Technology In Education:
Four Key Components

Ruben R. Puentedura, Ph.D.

Redefinition

Tech allows for the creation of new tasks, previously inconceivable

Modification

Tech allows for significant task redesign

Transformation

Augmentation

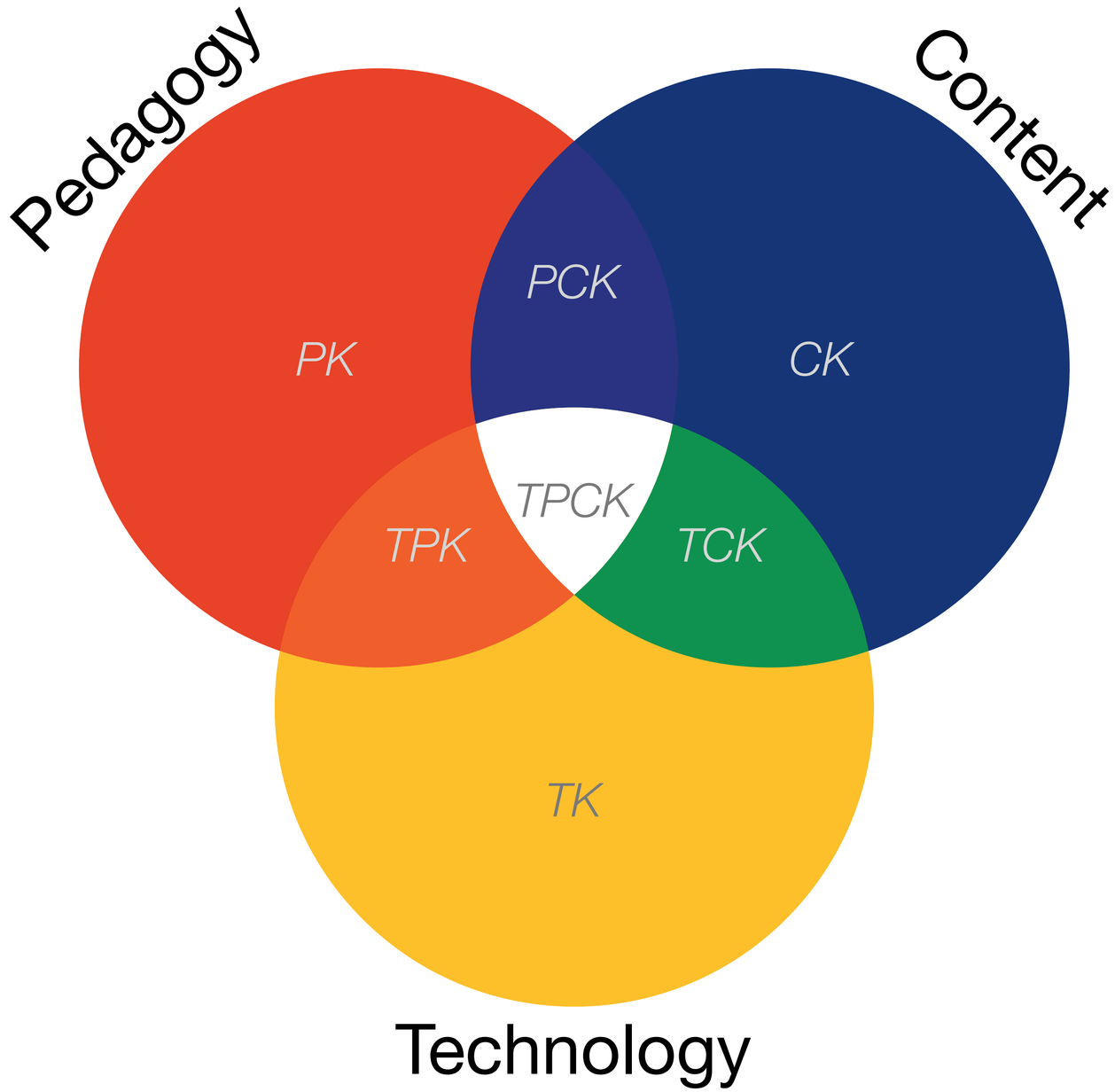
Tech acts as a direct tool substitute, with functional improvement

