Picking up STEAM?

Reflections on Korea's Creative Education Policy

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Intent and Plan

- Critical Analysis of Korea's recently proposed creative education policy called "STEAM Education"
- Provide food for thought on how to promote creativity in schools

The Plan

1. Origin and background of STEAM
2. Brief Introduction of STEAM policy and practices
3. Critical Analysis of STEAM's pros & cons
4. Ideas on creativity promotion in education based on UNESCO/KNCU's creativity programs (e.g. KNCU's Creativity Forum, Creative Cities, etc.)
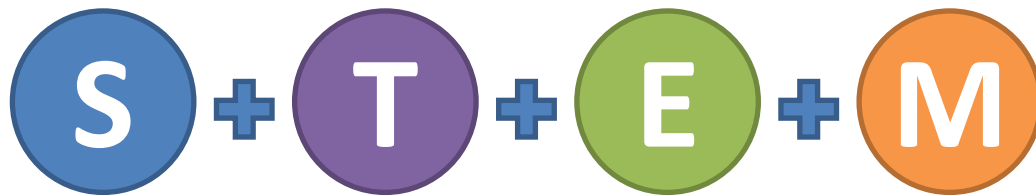
From STEM to STEAM

Science

Technology

Engineering

Math
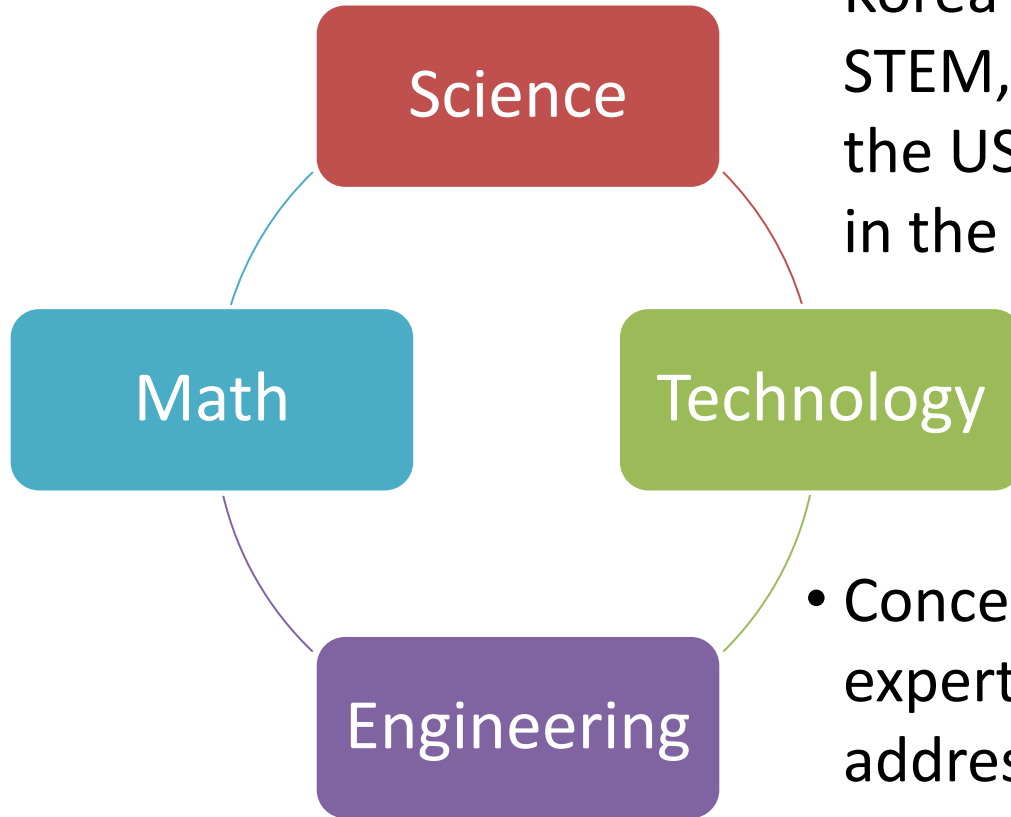
- Korea's STEAM originates from STEM, an acronym first proposed by the US National Science Foundation in the 1990s.

- Concept further developed by experts in North America mainly to address following problems:
  - Low ranking in PISA;
  - Low interest toward STEM.

