Bringing the factory to the students:
Enriching teaching cases with Virtual Reality

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The goal – How we <u>want</u> to teach factory management

Excursion to Geberit, ETH 2017

Excursion to Kvaerner, NTNU 2015

The problem – how we <u>actually</u> teach factory management

"If the mountain will not go to Muhammad, Muhammad must go to the mountain."

(Ancient proverb)

A solution - Virtual Reality (VR)

- VR enables students to immerse into surroundings
- From simple consumption of information, to an actual experience which students must actively navigate.
- Explore surroundings at their own speed and following their own curiosity
- Some evidence that VR assist with learning (Mahrer, 2014)
- C.f. Constructivist learning theory (Dewey, 1938; Yager, 1991; Dunleavy and Dede, 2014)

The plan

- Teamed up with **ABB Turbocharger Division** to make a **teaching case**
  - Course "Global Operations Strategy", ETH, Feb-June 2018.
  - About 60 enrolled students from different backgrounds (MSc and MAS)

- **Software**: Available app on AppStore and Google Play: "360 VR Tour"
  - Covers ABB's factories, located in Switzerland, Germany and Finland.
  - 360 degrees still pictures and videos, blended with virtual information

- **Hardware**: Smart phone with any commercially available VR viewer (shown is the most available, budget cardboard viewer)

App in AppStore
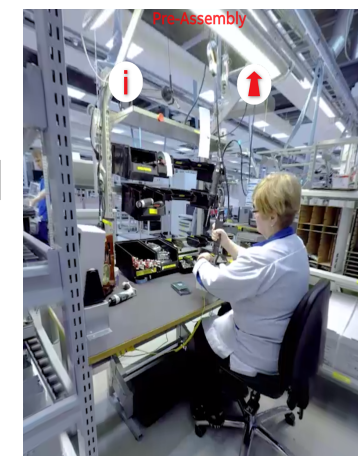
Snapshot from within app

Example: ABB Turbocharger, Baden, Switzerland
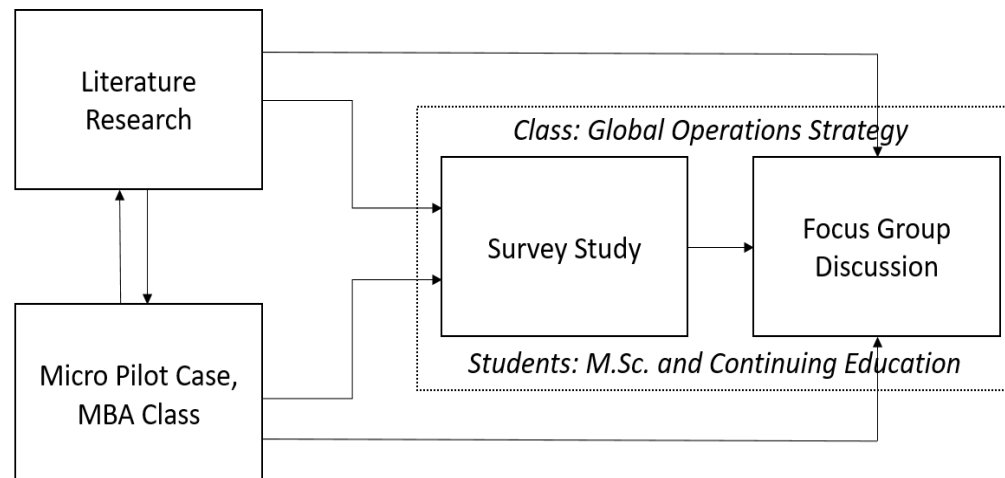
https://vrtour.elisaiot.com/ABB/CH/

Assessing the effect on students' learning experience

We examined the effect of VR on **learning experience** as a proxy for learning

Data collection methods:
1. Moderated focus group interviews
2. Evaluation survey
3. Feedback forms

Analysis of focus group statements

We **coded** the 20.000-words transcription by (1) themes discussed and (2) organised these into positive, neutral, and negative statements related to the perceived effect of VR on learning experience.

