Affordances of Technology to Support Learning and Instruction

D2L Brightspace Connect X HOGENT

Fien Depaepe

February 18 2026

Overview of the lecture

- Educational technology and quality of education
- Affordances of technology for learning
- Affordances of technology for instruction
- Concluding reflections

© Depaepe, F. et al. (2026). *Bewust Digitaal: Over leren en onderwijzen met technologie.* Lannoo Campus.

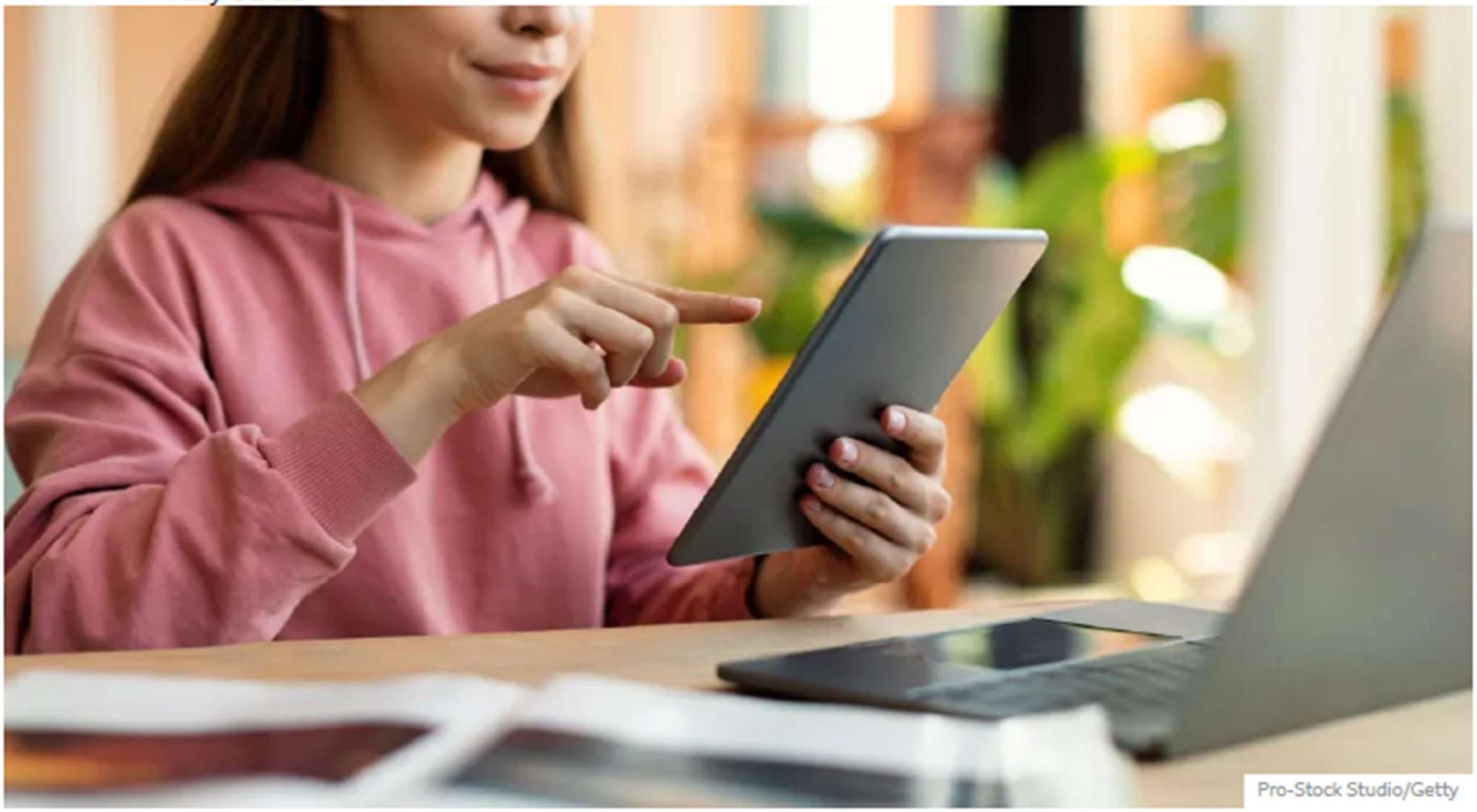
Educational technology and quality of education

Is education tech boom helping or harming pupils?

22 July 2025

Share Save

Amy Garcia BBC News, Yorkshire



Pro-Stock Studio/Getty

The use of educational technology - or ed tech - is being encouraged in schools, but some worry about the consequences

- Technological determinism (Oliver, 2011): Technology is assumed to determine learning, to have power on its own.

