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The RoI of Simulation-Based Training* vs Live Training** of Incident Commanders

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My background

Western Norway University of Applied Sciences

From: Western Norway University of Applied Sciences

- 16000 students (BSc, MSc, PhD) – 5 campuses

Professor of Informatics – Interactive Systems

- Leading the group Collaboration, Interaction and Graphics
- 2014 -, Simulation and serious games in emergency management training (Firefighter)

Since 2013 - training emergency management professionals

Since 2014 with Cecilia Hammar Wijkmark (MSB) working on projects about using simulation technologies and serious games for training firefighters

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The RoI of Simulation-based Training* vs Live Training**

1. Arguments for simulation-based training
2. Experiencing training values
3. Research questions
4. RoI of CST and LST
5. CST and LST – a controlled study
6. Results
7. Conclusions

**Simulation-based training for this work means computer or virtual simulation and serious games based training (CST)*
***Live training for this work means "live simulation" – also role-playing on the training fields with real objects (LST)*

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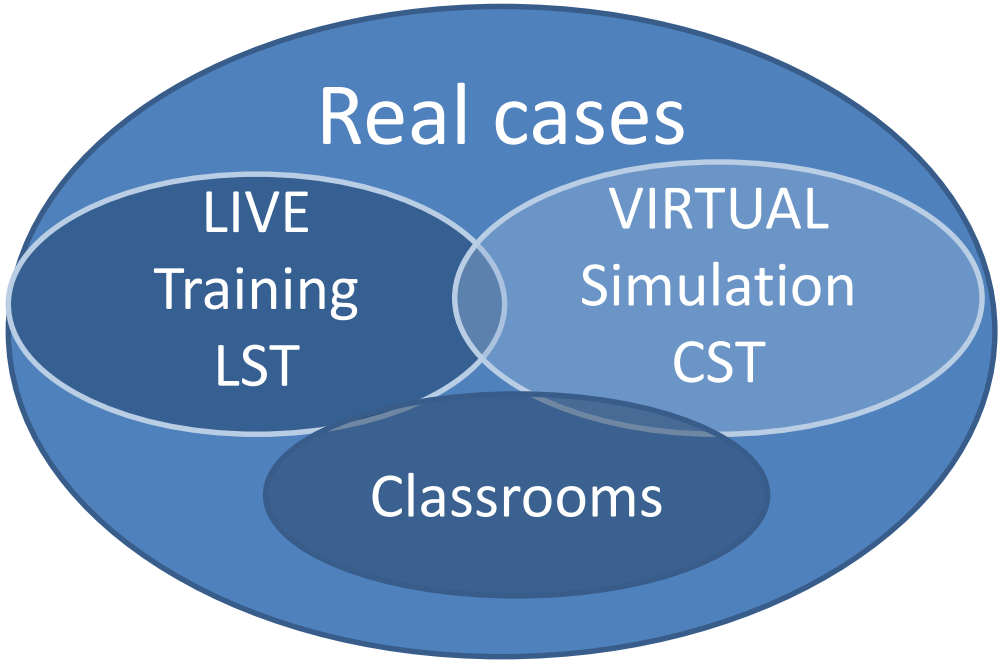
Arguments for simulation-based training (1)

Different training possibilities => different learning situations and learning goals



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Arguments for simulation-based training (2)

The influence of the applied technologies – to treat as specific, but added values for training

“Online lectures by video are fine for conveying facts, formulas and concepts, but by themselves they cannot help anyone learn how to put those ideas into practice.”

Waldrop M. Mitchell (2013) Education Online: The Virtual Lab, Nature 499, 268–270

”Putting ideas into practices needs experiences.”

Chris Dede, Harvard University (Interview about developing education)*

The main added value of simulation based training is enabling environments for achieving high experiences.

Realism behind this fire:

- **The car?**
- **The fire?**
- **The environment?**
- **The scenario**

=> Live simulation is not realistic!

