Hands-on learning
Some history and some principles

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Hands-on?

Hands-on (learning)

Can mean

Doing (active learning)
Any good pedagogy

«Real»-world (situated learning)
Apprenticeship
Community of practice
Project-oriented pedagogies

Manipulating objects (constructionist learning)
Micro-worlds, Simulations
(Guided) discovery
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

• Communities of practice

Rheingold, 1993
• Virtual communities

Learning is “becoming” (professional identity)

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

Fröbel, 1782-1852
• “Gifts” to experiment

Pestalozzi, 1746-1827
• Learner autonomy and responsibility
• “head, hand and heart”

Locke, 1632-1704
• Sensory experience

Rousseau, 1712-1788
• Romanticism

Piaget
• Constructivism

Montessori, 1870-1952
• “Materials”

Papert, 1928-
• Mindstorms (1980)
• LOGO (1967)

The construction kit stimulates learning through manipulation. It:
• Invites using it.
• Is intuitive,
• adaptable / flexible,
• robust.
• Create larger objects from small ones

Key idea:
Promote learning through hands-on interaction
3. Activity-based learning

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.

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)
### 4. Hands-on, “real-world” projects

<table>
<thead>
<tr>
<th>Fröbel, 1896-1966</th>
<th>Herbart (1776-1841)</th>
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<tbody>
<tr>
<td><strong>Dewey, 1859-1952</strong></td>
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<tr>
<td>• Structured learning through experience (hands-on, real world projects)</td>
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<tr>
<td>• Guided learner-centered pedagogy</td>
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<td>• Connecting subject matters to prior knowledge and experience</td>
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<th>Kilpatrick, 1871-1965</th>
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<td><strong>Freinet, 1896-1966</strong></td>
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<tr>
<td>• Learner-centered inquiry-based learning</td>
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<td>• Collaborative work, creating products</td>
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<td>Real-world experience (printing press, field trips, ....)</td>
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<td>• Responsibility of the child (participation)</td>
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<th><strong>Freire, 1921-1997</strong></th>
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<tr>
<td>• Balance of action and reflection</td>
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<td>• Dialogue, creating autonomy</td>
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**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

Associated pedagogies:
- Discovery learning
- Inquiry learning
- Guided discovery learning

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).

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.

Criticism & answer (I):
- Discovery learning is neither efficient nor effective

Criticism & answer (II):
Disconnected from the “real world”

All depends on guidance

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
- ....

Criticism & answer (I):
1. Discrimination of slow learners
2. Avoidance of difficult topics

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


http://edutechwiki.unige.ch/en/ (my wiki: search or browse by categories)