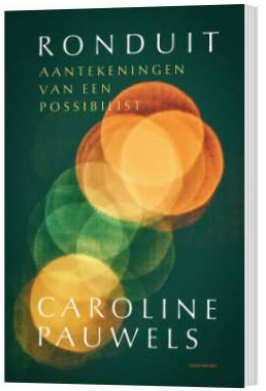
TECHNOLOGY → **LEARNING**

Technological positivism

Technological negativism

https://laescuelaqueviene.org/esto-no-es-una-escuela-o-si/

Technological possibilism



- Possibilism, inspired by a book of Caroline Pauwels (honorary rector VUB)

"the confidence that, using our intellect, we are able to analyse problems, find solutions to them and thus change and improve society and the world. (….) 'possibilism', namely the belief that things can get better, not that they will naturally and automatically become so."

(Pauwels, 2021, p. 16 – translated from Dutch)

- Technological possiblism
  - Theory of Affordances (Gibson, 1979)
    - Environment vs. animal / technology vs. learner
    - What technology affords (offers, provides to) the teacher/learner, for good or ill
    - New technological evolutions → new affordances
    - Not inherent characteristic of the technology itself, depends on how users perceive and use them

- Some premisses
  - Educational technology = physical means via which information is presented to learners (Reiser, 2001, p. 54)
    - Digital and non-digital
  - More than physical characteristics of technology (Kozma, 1994), importance of
    - Instructional design
    - Agency of teachers/students: How they interact with technology
  - Educational quality = How technology can support teaching and learning to enhance cognitive, non-cognitive and/or efficiency outcomes
    - Micro-level
    - Only one dimension of “good education”

The power of technology lies in the way humans design and use it.

Affordances of educational technology for learning

- Some affordances of technology for learning
  - Presenting information
    - Making information more visual, more authentic, more concrete…
    - Access to information (not bound by time, location, person)
  - Practicing learning content
    - Repeated practice
    - At own pace
    - Interaction with content (a.o. immediate feedback, manipulating learning objects)
    - Interaction with others (opportunities for collaboration)
  - Personalizing instruction
    - Adaptation of task difficulty
    - feedback
    - instruction

- Without overlooking possible negative effects …
  - Cognitive overload
  - Distraction
  - Butterfly detect
  - Quality of content
  - Privacy of data
- Important role of researchers, instructional designers, teachers … in revealing and shaping these affordances

Affordances of technology for learning: some examples from our research lab

- Synchronous Hybrid Learning and Teaching

- Lecture+ Developing an interactive, scalable & cost-effective lecture platform that enhances the (remote) learning (2017-2019)

1. How to measure engagement?
   (→ visualization on a teacher dashboard; see also affordances for instruction)
2. How to improve engagement?

RESEARCH PARTNERS

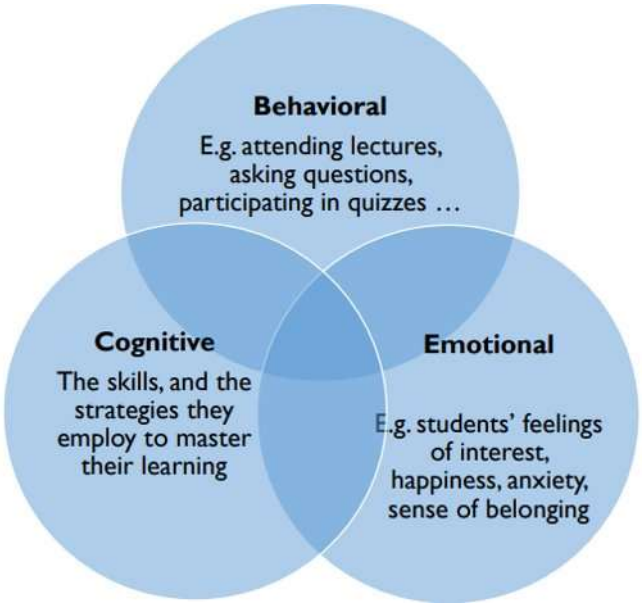
INDUSTRIAL PARTNERS

Lecture+


Tom Lebaca
For me as well as the students,
it was a fun, positive experience.
imec

