Sensing Engagement

Helping Performers to Evaluate their Impact

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ABOUT ME AND MY JOB
CWI: Centrum Wiskunde & Informatica

• National Research Institute for Mathematics and Computer Science (founded in 1946)
• Staff: 55 permanent, 40 postdocs, 70 PhDs
• CWI registered the ‘.nl’ domain (1986)
• 1st connection between Europe and the Internet (17 November 1988)
• Topics examples:
  • Holland’s first computer
  • Height/Strength dykes
  • Algol-68, Python and SMIL
DIS@CWI: research areas

- Social IoT and Smart Textiles
- QoE
- VR and Immersive Media
- Experience-Aware Networking
- Connected Shared Experiences
- Multi-Screen Media Consumption
21\textsuperscript{st} CENTURY CLASSROOM
21st Century Classroom

Components of a 21st Century Classroom

- Technology is undoubtedly changing the face of education, and it's easy to see the impact already. Imagine what classrooms will be like in 20 years with the speed of technological innovation. Learn more about some of the key advancements in the 21st century classroom.

91% of teachers have computers in their classroom...

But just 1 in 5 feel their classrooms have the right level of technology.

Increasing the presence of the following technologies could change that ratio drastically:

- Real World Education
  - Project-based learning (PBL) teaches concepts, but also organization, articulation, project management, and collaboration. Integrating life skills into education can improve student engagement and retention and prepare them for 21st century careers.

- Online Courses
  - Almost a third of all college students take at least one online course.
  - Online enrollments saw 21% growth while overall higher education student population only saw 2% growth.

- Games and Gamification
  - 43% of teachers have used online games in the classroom.
  - In one study, games raised average test scores: 91.5% with the use of digital games, 79.1% without the use of digital games.

81% of teachers believe tablets enrich classroom learning.

86% of students believe they study more efficiently with tablets.

1 in 5 students have used a mobile app to keep their coursework organized.

6 in 10 students have used a digital textbook. Just 4 in 10 had in 2011.

60% of college students cited wireless upgrades as their tech priority in 2011-12. 76% increase in mobile devices on campus in the previous year.

Top 3 Reasons for Teachers to Use Technology in the Classroom

- 75%
  - Adapt to diverse learning styles

- 77%
  - Boost student motivation

- 76%
  - Enhance the material being taught

6 in 10 students have used a digital textbook.

86% of students believe they study more efficiently with tablets.

59% of teachers use social media for coursework compared to now.

59% of students would like to use their own mobile devices to enhance learning.

One social media pilot program assisted in a class. 59% rise in grades.

Over 51% of colleges cited wireless upgrades as their tech priority in 2011-12. The 60% increase in mobile devices on campus in the previous year.

Integration of Social Networks

- Engaging students with a tool they already use can help them learn in new ways, gain focus, and increase participation.

One social media pilot program assisted in a class. 59% rise in grades.

4 in 10 students believe integrating social networks into the classroom would benefit their education.

# The 21st Century Classroom

21st Century Skills are a combination of cognitive processes and the technologies that enable individuals to leverage these processes for the greatest impact. The 21st Century classroom is one that is student-centered, project based, and focused on creating life-long learners.

<table>
<thead>
<tr>
<th>Research &amp; Information Fluency</th>
<th>Problem Solving, Critical Thinking</th>
<th>Collaboration &amp; Communication</th>
<th>Creativity &amp; Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher:</td>
<td>Teacher:</td>
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</tr>
<tr>
<td>- provides opportunities for students to develop and demonstrate essential skills.</td>
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<td>- creates structures that provide opportunities for students to develop and collaborate.</td>
<td>- provides opportunities for students to develop and demonstrate essential skills.</td>
</tr>
<tr>
<td>Students:</td>
<td>Students:</td>
<td>Students:</td>
<td>Students:</td>
</tr>
<tr>
<td>- select appropriate digital tools to assemble, evaluate, and utilize.</td>
<td>- apply multiple resources to plan, design, and execute real-world problems.</td>
<td>- initiate communicating in real and virtual time.</td>
<td>- apply critical thinking, research methods, and communication tools to create original work.</td>
</tr>
<tr>
<td>- apply research and create resources.</td>
<td>- use technology to collaborate and solve authentic problems.</td>
<td>- collaborate and participate with learners of diverse cultural backgrounds.</td>
<td>- collaborate effectively with an audience beyond the classroom to create original work.</td>
</tr>
<tr>
<td>- use information and resources to accomplish real-world tasks.</td>
<td>- develop open-ended questions using higher order thinking skills.</td>
<td>- form collaborative teams to solve real-world problems and create original works.</td>
<td>-</td>
</tr>
</tbody>
</table>
21st Century Classroom