From STEM to STEAM: Two STEMs

S + T + E + M   Initial NSF Definition; "Silo" Fields.

STEM   Emphasize 'integration, interdisciplinary Interaction, convergence' of the fields

From STEM to STEAM

STEM

Emphasize "integration, interdisciplinary Interaction, convergence" of the fields

"Integrative STEM education refers to technological/engineering design-based learning approaches that intentionally integrate content and process of science and/or mathematics education with content and process of technology and/or engineering education. Integrative STEM education may be enhanced through further integration with other school subjects, such as language arts, social studies, art, etc."

(Sanders & Wells, 2009)

From STEM to STEAM
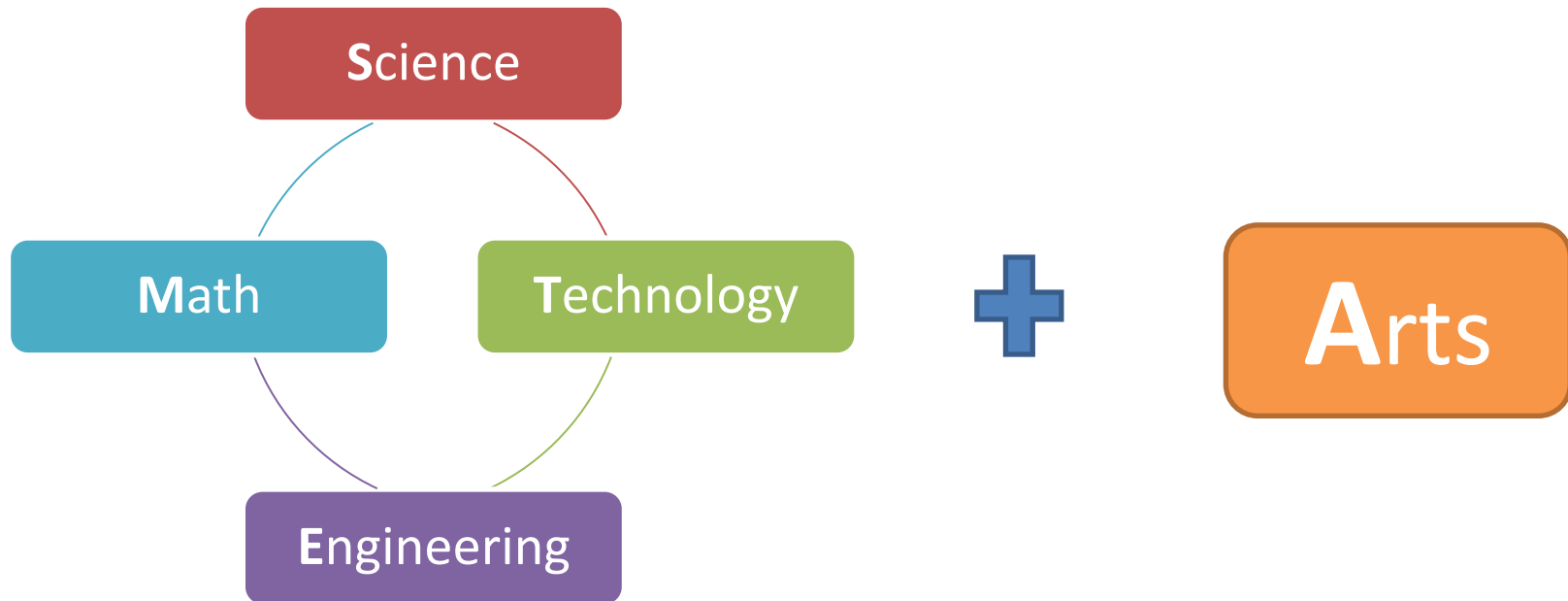
- Building on STEM, STEAM education first proposed in 2010.
- Ministry of Education, Science and Technology adopts STEAM as the official government programme for developing "Creative, Convergent Talents" in primary and secondary schools since 2011.

