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Teach how to cope with uncertainty in operations

Learning factory based teaching approach for the concept of agile operations

Konzeptpräsentation

25. Techno-Ökonomie-Kolloquium, 24.05.2019

Agenda

1. Problem description
2. Research question
3. Research contribution
4. Research method
5. Literature

Problem description

Research motivation & relevance

Agility - a concept to cope with uncertainty in operations

“agile manufacturing as a **business concept** with the aim of being **able to respond rapidly on change** to gain a **competitive advantage** through combining “the organization, people and technology into an integrated and coordinated whole“
[Kidd 1995]

“Agility enables companies to **prepare proactively** for uncertainties and **react quickly** to changes to **optimize the economic situation** by leveraging the whole value chain.”
[Ramsauer et al., 2017]

“**Agility** is seen as a **capability** that can **help** organizations **deal with uncertainty**; not necessarily by planning, but by nimbly adapting as needed.”
[Prange & Heracleus, 2018]

“…in recent years, **increase** in the level of **competitive pressure** and **environmental turbulence** has caused organizations move toward the **agile paradigm to gain competitive advantage** and this way create value for their customers.”
[Sharma & Bhat, 2014; Seyed et al. 2017]

- Agility is seen as capability to prepare proactively for uncertainties
- Early detection of relevant changes (internal and external)
- React quickly to these changes sensing and seizing business opportunities.

Problem description

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Research need

Japanese total quality control (**JTQC**), total quality management (**TQM**), Deming's system of profound knowledge, business process reengineering (**BPR**), **lean** thinking and **Six Sigma -** they have **implementation factors in common** → one of them: **training and education**."
[Chiarini, 2011]

"…Successfully scaling an **agile operating model requires new skills, behaviors, and mind-sets** across the organization. **Organizations** require existing staff to take on these new roles or responsibilities, and as such, **need a way to build new skills and capabilities**."
[Brosseau et al., 2019]

"…**training efforts** need to be **accelerated, dynamic, and experience-based** to support the **development of agile capabilities**."
[Gehler, 2005]

…a **learning factory conveys the experiential learning principles** by reproducing a simulated reality that stimulates learners' cognition by challenging them **to achieve abstract concepts through a direct and concrete practical application**."
[Zan et al., 2015]

- Agile operations requires specific skills, behaviors and mind-sets.
- Ways to build skills and agile capabilities are needed - experiential learning seems suitable to build such capabilities.
- Learning factory principle conveys experiential learning

Problem description

Learning factory based setting for agile operations training

Experiential learning

"…**Learning** can be defined as the **process** whereby **knowledge is created through** the **transformation of experience**. Knowledge results from the combination of grasping and transforming experience - in other words, **learning comes through experience**…"
[Kolb, D.A. 1984]

"…**experiential learning** is drawing together **theory and practice**…it **involves action learning** and **reflective practice**; it involves the **emotional aspects** of learning, and **incorporates the various environmental factors** that add to the learning experience."
[Beard & Wilson, 2013]

Meta-levels of experiential learning [Zan et al. 2015]

1. Concrete experience

1.1 Introductive briefing

1.2 As is state exploration

2. Reflective observation

2.1 Sharing

2.2 Re-elaboration

3. Abstract conceptualization

3.1 Theoretical concept transfer explanation

3.2 To-be state planning

4. Experimentation

4.1 To-be state application

4.2 Consolidation

Problem description

Learning factory based setting for agile operations training

Experiential learning

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Macro-phases of experiential learning (Zan et al. 2015)

Learning Factory

" A learning factory in a narrow sense is a **learning environment** specified by:

- **processes** that are **authentic,** include multiple stations, and comprise **technical** as well as **organizational aspects**
- a setting that is changeable and resembles a **real value chain**
- a **physical product being manufactured**, and
- a **didactical concept**"

[Tisch & Metternich, 2017]

Success fators of learning processes	Learning factory as a learning system
Contextualization[1]	Abstracted model of real operations provides context
Activation of learner[2]	Generation and application of knowledge in the learning factory
Problem solving[3]	Solving of real problem situations in the learning factory
Motivation[4]	Motivation by the reality character and the possibility to act hands-on immediately.
Collectivization[5]	Self-organized learning in groups is a suitable model in learning factories
Thinking and doing[6]	Alternation of hands-on and systematization phases

[1]Jonassen,1999 & Lave et al., 1991; [2]Johnson et al., 1991 & Bonwell et al., 1991; [3]Boudet al., 1999; [4]Deciet al., 1991; [5]Greeno et al., 1996; [6] Aebli, 1994

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Research question

Preliminary research questions

RQ1: How does a training concept in a learning factory based setting look like to support capability building of agile operations?

