and skills
- (3) an emphasis on learning how to learn
- (4) mechanisms for sharing what is learned. If a learning community is presented with a problem, then the learning community can bring its collective knowledge to bear on the problem. It is not necessary that each member assimilate everything that the community knows, but each should know who within the community has relevant expertise to address any problem.




Plan
Act
Observe
Reflect


Reflect
Plan
CYCLE 1
Observe
Action
Reflect
Revised
Plan
CYCLE 2
Observe
Action


Act
Plan
Act
Plan
Question
Reflect
Reflect
Question
Act
Plan
Act
Plan
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Reflect
Reflect
Question
Act
Plan
Act
Plan
Question
Reflect
Reflect
Question
Partnerships
Policies and procedures

Marlene Scardamalia
Natural Curiosity: A Resource For Teachers (p. 11)

What is Knowledge Building (KB) Discourse?

- Another key component of the inquiry process is Knowledge Building Discourse, a ***communal activity in which learners come together to pose questions, posit theories, and to revisit, negotiate, and refine ideas***.
- Knowledge Building Discourse "serves to identify shared problems and gaps in understanding and to advance understanding ***beyond the level of most knowledgeable individual"***. (Scardamalia, 2012, p.12).

Governments and International Organizations Everywhere Calling for Innovation

The Organization for Economic Co-operation and Development (OECD) has started referring to contemporary societies as "**innovation-driven**."

…**new ideas** are essential to the development of human capital and are key engines of economic growth, drivers of market productivity, and sources of **cohesion for all nations**… . (G8summit, 2006)

Innovation is not just about new ways to make money

Innovation is needed for economic progress, but…

- The need for new knowledge, new solutions, extends well beyond the economic sphere and is needed to deal with urgent and increasingly complex problems of health, environment, resources, crime, corruption, and oppression (Homer-Dixon 2000, 2006).

- One of the most pressing needs is for knowledge of how to deal with complexity itself.

How Can Schools Increase People's Ability to Create Knowledge?

- A mid-20th century answer: Develop skills, personal characteristics, habits of mind, and attitudes conducive to knowledge creation.
- There are no tested or even very plausible ways of achieving these objectives.
- The Knowledge Building alternative: Learn to create knowledge by actually doing it.
- This requires finding ways to **support novices in carrying out knowledge creation**.

Knowledge Building

- can be described as a capacity for "*productive work that advances the frontiers of knowledge as these are perceived by the community*" (Bereiter & Scardamalia, 2003).

Knowledge Building

12 Foundational Principles

- Collective cognitive responsibility
- Epistemic agency
- Real ideas, authentic problems
- Democratizing knowledge
- Symmetrical knowledge advancement
- Improvable ideas
- Idea diversity
- Rise-above
- Pervasive Knowledge Building
- Knowledge Building Discourse
- Constructive use of authoritative sources
- Concurrent, transformative and embedded assessments
- 12 Principles – available at: http://lcp.cite.hku.hk/resources/KBSN/Q1/KB_Principle.html

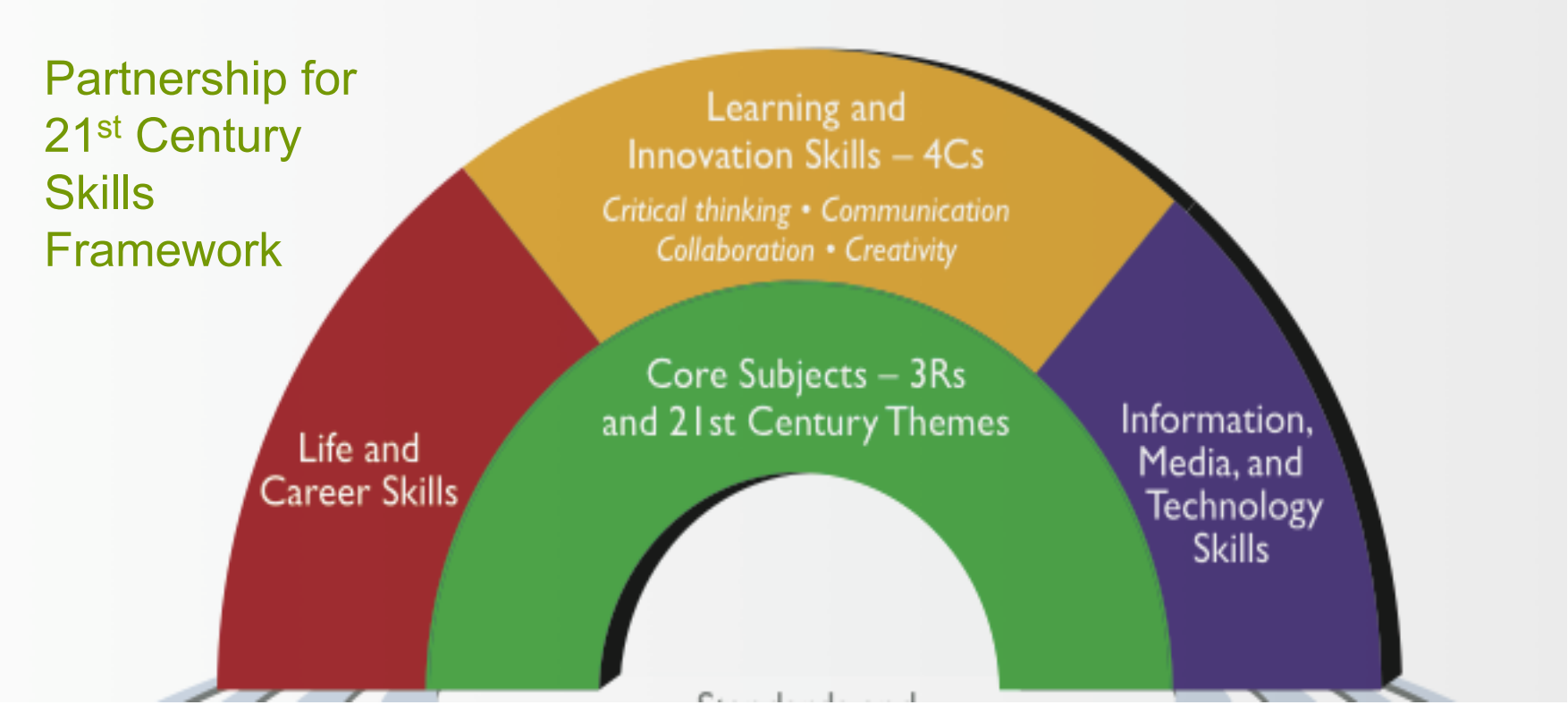
6 central themes

- *Knowledge advancement as community rather than individual achievement*
- *Knowledge advancement as idea improvement rather than acceptance or rejection of ideas*
- *Knowledge of in contrast to knowledge about*
- *Discourse as collaborative problem solving rather than argumentation*
- *Constructive use of authoritative sources*
- *Knowledge as emergent*

Scardamalia, M., & Bereiter, C. (2006). Knowledge building: Theory, pedagogy, and technology. In K. Sawyer (Ed.), *Cambridge Handbook of the Learning Sciences* (pp. 97-118). New York: Cambridge University Press

Fullan's 6 C's

- Communication
- Collaboration
- Critical Thinking
- Creativity
- Citizenship
- Character Education



Knowledge Building

Knowledge building represents an attempt to refashion education in a fundamental way, so that it becomes a **coherent effort to initiate students into a knowledge creating culture**. Accordingly, it involves students not only developing knowledge building competencies but also students coming to see themselves and their work as part of the civilization-wide effort to advance knowledge frontiers.