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Arguments for simulation-based training (3)

Summing up results from literature

Safety
Environmental friendly
Less resources (Fire trucks, petrol, protective gear etc.)
...
Training more – for a large number of students
Endless possibilities for scenarios/environment- variation
Scalable
Individual adjustments
Logging (AAR)
Equal assessments - evaluations

Decision/non decision – consequence
Good immersion (“Near to real visualizations is vital”)

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Experiencing training values?

Contributing factors, possible measurements

- Learning goals
- Learning scenarios
- Narratives
- Methodologies to learn (now and later)
- Resources needed to plan
- Availability to train
- Environments
- Technologies

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Research questions

- How can computer simulated training replace live simulations?
- What are the main values of computer simulated training?
- How the design of a computer simulated training scenario influence training?

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RoI: Return of investments

The study

- RoI is a performance measure, it measures
  - the efficiency of an investment or
  - compare the efficiency of a number of investments
- RoI for training by using CST and / versus LST
- To understand the differences and similarities between CST and LST – for achieving similar learning goals

Steps:

- Define measurements
- Compare the results

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ROI for CST vs LST

Study design

Learners (11, Incident commanders), Teachers (6)

TASK: Managing basic* house fire

Settings: Examining similar learning spaces for

- CST, virtual simulation – by using XVR
- LST, live training – on the ’usual’ training field in *Sandö*

Focus: Evaluating experiences during the training and how incidenct commanders (ICs) reporting

Data collected: Questionnaires, Observations, Interviews

*basic house fire = the fire ICs usually train in live training and a similar version, with some extra challenges in the virtual simulation


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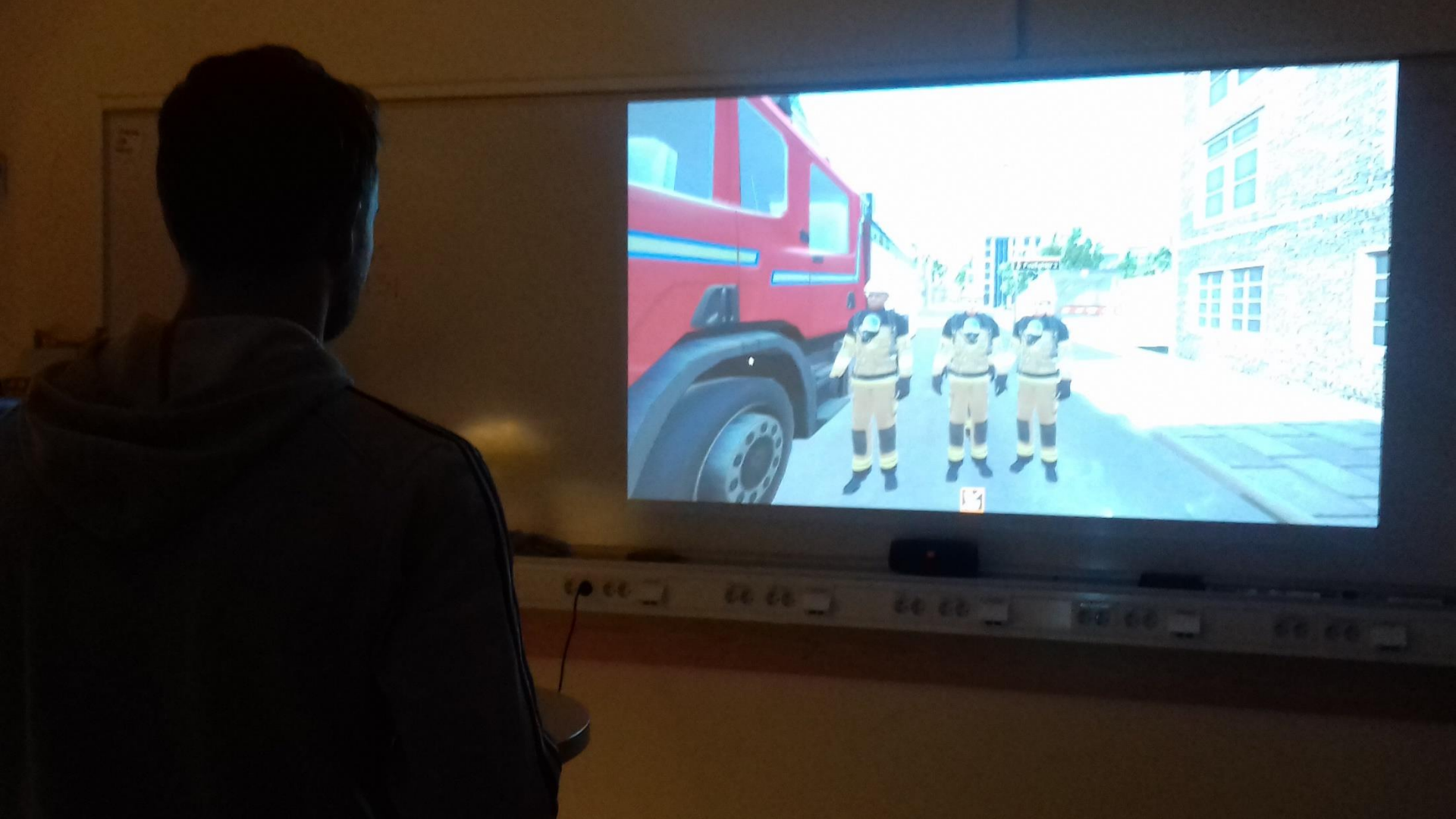