Substitution

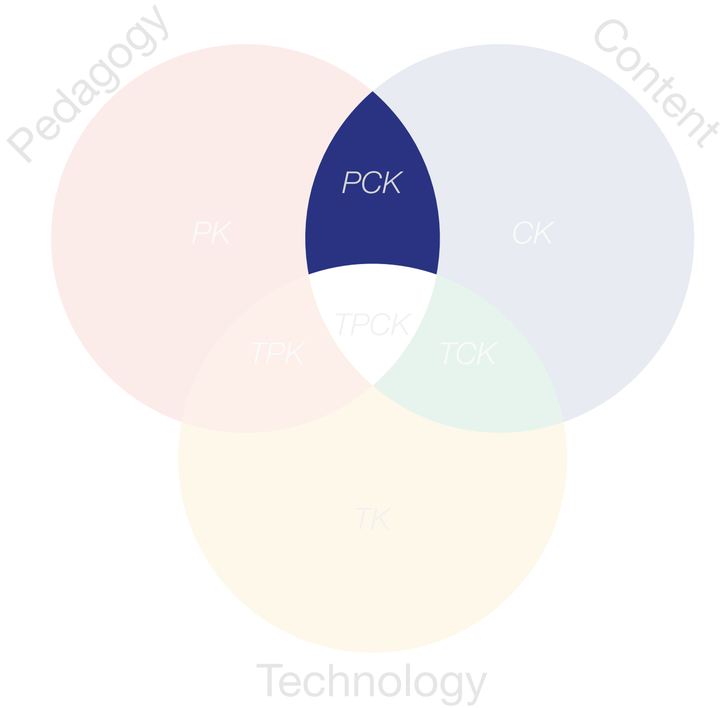
Tech acts as a direct tool substitute, with no functional change

Enhancement

1. The Importance of PCK



AACTE (Eds.) *The Handbook of Technological Pedagogical Content Knowledge for Educators*. New York:Routledge, 2008.



History – Core Concepts

- Causality
- Chronology
- Multiple Perspectives
- Contingency
- Empathy
- Change and Continuity Over Time
- Influence/Significance/Impact
- Contrasting Interpretations
- Intent/Motivation

History – Guiding Criteria

- Does the question represent an important issue to historical and contemporary times?
- Is the question debatable?
- Does the question represent a reasonable amount of content?
- Will the question hold the interest of students?
- Is the question appropriate given the materials available?
- Is the question challenging for the students you are teaching?
- What organizing historical concepts will be emphasized?

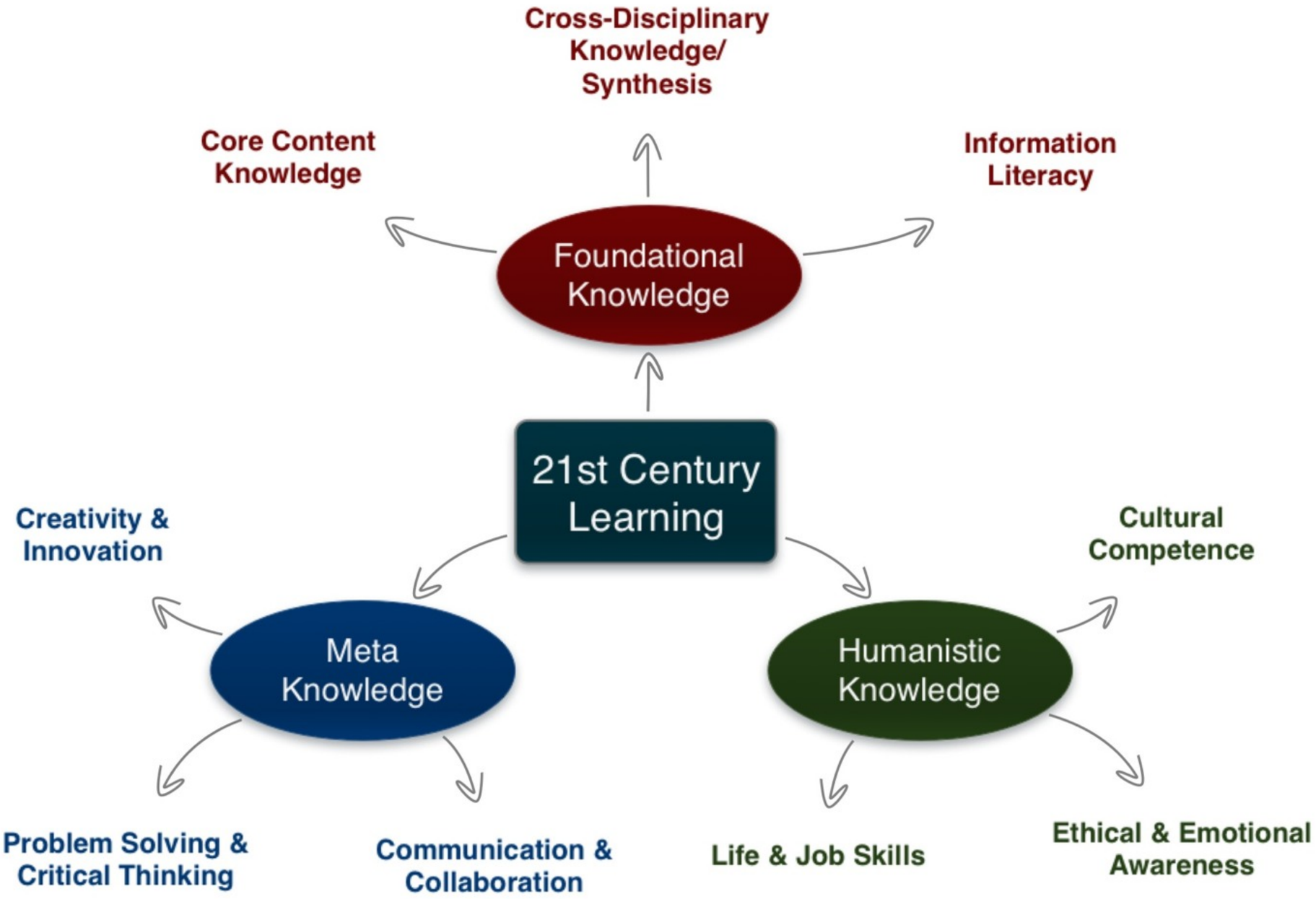
Lee S. Shulman, "Those Who Understand: Knowledge Growth in Teaching." *Educational Researcher*, Vol. 15, No. 2 (Feb., 1986)