Modeling student engagement: A multimodal approach

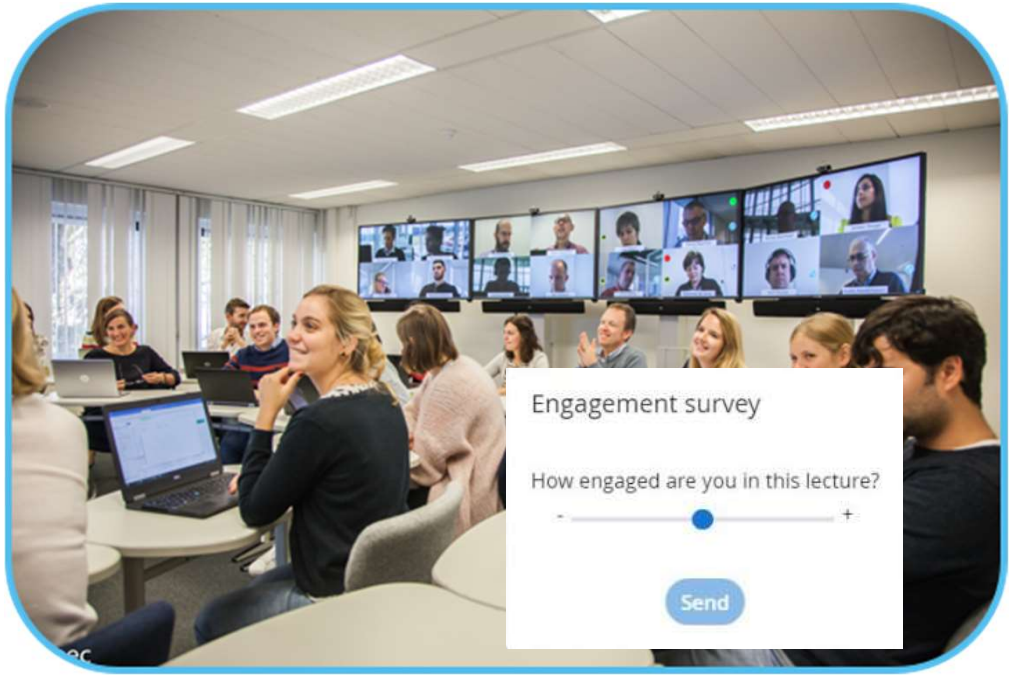
- Literature study on user engagement
  - Complex & multidimensional



(Dobins & Dentons, 2017)

- Methdological challenges & opportunities
  - Self-report measures have many shortcomings and biases (Schrerer, 2004)
  - New technologies have the opportunity to observe, measure, and understand learning and assessment processes more unobtrusively and in real time (Gomez & Danuser, 2007; Sakr, Jewitt & Price, 2016)

Modeling student engagement: A multimodal approach



Process data

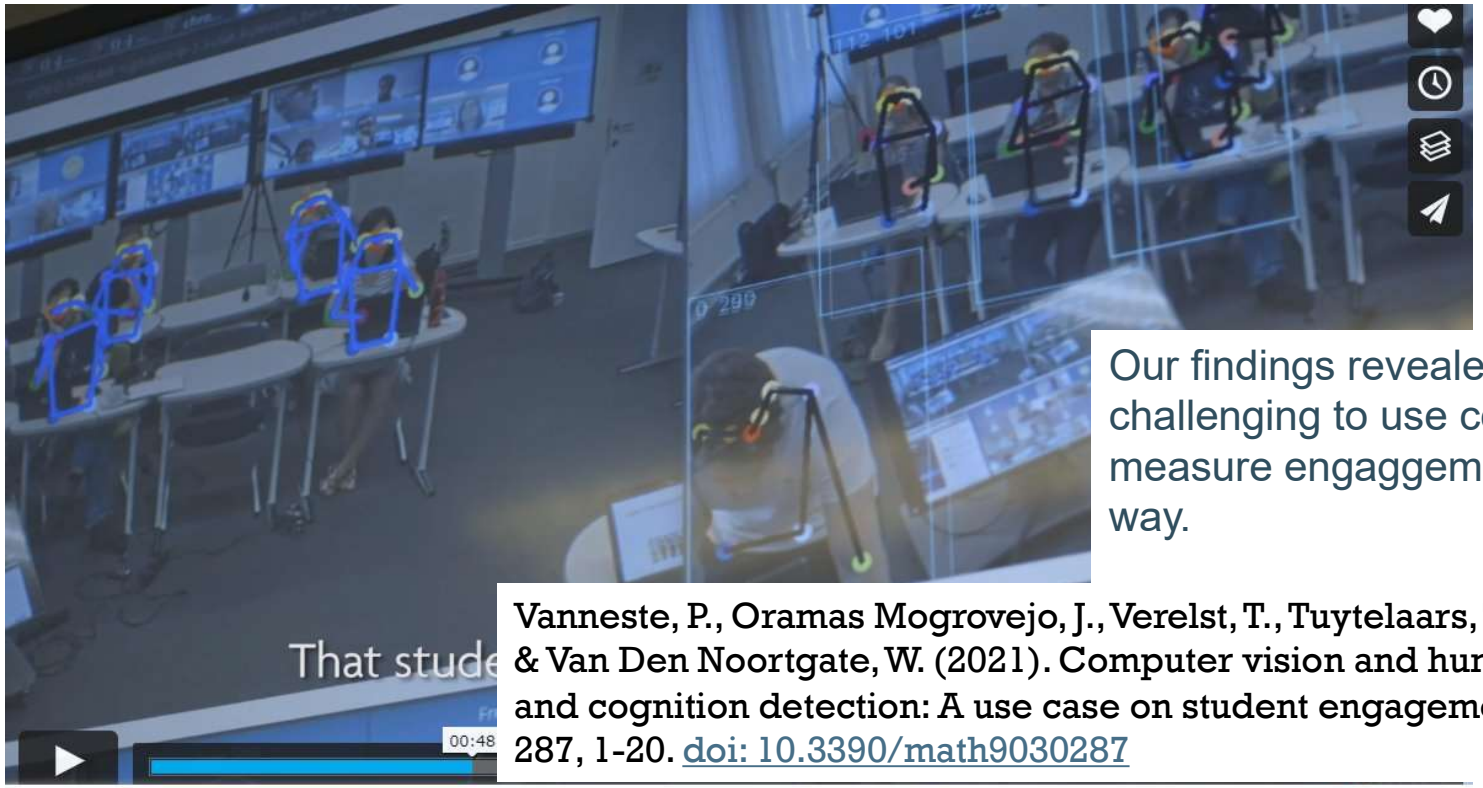
0 1 1 0 1

log data

Audiovisual data

Psycho-physiological data

Capturing behavioral engagement through audiovisual data?



