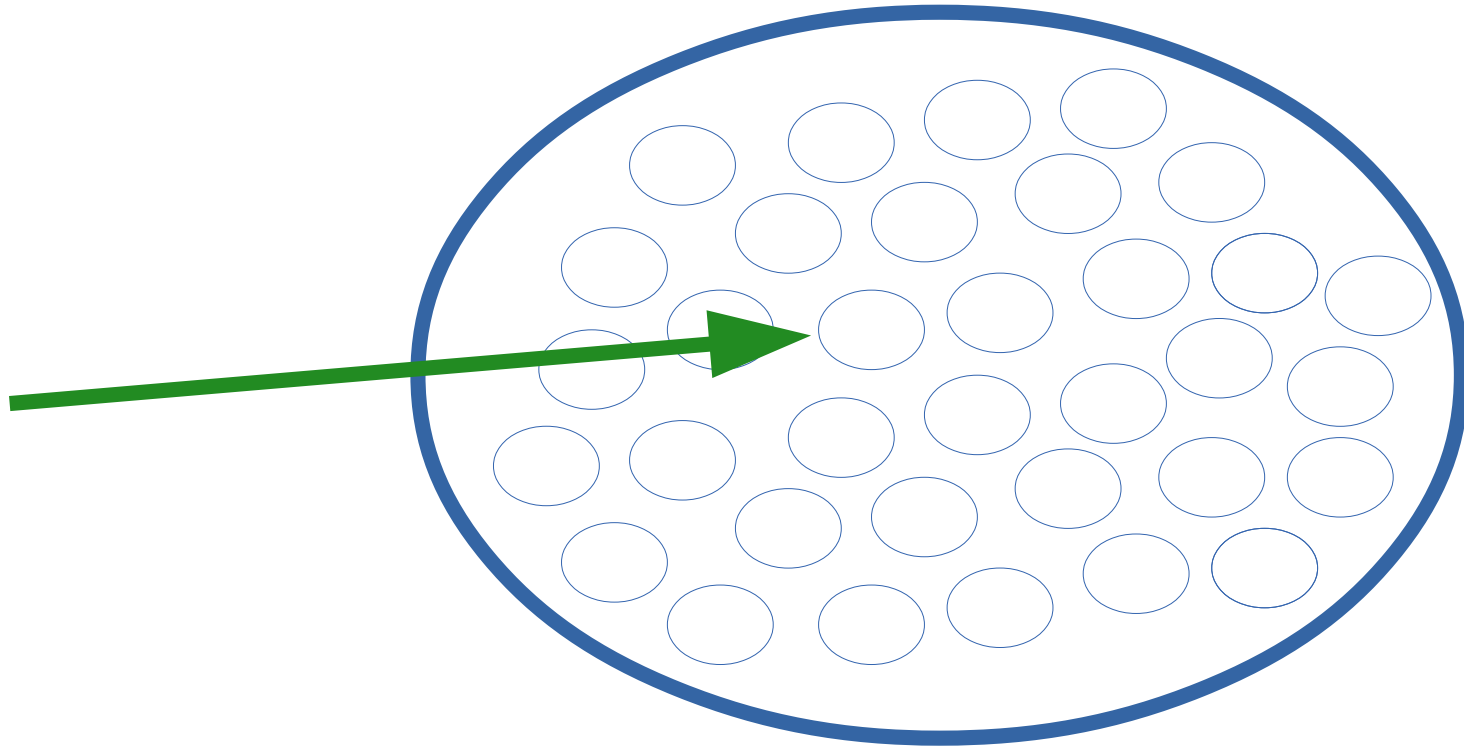


# Digital learning materials – advantage or nuisance?

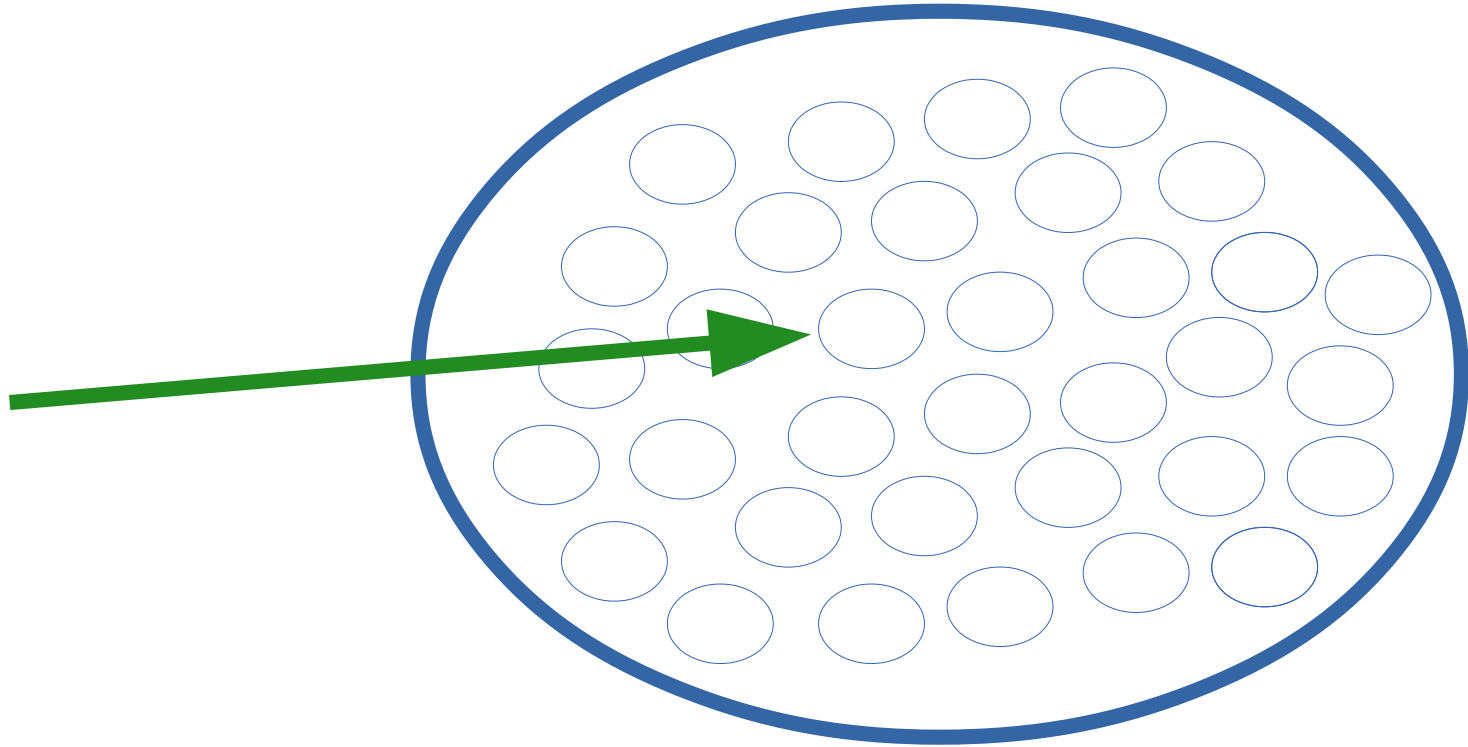
Professor Jeppe Bundsgaard  
Danish School of Education (Aarhus University)

Does digitization have an effect?

