



DEPARTMENT OF
LEARNING TECHNOLOGIES
College of Information

Inspired to Make

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Content

2

- Critical thinking and problem solving
- History of critical thinking and problem-solving in the classroom
- Maker movement's role in critical thinking and problem-solving skills

Critical thinking and problem solving

3

- 21st century skills: Critical thinking, creativity, collaboration, and communication (4Cs; Partnership for 21st Century Skills, 2008a).
- The significance of critical thinking is paramount. Its connection to other skills is equally valued.

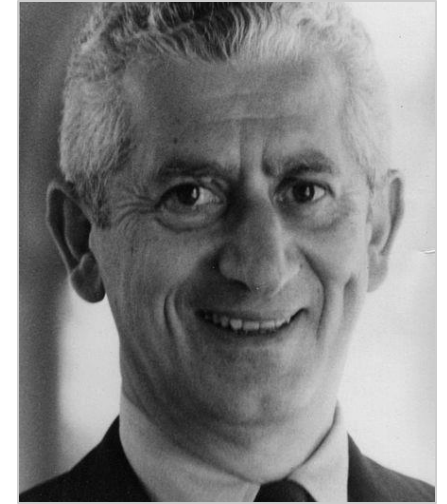
Critical thinking definition



Robert J. Sternberg
Psychology



Robert H. Ennis
Philosophy



Benjamin S. Bloom
Education

A reasonable reflective
thinking that is focused on
deciding what to believe or do
(Ennis, 1993)

Boom's Taxonomy
(Bloom, 1958)

A set of cognitive skills and strategies that are
purposeful and goal directed that enable someone to
be likely to achieve problem solving (Sternberg,
Roediger, & Halpern, 2007)

Critical thinking and problem solving

American Philosophical Association- Delphi

“*Critical thinking* is purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based.The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, wiling to reconsider, clear about issues, orderly in complex maters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit.....” (Facione, 1990, p.3).



Critical thinking and problem solving

6

- The National Education Association (2011) defined critical thinking in four phases: to reason effectively, use system thinking, make judgements and decisions, and solve problems.
- “Students who are able to think critically are able to solve problems effectively” (Snyder & Snyder, 2008, p.90)

Critical thinking and problem solving

7

- Developing problem-solving skills has been identified as essential to student success in the 21st century, not only inside the classroom but also in all professions (Jonassen, 2010; Kereluik, Mishra, Fahnoe & Terry, 2013).
- There is a lack of critical thinking and problem solving reported in K-12 education (Partnership for 21st Century Skills, 2008b; Phonapichat, Wongwanich, & Sujiva, 2014).
- The Next Generation Science Standards (National Academies of Sciences, Engineering, and Medicine, 2019).

Critical thinking and problem-solving in K-12

8

- The "Traditional" Classroom, as defined by Hertz-Lazarowitz, 1992
- Teacher-centered communication, rote memorization

- Problem-Based Learning, McMaster Univ, 1969
- Focus on deeper learning, critical thinking

- STEM
- Definition is "underconceptualized" (Ostler, 2012) & too broad to be defined (Gerlach, 2012)

- STEAM
- Innovations "transcend either discipline" (Peppler & Wohlwend, 2018)

- Maker Movement

Maker Movement

9

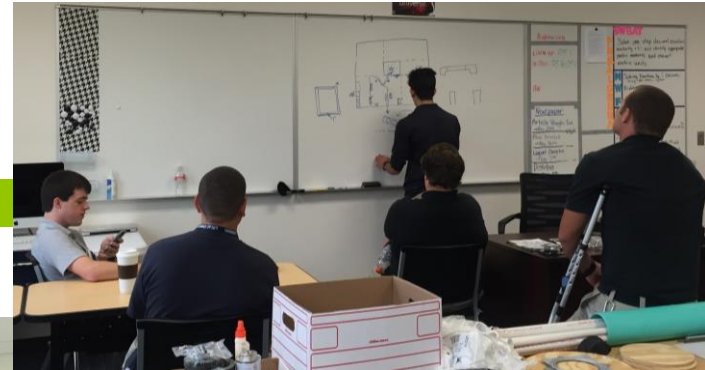
A Brief History of Making



Makerspaces

10

- Locations
 - ▣ Elementary
 - ▣ Middle/HS
 - ▣ College
 - ▣ Community



Maker Movement's Role in Critical Thinking and Problem-Solving Skills

11

- Cooper and Heaverlo (2013) found that problems and their potential solutions are a common driving force in motivating students to want to learn.
- “Foster higher levels of epistemic and intellectual development in students”
- Blackley, and Maynard (2017) argued that “a makerspace approach to STEM education can be an authentic and robust pedagogical practice providing there are strong and explicit connections the curricula of mathematics, science and technology and the resultant [makerspace] product...” (p. 152).

Significance

12

Why was this concept and review of the literature important?

- ❑ Inspires students
- ❑ Builds confidence
- ❑ Introduce opportunities for critical thinking
- ❑ Provides collaborative experiences
- ❑ Enhance job skills

What's Next?

- ❑ How are we currently planning for makerspace implementations and activities?
- ❑ How are we training teachers to design experiences that develop critical thinking skills?



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Resources

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15

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