Our findings revealed that it is challenging to use computer vision to measure engaggement in an accurate way.

Vanneste, P., Oramas Mogrovejo, J., Verelst, T., Tuytelaars, T., Raes, A., Depaepe, F., & Van Den Noortgate, W. (2021). Computer vision and human behaviour, emotion and cognition detection: A use case on student engagement. *Mathematics*, *9* (3), 287, 1-20. doi: 10.3390/math9030287

Engagement in different learning settings and the effect of quizzes? A within-subject design

- RQ1: What is the experienced motivation of students in four different learning settings?
- RQ2: To what extent does motivation change over time during the lecture and what is the effect of quizzes on students' motivation?
- RQ3: To what extent is motivation positively related with students' learning achievement?

ELSEVIER

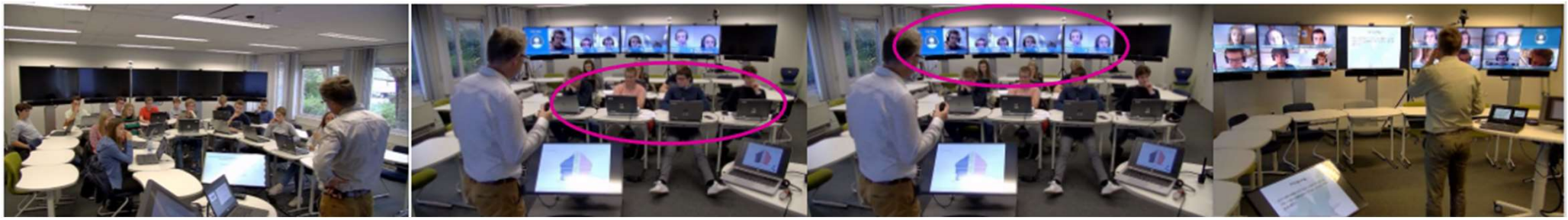
Computers & Education
Volume 143, January 2020, 103682

Learning and instruction in the hybrid virtual classroom: An investigation of students' engagement and the effect of quizzes

Annelies Raes [a, b], Pieter Vanneste [a, b, 1], Marieke Pieters [a], Ine Windey [a, b], Wim Van Den Noortgate [a, b], Fien Depaepe [a, b]

Engagement in different learning settings and the effect of quizzes? A within-subject design

When are students most/least motivated?



1 – When participating F2F

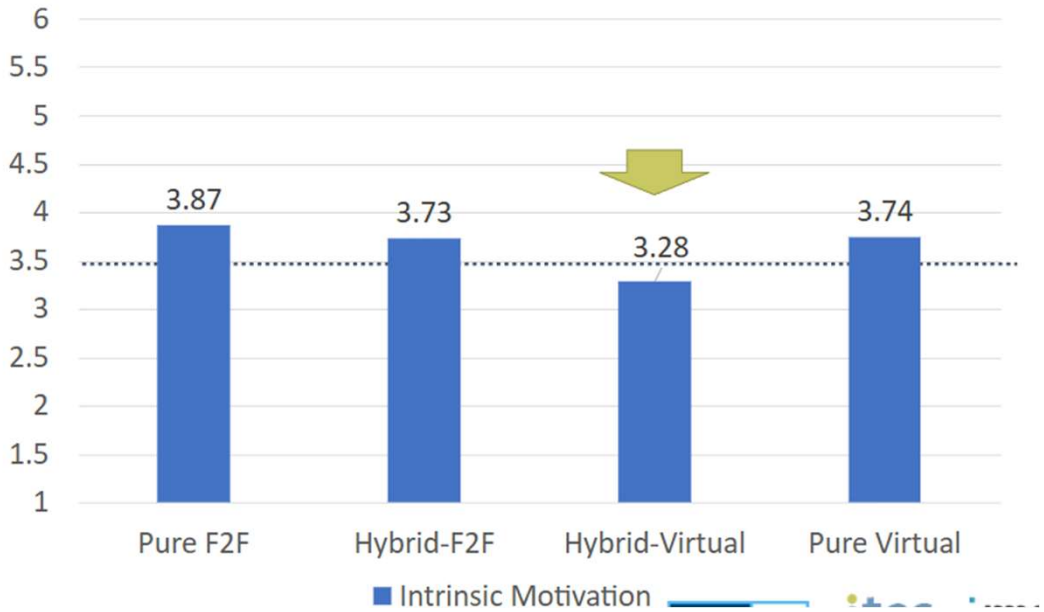
2 – When participating F2F in the hyrbrid setting