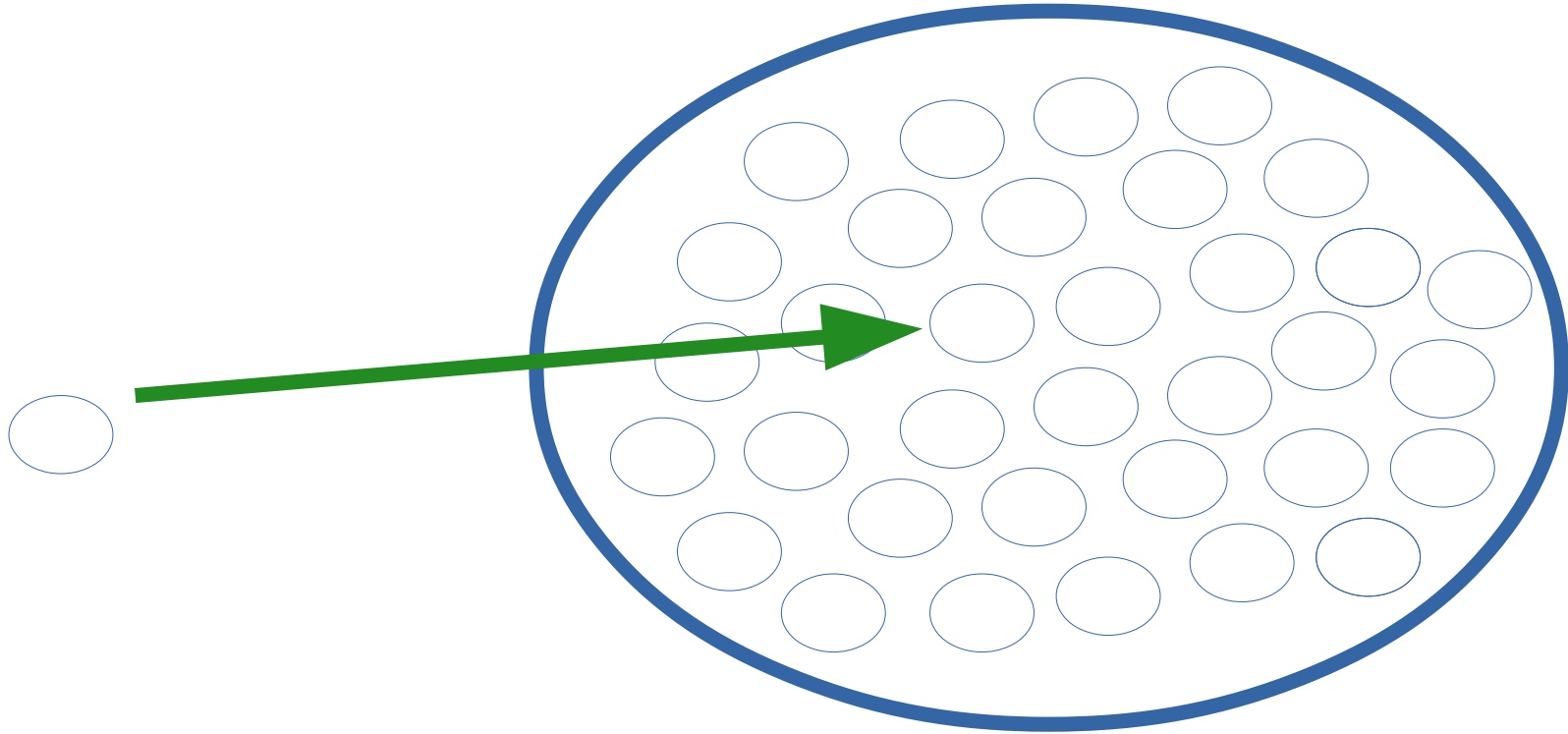
# Simpel effect



# Complex effect



# Dialectic effect



# Relations

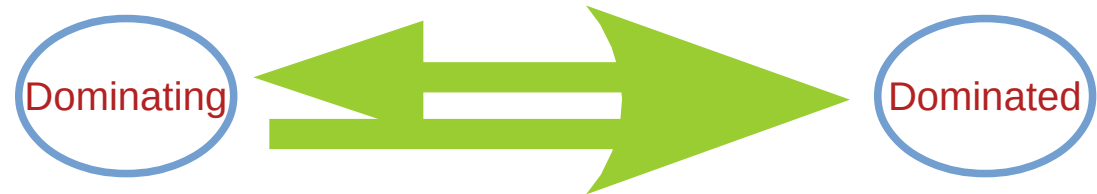
- Unilateral



- Interaction



- Dialectic



Effect

of something

to something

for somebody

somewhere, sometime

# Everything works!

## including digital learning material

- The question is not, if digital learning material works, but
  - What relations the digital learning material is part of
  - How digital learning material and other phenomena are collectively creating effects
- The question therefore could be:
  - Which goals and aims do we have (and who are we?)
  - How can we (get the participants to) act to get these goals and aims promoted?
  - And how do we make digital learning material that supports this?
- And also:
  - What un-expected effects (positive, negative, neutral) rise from this constellation of participants and technologies?

# What does a learning material do?

- Provides content
  - On a certain level
  - With a certain conception of what the subject is and should do
  - In a given form (images, written text, sound, etc.)
- Arranges
  - Structure in content
  - Process in which to work with the content
  - In a progression
- Organizes
  - Imposes, support or expects a relation between students & students and students & teacher
  - Imposes, support or expects work processes of students and teacher
  - Imposes or expects organization of rooms and space and participants

# What is the something we aim for?

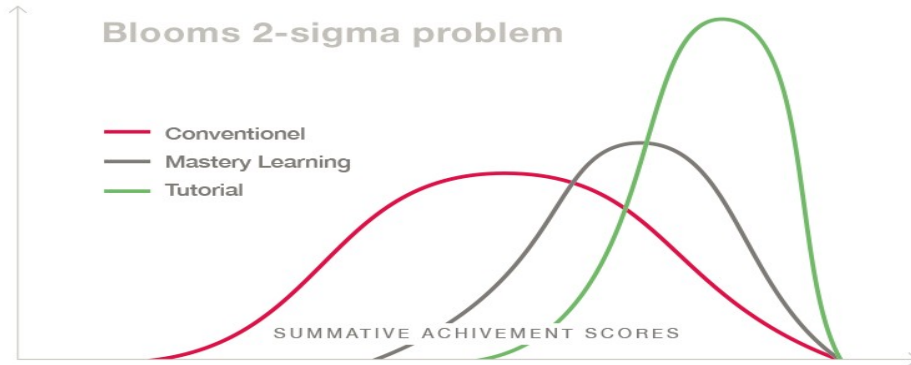
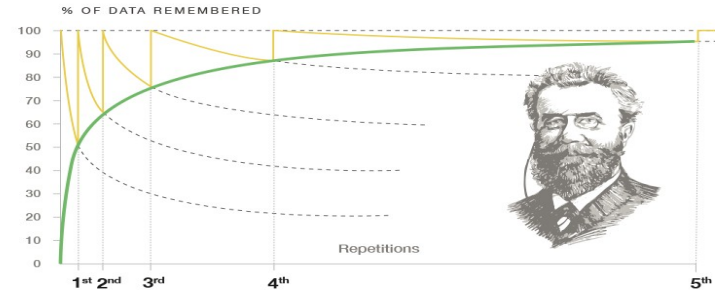
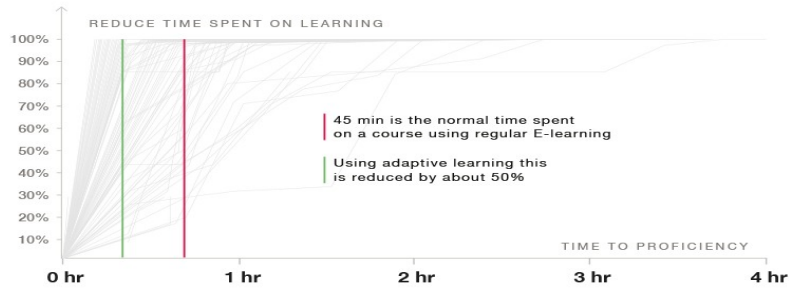
- More effective acquisition of knowledge?
- More effective acquisition of procedures?
- Coverage of the subject content
- More investigative, active, engaged students?
- More creative, innovative, self-confident students?
- More critical, actively participating democratic citizens?
- ...?