A Humanistic Perspective on Education for Innovation

Education in its largest sense means **initiating students into the world-wide knowledge-creating culture**.

This is neither cultural transmission nor importing of a foreign culture. It is more like cultural nurturance.

Culturally Sensitive Innovation

BCCI Building Cultural Capacity for Innovation

A Multi-Nation Design, Research and Development Initiative

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Increase societal capacity for the creation of new knowledge, new solutions, and needed advances

Shallow Constructivism	Rating/ Example	Deep Constructivism	
Collaborative Learning --> Community Knowledge			
COLLABORATIVE LEARNING		COMMUNITY KNOWLEDGE, COLLECTIVE RESPONSIBILITY	
Differential Participantion --> Equitable Participation in Knowledge Work			
INDIVIDUAL DIFFERENCES		DEMOCRATIZING KNOWLEDGE	
Authenticity: Teacher --> Student Point of View			
MEANINGFUL ACTIVITIES		REAL IDEAS, AUTHENTIC PROBLEMS	
Canonical Knowledge --> New Knowledge			
CURRICULUM		IDEA DIVERSITY	
Belief Mode/Right-Wrong --> Design Mode/ Continual Improvement			
INQUIRY: QUETION-ANSWER		IMPROVABLE IDEAS	
Comprehending/Finding Answers --> Advancing the State of Knowledge			
UNDERSTANDING GIVEN INFORMATION		CONSTRUCTIVE USES OF AUTHORITATIVES SOURCES	

Self-Regulation/Student Choice --> Taking Charge at the Highes Level			
STUDENT INPUT/CHOICE		EPISTEMIC AGENCY	
Truth --> Ever-Advancing Understanding			
DISCIPLINED DISCOURSE		KNOWLEDGE BUILDING DISCOURSE	
Best Practice --> Beyond Best Practice			
CONSENSUS		RISE ABOVE	
Guided Discovery --> Knowledge Creation			
HIGHER-ORDER THINKING		PERVASIVE KNOWLEDGE BUILDING	
Externally Defined Benchmarks --> Self Organization			
STANDARDS		CONCURRENT, EMBEDDED AND TRANSFORMATIVE ASSESSMENT	
Local Community --> Global Community			
HIGH-PERFORMING CLASSES		SYMMETRIC KNOWLEDGE ADVANCEMENT	

Distinguishing Knowledge Building from Learning: Accessible at: http://ikit.org/fulltext/AnnBrownOct10.06.pdf

Scardamalia, M., & Bereiter, C. **(2003)**. Knowledge Building. In *Encyclopedia of Education, Second Edition.* New York: Macmillan Reference, USA.

Knowledge Building: What is Different?

If compelled to put into one sentence what is different: ***giving students collective responsibility for idea improvement***

Beyond Inquiry: Education for Innovation

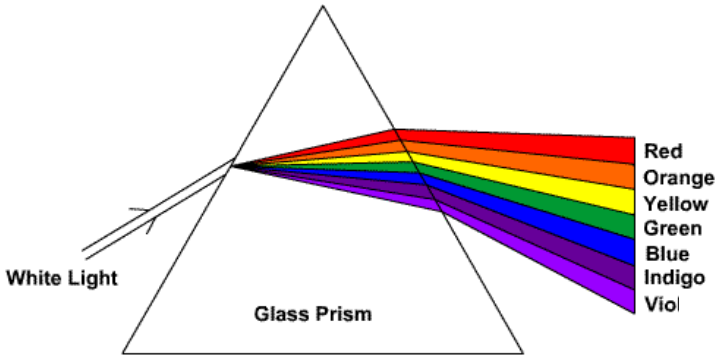
With most inquiry approaches, responsibility for idea improvement remains with the teacher *or curriculum or educational technology designer*

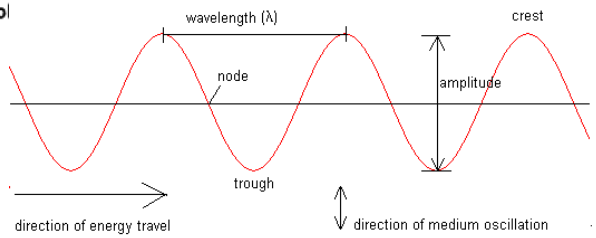
Knowledge Building: What is Different?

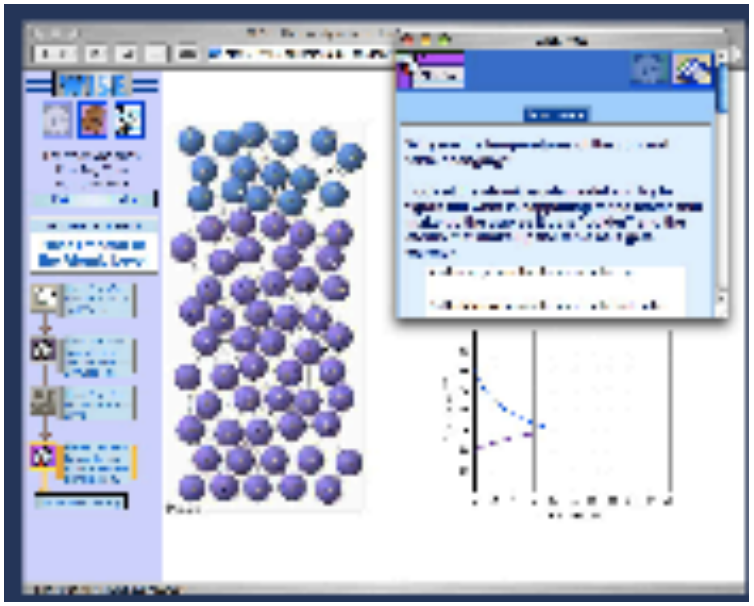
CASE STUDY: **Exploring light**

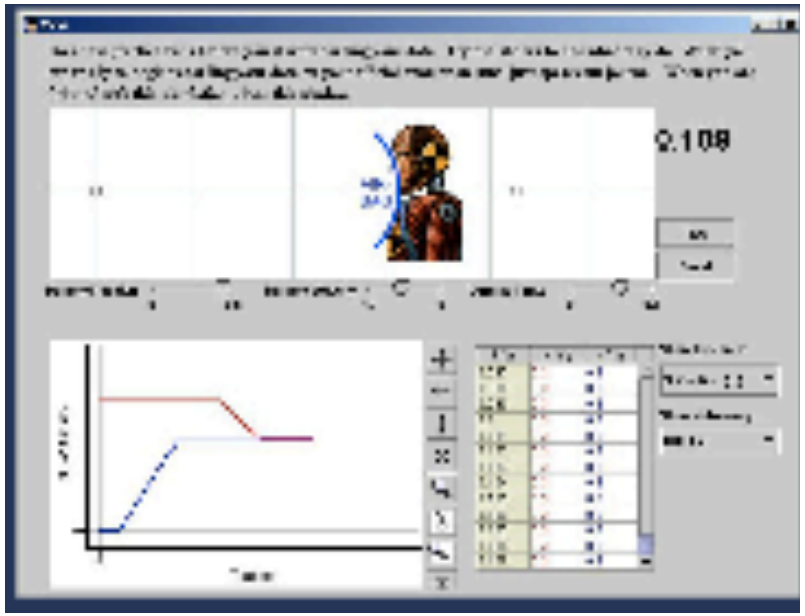
Knowledge Building using Knowledge Forum