RQ1.1: What are meaningful learning objectives for the concept of agile operations?

RQ1.2: What are specific requirements of learning objectives for agile operations concerning teaching methods and the learning environment?

RQ2: To which degree does a learning factory based setting fulfill agile operations training needs?

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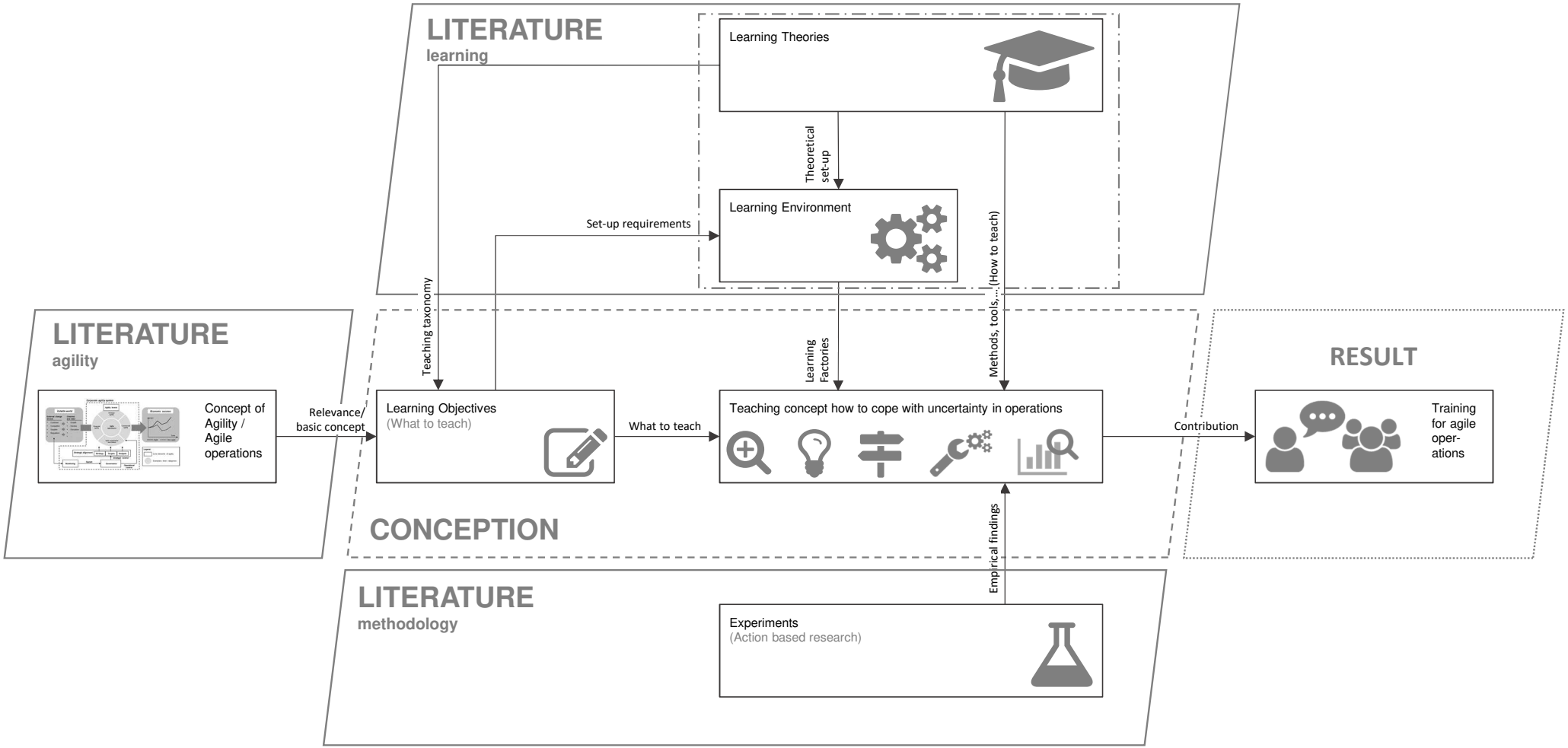
Research contribution

Research framework



Research contribution

Target outcome

Learning factory based training to build awareness for uncertainties, subsequent effects on operations and build knowledge concerning the concept of agile operations to cope with these uncertainties.