# Effective acquisition of knowledge

- “Our mission is to help deliver the world’s best educational and training outcomes validated by a long-term scientific approach.
- Area9 Lyceum adapts your content on a moment-by-moment basis to optimize your personal journey to mastery.”
- ”I Area9 har vi viet mere end 20 år til det at forstå, hvordan folk tænker og lærer – og hvordan man kan forbedre disse processer. I to årtier har vores forskning fokuseret på menneskelige faktorer, læring, produktudvikling, indholdsudvikling og datalogi.
- Den røde tråd er TEKNOLOGI + HJERNER
- Vi har systematisk investeret i “supercharging” af mennesker gennem specialiseret software og teknologi. Det skyldes, at vi ved, at kombinationen af mennesker og teknologi er stærkere end teknologi og mennesker hver for sig.”



# It works!



Which term defines what happens when your employees think they know something, but in reality they don't?

Click the answer you think is right.

- ☒ Unconscious Incompetence
- ☐ Conscious Incompetence
- ☐ Non-adaptiveness
- ☐ Consciously Competent

Do you know the answer?

I KNOW IT

THINK SO

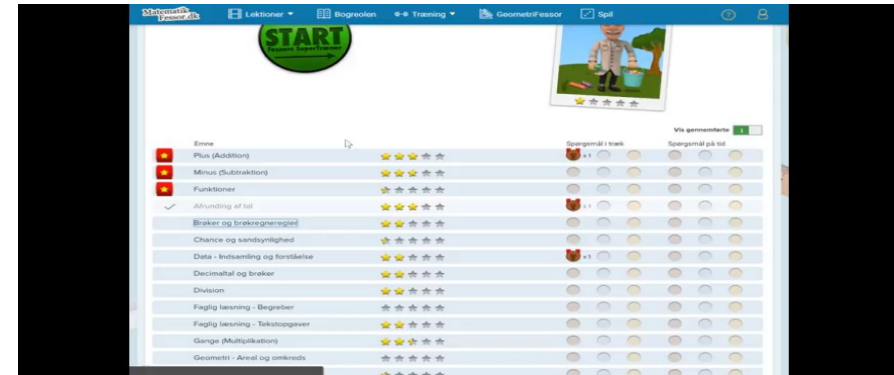
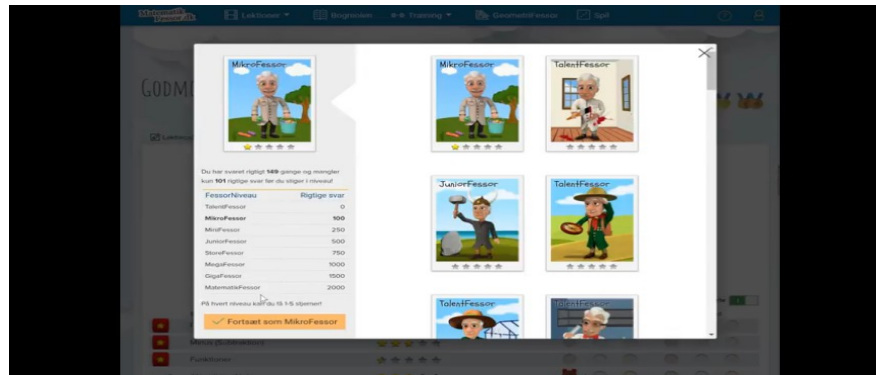
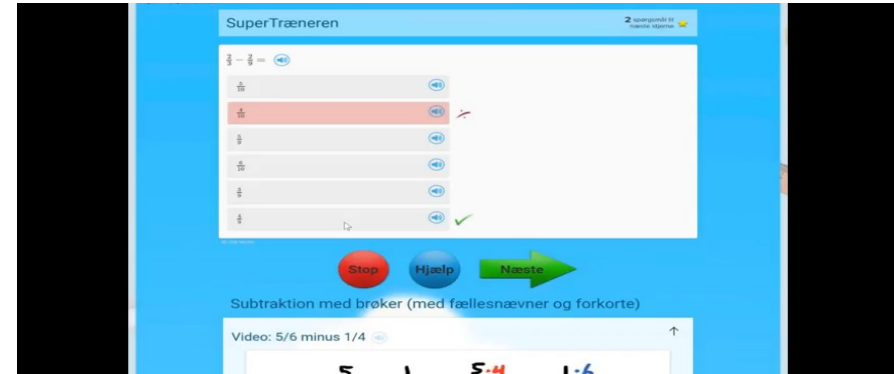
UNSURE

NO IDEA

# Effective acquisition of procedures

## "motivation and gamification"

- Gamification
  - Win badges, stars, points when you answer questions
  - Rise to next level
  - Leaderboards, competition



# It works!



## **Fessor fordobler Arenaskolens karaktersnit**

"I skoleåret 2014/15 resulterede samarbejdet mellem Arenaskolen i Greve og MatematikFessor.dk i en fordobling af gennemsnittet ved afgangsprøven i matematik for skolens 9. klasse."

[Læs mere her](#)



## **MatematikFessor skaber gode resultater**

Lundehusskolen på Østerbro har på kort tid løftet matematikniveauet hos 2.-9. klasserne mærkbart.

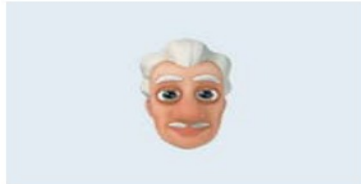
[Læs mere her](#)



## **Digital matematiktræning løfter niveauet**

Intensiv efteruddannelse i digital matematiktræning til lærere samt individuelt tilrettet matematikundervisning til eleverne på Lundehusskolen på Lersø Park Allé har på kort tid løftet matematikniveauet.

[Læs mere her](#)



## **Elever gik matematik-amok**

"Eleverne har gjort noget ret unikt. De har lavet mere på 3 uger, end hvad en skole normalt laver på et helt år."

[Læs mere her](#)

# Repetitive learning materials

- Matematikfessor
- Area9
- Grammatip
- Spelling drill and practice
- Etc.



# Behavioristic theory of learning

- Operant conditioning
  - Stimulus -> Response
  - Reinforcement or punishment
- Start with simple procedures and facts.  
Continue towards more complex procedures and facts

# Coverage of the subject content



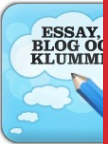



**dansk** 7-10. KLASSE Log ind GYLDENDAL

• FORSIDE BIBLIOTEKET **FORLØB** REDSKABER TRÆNING TIL LÆREREN

FORFATTERSKABER  
GENRER  
HOVEDVÆRKER  
LÆSNING  
MUNDTLIGHED  
PERIODER  
SKRIFTLIG  
FREMSTILLING  
SPROG  
TEMAER

**FORLØB**


NYESTE UNDERVISNINGSFORLØB



**Dansk**

Du og dine elever kan prøve udvalgte forløb gratis.

Søg i forløb, tekster, opgaver og aktiviteter **Søg**



**Materialer** 5. klasse x Fjern filtre

Forløb 34  
Tekster 57  
Opgaver / aktiviteter 161

**Filtrer**

Klassetrin

☐ 0. klasse  
☐ 1. klasse  
☐ 2. klasse

**Forløb (34)**

5. 6. klasse  
**Astrid Lindgren**  
Gratis skoleåret 2019/20  
Ca. 14,5 lektioner

5. 6. klasse  
**Billedanalyse**  
Gratis skoleåret 2019/20  
Ca. 3 lektioner

3. 4. 5. klasse  
**Det rimer**  
Gratis skoleåret 2019/20  
Ca. 7,5 lektioner


5. 6. klasse  
**Filmfabrikken**  
Gratis skoleåret 2019/20  
Ca. 6,5 lektioner

**Danskfaget** 1.-3. klasse

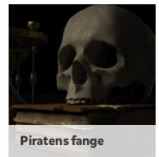
Forløb Emner Aktiviteter Læs Opgavesæt Ressourcer Søg