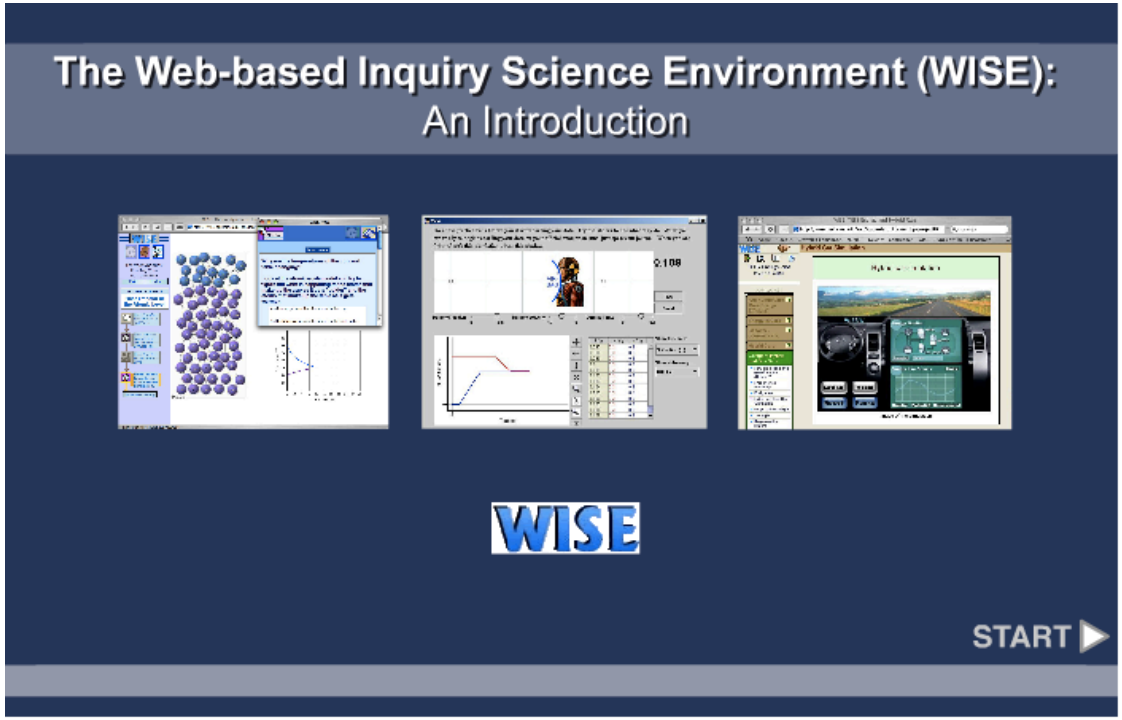
Inquiry-Based Learning using Web-Based Inquiry for Science (WISE) platform










The Web-based Inquiry Science Environment (WISE):
An Introduction
WISE
START

Two Effective Models of Science Education: WISE Compared to Knowledge Building

- WISE (Web-Based Inquiry Science Environment) project provides well-designed examples.
- From the WISE homepage: “WISE is a simple yet powerful learning environment where students examine real world evidence and analyze current scientific controversies.”
- Some WISE projects engage students in developing and improving their own explanations of natural phenomena, but others center on debate and do not involve students’ own ideas

A WISE Inquiry Project on Light

- Two hypotheses about light are presented:
  -Light goes on forever until it is absorbed
  -Light dies out as it gets farther from the source
- Many different kinds of evidence--visual, verbal, and qualitative--are presented
- It is up to the students to evaluate the evidence in order to decide between hypotheses.

Bicyclists at Night

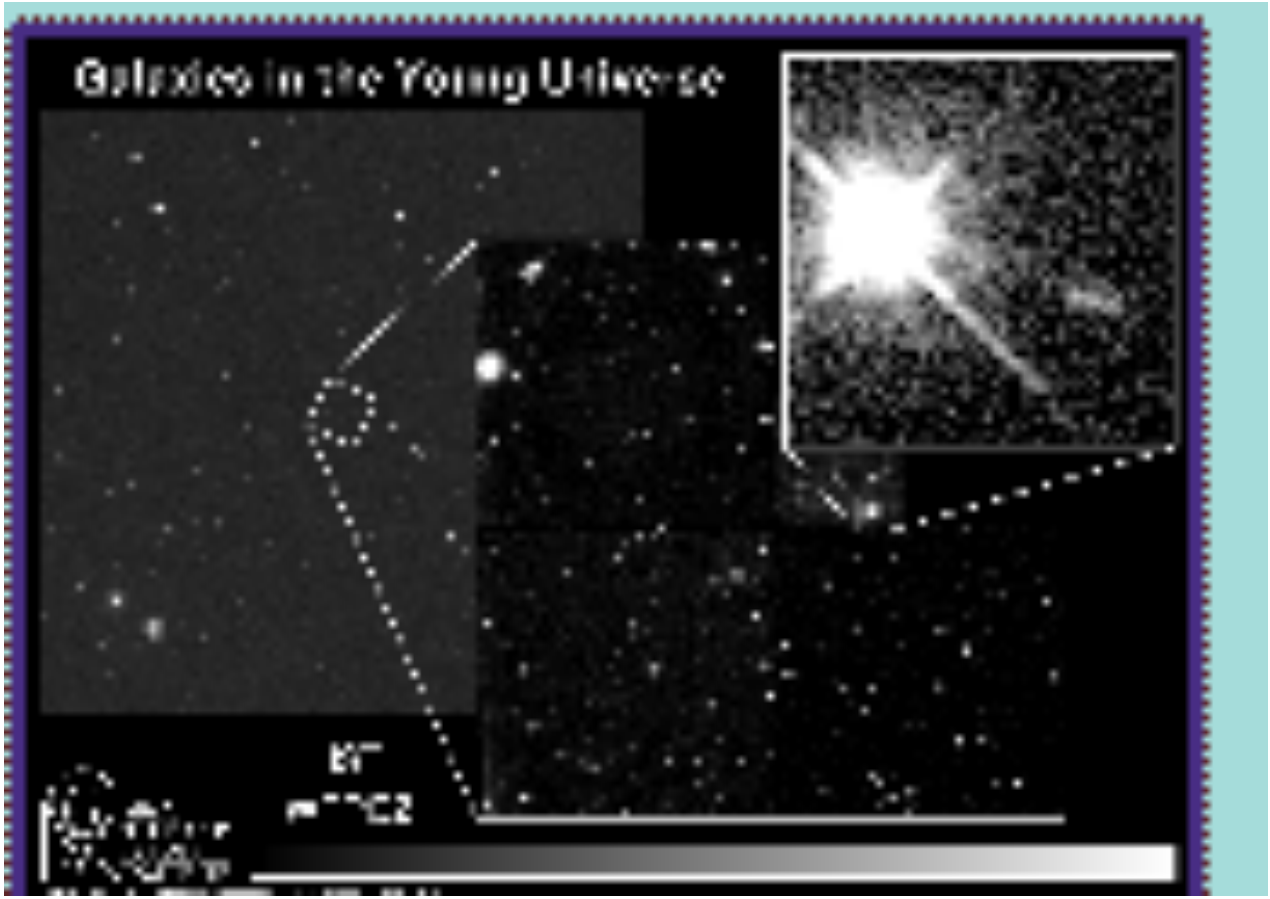
Rider wearing white is more visible than rider wearing black

