

Hands-on learning

Some history and some principles

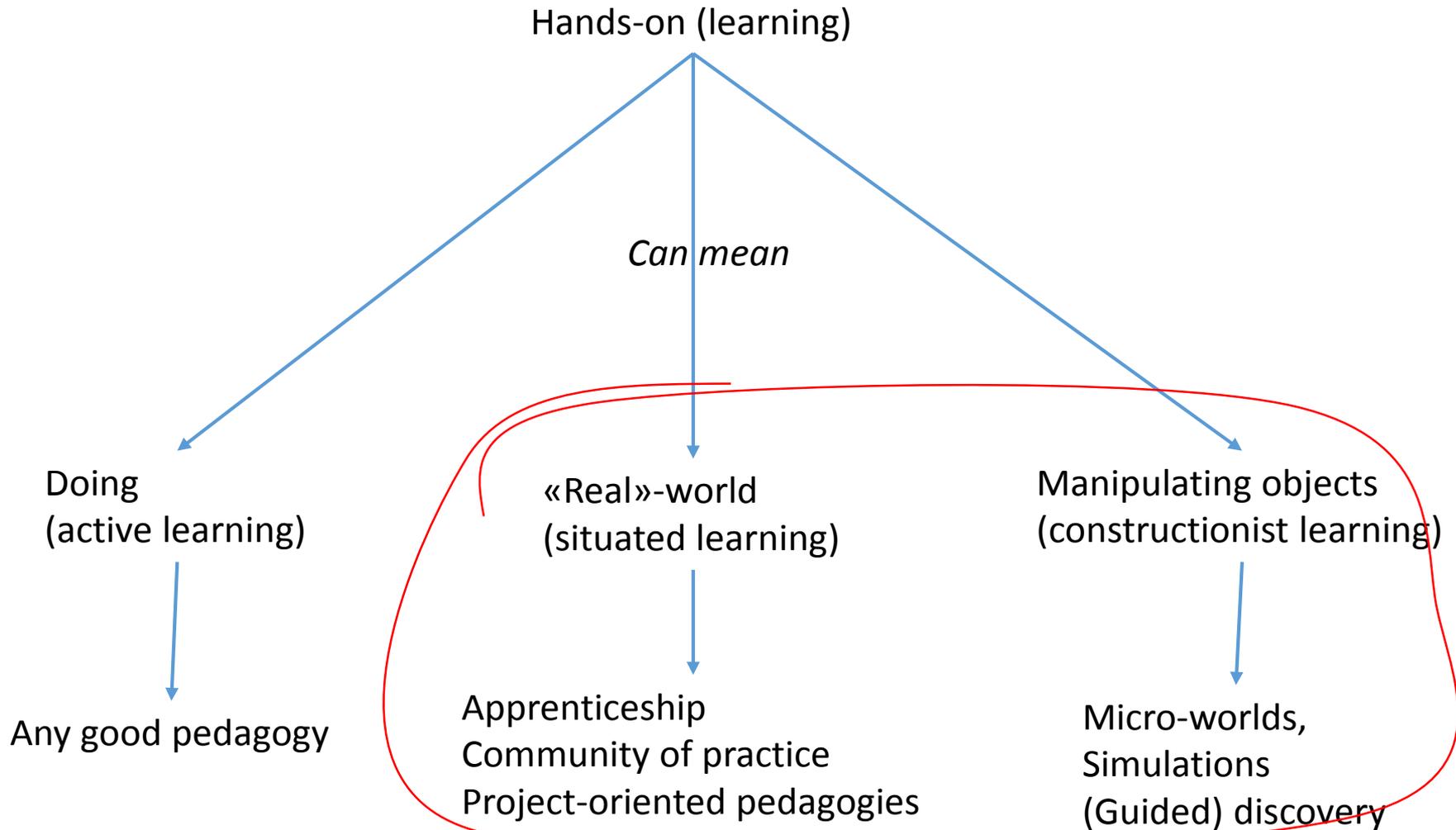
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Hands-on ?



1. (Some!) roots

Europe-centered, sorry

1. Apprenticeship, vocational education & communities of practice

Middle ages:

- Indenture with master craftsmen,
- Rules from craft guilds

19th-20th century:

- Vocational training systems (D, CH,...)

20th century

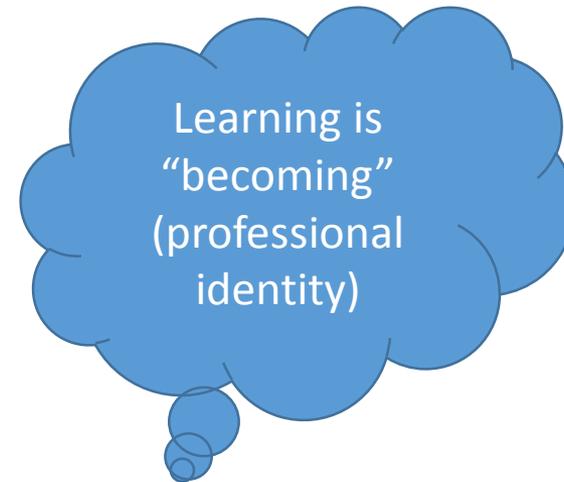
- Higher vocational training increases internships

Lave & Wenger, 1991.