3 – When participating virtual in the hybrid setting

4 – When participating virtual

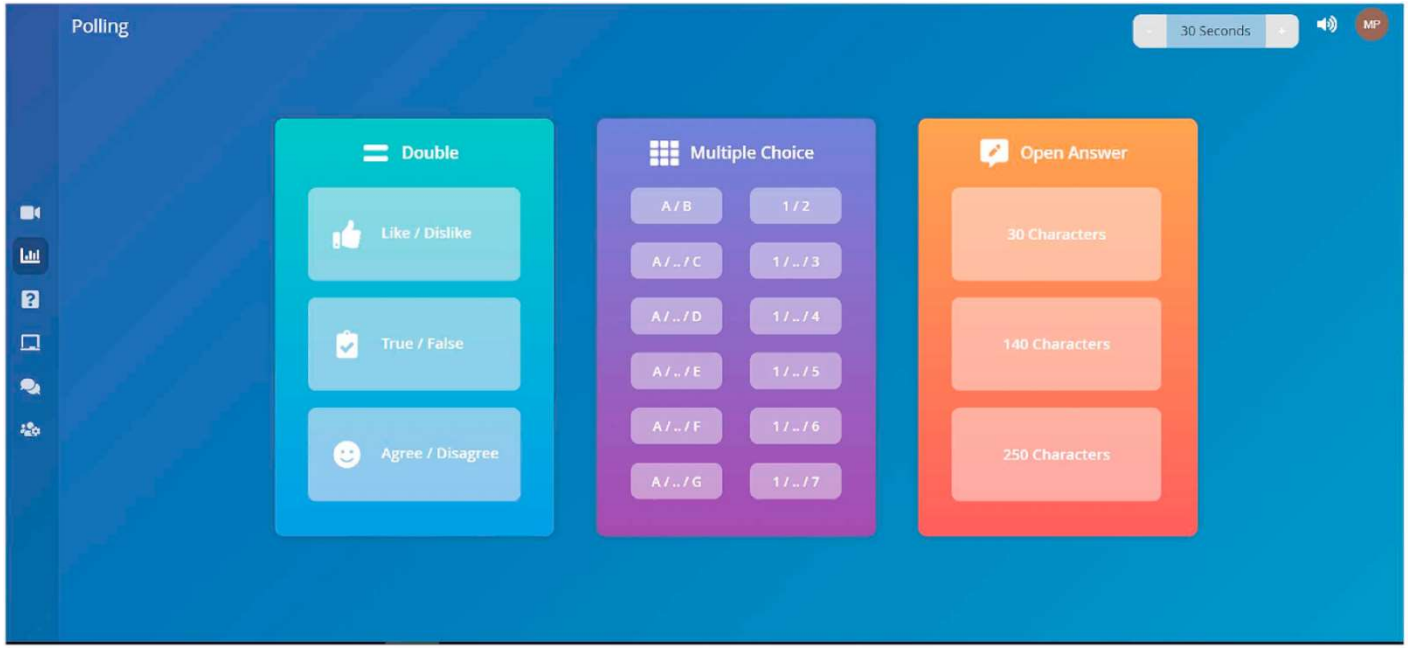
Engagement in different learning settings and the effect of quizzes? A within-subject design

When are students most/least motivated?



Engagement in different learning settings and the effect of quizzes? A within-subject design

Effects of launching quizzes?



Engagement in different learning settings and the effect of quizzes? A within-subject design

Effects of launching quizzes?

- Students' intrinsic motivation significantly decreased over time during the lecture, BUT
- Students' intrinsic motivation was found to be higher during quiz moments than during other moments of the lecture
- All students experienced the quizzes positively (no effect of educational setting)

Engagement in different learning settings and the effect of quizzes? A within-subject design

Effect of motivation on learning achievement?

Significant effect of motivation on students' learning achievement (measured through quizzes)
→ "the more engaged students are, the more likely to obtain better learning outcomes on the formative assessments conducted through quizzes"

Affordances of educational technology for instruction

- Some affordances of technology for instruction
  - For different instructional activities
    - Designing lessons and creating learning material
    - Managing classroom processes
    - Providing information about students' learning processes
    - Presenting information to learners
    - Providing opportunities to practice learning content
    - Personalizing instruction
    - Evaluating student work
  - During different phases of the instructional process
    - Before instruction
    - During instruction
    - After instruction

- Without overlooking possible negative effects, relating a.o. to
  - Quality of technology (content, algorithm…)
  - Teachers' competence to use technology and interpret learning analytics
  - Which teaching tasks can and cannot be done by technology
  - Teacher-technology nexus

- Technology-enhanced teaching needs excellent technology, but also excellent teachers