UNDERVISNINGSFORLØB 3. KLASSE


Forløb Årsplaner




Folkviser



Piratens fange



Grundtvigs stjerner

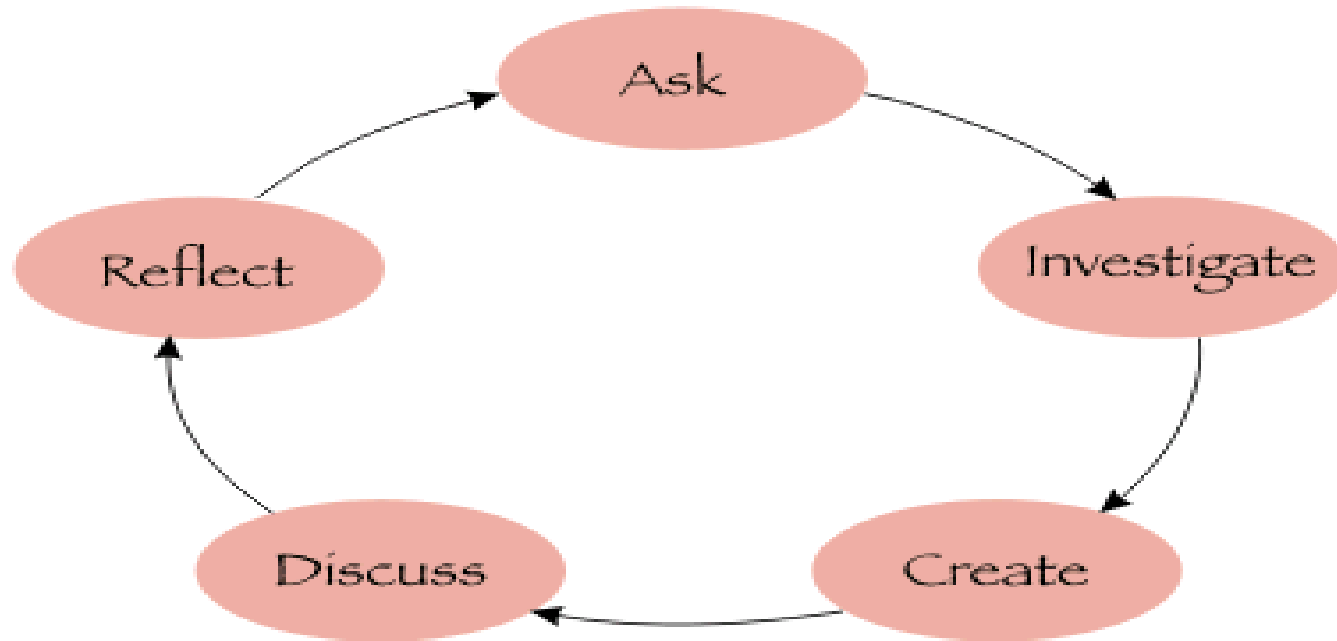


Forholdsord

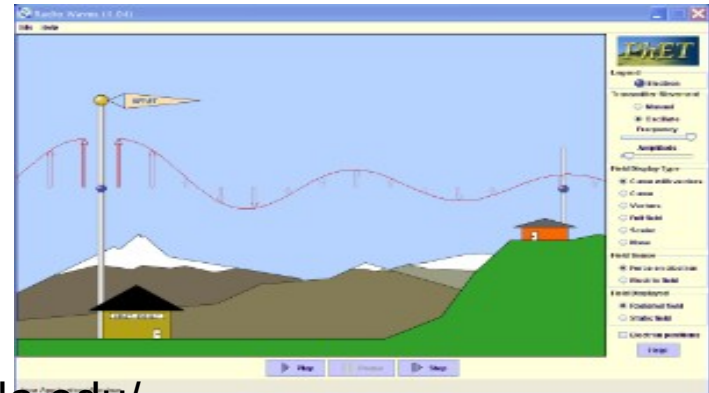
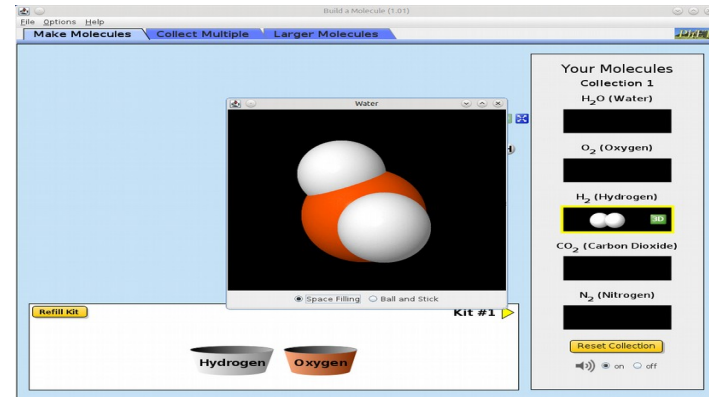
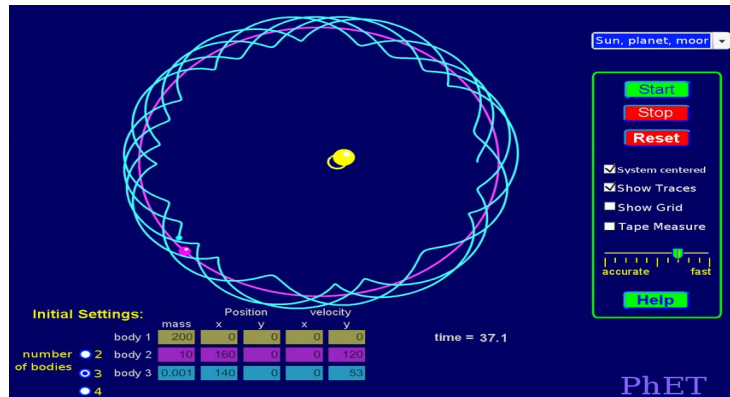
# Instructivism

- Knowledge is a collection of facts about the world, and procedures for how to solve problems.
- The goal is to get these facts and procedures into the students' heads.
- Teachers know these facts and procedures, and their job is to transport these facts and procedures to the students.
- "Basic"/"simple" facts and procedures are taught first, more complex later.
- Success is measured by testing the number of facts and procedures the students know.

# Inquiry based science education

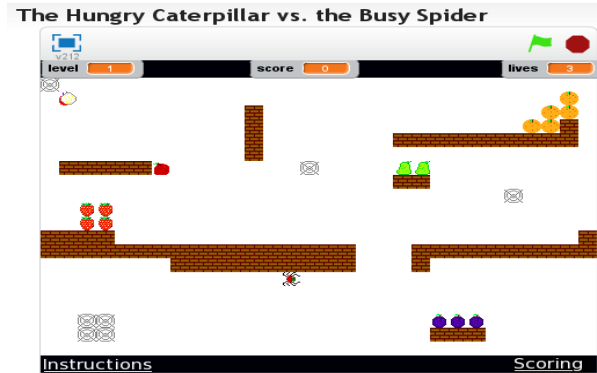
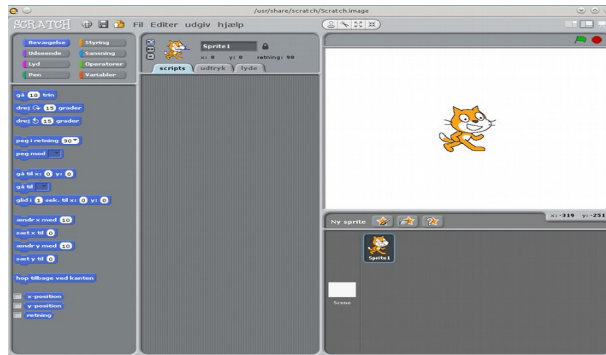
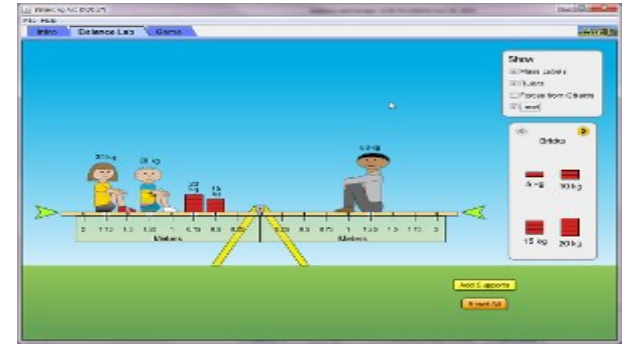
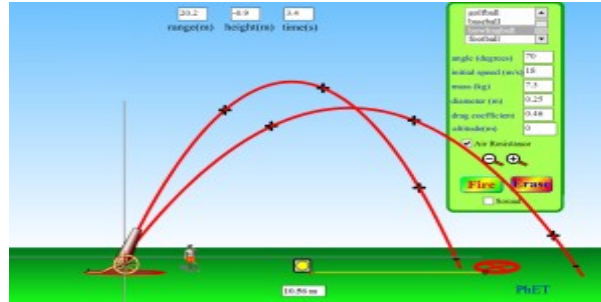
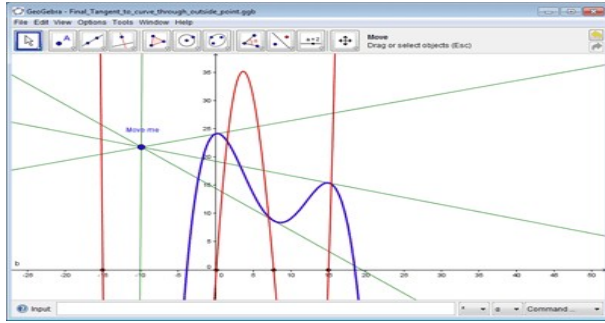