Searchlight Photo

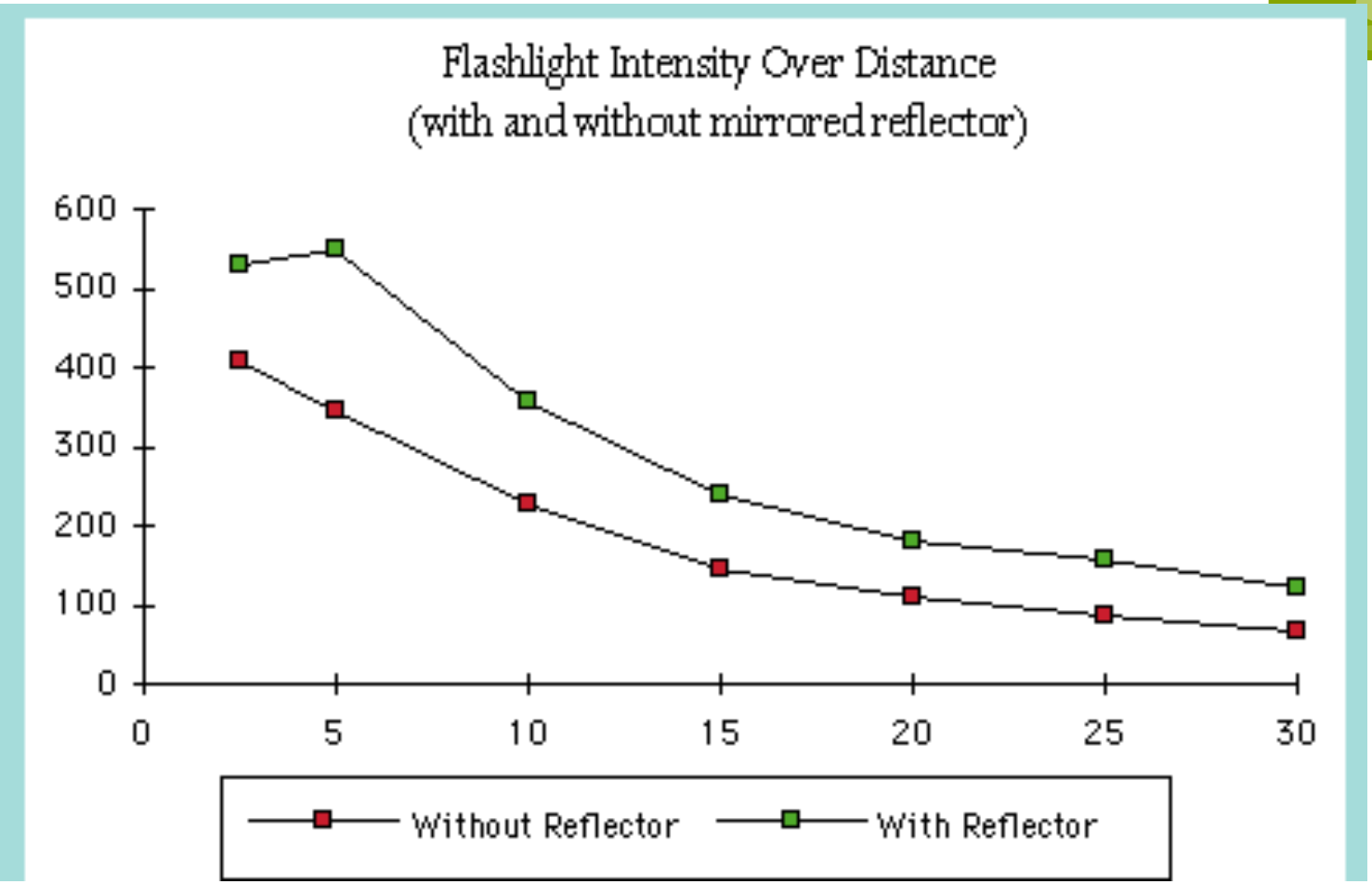
Showing high light intensity at source, becoming less as it goes farther away

Galaxies in the Young Universe

Ordinary camera on left, Hubble photo on right, enlargement in corner



	A	B	C	D	E
1					
2	Light intensity measured at increasing distances from light source.				
3	Light source is flashlight with and without a mirrored reflector.				
4					
5					
6		Intensity	Intensity		
7	Distance	No Reflector	With Reflector		
8	(cm)	(Cd)	(Cd)		
9					
10	2.5	410.3	531.4		
11	5.0	347.1	550.0		
12	10.0	227.4	359.1		
13	15.0	146.1	239.1		
14	20.0	111.6	180.4		
15	25.0	87.1	158.0		
16	30.0	69.7	124.4		
17					


Flashlight Intensity Over Distance
(with and without mirrored reflector)
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Without Reflector
With Reflector

Debating Two Hypotheses About Light

Student Activities

- Students examine each piece of evidence with regard to relevance, methods, and credibility of the source.
- Sort evidence into 3 categories: supporting “Light Goes on Forever,” supporting “Light Dies Out,” and “irrelevant.”
- Debate. Teams select the strongest evidence supporting their hypothesis, and also select counter-evidence for which they prepare replies.

Debating Two Hypotheses About Light: A Critique

- Students draw their own conclusions from evidence.
- They process much interesting scientific information.
- But fundamental questions are glossed over:

What is light? *How do we see?*

What happens to light when it is absorbed?

What causes light?