Theme	Mentions	Positive	Neutral	Negative
Immersion	41	32	7	2
Motivation	26	15	6	4
Case integration	19	7	8	4
Current state of technology	55	2	13	27
Physiological side-effects	14	0	4	10
Total	155	56	38	47

**VR is a new and innovative way to enrich teaching.
However, the technological implementation was associated with rather mixed views (budget cardboard viewers and App) .**

Survey results for learning experience variables
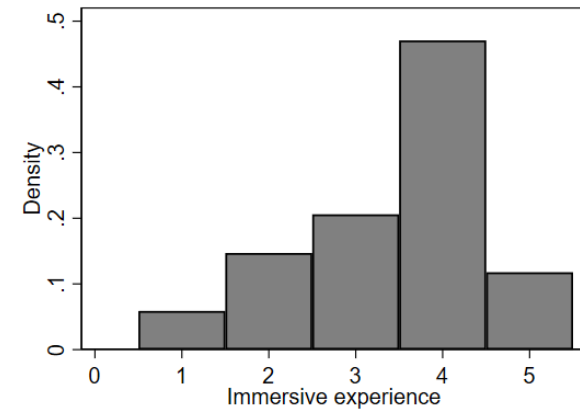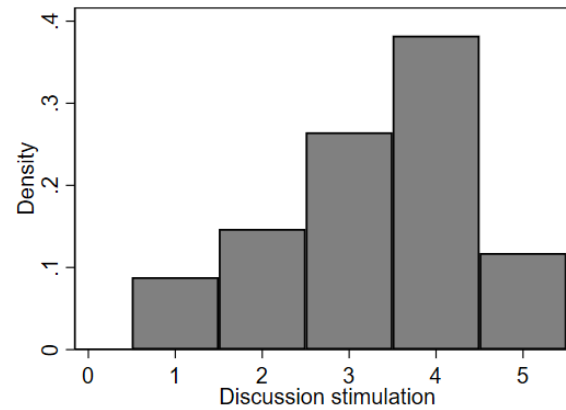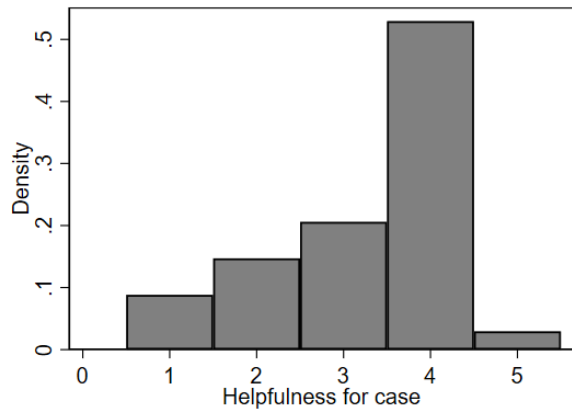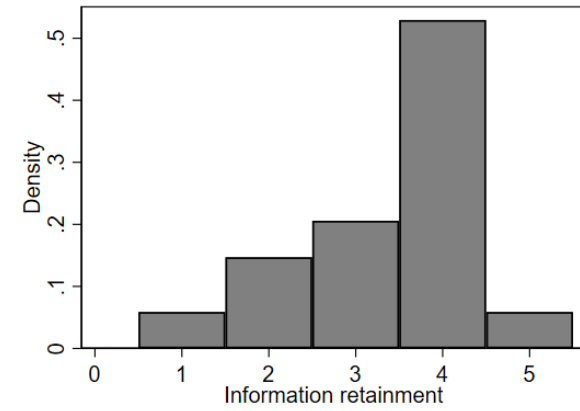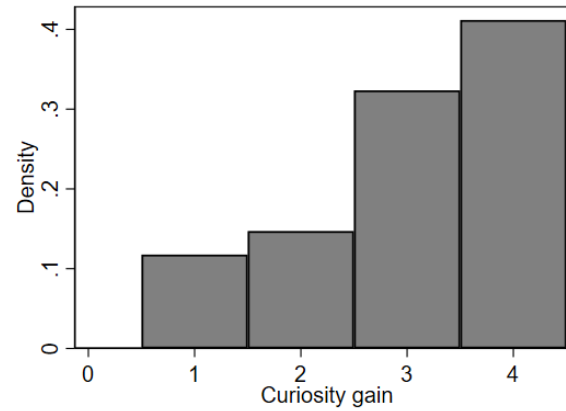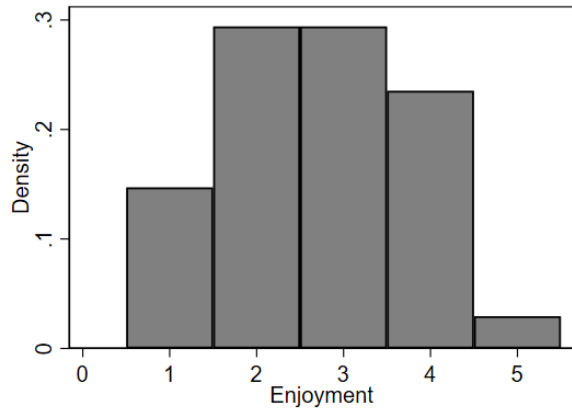
Conclusions