- Communities of practice

Rheingold, 1993

- Virtual communities



Becoming a member of a community by:

- moving from the periphery towards the center,
- learning through participating and guidance
- sharing artifacts (tools, documents, models),
- adopting common "language" and practice

2. Intelligent hands and experimenting

Rousseau, 1712-1788

- Romanticism

Locke, 1632-1704

- Sensory experience

Pestalozzi, 1746-1827

- Learner autonomy and responsibility
- “head, hand and heart”

Fröbel, 1782-1852

- “Gifts” to experiment

Montessori, 1870-1952

- “Materials”

Piaget

- Constructivism

Papert, 1928,-

- Mindstorms (1980)
- LOGO (1967)

Key idea:
Promote
learning
through hands-
on interaction

The construction kit stimulates learning through manipulation. It:

- Invites using it.
- Is intuitive,
- adaptable / flexible,
- robust.
- Create larger objects from small ones

3. Activity-based learning

Key idea:
Learning takes place in a social, cultural and material context

Karl Marx, 1818-1883

Pavlov, 1849-1936

Vygotski, 1896-1934

- Socio-constructivism
- Zone of proximal development

Leontief, 1903-1979

- Activity theory (USSR)

Activity theory (Scandinavia)

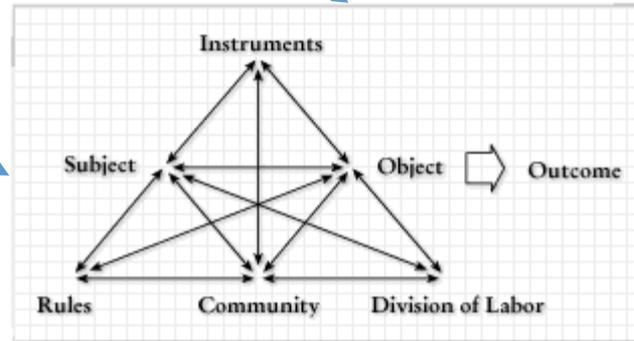
- Expansive learning (Engeström, 1987)

Nardi, 1995 (use in HCI)

Learning happens through activities, i.e. reflection of social knowledge

Activities are:

- hierarchical: activity (needs, motivation), action (goal), operation (task);
- focused on objects carrying culture;
- mediated by tools carrying culture;
- continuously developed/adapted.



4. Hands-on, “real-world” projects

Fröbel

Herbart (1776-1841)

Dewey, 1859-1952

- Structured learning through experience (hands-on, real world projects)
- Guided learner-centered pedagogy
- Connecting subject matters to prior knowledge and experience

Kilpatrick, 1871-1965

Freinet, 1896-1966

- Learner-centered inquiry-based learning
- Collaborative work, creating products
- Real-world experience (printing press, field trips,)
- Responsibility of the child (participation)

Freire, 1921-1997

- Balance of action and reflection
- Dialogue, creating autonomy

Key idea: Learning through interaction with the “real world”, doing projects with some learner autonomy.

• Teacher as guide

• Project-based learning
• “hands-on”
• Connect with real world

• Respect of autonomy

Current situation ?

Two broad approaches ...

1. Educational “manipulatives”

Manipulatives/expressive media favor learning by manipulation and discovery

Such “reality subsets” provide focus:

1. A basic **set of elements and operations**,
2. that can be **combined** (like words and sentences in a language).
3. Ready for **exploration**.

Variants:

- Physical kits, e.g. Fröbel gifts, Lego, puzzles;
- Augmented kits (with electronics) e.g. Lego-Mindstorms, Cricket;
- Micro-worlds, e.g. Logo, Scratch;
- Simulations and serious games.

Associated pedagogies:

- Discovery learning
- Inquiry learning
- Guided discovery learning

Criticism & answer (I):

- Discovery learning is neither efficient nor effective

All depends on guidance

Criticism & answer (II):

Disconnected from the “real world”

A bounded reality allows to focus on essentials

2. Project-oriented learning

Favors deep, applicable learning since learners acquire problem-solving skills

In addition,

- Meaningful activities increase motivation.
- Contact with real problems anchor new knowledge with existing one.
- Help acquiring soft-skills
- Enable development of individual interests and abilities

Associated pedagogies:

- Project-based learning
- Problem-based learning
- Inquiry learning
- Case-based learning
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Criticism & answer (I):

1. Discrimination of slow learners
2. Avoidance of difficult topics

1. Guidance & structure.
2. There is a time for explicit instruction

3. Hands-on

Is very much alive in formal and informal education

- Children **develop through play**, adults through work and hobbies
- “Hands-on” vocational training is **dominant in high employment countries** (CH,D)
- Project-oriented learning is **important in adult education** and **in some applied sciences**
- **Any** good pedagogy includes *some* hands-on

But:

- “Hands-on” can mean many things
- Key ideas are only about 50-150 years old and not fully explored (reform in education takes longer)
- Unguided discovery (student-led “hands-on”) learning is very controversial
- (Probably) requires sophisticated learning designs and excellent teachers
- Is very costly

Further reading

Zuckerman, Oren (2006), Historical Overview and Classification of Traditional and Digital Learning Objects MIT Media Laboratory,
<https://llk.media.mit.edu/courses/readings/classification-learning-objects.pdf>

[Mitchel Resnick](#) et al. (1998) Digital Manipulatives: New Toys to Think With.
<http://web.media.mit.edu/~mres/papers/chi-98/digital-manip.html>

Michael Knoll (1997). The Project Method: Its Vocational Education Origin and International Development, *The Journal of Industrial Teacher Education*, 34.
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<http://edutechwiki.unige.ch/en/> (my wiki: search or browse by categories)