From theory to practice – practice to theory:

Simulator-based instruction at different stages of driver training

Eepsoft Oy

TTS

Marko Koivumäki and **Timo Manninen, TTS**

Eero Pajarre and **Eila Pajarre, Eepsoft Oy**

ITK Conference 23.4.2026

A little about us…

- We have 2 high-quality full-size simulators
  - Bus simulator, since 2004
  - Truck simulator, since 2006
- Both simulators are approved by Traficom for driver training
- Motion platform
- Controls of the corresponding real vehicle
- Use cases:
  - For C and D licence training
  - Defensive driving
  - Eco-driving

… and a little about driver training

- In Finland, more than 11,000 buses and 92,000 trucks are in use
- There are over 10,000 bus or tram drivers and over 42,000 truck drivers (Traficom 2024)
- More than one third of current drivers are over 55, and a large share will retire this decade and the next (Tilastokeskus 2026)

⇒*Growing need to train new drivers*

Challenges in driver training in Finland:

- Attractiveness of entering the field
- Suitable and motivated students
- Language skills
- Prior skills / lack of them => starting level and ensuring the required competence is achieved
- Shift to ever heavier and longer transport vehicles

Why and how to implement simulator training in driver training?

"Traditional" approach:

Simulators replace and complement *practical* training.

- Practice of previously taught theory in a safe environment

Our pilot:

With simulators, it is possible to combine *theory and practice* in a way that traditional teaching cannot.

Research on the connection between theory and practice

Professional development cannot be achieved solely by increasing knowledge … the acquisition of complex skills can only take place by creating conditions that are as similar as possible between work and training situations

(Poikela & Poikela 2002, Harjula 2021)

When the student sees a direct connection between theory and practice and experiences learning as personally meaningful, learning deepens. (Lonka 2015)

“In learning and remembering, it is about the formation and activation of contexts, as well as the creation of socially shared meanings.” (Lonka 2015, 17)

Integrating technology into teaching - **SAMR model** (Puentedura 2006)

Enhancement

Transformation

Change level boundary

Substitution
- Technology as a substitute for the previous tool
- the activity itself does not change

Augmentation
- Technology as a substitute for the previous tool
- functional improvement/added value produced with the help of technology

Modification
- Technology enables the task to be renewed/redesigned

Redefinition
- Technology enables the creation of new tasks that were not previously possible

SAMR model

- Illustrates whether the information and communication technology used in teaching provides new approaches to learning tasks or whether the new technology, for example, acts as a substitute for pen and paper, bringing only a small addition to completing the task.
- On the first two levels **the learning situation does not change** into something different due to technology.
- On the third and fourth levels, the learning task changes thanks to technological solutions in such a way that it could not otherwise be carried out. On the last level, the learning task is designed according to the features enabled by technology, and technology is used for learning tasks in new ways that would otherwise not be possible.
- According to Puentedura, when moving to the level of redefinition one should answer four questions:

  1) What is the new task?

  2) Can some part of the original task be preserved?

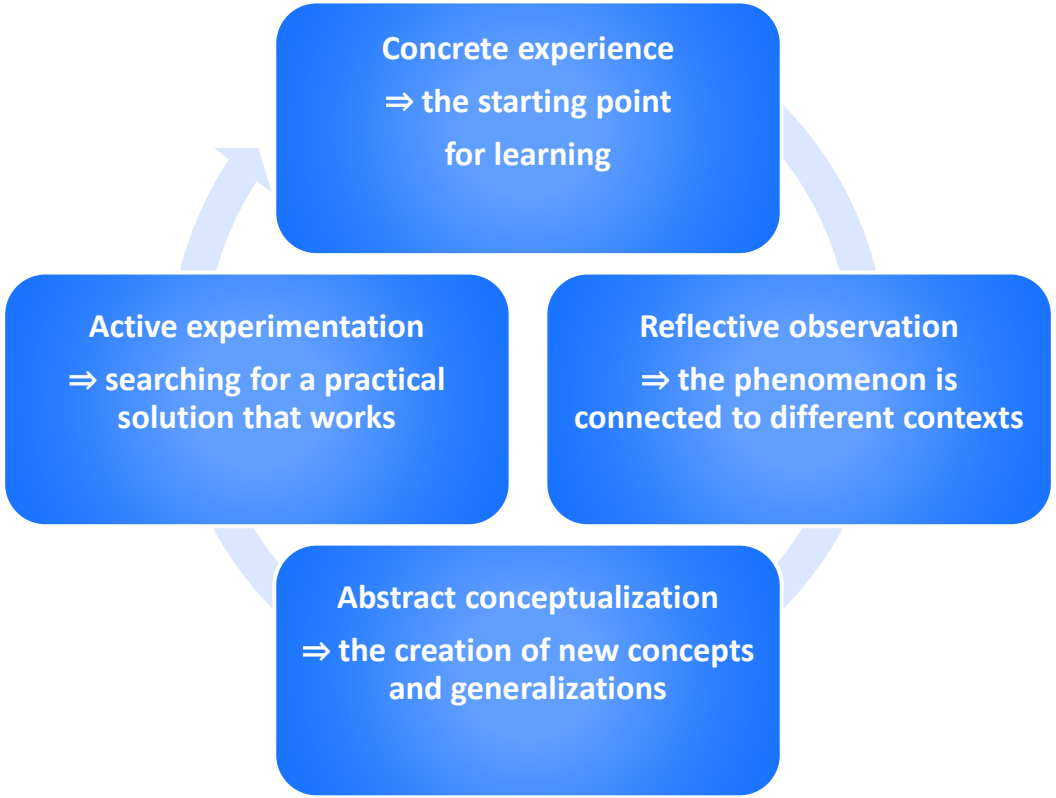
  3) In what way has the new task become possible thanks to the new technology?