Emphasis of Convergence

IT **BT** **NT** **GT**

Two-sides of PISA

SCIENCE	PISA SCORE	READING	PISA SCORE	MATH	PISA SCORE
Shanghai, China*	575	Shanghai, China	556	Shanghai, China	600
Finland	554	Korea	539	Singapore	562
Hong Kong, China	549	Finland	536	Hong Kong, China	555
Singapore	542	Hong Kong, China	533	Korea	546
Japan	539	Singapore	526	Taiwan	543
Korea	538	Canada	524	Finland	541
New Zealand	532	New Zealand	521	Liechtenstein	536
Canada	529	Japan	520	Switzerland	534
Estonia	528	Australia	515	Japan	529

Despite Korea's constant high ranking in S&M, it ranks 43 out of 49 countries in student interests in S&M.
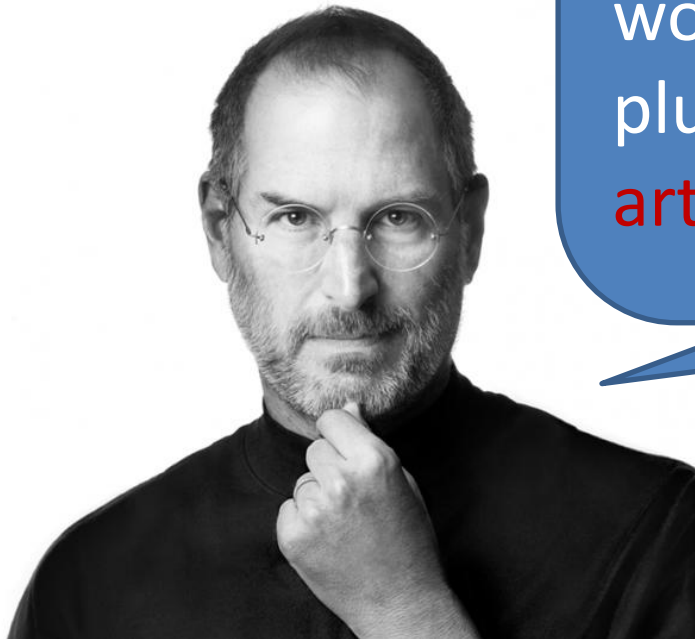
Why STEAM? Why Arts?

SAMSUNG vs. 🍎

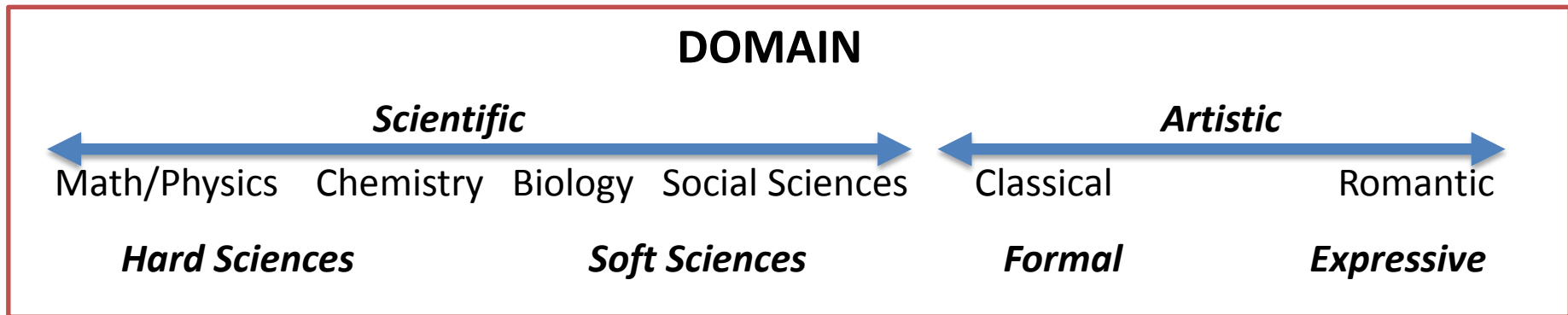Why Samsung failed to produce the iPhone first?

Why STEAM? Why Arts?

"We're not just a tech company, even though we invent some of the highest technology products in the world... It's the marriage of that plus the humanities and the liberal arts that distinguishes Apple."

Why STEAM? Why Arts?

In addition to practical reasons, there is theoretical base for advocating the convergence of sciences and arts (D. Simonton)

DOMAIN

Scientific ⟷ *Artistic*

Math/Physics   Chemistry   Biology   Social Sciences   Classical   Romantic

Hard Sciences   **Soft Sciences**   **Formal**   **Expressive**

Difference of Creativity Traits:

Objectivity	versus	Subjectivity
Logic	versus	Intuition
Formality	versus	Informality
Rationality	versus	Emotion
Algorithms	versus	Heuristics

Why STEAM? Why Arts?