- Content
- Environment
- Method

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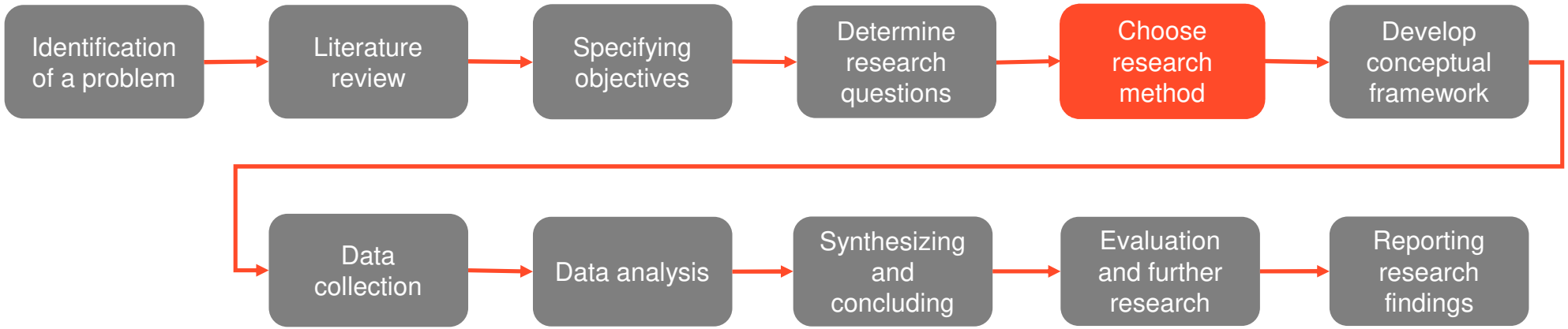
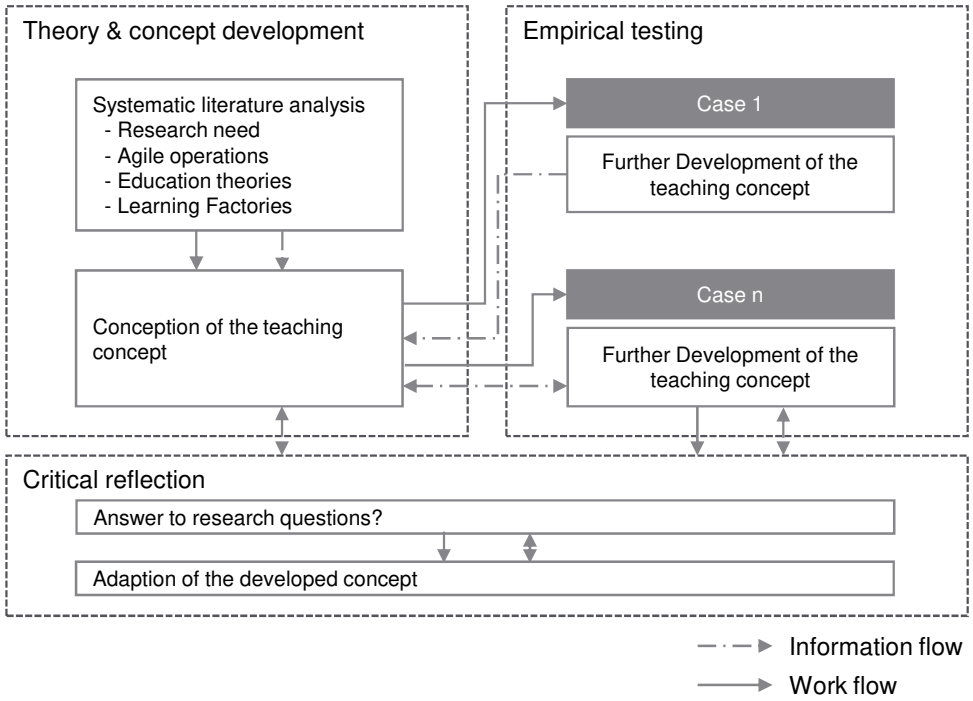
Research process[1]