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CST vs LST

Defined measures for preparation, proper work and after work

Time taken – from teachers and from IC students
Objects needed –
Instructions needed –
Other resources needed – e.g. Role playing, technical help etc

Experiences (observed and reported) –
overall, environments, objects, people (avatars)
Work after training –
Information disemination (e.g. AAR) –
Costs (per hour) –

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Results (1)

RQ1: How can virtual simulation replace live simulations?

It cannot replace live simulations.

However, it has a large number of added values, e.g.:

- more posibilities for training
- for training to give structured reports
- training at ’own places’
- practicing different roles needed for one and the same situations
- experiencing possible endings that cannot be experienced before, new emergency cases

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Results (2)

RQ2: What are the main values of computer simulated training?

Training for the unexpected ... Based on possible, actual situations

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Results (3)

RQ3: How the design of a CST influences training?

- Design of narratives (situational awareness). What matters is:
  - Recognizing environments (happening)
  - Recognizing importants signs leading through the narrative
- Photorealism is not the most important feature of
  - people (avatars). Examples: it is important to see ”understanding” the conversation, but not the avatars facial structure. Avatar size is important to relate objects, positions in environment ...
  - Buildings. Unless they do not influence needed activities
  - Objects
- To change roles and train different roles is important

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Results (4)

Costs

Only for this study, considering the

- procurement of technology, licenses, laptops
- time from instructors,
- technical support needed,
- classrooms and environments,
- pre-study for design (for CST),
- …

One hour LST costs 300 Euro vs one hour CST 165 Euro.

During a training day more than twice as many CST training is possible than LST training for a ‘usual’ house-fire (in LST, and ‘usual’ house fire with different possible outcomes in CST.

…

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Results (5)

User experiences (presence) in CST from a follow up studies (2019)

Study 2: Examined 44 pers (command, IC commanders)

- 41 reported high, and very high level,

  on a scale from 1 (very low) to 5 (very high)*

Study 3: Examined 15 pers, commanders on strategic levels

- 13 reported high, very high level,

  on a scale from 1 (very low) to 5 (very high)*

Using a presence questionnaire earlier defined by Usoh, Slater and Steed 1994-1999.

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Conclusions

- CST and LST have different roles and contribute to achieving different, unique learning goals
- Presented concrete return of investments values for a controled study
- Using virtual simulation and serious games means integrating the technology:
  - in organizations
  - in education
- Learning goals / learning places have to be designed based on narratives when realism is not photorealism but design contributing to achieving situational awareness
- The role of instructors in relation to responsible stakeholder needs to be clarified better

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Thank you for the attention!

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