Bruce Lesh. ''*Why Won't You Just Tell Us the Answer?*'' *Teaching Historical Thinking in Grades 7-12*. Stenhouse Publishers. (2011)

2. Conceptually Informed Technological Practice

Social	Mobility	Visualization	Storytelling	Gaming
200,000 years	70,000 years	40,000 years	17,000 years	8,000 years

Ruben R. Puentedura, "Technology In Education: The First 200,000 Years" *The NMC Perspective Series: Ideas that Matter*. NMC Summer Conference, 2012.



P. Mishra and K. Kereluik. “What is 21st Century Learning? A review and synthesis.” Paper submitted to the SITE2011 Conference. (2011)

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3. Effective Communities of Practice

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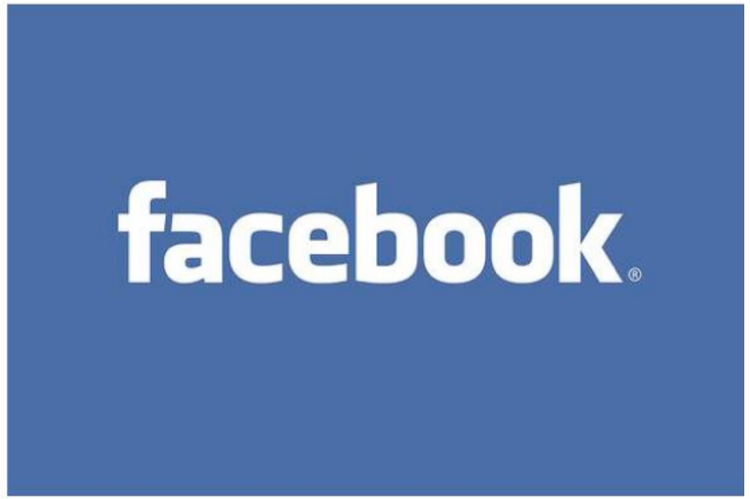