[1] Karlsson, 2016

Research method

Action based research[1]



Living educational theory approach to action research:

"... it confronts the researcher to **challenge** the status quo of their **educational practice** and to answer the question, 'How can I improve that I'm doing?' The vision of a living educational theory researcher is to make an original **contribution to** knowledge through generating an educational theory proven to **improve the learning of people within a social learning space**."
[Atkins and Wallace, 2012]

[1]Argyris, Putman and Smith, 1985; Ulrich, 1983; Eden and Huxham 1996

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Literature

Excerpts from literature

Agile operations

- Nagel D. 21st Century Manufacturing Enterprise Strategy: Lehigh University Press Inc.,; 1991
- Kidd PT. Agile manufacturing: Forging new frontiers. Reprinted. Wokingham, England: Addison-Wesley; 1995. (Addison-Wesley series in manufacturing systems)
- Ramsauer C, Kayser D, Schmitz C, editors. Erfolgsfaktor Agilität: Chancen für Unternehmen in einem volatilen Marktumfeld. 1. Auflage. Weinheim: Wiley-VCH; 2017
- Prange C, Heracleous LT, editors. Agility.X: How organizations thrive in unpredictable times. Cambridge: Cambridge University Press; 2018
- American Management Association (2006). Agility and Resilience in the Face of Continuous Change: A Global Study of Current Trends and Future Possibilities. AMA/HRI
- McCann, Joseph, Selsky, John, and Lee, James (2009). Building agility, resilience and performance in turbulent environments
- Daniel Brosseau, Sherina Ebrahim, Christopher Handscomb, Shail Thaker. The journey to an agile organization: McKinsey Insights; 2019
- Seyed Mahmoud Zanjirchi, Negar Jalilian, Ali Mirhoseini, (2017) "Risk-agility interactive model: a new look at agility drivers", Journal of Modelling in Management, Vol. 12 Issue: 4
- Rabitsch C. (2016) Methodology for implementing agility in manufacturing companies, doctoral thesis, Graz University of Technology

Educational theory / Learning factories

- Kolb DA. Experiential learning. Englewood Cliffs, N.J.: Prentice-Hall; 1984.
- Boud D, Keogh R, Walker D, editors. Reflection: Turning Experience into Learning. New York: Nichols Publishin Company; 1994
- Gentry JW, editor. Guide to business gaming and experiential learning. London, East Brunswick: Kogan Page; Nichols/GP Publ; 1990.
- Kirkpatrick DL, Kirkpatrick JD. Evaluating training programs: The four levels. 3. ed. San Francisco: Berrett-Koehler; 2006
- Ammar S. Experiential learning activities in Operations Management. International Transactions in Operational Research 1999
- Tisch M, Hertle C, Cachay J, Abele E, Metternich J, Tenberg R. A Systematic Approach on Developing Action-oriented, Competency-based Learning Factories. Procedia CIRP 2013
- Abele E, Metternich J, Tisch M, editors. Learning Factories. Cham: Springer International Publishing; 2019
- Reiner D. Methode der kompetenzorientierten Transformation zum nachhaltig schlanken Produktionssystem [Dissertation]; 2009
- Kolb AY, Kolb DA. Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education. 2005

Karre H, Hammer M, Kleindienst M, Ramsauer C. Transition towards an Industry 4.0 State of the LeanLab at Graz University of Technology. Procedia Manufacturing 2017; 9:206–13.

Karre H, Hammer M, Ramsauer C. Learn how to cope with volatility in operations at Graz University of Technology's LEAD Factory. Procedia Manufacturing 2018; 23:15–20.

Karre H, Hammer M, Ramsauer C. Building capabilities for agility in a learning factory setting. Procedia Manufacturing 2019; 31:60–65.

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THANK YOU

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