# Using simulations

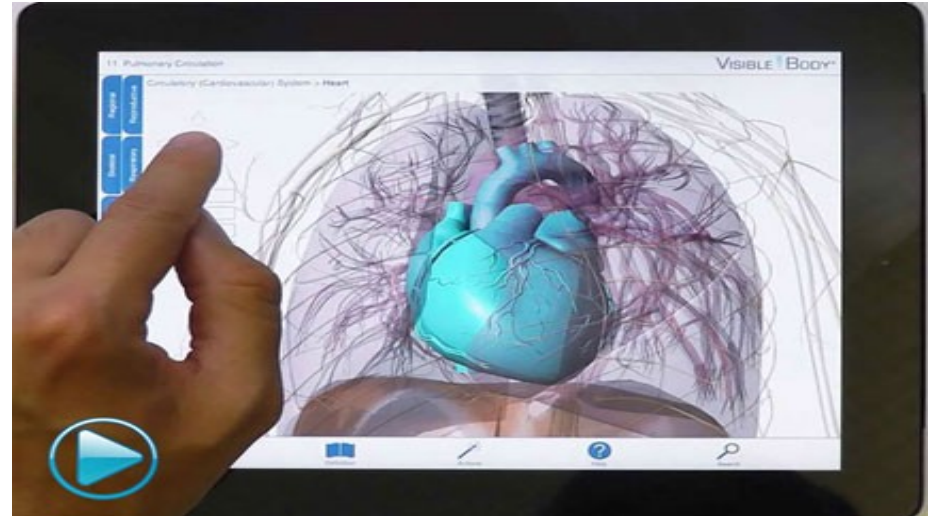
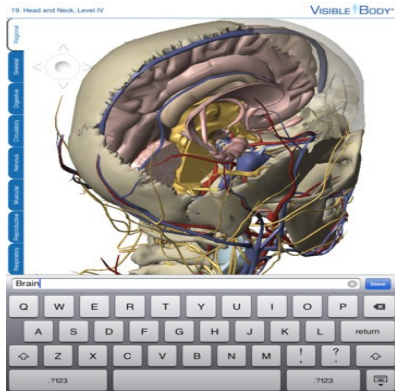
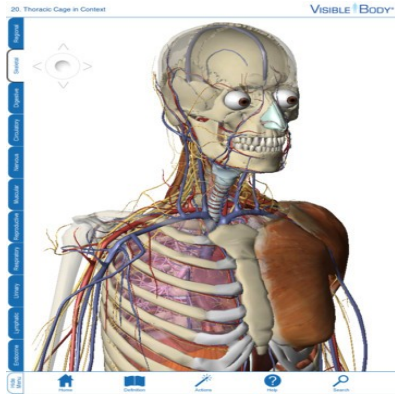


<http://phet.colorado.edu/>

# And other interactive learning materials



# And interactive books



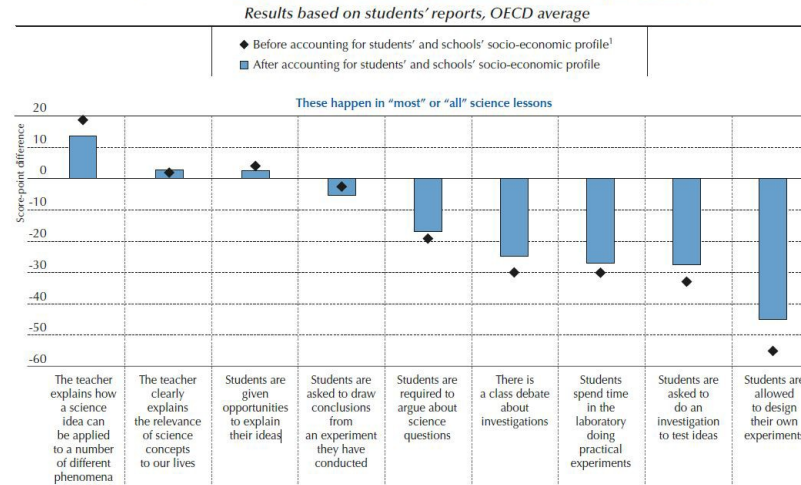
# Constructivist learning theory

- Students construct their own understanding of the phenomena
  - Form hypothesis
  - Interact with the world (real or simulated)
- The learning material responds, but doesn't give the correct answer
- The teacher supports the students by challenging their hypothesis, shows the road to a deeper and more complex understanding
- And the teacher helps the students to see the phenomena in a larger context, using a critical approach

# It works! (sometimes...)



Figure II.2.20 ■ **Enquiry-based teaching practices and science performance**



1. The socio-economic profile is measured by the PISA index of economic, social and cultural status.

Note: All differences are statistically significant (see Annex A3).

Source: OECD, PISA 2015 Database, Table II.2.28.



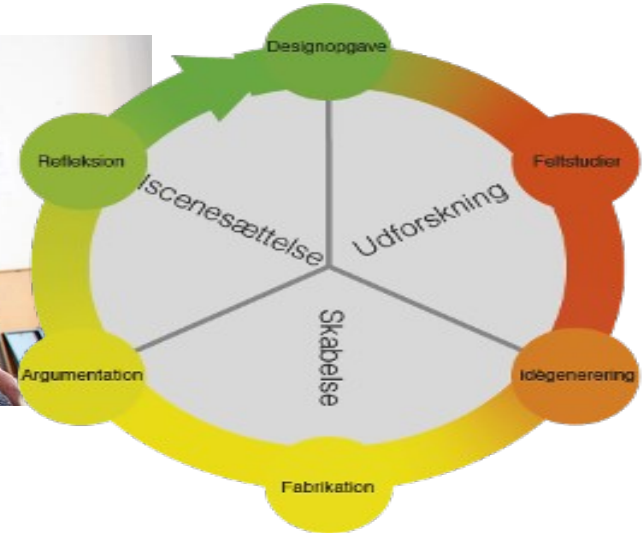
# Innovation and Entrepreneurship



# Innovation and Entrepreneurship



# FabLab@School



# Recent learning research

- The best way to learn new things is by having a problem that you want to solve in a real situation in social relationships
- We need to use what we learn, otherwise we forget.
- We are very bad at remembering arbitrary elements
- We are very good at seeing (or wanting to see) connections and recognize something new as something familiar (of a kind)
  - Schools should support that it is the right connections we see
  - Schools should make us discover details we didn't see before, and understand how they connect to other things we already know.

But how do you support that with  
digital learning material?

# An engineering work place



# Organizes and structures work

- and supports the teacher's overview

The image displays the FutureCity web application interface, which is used for organizing and structuring work. The interface is shown in a Mozilla Firefox browser window with the URL <http://www.futurecity.dk/Default.aspx?user=teacher&id=42&expld=1>.