Affordances of technology for instruction: some examples from our research lab

- Group Compositor Tool for Collaborative Learning

- From Data to Action: How Learning Analytics Dashboards empower Teachers

- Group Compositor Tool for Collaborative Learning
  - STEAMS – Supporting Teamwork in AMbient learning Spaces – imec ICON
  - PhD project Siem Buseyne, supervisors: Annelies Raes & Jean Heutte, co-supervisors: Fien Depaepe & Thierry Danquigny (2021-2025)
    Collaborative Problem Solving in the context of non-formal adult education: Unravelling the links between input variables, team processes and flow

- Group Compositor Tool for Collaborative Learning
  - Different possibilities to compose groups
    - Self-selected composition by students
    - Composition on the choice of a teacher
    - Random team composition (either or not technology-driven)
    - Smart composition by a computer system

- Group Compositor Tool for Collaborative Learning

Group Size

Number of students per group

2 3 4 5 6 7 8

Exclude Students?

Please select students to be excluded.

Personality Dimensions

Emotional - Controlled | Realist - Optimist | Routine - Change | Coordinated - Meticulous

Homogenous

Calm - Energetic

Heterogenous

Thinker - Doer | Independent - Team Player

- From Data to Action: How Learning Analytics Dashboards empower Teachers

  - PhD project Ann Fastré, supervisors: Fien Depaepe & Inge Molenaar, co-supervisors: Stefanie Vanbecelaere & Carolien Knoop-Van Kampen (2024-2028)
    Designing and evaluating theory-informed, actionable learning analytics dashboards
  - Post-doctoral project Stefanie Vanbecelaere, supervisor: Fien Depaepe, co-supervisor Bert Reynvoet (2023-2027) - fwo

Detect, Interpret, Act

Inspired by the Learning Analytics Process Model from Verbert et al. (2013)

Information about the learning process is captured within the learning environment (+ analyses are conducted)

Sense-making phase

Following up with adaptation

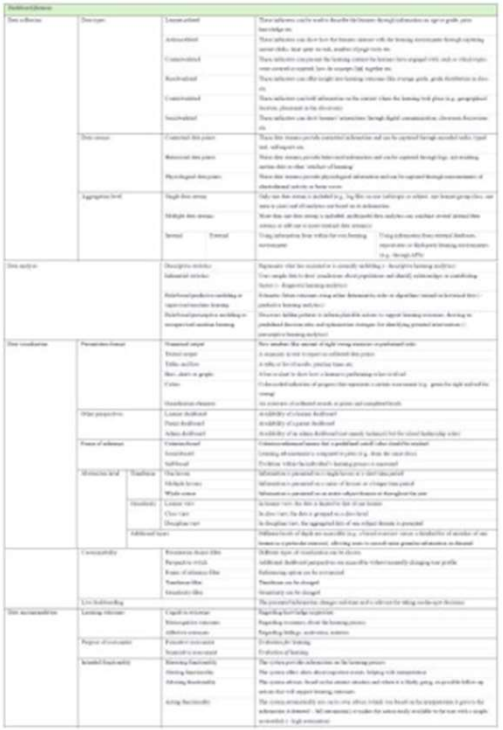
How can learning analytics dashboards help teachers make data-driven, theory-informed and pedagogically meaningful decisions?

- How learning analytics dashboards are designed?