• Material and assignments
  – Empowering students
  – Video annotation

• Remote Learning and Collaboration
  – Breaking distance
  – Remote delivery: e.g., MOCC or Skype
  – Communication between students

• Feedback and Grading
  – New metrics and ways of evaluating
  – Intelligence: Avatars as teachers
  – Gathering data: sensors
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Empowering students
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pick the right location in the context
Empowering students
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Intelligence: Avatars as teachers

• Agents
  – React on user engagement: call for attention
  – Have a simple multimodal dialog: individual and group
  – Natural gaze behavior

• Avatars
  – Reflect engagement
  – Reflect camera view
  – Gestures (request to speak)
  – Puppeting (body, face)
Intelligence: Avatars as teachers
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SENSING ENGAGEMENT
Objective: quantifying engagement

Unconscious psycho-physical responses and states, e.g., heart rate, skin conductance.

Lifelong engagement/memory weeks or years later.

Observed post-event hours or days later, and typically measured afterwards.
Objective: quantifying engagement

One of the aims of the European Framework 7 Vconnect program is to use the rollout of superfast broadband in Cornwall.
Methodology: research in the wild
**Sensing: Devices**

**Method:** Measure GSR data from 15 audience members while they watched a 28-minute pseudo play.

**Method:** Measure GSR data simultaneously from 12 live and 12 remote audience members. The show was streamed live to another location.

**Method:** Measure GSR data from 20 audience members while they watch a one hour commercial dance performance in an actual theater.

**Method:** Visualize measured GSR data on a digital display and use data to control heights of balloons.

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**First generation of sensors:** Consisting of one Arduino UNO board, one Xbee wireless module (for every five users), and noise filter.

**Second generation of sensors:** Consisting of one Jeenode board and one RFM12B radio module each.

**Third generation of sensors:** Repackaged the hardware with a new version of software.

**Visualization to indicate audience engagement**

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Sensing: Devices
Sensing: Devices
Sensing: Devices
Sensing: Infrastructure
Sensing: Understanding
Sensing: Understanding
Sensing: Understanding

1. 李玟
2. 张信哲
3. 老狼
4. 李克勤
5. 徐佳莹
6. 容祖儿
7. 赵传
8. 金志文
9. 苏运莹
10. 关喆

55%
26%
10%

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Sensing Examples: Student Theatre
Sensing Examples: Holland Dance
Sensing Examples: War Horse
Sensing Examples: Jazz at Goethe
Sensing Examples: Jazz at Goethe
Sensing Examples: Lectures

Audience: Wireless GSR Sensor Network

Collecting Sensor Data

Redistribution

Controlling Balloon

Internet Visualization

Digital Display
Sensing Examples: Lectures

ENGAGEMENT

DISTANCE (METERS)

HEART RATE (BPM)

ENGAGEMENT OF THE AUDIENCE

32% ENGAGED
36% AWAKE
12% BORED
20% GONE

110.8
06:23:00

Hi 99
Lo 72
Avg 83

24 MIN AGO
NOW
Sensing Examples: Lectures
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Remote Learning and Metrics

Graph from http://mfeldstein.com/battle-for-open-mooc-completion-rates/
Self Regulated Learning

Performance
- Self-Control
  - Imagery
  - Self-instruction
  - Attention focusing
  - Task strategies
- Self-Observation
  - Self-recording
  - Self-experimentation

Forethought
- Task Analysis
  - Goal setting
  - Strategic planning
- Self-Motivation Beliefs
  - Self-efficacy
  - Outcome expectations
  - Intrinsic interest/value
  - Learning goal orientation

Self-Reflection
- Self-Judgment
- Self-evaluation
- Causal attribution
- Self-Reaction
  - Self-satisfaction/affect
  - Adaptive/defensive

SRL Model from Zimmerman and Campillo (2003)
Remote Learning and Metrics

Google Hangouts

wireless GSR sensor networking

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Thanks!

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David A. Shamma
Demosthenis Katsouris
Amritpal Singh Gill
Chen Wang

... (and so many more people)