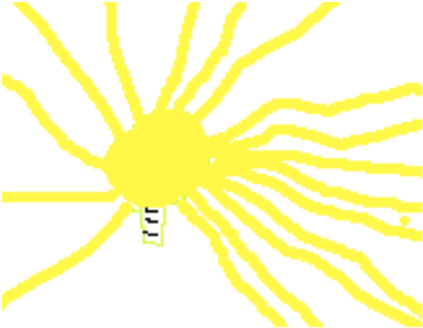
The Most Serious Weakness of Project-Based Inquiry: ***No Insight into How Scientific Ideas, Hypotheses, and Theories are Created***

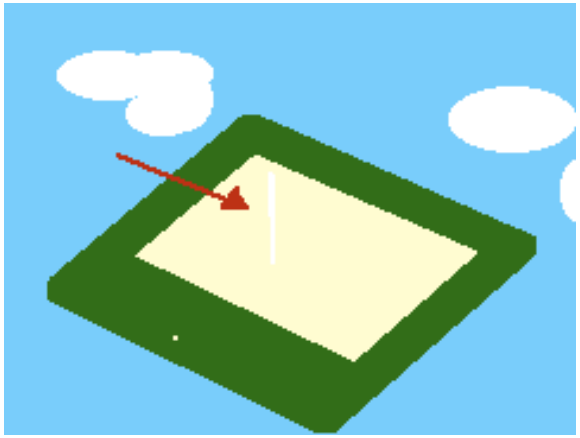
- How did anyone get the idea that “Light goes on forever”?
- Could any evidence actually prove that light goes on forever unless it is absorbed?
- Then why do most scientists believe it?
- Answer: They don’t believe it as an isolated hypothesis. They have confidence in a theory that implies light goes on forever unless it is absorbed.

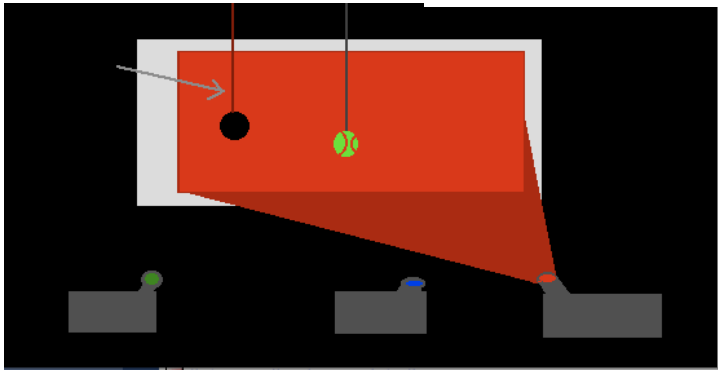
Science Learning through Knowledge Building

Example from a Grade 4 Knowledge Building Classroom

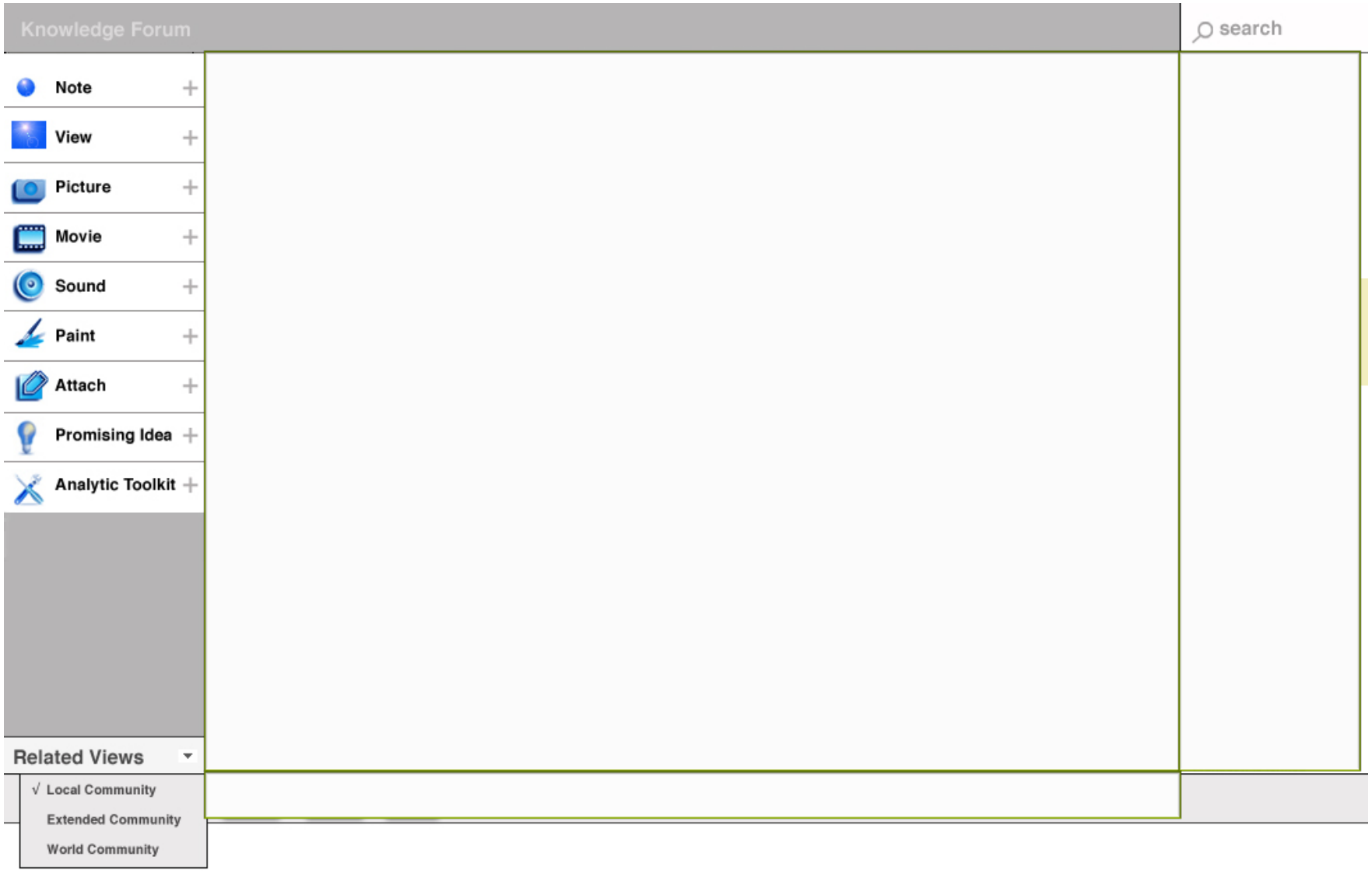
Part of a long, student-directed inquiry into questions about light