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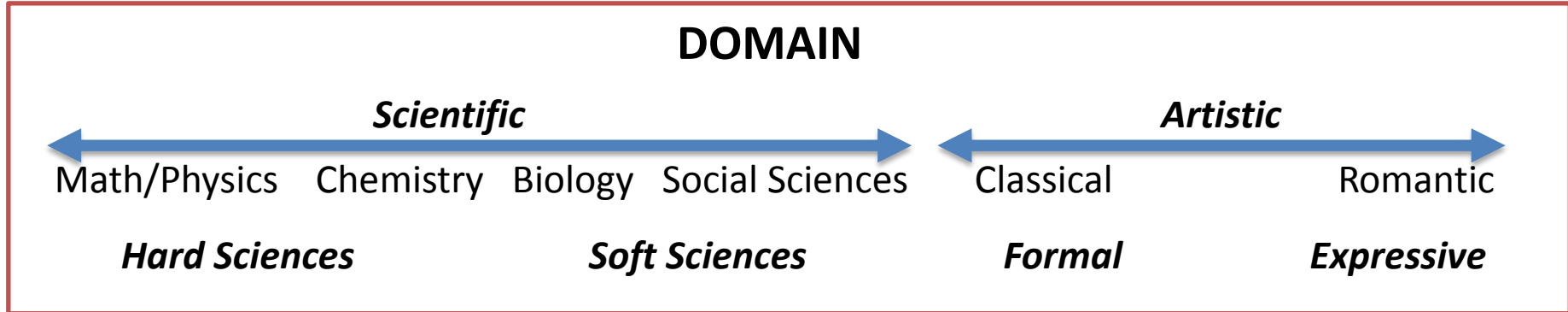
- Simonton and Psychologists found that eminently creative figures tended to have creative traits that were similar to more average creators lower down in the disciplinary hierarchy.

- Scientific creativity positively associated with involvement in the arts especially for Nobel laureates compared to control group scientists.

Why STEAM? Why Arts?

- Albert Einstein: "to these elementary laws there leads no logical path, but only intuition, supported by being sympathetically in touch with experience."

- Max Planck: creative scientists "must have a vivid intuitive imagination, for new ideas are not generated by deduction, but by an artistically creative imagination."

Hence, STEAM! (Pros)

1. Holistic approach, emphasizing the convergence of disciplines;
2. Increase interest and deliberation of STEM through combining sciences with the arts and history;
3. Encourage innovative teaching using story-telling, hands-on approaches and team work, as well as emphasizing new dimensions such as design and subject meaning

STEAM Policy

Restructured the Korean Science Culture Foundation into **KOFAC**: Mandate of Creative Education (STEAM)

| STEAM Teacher Research Group | STEAM Education Task Force | STEAM Education Local Centers |

In 2011 (First Year):
- Established the STEAM TF
- Established 47 STEAM Teachers' Research Groups
- Designated 16 STEAM pilot schools