  4) How does the new technology promote learning?

Puentedura, 2010; Piispanen & Meriläinen, 2016

Experiential learning cycle (Kolb, 1985)

“Theoretical instruction should always be connected to practical experiences” (Kolb, 1985)



On experiential learning

Simulation pedagogy is a teaching method based on experiential learning.

- In simulations, learning happens in practice, through active doing, experience and reflection through.
- “Simulation pedagogy combines theory and practice into a whole.”

(Silvennoinen & Aksovaara, 2025)

Previously studied and observed about combination vehicle drivers’ on-the-job learning : (Kuivanen, 2024):

- Drivers’ learning is strongly experiential and problem-based and follows Kolb’s experiential learning model:
  - Learning occurs primarily in problem situations (traffic and weather challenges, technical problems with vehicles)
  - Reflective analysis and considering one’s own solutions strengthen drivers’ professional competence
  - Peer support promotes learning; experiences shared with colleagues support learning and problem-solving

Our pilot:
Simulator supporting theory instruction

Continuation of last year's project, where a vehicle simulator was used to demonstrate different situations to students:

- Blind spots (Y-junction, vulnerable road users, cyclists)
- Start assist systems
- Rear swing
- Use of the retarder

These exercises were developed on the basis of both feedback collected from students and the feedback students received from the theory tests in the driver examination.

The pilot was successful and led to **changes to our training framework:**

- Guided review sessions

- Simulator demos as part of instruction (most of the time)

Impacts of the previous pilot on the structure of instruction

Previously:

- C theory instruction for 2 full days (6h per day)
- Road Traffic Act (half-day)
- Review day (half-day) Not always implemented
- Missing guided practice (independent practice)
- Vehicle handling exercises with a simulator

Change:

- C theory instruction for 2 half-days (3h/day) and one full day (6 h)
- Road Traffic Act (half-day)
- Review day (half-day, introduction to the theory test practice program, etc.)
- **Added one review day (full day) -> controls + DEMOS**
- Vehicle handling exercises with a simulator **+ new driving route tasks -> Driver examination theory test**

Pilot phases

Planning phase

- Curriculum (C-ops) and experiences from last year's pilot as the foundation
- Starting point: from demonstrations to practice
- Feedback from exams and driving tests
- Own experiences and observations
- Planning and testing of simulator exercises

Implementation phase

- 1 test group at the end of 2025
- 3 groups (January–April 2026)
- Feedback collected verbally immediately after simulator sessions
- Collection of feedback from exams and driving tests continues

Evaluation phase

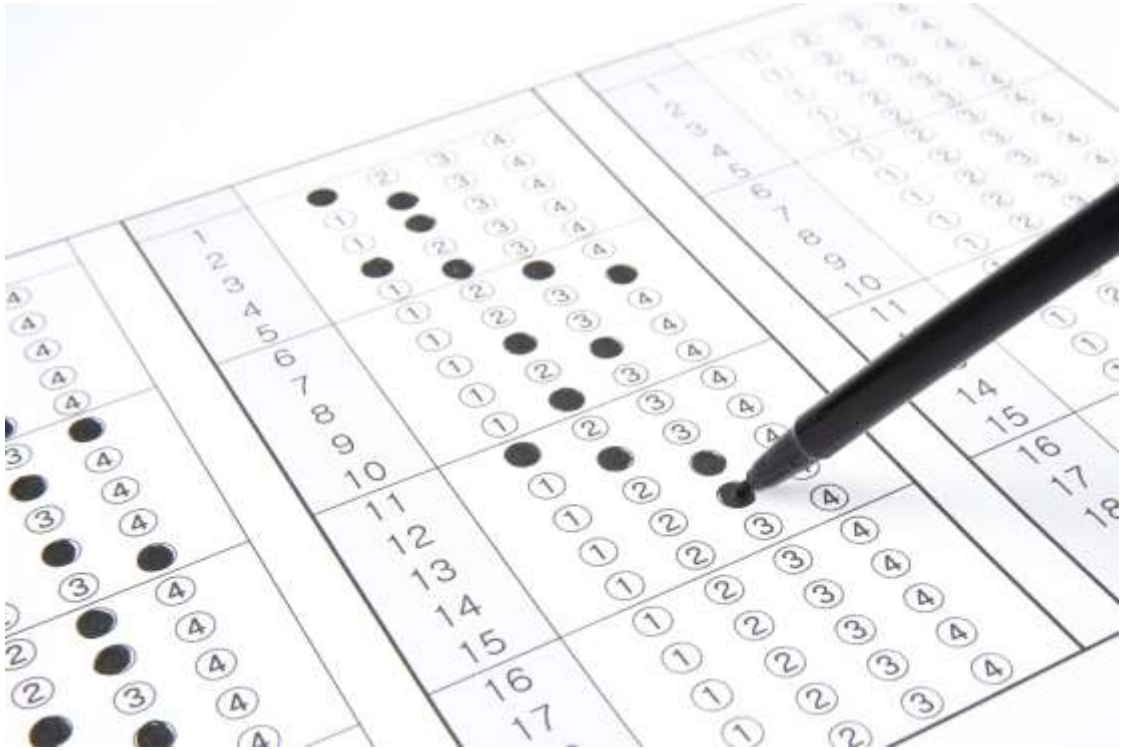
- Analysis of feedback
- Analysis of performance in exams and driving tests
- Consideration of own experiences