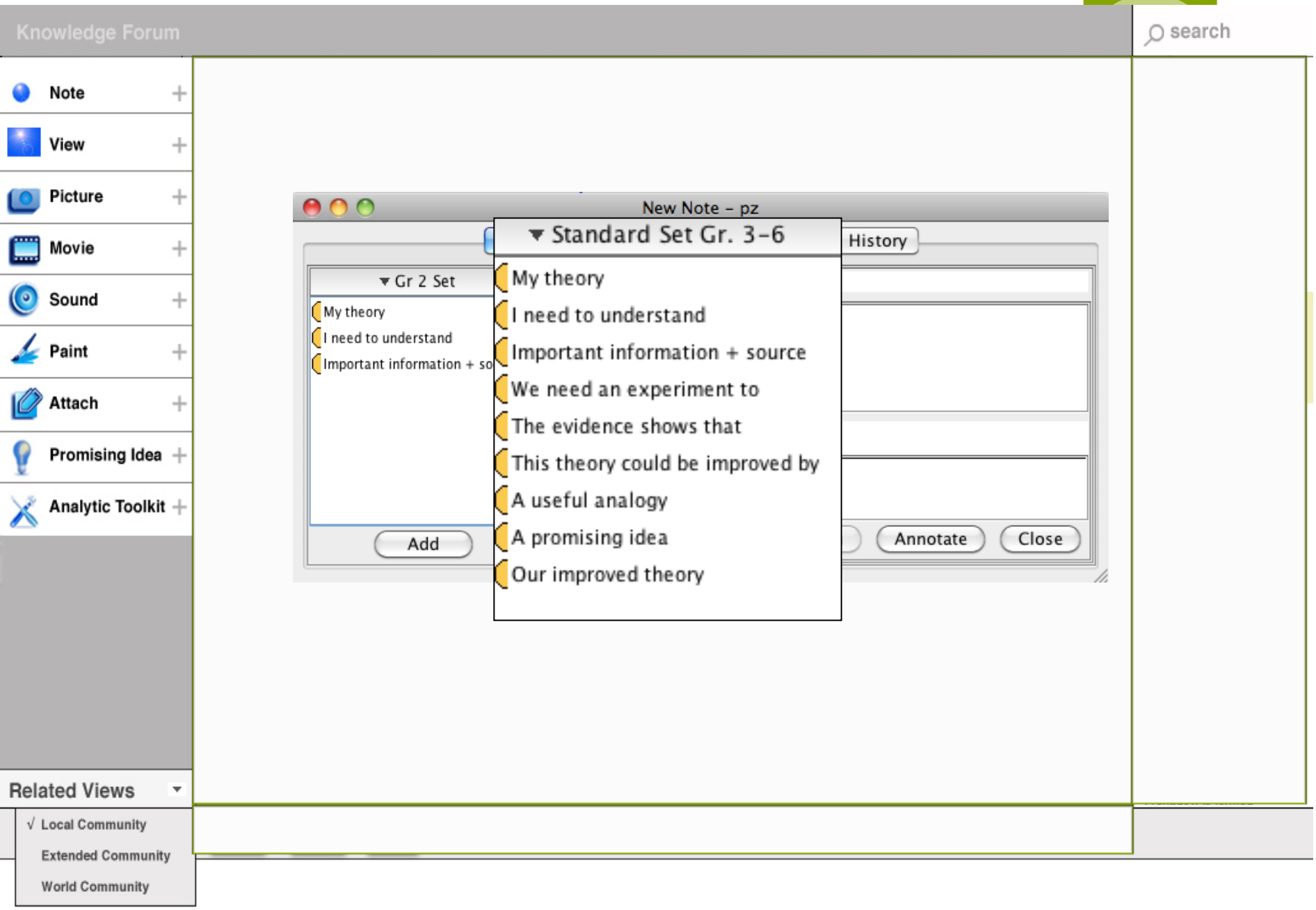




Knowledge Forum (KF) provides a community workspace to support *Community Knowledge, Collective Responsibility*



KNOWLEDGE FORUM INTERFACE



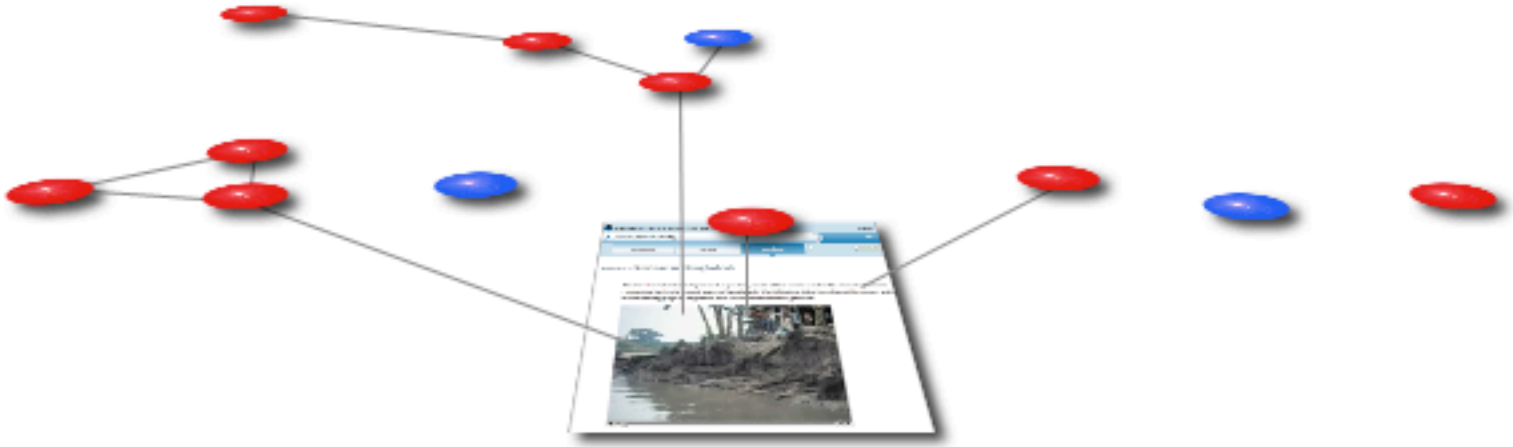
Successful knowledge-building discourse depends on authentic problems—things the students actually wonder about.