Plan to expand to 160 Research Groups & 160 schools in 2012

STEAM Curriculum Example: Light

The Light Spectrum

가시광선

3D Tech Theory

3D TV that do not need 3D glasses
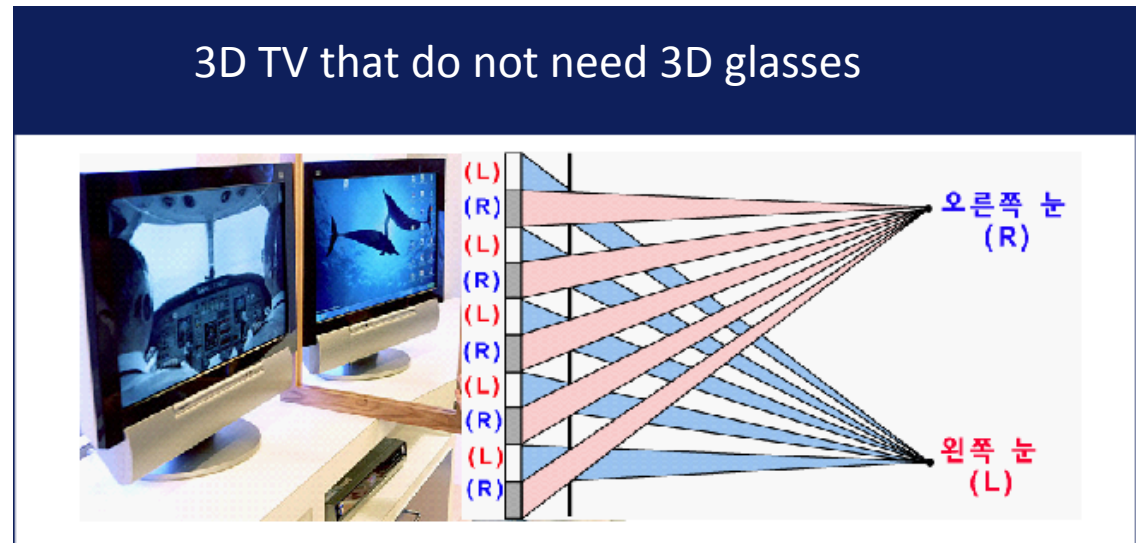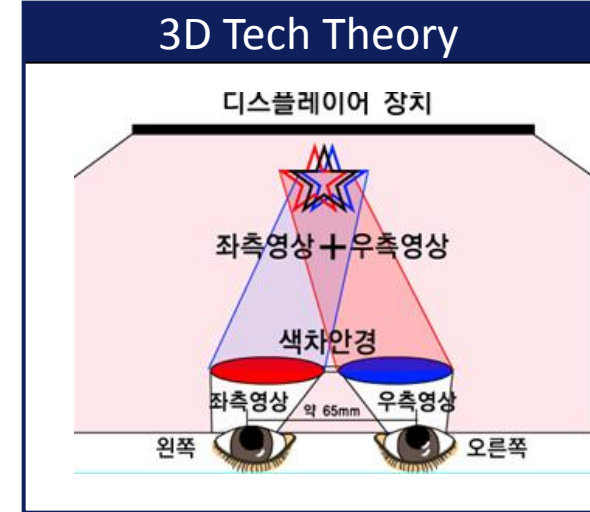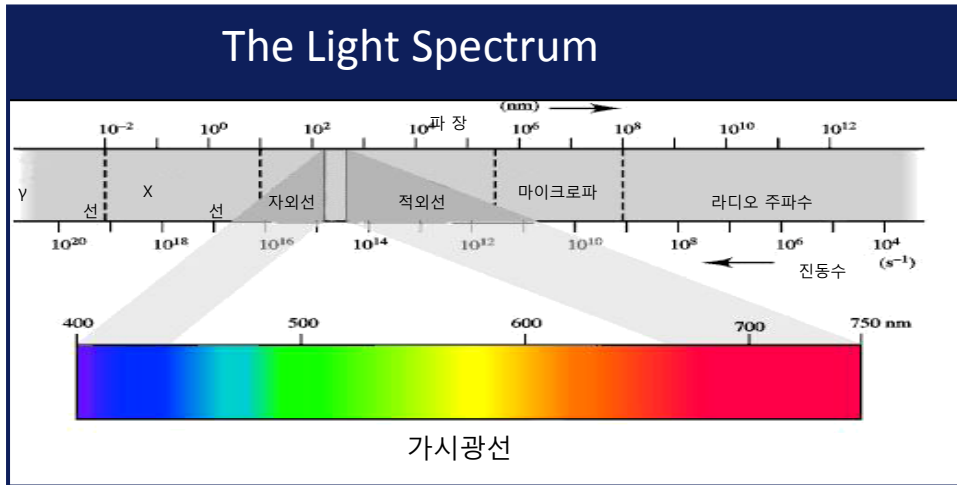
STEAMing off: Limitations

Unbalanced convergence: Too much STEM too little A

- Arts are not merely design and a factor to increase interest for the sciences;

- What is does the Arts gain from convergence?