1. **Immersion:** Use of VR allows students to "explore" inaccessible locations at their own pace and availability without actually going to the physical location.

2. **Motivation:** Use of VR as a new teaching form positively affects students' motivation for the course and subject—at least in the early phase.

3. **Case integration:** Use of VR needs a good fit with the teaching case.

4. **Current state of the technology:** The current state of (affordable) VR technology and apps available have several limitations.

5. **Physiological side-effects**: Current VR technology has negative physiological side-effects (most prominently, dizziness).

Recommendations for teaching staff

- **Know your audience** and adapt your use of VR accordingly

- **Caution students** about side effects. Better VR viewers usually lead to fewer side-effects.

- Use VR as a teaching **resource**, not the basis of your course design.

- **Manage expectations** by describing the VR resource accurately.

- VR **content must be relevant** to the assignments students are required to complete.

- Ensure App works on a **range of devices.**

Discussion

In groups of three, discuss potential of VR in your own contexts.

Think about what inaccessible locations you might want course participants to explore.

Consider meaningful (aligned) learning tasks that require students to use the app.

Report one good idea back to the full group.

References

- Brandon-Jones, A., Piercy, N. & Slack, N. 2012. Bringing teaching to life: Exploring innovative approaches to operations management education. *International Journal of Operations & Production Management,* 32 (12), 1369-1374.

- Davis, C. & Wilcock, E. 2003. Teaching Materials Using Case Studies, The UK Centre for Materials Education. The Higher Education Academy.

- Deci, E. L. & Ryan, R. M. 2000. The" what" and" why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological inquiry,* 11 (4), 227-268.

- Dede, C. 1995. The evolution of constructivist learning environments: Immersion in distributed, virtual worlds. *Educational technology,* 35 (5), 46-52.

- Dede, C. 2009. Immersive Interfaces for Engagement and Learning. *Science,* 323 (5910), 66-69.

- Dunleavy, M. & Dede, C. 2014. Augmented Reality Teaching and Learning. *In:* Spector, J. M., Merrill, M. D., Elen, J. & Bishop, M. J. (eds.) *Handbook of Research on Educational Communications and Technology.* New York, NY: Springer New York.

- Greene, J. P., Kisida, B. & Bowen, D. H. 2014. The Educational Value of Field Trips. *EducationNext,* 14 (1), 78-86.

- Mahrer, M. 2014. *Learning and Teaching in a Virtual World: Evaluation of the Learning Effectiveness and the Motivation.* Master Thesis, Univerisity of Zurich.

- Orion, N. & Hofstein, A. 1994. Factors that influence learning during a scientific field trip in a natural environment. *Journal of research in science teaching,* 31 (10), 1097-1119.

- Scholten, K. & Dubois, A. 2017. Advancing the skill set of SCM graduates – an active learning approach. *International Journal of Operations & Production Management,* 37 (11), 1683-1699.

- Stewart, D. W. & Shamdasani, P. N. 2014. *Focus groups: Theory and practice*, Sage publications.

- Watts, M. & Ebbutt, D. 1987. More than the sum of the parts: research methods in group interviewing. *British educational research journal,* 13 (1), 25-34.

- Wilson, V. 1997. Focus groups: a useful qualitative method for educational research? *British Educational Research Journal,* 23 (2), 209-224.

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Thank you!

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