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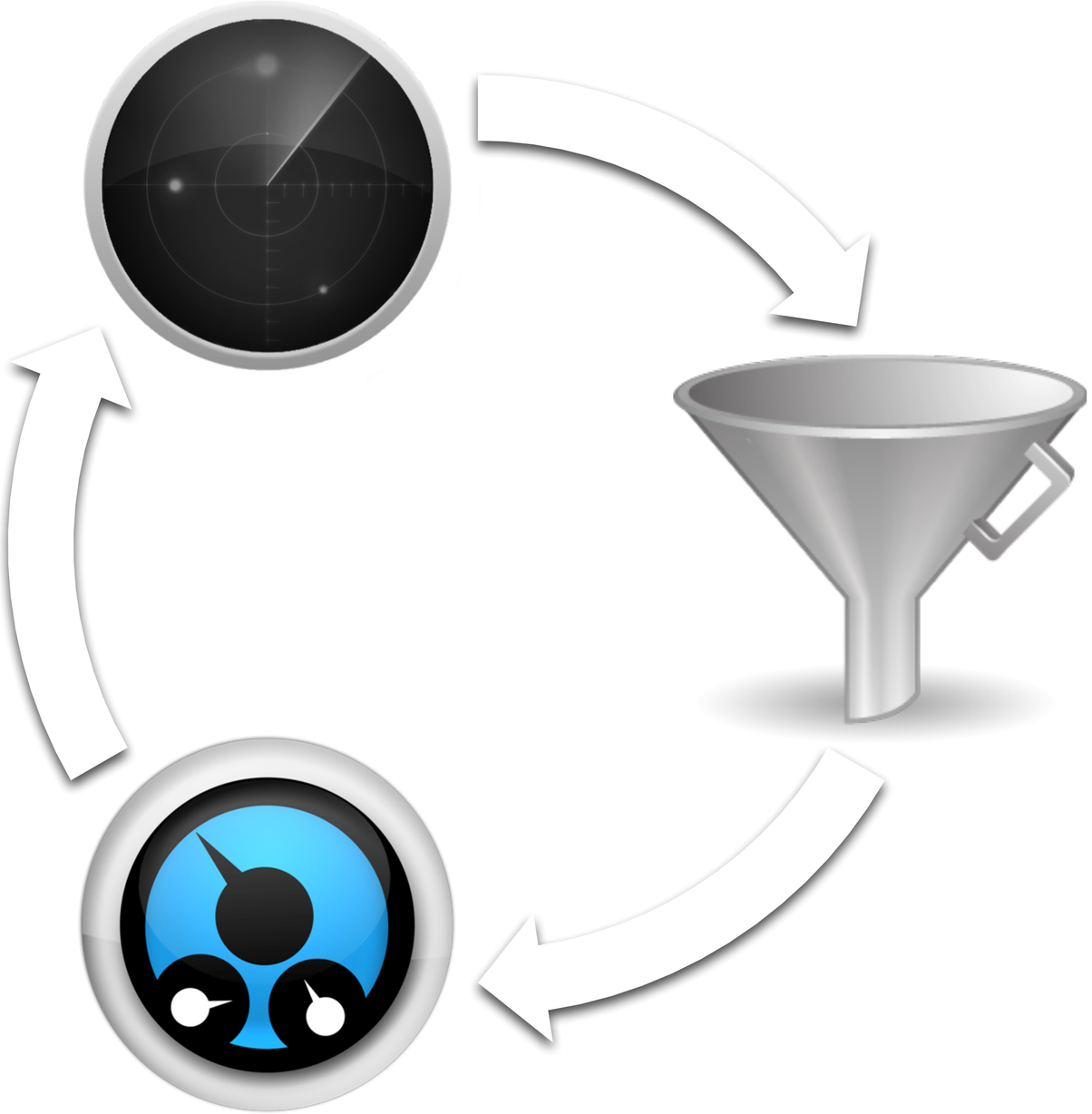

Howard Rheingold. *Net Smart: How to Thrive Online*. MIT Press (2012)