Focus on content not context

- STEAM continues to be just another box, when creativity is thinking outside of the box;

- Despite some meaningful emphasis on experience, teamwork and storytelling, STEAM is more about the content than the process

STEAMing off: Limitations

Too little time and flexibility for creativity:

- Despite efforts to reduce subject no. and encourage flexibility, doubtfully of success due to emphasis on College Entrance Exam & lack of proper infrastructure
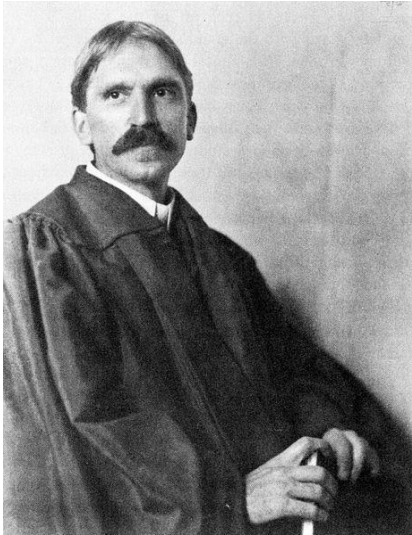
John Dewey: the doing of sciences "[Sciences] significance can be learned only by use."

Food for Thought: Is it really a lack of talent?

Evidence of Korea's Creativity and Science Literacy:
- Top class PISA scores in Sciences and Math;
- Top ranks in S&M Olympiads;
- Number of world class high-tech firms (e.g. Samsung, Hyundai, LG, Posco, etc.) as well as the number of patents generated.

Why iPhones were made by Apple first?
- Environmental Tolerance toward new ideas;
- Culture of accepting risk and diversity;
- Catch-up versus pioneering mentality

The Story of the Android
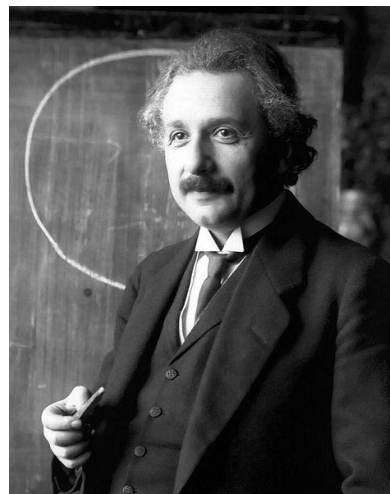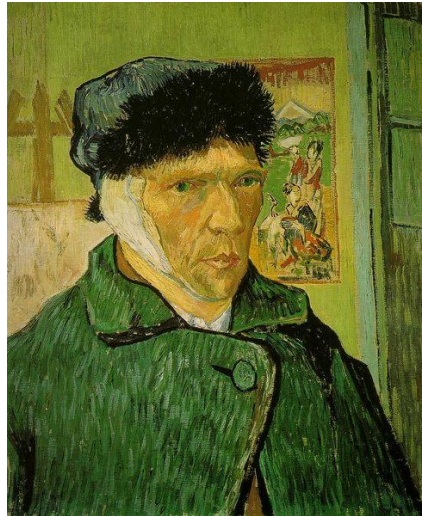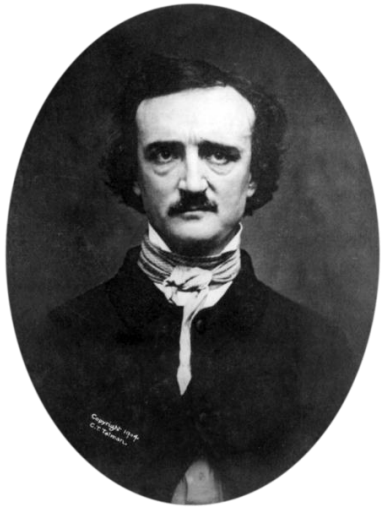
Established by Andy Rubin in 2003

Acquired by Google in 2005

- Tolerance: failure to value the new idea and possibility of software to hardware;
- Risk aversive and catch-up culture.

OUTCOME: Samsung/LG use Android; Motorola is now owned by Google!

Recognizing Creativity

How Creative was Korea's Creative Education Policy STEAM?

- Tolerance of new ideas?
- Accepting Risks & Diversity?
- Catch-up or Pioneering Culture?

Can Creativity be taught?

I don't know. But we can make environments including schools conducive toward creativity.

- Increase tolerance and flexibility towards new ideas and diversity;
- Encourage interaction between people & ideas;
- Process-learning than content-learning.

UNESCO/KNCU programs: Cultural diversity, Education for Sustainable Development (ESD), Creative Cities, Science Clusters, Creativity Forum, etc.

Thank You

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