Classification scheme

Tool characteristics

Adaptivity features



Dashboarding features

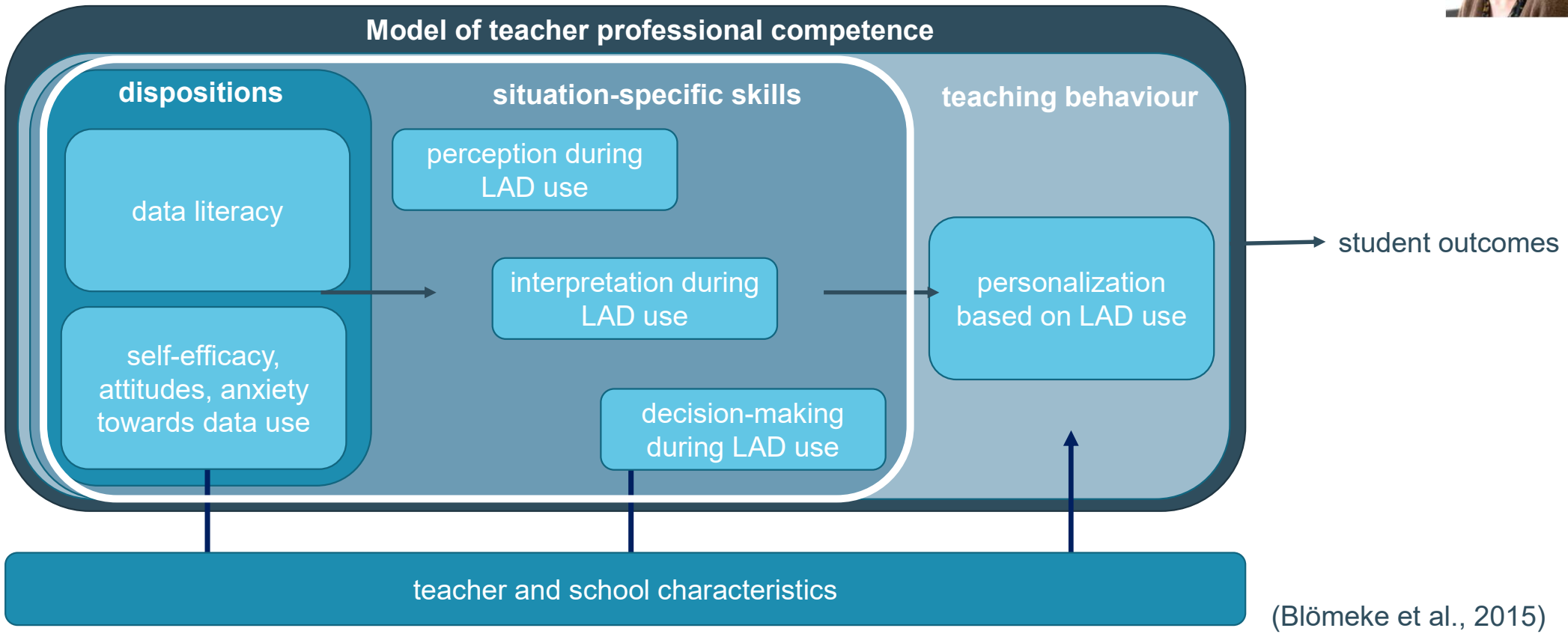
- Data collection: information about learning progress is captured, either tracked automatically and unobtrusively within the system or through (another) hardware/software device or method of inquiry
- Data analysis: which analyses are performed on the collected data by the system's algorithm?
- Data visualization: how are the raw data and their analysis results presented to the user(s)?
- Data recommendations: stimulating sense-making and eliciting decision-taking (~ impact)

Charleer et al., 2016; Klerkx et al., 2017; Masiello et al., 2024; Sahin & Ifenthaler, 2021; Schwendimann et al., 2017; Sedrakyan et al., 2019; van Leeuwen & Rummel, 2021 ...

- How teachers use dashboards?
  - Teachers struggle to interpret dashboards accurately

"Yes, I find this [dashboard] very difficult to interpret actually. I'm not much of a graph guy either... Well, in education we only start using dashboards. Until now we had to do a lot of error analysis on pen and paper, which was very simple, so this [reading a dashboard] takes some time to getting used to. But I'll be honest, I wouldn't immediately know how this would help me." (teacher in primary education)

