DIGITAL REVOLUTION IN EDUCATION: THE WHAT AND HOW OF LEARNING

“If you can not measure it, you can not improve it.”
Kelvin

CSEDU 2021
13th International Conference on Computer Supported Education
April 23-25. 2021
A POTENTIAL REVOLUTION IN EDUCATION

WILL THE PANDEMIC CHANGE SCHOOLS?
31.03.2020
affected:
84% of learners
Unprecedented challenges

- for students and teachers
- proper infrastructure
- technical assistance
- reinvent themselves in record time to keep school running.
Effects of school lockdowns in response to COVID-19

- Only a few days for transforming - “new normal”,
- accelerated the spread of the application of technologies, digitalization,
- enhanced teachers’ cooperation + opportunities
Expected

- Teachers can reinvent and renew education in only a few days
- A rapid pedagogical shift
- Adaptation to new learning methods and environments
- Forgetting the fitting for all approach
Experienced

- not enough infrastructure
- not enough digital competencies
“Children of today have been surrounded by digital technology” (Livari et al., 2020)

But

• Used not for learning
• => Much larger digital divide
• Need for proactive technology usage: critically considering how it could and should be used
Experienced

- not enough infrastructure
- not enough digital competencies
- explore good practices
- accelerated the spread of the application of technologies
- lack of proper methodological knowledge
- frontal teaching methods in digital environment
- mostly unmotivated kids
Positive effects

- **Students**
  - Technology + learning
  - Self-direction + New learning methods

- **Teachers:**
  - ICT competencies + cooperation with other teachers
  - The What of teaching
  - „Fitting for all” – not working
  - Alternative assessment methods (e.g. portfolio)
We have learnt

- more than just technology
- highly complex
- whoever lags behind, is ultimately lagging behind
- personalised education
- rething and redesing ed.
- methodologies, competencies, and assessment methods
- First step: infrastructure
The present situation have created not only fertile opportunities for reshaping education but also highlighted the difficulties and challenges in this process.
CSEDU 2021
13TH INTERNATIONAL CONFERENCE ON COMPUTER SUPPORTED EDUCATION
ONLINE STREAMING  
23 - 25 APRIL, 2021

1920

PATENT NUMBERS
1,670,430 - MAY 23, 1928
1,762,326 - MARCH 4, 1930

PRESSEY TESTING MACHINE
W.M. Welch
Scientific Company
SER. NO. 407
Chicago, Ill.
Technology in education (Scopus)
Computer supported education (Scopus)
how to maximize to increase the effectiveness of learning

learning outcome + motivation + engagement

Technology supported education – focus

1990
media comparison studies

2000

2010
adapt these technologies to the human mind

2020
Today

- fine-grained, process-oriented data
- Intelligent tutors - formative feedback
- learning analytics
- require development of new learning theories
- reconceptualization of research
Educational technologies have brought about developments and challenges in theory, methods, and practice.
How can we best use technology to help students learn?

- rigorous experimental research is needed
- to identify instructional features in technology-rich environments
- that maximize learning outcomes and
- promote appropriate learning processes.
Why is this important?

Why is the “one size fits all” approach inefficient?

Why do we need to change to what and how of learning?
Age does not determine skills and abilities.
Children are very diverse and in many different ways diverse.
Technology can help to address this issue and personalise education.
Questions for teaching and learning

- how the use of technology can reshape the methods of traditional teaching
- how it could be maximized to
  - increase learning effectiveness,
  - support differentiated instruction,
  - boost student concentration,
  - raise their limits of endurance,
  - and maintain their motivation?

- COVID-19: opportunity for reimagining and digitally transforming (starting) education
The WHAT of teaching

• Leaving the „fitting for all approach” and personalise education

• What do we need to know?
  – How skilled our students are?
  – What do they know in the most important domains of education?

• The profile of assessment from a summative approach to a diagnostic, more learning-centred view - use assessment to facilitate learning.
Possibilities of technology based assessment

- among the most dynamically developing areas
- huge improvement of data transfer technology and data analysis methods
- qualitative change of assessment needed
Computer-based assessment

• extraordinary opportunities
• more realistic, application-oriented, engaging and authentic context
• innovative item development opportunities, producing dynamic, interactive multimedia items
• more valid assessments
• provide instant, objective, standardised feedback
• adaptive test algorithms
Instant feedback + adaptivity

- make video games so popular
- technology-based assessment and game-based learning are converging
What do we know in 2021?

• we can develop complex, real-world, authentic, high-quality tests
• the ‘one-size-fits-all’ approach is not effective
• summative test results do not meet the individual needs of students
• tests needed: improving the learning process -> re-think the essence of assessment
• more a learning-centred, low-stakes approach
• Diagnostic assessment to facilitate learning.
Diagnostic assessment – what do we need?