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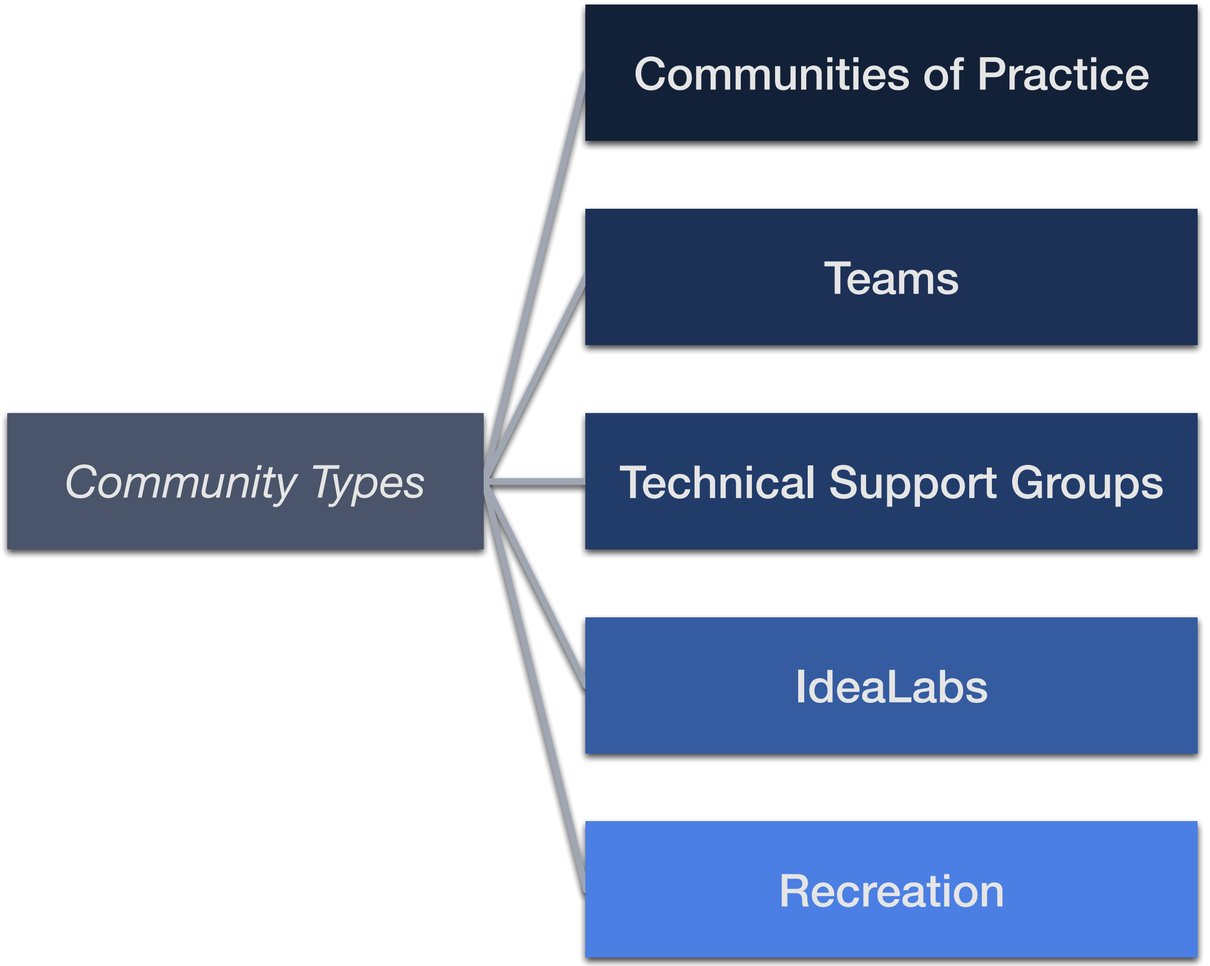

Muller, M., Ehrlich, K., Matthews, T., Perer, A. A., Ronen, I., and Guy, I. *Diversity among enterprise online communities: Collaborating, teaming, and innovating through social media*. 2012 ACM SIGCHI Conf. on Human Factors in Computing Systems (2012)