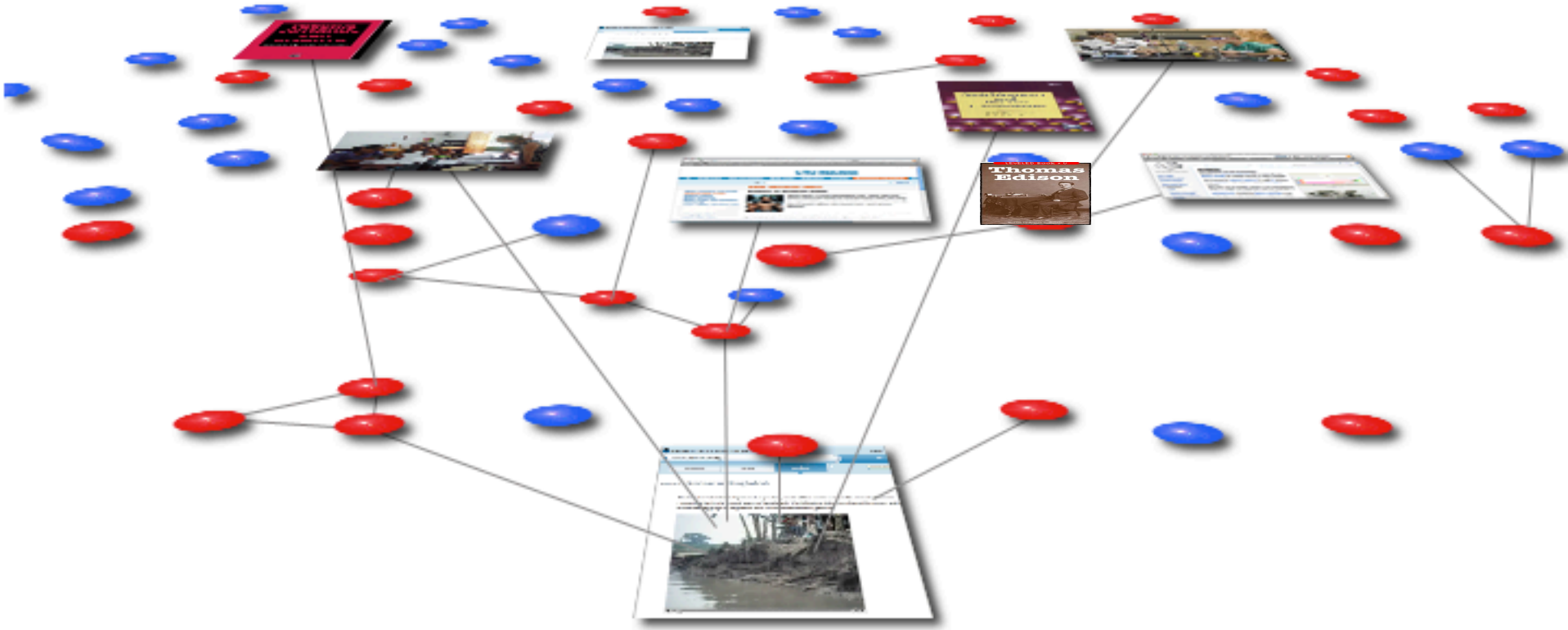
- *What is light? It's not animal or vegetable or mineral, so what is it?*
- *Can light bend?*
- *How does light travel?*
- *What are rainbows made out of?*

Research Results: Span Basics + 21st C

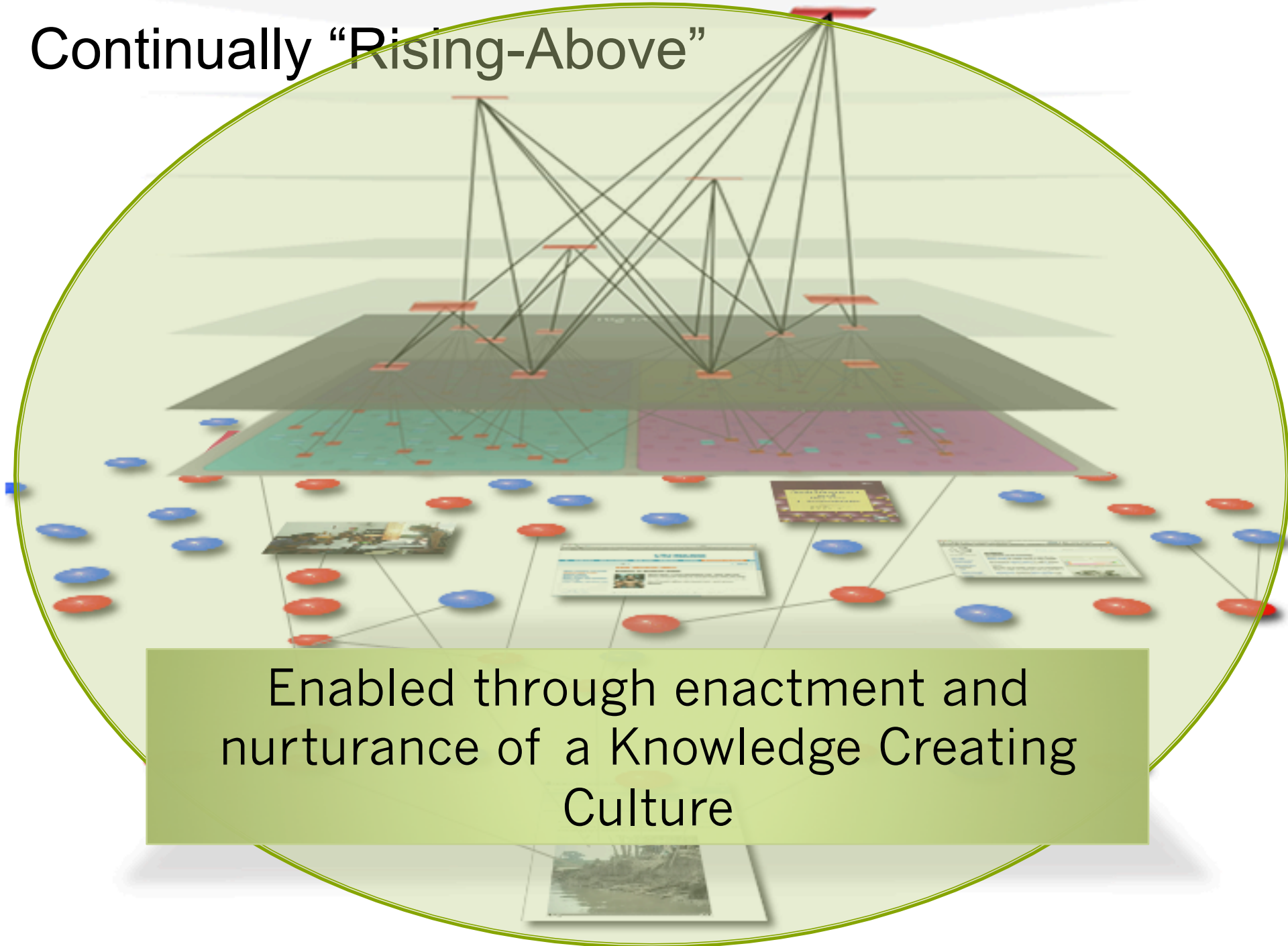
- Standardized test scores in reading comprehension, vocabulary, and spelling
- Ability to read difficult texts
- Quality of questions and comments
- Depth of explanation
- Graphical literacy
- Conceptual change
- Math problem solving
- Portfolio commentaries
- Collaborative processes
- Inquiry processes
- Results beyond grade-level expectations
- Emergence of new competencies

How does light travel?
What makes a rainbow?