- Theory – frameworks
- Assessment platform
- Tasks (based on theory) -> Itembank (running in the assessment platform) -> Scaled itembank
Diagnostic assessment - theory

• identifying all important knowledge elements

• three main goals of schooling:
  – to cultivate students’ minds, general cognitive abilities and thinking skills
  – to develop usable, applicable knowledge
  – to transmit content knowledge
Three-dimensional model of knowledge

Internal (psychological) dimension

Social and cultural dimension

Disciplinary (content) dimension
Three-dimensional model of mathematical knowledge

- Internal (psychological) dimension
  - the interaction between students’ cognitive development and learning mathematics at school

- Disciplinary (content) dimension
  - content knowledge described in the national core curriculum

- Social and cultural dimension
  - literacy: the type of skills that make mathematics useful in areas other than the immediate school context
Diagnostic assessment – assessment platform

- learning centred
- easy-to-use, but innovative possibilities
- Item builder module for first-, second- and third-generation tasks
- administer both fix and adaptive tests
- any device + even low-speed internet
- prompt or quick scoring
- good feedback module – embedded visualization
Diagnostic assessment - tasks

• Several thousand tasks based on the theory
• Empirically scaled + labelled item bank
eDia online diagnostic assessment system for personalised learning

- Theory: three-dimensional model of knowledge
- Innovative assessment platform
Tudd meg, mit tudsz!
 Köszönjük, hogy megoldottad a tesztet!

A teszten elért eredményed annál magasabb, minél több lúftát látsz Malacka fölött.

Eredményed: **0%-os**

Tanulási hatékonyságod:

0%
Az újonnan tanultak alkalmazása:

0%
eDia - diagnostic assessment - tasks

At about 25,000 tasks in the field of Mathematics, Reading and Science.
Mathematical reasoning task: whole numbers + inductive reasoning

Dumpling Arthur got 20 bars of chocolate for his birthday. He ate a few pieces from each chocolate bar, and then he put the rest of the chocolate into groups according to a certain rule. There is an odd one out in each row. Which one is it? Click on it.
Mathematical literacy task: adding up to 10 in realistic application context

Keep putting Teddy bears on the bed till you have 8 bears there.
The different colours tell you who made the throw.

Click on the name of the person with the least points.

Who got more points?

Mary or John:  Click here!  
Lisa or Paul:  Click here!  
Mark or Lisa:  Click here!

True or false? Mark the sentences T (true) or F (false).

John has one more point than Mark.  Click here!
Mark has three more points than Paul.  Click here!

Mathematical disciplinary task
Which animal sound do you hear? Click on the right picture.
eDia partner schools
Technology-Based Assessment is Applicable in an Educational Context
Disciplinary, application and psychological dimensions of learning mathematics, reading and science can be empirically distinguished independent of the measured grade.
Item banks are well structured and fit the knowledge level of first- to sixth-graders in all three main domains of learning.
The eDia-system is appropriate to make learning visible in the three main domains of learning and beyond.
Extra moduls

- eDia teacher test modul (www.ovi.edia.hu)
- eDia kindergarten test modul (www.teszt.edia.hu)
Effect of disruptive education in the last year (Sept-Oct)

<table>
<thead>
<tr>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mathematics

<table>
<thead>
<tr>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reading

<table>
<thead>
<tr>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Science
<table>
<thead>
<tr>
<th></th>
<th>Mathematics</th>
<th>Reading</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>2019</td>
<td>2020</td>
<td>2018</td>
</tr>
<tr>
<td>2</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>3</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>4</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>5</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>6</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>7</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>8</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2019</th>
<th>2020</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>4</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>5</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>6</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>7</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>8</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2020</th>
<th>2020</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>4</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>5</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>6</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>7</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>8</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>
The HOW of teaching

• Learning strategies: virtual vs. traditional classroom – differ
• to recite, repeat and remember knowledge without of any meaning, without any attempt to tie to anything in their lives

VS

• for tomorrow, for the needs of the future
• proactive usage of technological tools
• Cooperative, collaborative, problem-based
• At all level of education
Educational technologies of the future

- intelligent systems incorporating sophisticated learner and teacher models
- monitor and model the emotional, metacognitive, and cognitive states of learners
- interact with them
- support collaborative and cooperative learning
- applying adaptive models of assessment
Key Takeaways

• Leave the „fitting for all approach”
• Integrate knowledge from different fields
• Change: what and how of teaching
• Evidence-based, theory-grounded, rigorous experimental research
• Use the advantages of technology as a tool, supportive medium – rather than expect adaptation to every new technology
• For personalize learning
Thank you for your kind attention!

“If you can not measure it, you can not improve it.”
Kelvin