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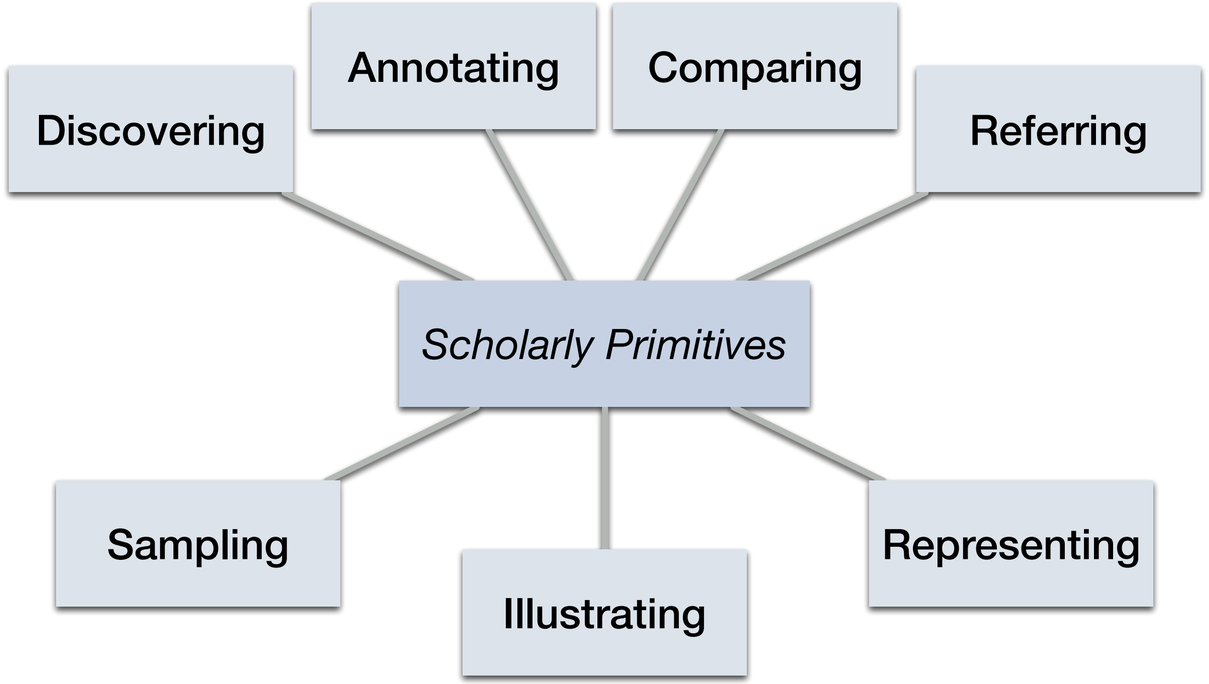


John Unsworth. *Scholarly Primitives: What Methods Do Humanities Researchers Have in Common and How Might Our Tools Reflect This?* Humanities Computing, Formal Methods, Experimental Practice Symposium, Kings College, London. (May 2000)

4. Assessing Progress

Seymour Papert: Four Expectations

- **Expectation 1:** the scholastically unsuccessful group among the students will advance by several grade levels on standard achievement tests in mathematics and language. We shall, of course, confirm the significance of any such observation by comparison with a control group matched on a series of variables set up before the outset of the experiment.
- **Expectation 2:** observers will agree that the student in the experiment not only learned more than in a traditional class, but learned it in a more articulate, richer, more integrated way.
- **Expectation 3:** students will develop, or adapt concepts and metaphors derived from computers and use them not only as intellectual tools in the construction of models of such things as "number" and "theory" but also in elaborating models of their own cognitive processes. This will in turn have an impact on their styles of learning and problem-solving.
- **Expectation 4:** the use of computer metaphors by children will have effects beyond what is normally classed as "cognitive skill". We expect it will influence their language, imagery, games, social interactions, relationships, etc…

S. Papert. *An Evaluative Study of Modern Technology in Education*. MIT Artificial Intelligence Laboratory Memo No. 371. (June, 1976)

Measuring the Four Expectations

- **Expectation 1:** suitably designed formative/summative assessment rubrics will show improvement when compared to traditional instruction.
- **Expectation 2:** students will show more instances of work at progressively higher levels of Bloom's Taxonomy.
- **Expectation 3:** student work will demonstrate more – and more varied – critical thinking cognitive skills, particularly in areas related to the examination of their own thinking processes.
- **Expectation 4:** student daily life will reflect the introduction of the technology. This includes (but is not limited to) directly observable aspects such as reduction in student attrition, increase in engagement with civic processes in their community, and engagement with communities beyond their own.

Black and Wiliam: Defining Formative Assessment

"Practice in a classroom is formative to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited."

Black, P. and Wiliam D. "Developing the theory of formative assessment." *Educational Assessment, Evaluation and Accountability*. 21:5-31 (2009)

Stiggins: Seven Principles of Assessment

- **Where Am I Going?**
  - Provide a clear and understandable vision of the learning target
  - Use examples and models of strong and weak work
- **Where Am I Now?**
  - Offer regular descriptive feedback
  - Teach students to self-assess and set goals
- **How can I close the gap?**
  - Design lessons to focus on one aspect of quality at a time
  - Teach students focused revision
  - Engage students in self-reflection, let them keep track of and share their learning

Stiggins, R. J., Arter, J. A., Chappuis, J., & Chappuis, S. *Classroom assessment FOR student learning: Doing it right—using it well*. ETS Assessment Training Institute. (2004)