Next steps

- Establishment
- Dissemination
- Further development

Themes studied in simulator exercises

- Based on the feedback collected from theory tests, the exercises were developed to address in **particular** the following themes:
  - Yielding when turning left
  - Yielding when driving straight
  - Parking
  - Stopping
  - Risk recognition



What’s new in this year’s pilot?

We have developed, as part of the theory instruction:

- 5 simulator driving exercises that focus the topics students find difficult in the theory test
- A shift in the student’s role from a passive listener to an active participant and observer

Example exercise, route 4

- **Stopping**
  - A vehicle stopped before the crosswalk
  - Stopping at a STOP sign
- **Giving way when turning right**
  - Pedestrian on the crosswalk
- **Giving way when going straight**
  - E.g., right-of-way rules in parking areas, supplementary **signs**, etc.
- **Giving way when turning left**
- Parking

Experiential learning cycle

1. **Concrete experience -> student drives the driving route**
   - The driving route includes several events, including yielding when turning left
2. **Reflective observation**
   - The student evaluates their own performance from a recording together with the instructor and fellow students.
3. **Abstract conceptualization**
   - Based on reflection, new operating models **emerge**.
4. **Active experimentation**
   - The exercise is repeated

Feelings now…

- The pilot has now been tested for three months
- Feedback from students has been encouraging
- In addition, the instructor’s experiences and observations strongly support this
- Driving routes have worked as planned
- Exercises have sparked very good discussion in class
- We have developed a working model for C training that combines traditional classroom teaching and simulator training
- Initial experience suggests that performance in theory tests has improved thanks to the new operating model
- Simulator exercises work well, as long as group sizes are small

Further development areas 1/2

- Collecting feedback from students
- Fine-tuning driving routes
- Improving the simulator’s student-specific feedback
- Recording model performances that can be shown in the simulator as examples

Further development areas 2/2

- Bringing demos and route-driving exercises into D training
- E.g. fault situation identification
  - C and D training: methods for identifying causes of faults
  - Vehicle technology
    - Warning lights, e.g. ABS, air pressure, engine temperature, fuel, oil pressure…
- Expanding to other vocational topics

Image: Copilot

References

- Harjula, E. (2021). *Teknologia työssä – lentäjien kokemuksia simulaattoreiden käytöstä työssä oppimisessa*.
- Karesola, J. (2025). *Ammattikuljettajien riittävyys Suomessa*. Logistiikkayrityksen haasteet ja strategiat tulevaisuuden turvaamiseksi.
- Kolb, D. A. (1984). *Experiental learning. Experience as the source of learning and developement*.
- Kuivanen, J. (2024). *Ongelmista oppimiseen: yhdistelmäajoneuvonkuljettajien kokemuksellinen työssä oppiminen*.
- Lonka, Kirsti. (2015). *Oivaltava oppiminen*.
- Piispanen, M., Meriläinen, M (2016). *SAMR-malli oppimaiseman arkkitehtinä.*
- Poikela, E. & Poikela, S. (2002). *Tieto ja osaaminen oppimisen lähtökohtana ja tavoitteina.*
- Puentedura, R. (2010). *SAMR and TPCK: Intro to Advanced Practice.*
- Salanne, I., Tikkanen, M., Tuominen, J. & Kiiskilä, K. (2024). *Kuorma- ja linja-autojen ammattikuljettajien saatavuustutkimus.* Traficom.
- Silvennoinen, M. & Aksovaara, S. (2025). *Simulaatiopedagogiikka ammattiosaamista tukemassa.* Jamk Arena.
- Tilastokeskus (2026). *Työlliset ammattiryhmän (AML 2010, tasot 1-5), sukupuolen, iän ja vuoden mukaan, 2010-2023*.

→tts.fi

Eepsoft Oy

Thank you

Further information:

TTS:
Marko Koivumäki
marko.koivumaki@tts.fi

Eepsoft Oy:
Eila Pajarre
eila.pajarre@eepsoft.fi