The main interface features a navigation bar with links: Forside, Lærerforside, Lærervejledning, and Projekter. The central area is titled "UGEPLAN FOR ENERGI" and shows a weekly schedule for "Uge 39, 2009". The schedule is organized by day (Mandag, Tirsdag, Onsdag, Torisdag, Fredag) and time slots (1. time to 7. time). Activities are listed in the schedule, such as "Spil Sim City" and "Faglig læsning".

Below the schedule, there is a section for "Dagens aktiviteter" (Today's activities). This section includes filters for "År" (Year) and "Ugenummer" (Week number), and a "Hent aktiviteter" (Get activities) button. The activities are listed in a table with columns for "Rapport", "Assistent", "Gruppe", "Kommentar", and "Læst".

The "Dagens aktiviteter" section also includes a "Beskrivelse af timen" (Description of the hour) and a "Materialekrav" (Material requirements) section. The "Beskrivelse af timen" section describes the activity "Spil Sim City" and its duration. The "Materialekrav" section lists the materials needed for the activity, including "Sim City" and "Computer".

The interface also includes a "Rapporter" (Reports) section on the right side, which provides information about the reports and how to use them. The "Rapporter" section includes a "Tilbage" (Back) button.

# Academic education

## Students are educated as engineering experts



# Students work both online and offline

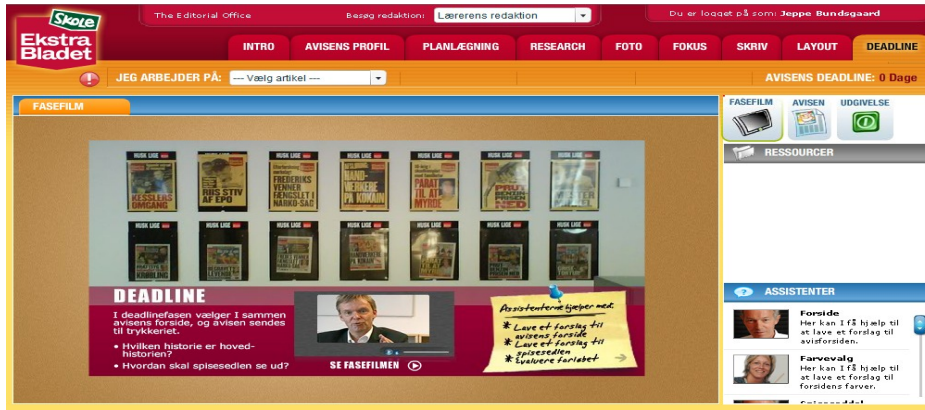


More critical, actively participating  
democratic citizens

# That is, actually, the goal...

- § 1. Folkeskolen skal i samarbejde med forældrene give eleverne **kundskaber og færdigheder**, der: **forbereder dem** til videre uddannelse og giver dem lyst til at lære mere, gør dem **fortrolige med dansk kultur og historie**, giver dem **forståelse for andre lande og kulturer**, bidrager til deres **forståelse for menneskets samspil med naturen** og fremmer den enkelte elevs **alsidige udvikling**.
- Stk. 2. Folkeskolen skal udvikle arbejdsmetoder og skabe rammer for oplevelse, fordybelse og virkelyst, så eleverne udvikler erkendelse og fantasi og får tillid til egne muligheder og baggrund for at tage stilling og handle.
- Stk. 3. Folkeskolen skal **forberede eleverne til deltagelse, medansvar, rettigheder og pligter** i et samfund med frihed og folkestyre. Skolens virke skal derfor være præget af åndsfrihed, ligeværd og demokrati.

# The Editorial Office



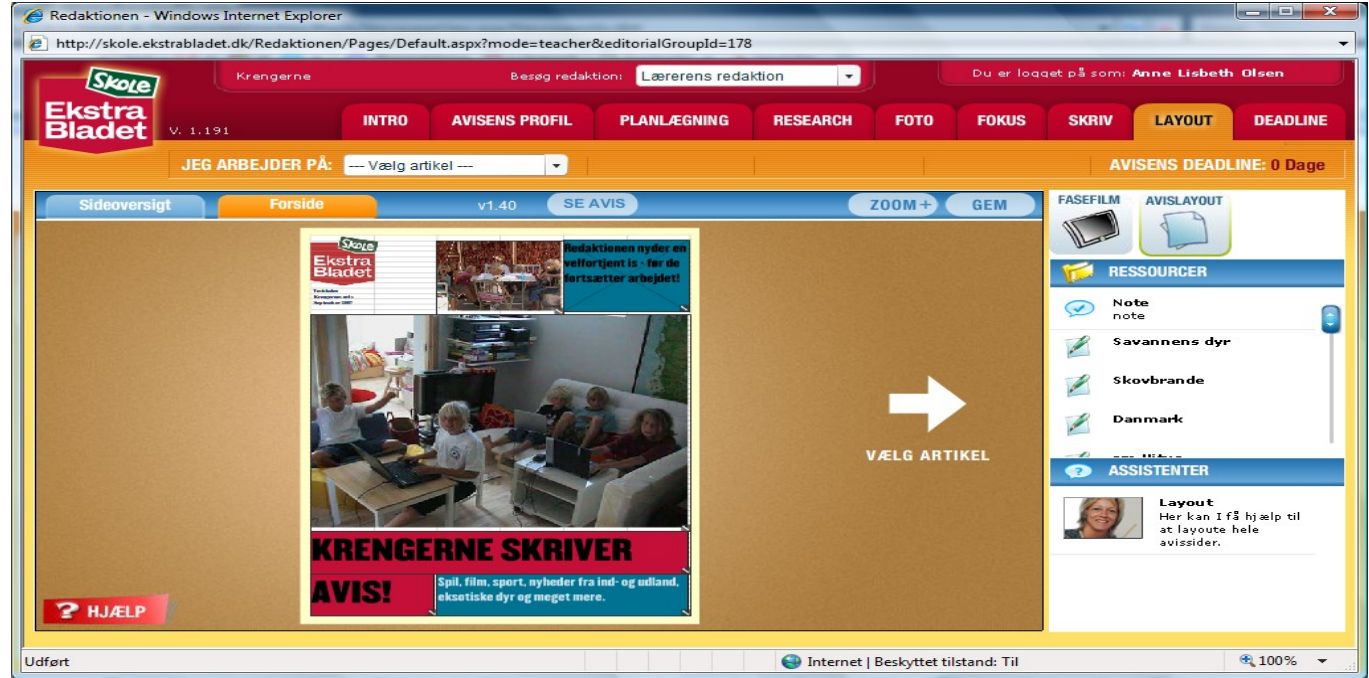
- Support a journalistic community of practice from decision of the newspaper profile to the deadline
- Newspaper production online
- Newspaper printed in 1000 copies in colors

# Glimpses from practice



# Structuring students' work

profile  
planning  
research  
photo  
focus  
writing  
Layout  
Deadline



# Organizing collaboration

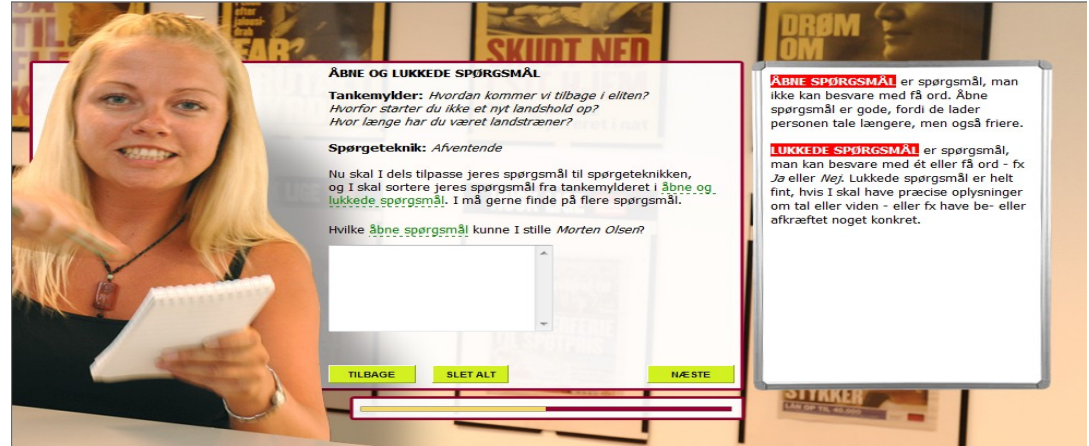
- Organizes the process from start to finish
  - Students create articles,
  - divide tasks among them ... and
  - set deadlines ...
- The students know what to do
- The teacher has an overview and can take action when and where it is needed