Thomas
Edison

Continually “Rising-Above”



Enabled through enactment and nurturance of a Knowledge Creating Culture

Early primary Knowledge Building teachers discuss their practice

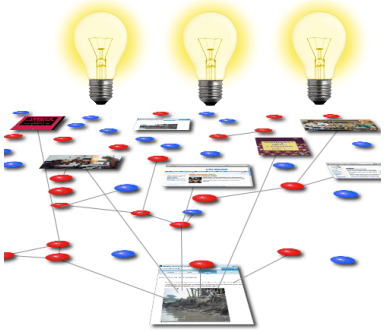
- Zoey Donahue – Grade 1 teacher at the Dr. Eric Jackman Institute for Child Studies (EJ-ICS) at the University of Toronto

- Carol Stephenson – Senior Kindergarten teacher at the Dr. Eric Jackman Institute for Child Studies

- FULL VIDEO AVAILBLE AT:

http://ikit.org/kb_resources/?p=1093

Next Steps: Innovation, Idea Improvement, "Rise Above"



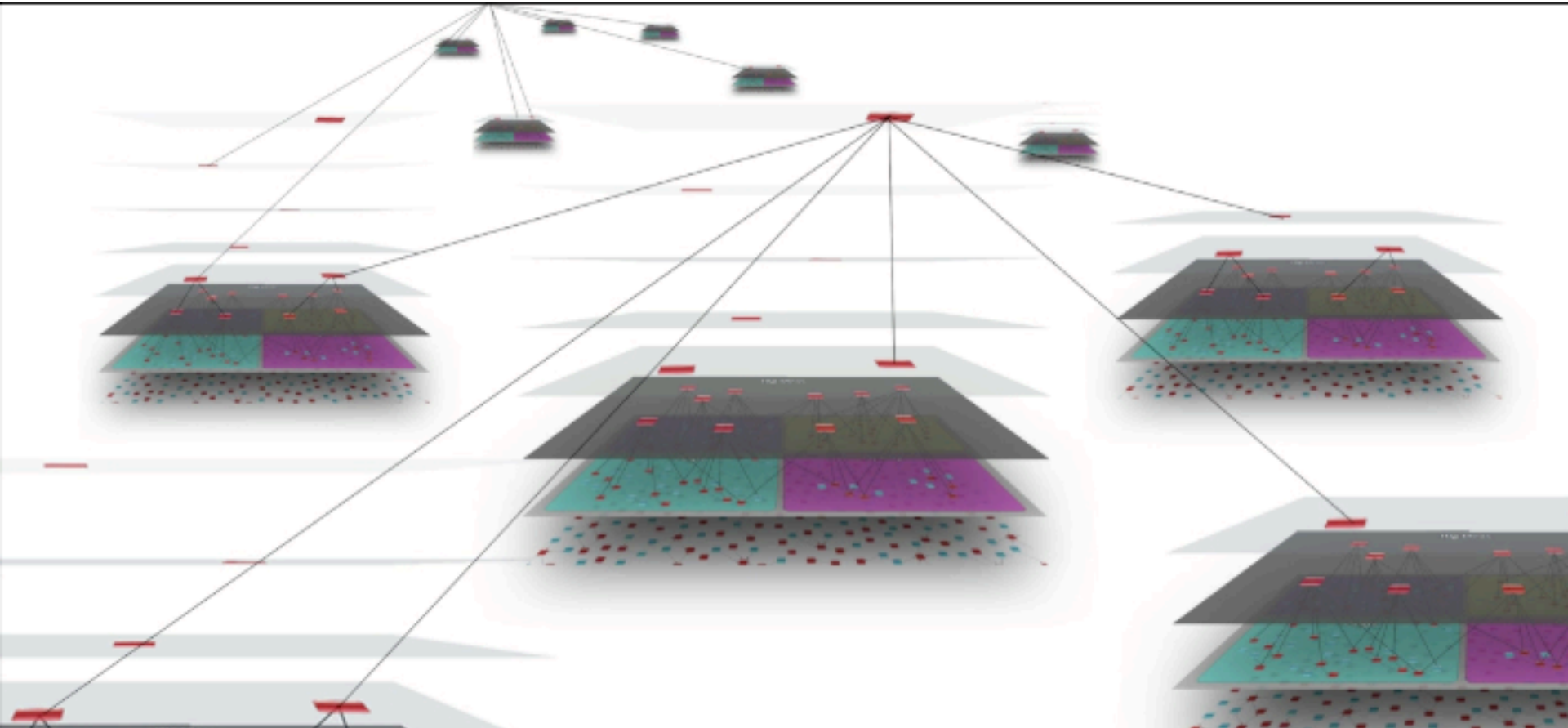
- Producing new ideas is easy (at least for children); improving ideas is hard. **We need to make the process more intellectually engaging over longer spans of time and for a broader range of students**

- "Rise-above" requires creation of a new, higher order knowledge object. **We need to make advances—as well as plateaus and dead ends—more evident to all**

- Significant innovation requires ***sustained*** creative work with ideas. **We need greater support for pervasive knowledge building**

Making Connections Across Communities

Rise Above and Connectedness Across Multi-Level Knowledge Building Communities



Reach Every Student

Our Goals:

- ✓ High levels of student achievement
- ✓ Reduced gaps in student achievement
- ✓ Increased public confidence in education

Improvement Journey	Poor to Fair	Fair to Good	Good to Great	Great to Excellent
Theme	***Achieving the basics of literacy and numeracy***	***Getting the foundations in place***	***Shaping the professional***	***Improving through peers and innovation***
Intervention cluster	• **Providing motivation and scaffolding for low skill teachers** – Scripted teaching materials – Coaching on curriculum – Instructional time on task – School visits by center – Incentives for high performance • **Getting all schools to a minimum quality level** – Outcome targets – Additional support for low performing schools – School Infrastructure Improvement – Provision of textbooks • **Getting Students in seats** – Expand school seats – Fulfill students' basic needs to raise attendance	• **Data and accountability foundation** – Transparency to schools and/or public on school performance – School Inspections and Inspection Institutions • **Financial and organizational foundation** – Optimization of school and teacher volumes – Decentralizing financial and administrative rights – Increasing funding – Funding allocation model – Organizational redesign • **Pedagogical foundation** – School model/ streaming – Language of instruction	• **Raising calibre of entering teachers and principals** – Recruiting programs – Pre-service training – Certification requirements • **Raising calibre of existing teachers and principals** – In-service training programs – Coaching on practice – Career tracks – Teacher and community forums • **School-based decision-making** – Self-evaluation – Independent and specialized schools	• **Cultivating peer-led learning for teachers and principals** – Collaborative practice – Decentralizing pedagogical rights to schools and teachers – Rotation and secondment programs • **Creating additional support mechanisms for professionals** • **Release professionals from admin burden by providing additional administrative staff** • **System-sponsored experimentation/ innovation across schools** – Providing additional funding for innovation – Sharing innovation from front-line to all schools

McKinsey Report (2011). *From Great to Excellent*.

Establish Knowledge Building Discourse as a New Norm

This requires connected knowledge building communities—policy makers, teachers, students…all taking responsibility for educational breakthroughs

Establish Knowledge Building Discourse as a New Norm

Culture of Collaborative Inquiry

"Inside out" learning – looking deeply into the instructional core, developing theories of action to guide our work

Evidence-based - student work as a source of information about effective strategies for teaching, leading and learning

Collaborative and Competency-based – professionals working together to uncover, articulate, develop and share current best thinking

Deeper implementation - based on thoughtful analysis of evidence from practice and achievement indicators

Adaptive work – building our collective professional capacity (knowledge and practice) to reach every student

School/Classroom Leadership

Task Predicts Performance

Features of effective learning tasks:

- They require and instil deep thinking.
- They immerse the student in disciplinary inquiry.
- They are connected to the world outside the classroom.
- They have intellectual rigour.
- They involve substantive conversation.

What did you do in school today? Transforming classrooms through social, academic and intellectual engagement. Willms & Milton (2009)

References:

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