- Teachers' professional competence to use learning analytics dashboards

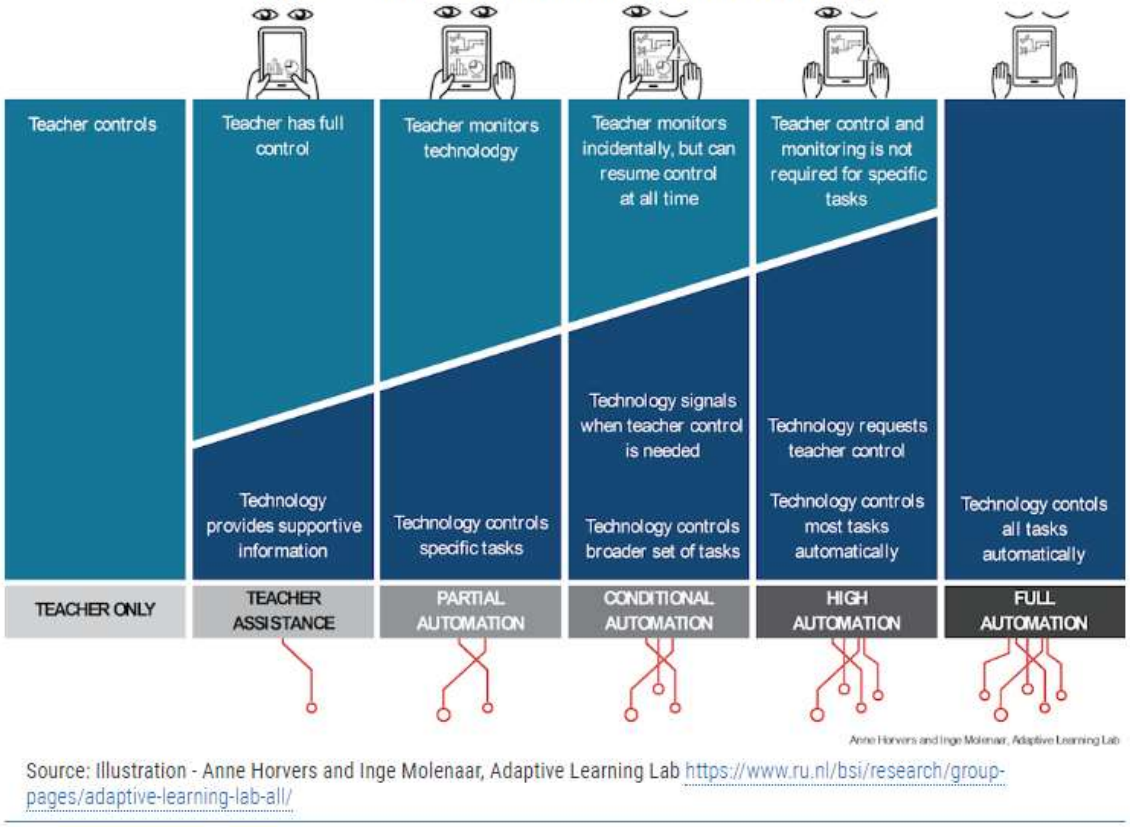


(Blömeke et al., 2015)

- The way forward: teacher-technology nexus (Van Schoors et al., 2023)

- The way forward: teacher-technology nexus (Van Schoors et al., 2023)

Figure 3.2. **Six levels of automation of personalised learning**



Source: Illustration - Anne Horvers and Inge Molenaar, Adaptive Learning Lab https://www.ru.nl/bsi/research/group-pages/adaptive-learning-lab-all/

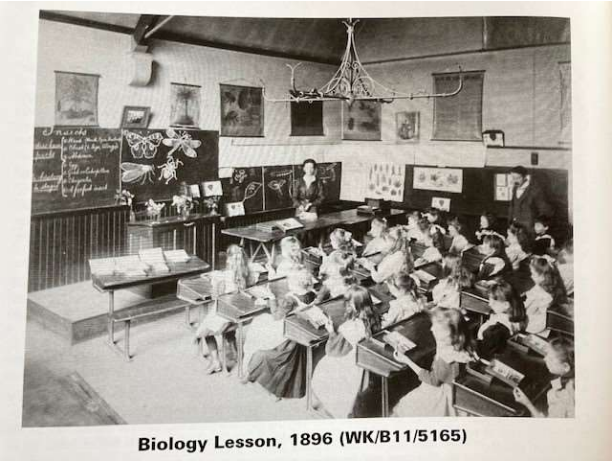
Concluding reflections

- What is technologically possible ≠ educationally desirable
  - Prioritize educational value above technological or economical considerations (e.g., Laurillard, 2012)
    - Informed by theories on how learning can be supported
    - Addressing students' needs
    - Critically reflecting on the goals we want education to pursue

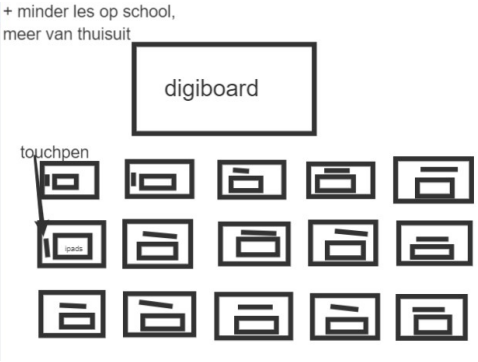
Salomon (2002, p.75):

"It is not the computer per se that makes a difference, for it only offers affordances and opportunities; it is the pedagogical way in which it is used that makes the difference".

- What is educationally desirable ≠ actually happening in schools
  - At the teacher-level
    - Domistication of educational technology tools in current practices, substitution rather than transformation
    - Grammar of schooling (Tyack & Tobin, 1994, p. 454): “the regular structures and rules that organize the work of instruction”


Biology Lesson, 1896 (WK/B11/5165)

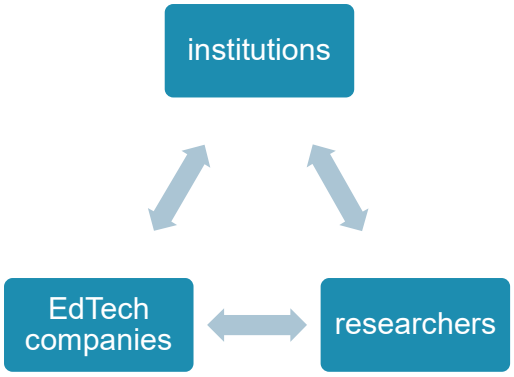
Future education in an EdTech context according to a pre-service teacher



- What is educationally desirable ≠ actually happening in schools
  - At the student-level
    - Students do not always use the educational tools as initially intended
    - Instructional disobedience (Elen, 2020, p. 2022): “learners do not act in particular learning environments as intended by the instructional designer and as assumed to be effective in view of realizing preset learning outcomes”

- Possiblistic perspective of educational technology in education
  - Opportunities to leverage educational quality, if …
    - Well-designed:

      Need for an eco-system:
      Co-creation of educational technology



    - Appropriately used (teachers/students)

Special thanks go to…

the research teams

itec

cip&t

Special thanks go to…

our research lab

Contact:
fien.depaepe@kuleuven.be