The screenshot shows the 'Redaktionen' web application for 'Skole Ekstra Bladet'. The interface is designed for organizing collaboration in a school newspaper. It features a top navigation bar with tabs for 'INTRO', 'AVISENS PROFIL', 'PLANLÆGNING' (active), 'RESEARCH', 'FOTO', 'FOKUS', 'SKRIV', 'LAYOUT', and 'DEADLINE'. Below this is a section for 'JEG ARBEJDER PÅ' (I am working on) with a dropdown menu to select an article. The main area is titled 'TIDSPLAN' (Timeline) and 'Krengerne' (The Gears). It contains a table with columns for 'Artikler' (Articles), 'Ansvarlig' (Responsible), 'Startdato' (Start date), and 'Dage' (Days). The table lists tasks for two articles: 'Drengen og ålen' and 'Flodhesten'. To the right of the table is a calendar view for August, showing the timeline of tasks. The sidebar on the right includes 'FASEFILM', 'TIDSPLAN', 'RESSOURCER' (Resources) with a 'test note' and 'Note note', and 'ASSISTENTER' (Assistants) with profiles for 'Idé' and 'Tidsplan'.

Artikler	Ansvarlig	Startdato	Dage
▲ Drengen og ålen		8. august	6
✓ Research		8. august	4
✓ Foto		9. august	3
✓ Fokus		8. august	3
✓ Skriv		10. august	3
✓ Layout		12. august	2
▲ Flodhesten		10. august	4
✓ Research		10. august	3
✓ Foto		12. august	2

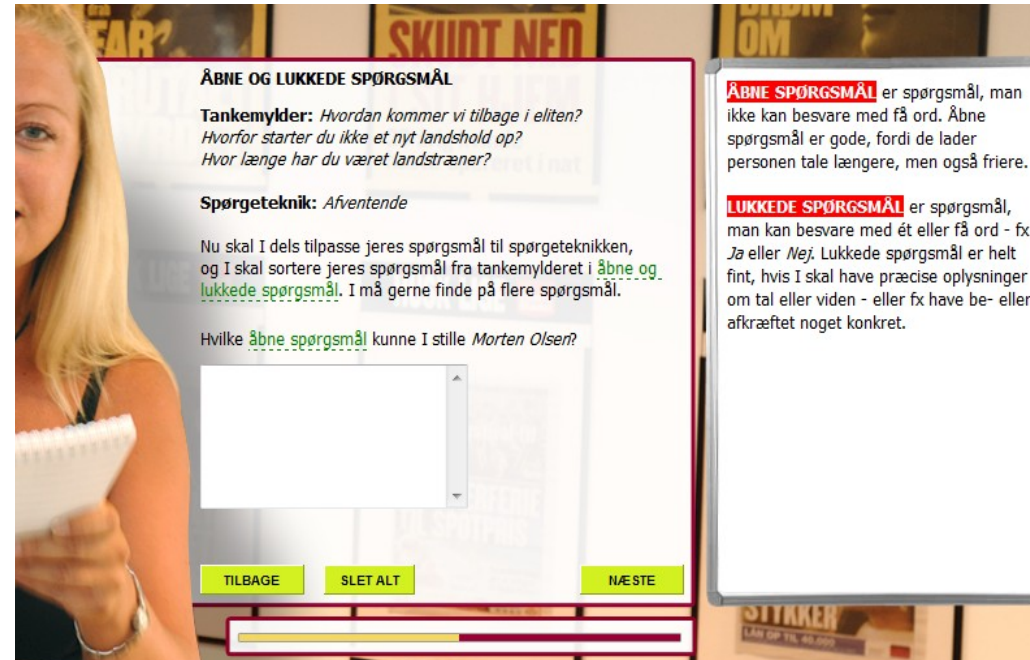
# Supporting development of skills and knowledge: Interactive assistants

- An **interactive assistant**
- Has a **specific task** as it's starting point
- **Leads the student** through the task
- The computer **structures** – the student **thinks**
- The computer doesn't have all the answers – **no "multiple choice"**

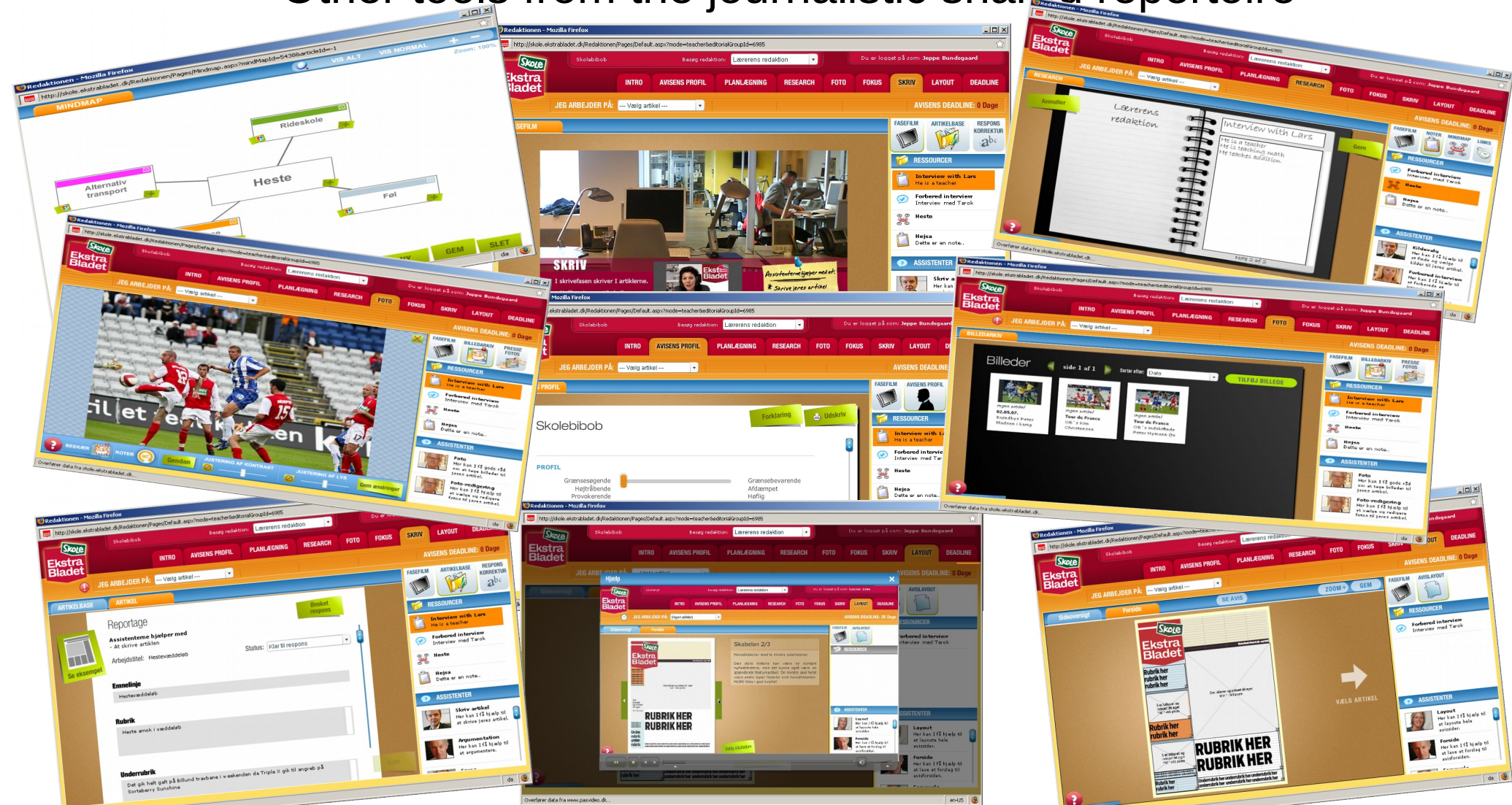


# Interactive assistants II

- The computer asks carefully thought out questions, and **the student** carry on the thinking on this basis
- **Integrates the student's response** in the next question
- **Presents subject related concepts and methods** integrated in the work with the task