Wiliam: A Framework for Formative Assessment

	Where the learner is going	Where the learner is right now	How to get there
Teacher	Clarifying learning intentions and criteria for success	Engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding	Providing feedback that moves learners forward
Peer	Understanding and sharing learning intentions and criteria for success	Activating students as instructional resources for one another	
Learner	Understanding learning intentions and criteria for success	Activating students as the owners of their own learning	

Dylan Wiliam, *Embedded Formative Assessment*. Solution Tree (2011)

Bloom's Taxonomy: Cognitive Processes

Anderson & Krathwohl (2001)	Characteristic Processes	
Remember	• Recalling memorized knowledge • Recognizing correspondences between memorized knowledge and new material	
Understand	• Paraphrasing materials • Exemplifying concepts, principles • Classifying items • Summarizing materials	• Extrapolating principles • Comparing items
Apply	• Applying a procedure to a familiar task • Using a procedure to solve an unfamiliar, but typed task	
Analyze	• Distinguishing relevant/irrelevant or important/unimportant portions of material • Integrating heterogeneous elements into a structure • Attributing intent in materials	
Evaluate	• Testing for consistency, appropriateness, and effectiveness in principles and procedures • Critiquing the consistency, appropriateness, and effectiveness of principles and procedures, basing the critique upon appropriate tests	
Create	• Generating multiple hypotheses based on given criteria • Designing a procedure to accomplish an untyped task • Inventing a product to accomplish an untyped task	

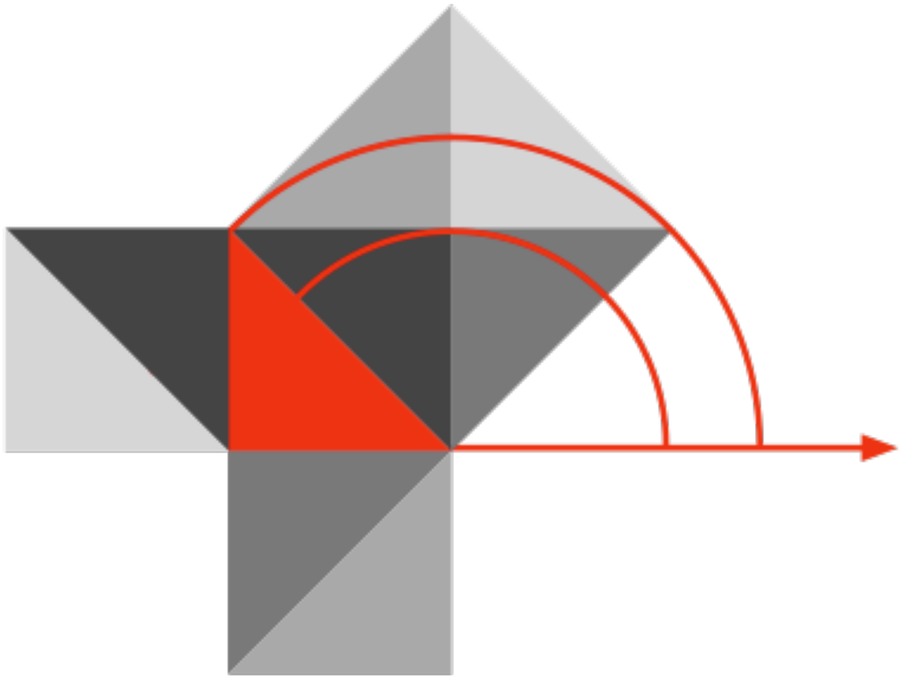
Lorin W. Anderson and David R. Krathwohl (Eds.), *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives, Complete Edition*. Longman. (2000)

Critical Thinking: Cognitive Skills and Subskills

Skill	Subskills
Interpretation	Categorization Decoding Significance Clarifying Meaning
Analysis	Examining Ideas Identifying Arguments Analyzing Arguments
Evaluation	Assessing Claims Assessing Arguments
Inference	Querying Evidence Conjecturing Alternatives Drawing Conclusions
Explanation	Stating Results Justifying Procedures Presenting Arguments
Self-Regulation	Self-examination Self-correction

Peter Facione, *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction - Executive Summary*. "The Delphi Report". American Philosophical Association, Committee on Pre-College Philosophy. California Academic Press, 1990

Hippasus



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