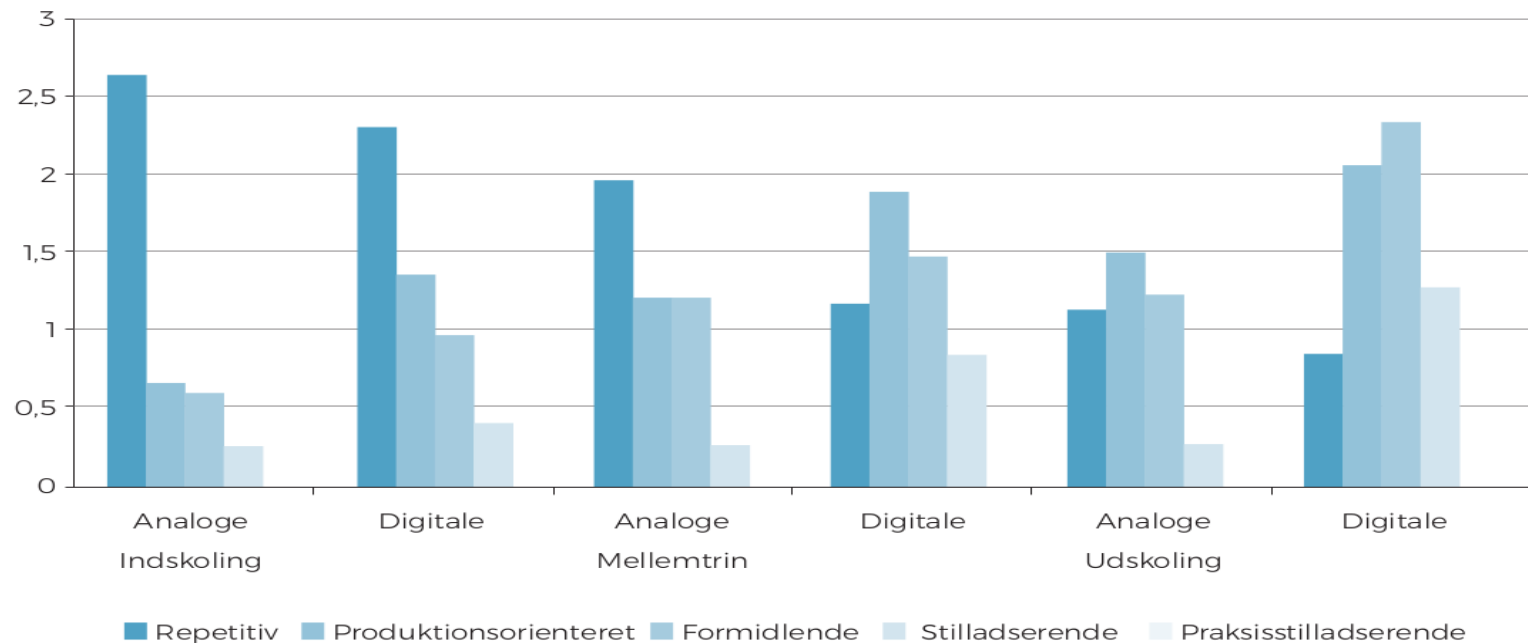


# Other tools from the journalistic shared repertoire



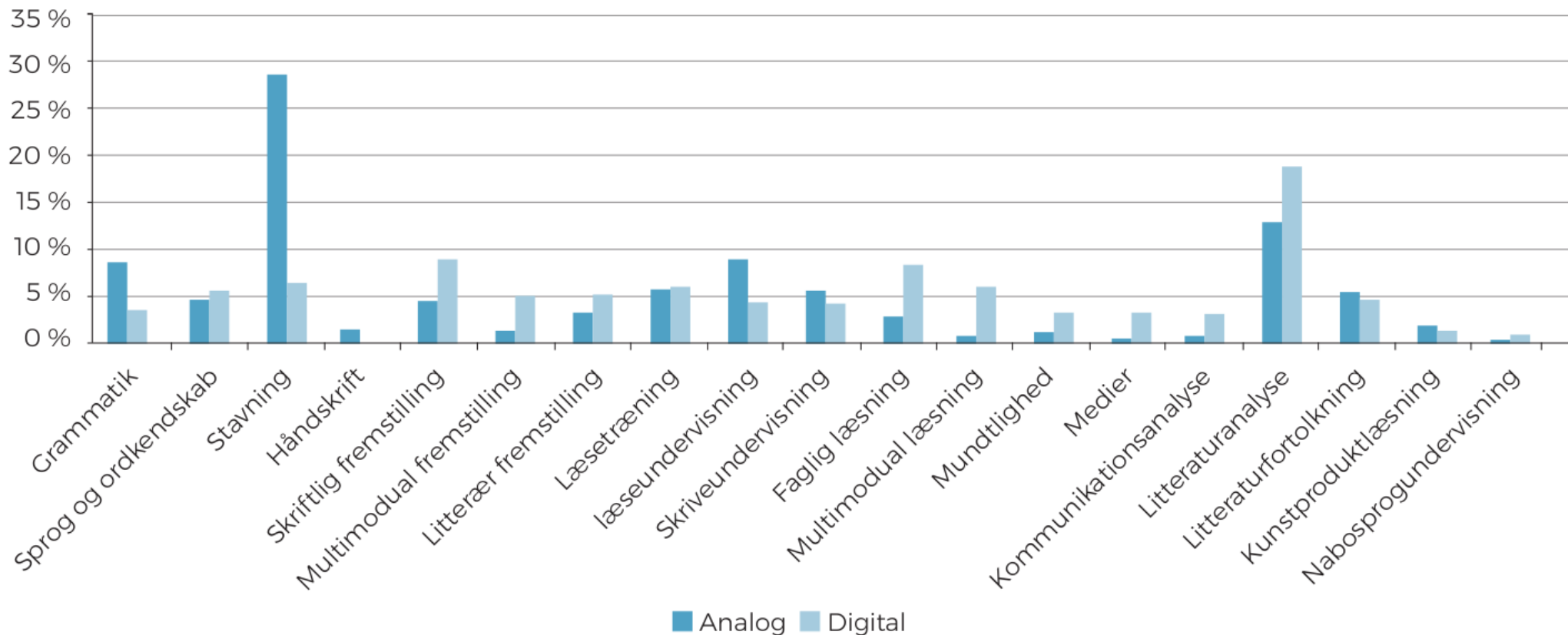
How is the status today?

# Pedagogical approaches of digital learning materials



**Figur 4.** Didaktisk tilgang for henholdsvis analoge og digitale læremidler opdelt på trin.

# Content in learning material



Jeppe Bundsgaard, Bettina Buch og Simon Skov Fougst (2018). De anvendte læremidlers danskfag belyst kvantitativt I: *Læremidlernes Danskfag*. Aarhus Universitetsforlag

# What does a learning material do?

## Revisited

- Provides content
  - On a certain level
  - With a certain conception of what the subject is and should do
  - In a given form (images, written text, sound, etc.)
- Arranges
  - Structure in content
  - Process in which to work with the content
  - In a progression
- Organizes
  - Imposes, support or expects a relation between students & students and students & teacher
  - Imposes, support or expects work processes of students and teacher
  - Imposes or expects organization of rooms and space and participants

# Are digital learning materials an advantage or a nuisance?

That depends!

# Thanks!

<http://pure.au.dk/portal/da/jebu@edu.au.dk>

