The Use of ICT for the Assessment of Key Competences

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Yves Punie
IPTS: Part of Joint Research Centre of the EC: 7 Research Institutes across Europe

Mission: “to provide customer-driven support to the EU policy-making process by developing science-based responses to policy challenges that have both a socio-economic as well as a scientific/technological dimension”
Future Learning Spaces in 2020
- eLearning in the EU10 MS
  - Review ICT Impact
    - Digital Competence
    - Active Ageing & Learning

Learning 2.0 in formal E&T
Learning 2.0 in informal settings
Creativity & Innovation in schools in EU
The Future of Learning

Tell-Net Teacher Networking

ICT for the Assessment of Key Competences
Digital Competence

Mainstreaming Creative Classrooms
1to1 Learning initiatives in Europe
Mapping Technologies for Learning
Open Education in Europe
There is scope for improvement

Central recommendations on the use of ICT in pupil assessment in compulsory education in primary and general secondary education (ISCED 1, 2, 3), 2009/10

Examples

1st Generation CBA: Problem-Solving

http://www.worldclassarena.org/v5/flash/09_year_old/backtofront.swf
World Class Arena Sample Test: Problem Solving (9 years)
Examples

Generation Re-Invention: Problem-Solving

http://www.worldclassarena.org/v5/flash/13_year_old/pyramids.swf
Problem Solving 13 years
1. Please consider the situation, and then select what you feel is the most effective **AND** the least effective response or action from the four statements.

You have recently been appointed to a position in a new project team. Although you are experienced in the technical aspects of the job, there are aspects of the work that you need to understand. Your job will eventually require internal liaison and collaboration with other project teams. Although your manager has proposed an induction and training period for you, many of the issues you are responsible for require urgent attention.

<table>
<thead>
<tr>
<th>Most effective</th>
<th>Least effective</th>
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</thead>
<tbody>
<tr>
<td>Immediately arrange meetings with those individuals you feel you will need to work with</td>
<td>X</td>
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<tr>
<td>Quickly try to establish how your objectives will relate to your project manager's objectives</td>
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<td>In the initial stages, make sure that you are doing your job as you understood it from the job description</td>
<td>X</td>
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<tr>
<td>Spend time building your understanding of the team’s objectives for the future</td>
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</tbody>
</table>

Generation Re-Invention: e-tray exercise

Examples

E-tray AST1 Example

From: Sylvia Portales
To: All
Date: 3 January 200X
Subject: Telephone system

Dear

In the event of relocation, the telephone system will be taken care of by DG Communication and Information Systems (DG CIS). So that your incoming phone calls continue to be answered in a professional manner, we would kindly ask you to inform Reception on 34021 about the timing of your relocation to a new office, and when you expect to be available again. Incoming messages will be noted and sent to you by e-mail.

If your entire Unit is being relocated, Reception will be informed directly by the relocation coordinator assigned in your Unit. You will not have to take any further action.

Kind regards,

Sylvia Portales
Head of Reception

8 offices from your Unit have been relocated this morning and everything is installed and seems to work. You are, however, still receiving e-mail messages from Reception about your incoming phone calls. Which of the following actions best reflects your chosen course of action under these circumstances? Rank the following responses on a scale ranging from totally disagree (- -) to totally agree (++)

A. You contact DG CIS since they are in charge of the telephone systems. You ask them why your phone calls are still being directed to Reception and when they can fix this.

B. You ask whether other colleagues are experiencing the same problem. Secondly, you contact the relocation coordinator, as he/she is in charge of the relocation of your unit, and ask him/her to fix the problem.

C. You contact Reception to inform them that your relocation is complete. They no longer need to answer your phone calls.

Close questionnaire

Future eAssessment Strategies

**Generation 1**
Automated administration and/or scoring of conventional tests

**Multiple Choice**

**Short Answer**

**Generation 2**
Adaptive Testing

**Data Mining & Analysis**

**Behavioural tracking**

**Learning Analytics**

**Generation 3**
Continuous integrated assessment

**Automated Feedback**

**Intelligent Tutors**

**Generation 4**
Personalised feedback and tutoring

**Games**

**Virtual Worlds**

**Online collaboration**

**Peer assessment**

**Learning 2.0**
Collaborative multimedia learning environments

**Technology-enhanced learning**

**Generation Re-invention**
Transformative strategy: use technology to change test formats

**Computer-Based Assessment (CBA)**


Examples

Towards Generation 3: Datamining

Signals
http://www.itap.purdue.edu/ltt/signals/signals_final/index.htm

Similar: GPS at Northern Arizona University
http://resourceconnect.nau.edu/grade-performance-status.asp
Towards Generation 3: Behaviour Tracking

**Example: SNAPP**
SNAPP is a software tool that allows users to visualize the network of interactions resulting from discussion forum posts and replies. Teachers can rapidly identify patterns of user behaviour. SNAPP can extract all user interactions from various commercial and open source learning management systems, such as BlackBoard and Moodle.
Towards Gen 4: Intelligent Tutoring Systems

AutoTutor
https://www.youtube.com/watch?v=aPcoZPjL2G8

GnuTutor (http://gnututor.com/)
OpenSource version of AutoTutor
https://www.youtube.com/watch?v=k6HDEEnYuIA&feature=player_embedded
We are in a transitional period: Moving from the “Testing Paradigm” to the (future) “Tutoring Paradigm” in which explicit testing could become obsolete.

Generation Re-Invention

- Replication of complex real-life situations within a test
- Computer-Based Assessment (CBA)

Learn 2.0

- Collaborative multimedia learning environments
- Technology-enhanced learning
- Data mining and analysis will make integrated assessment and tutoring possible in the future.
- Peer and portfolio assessment evolve naturally.
- Multimedia collaborative learning environments support key competence development.
- Personalised feedback and tutoring
- Continuous integrated assessment

Technological trends

1990 - Efficient testing
1995 - Personalised learning
2000 - Generation 1
2005 - Generation 2
2010 - Generation 3
2015 - Generation 4
2020 - Learning 2.0
2025 - Technology-enhanced learning

- Mainstream use for high stakes testing
- Further development of innovative test formats
- Increased ease of use at school level
- Trend towards automated scoring
- Cultural change: increased acceptance of CBA

- Automated administration and/or scoring of conventional tests
- Further development of innovative test formats
- Increased ease of use at school level
- Trend towards automated scoring
- Cultural change: increased acceptance of CBA


Key Questions

Which ICT tools, formats, environments, devices etc. are most suitable for the assessment of which Key Competences?

How can ICT be used to support competence-based assessment strategies that adequately capture the skills and attitudes dimensions of all eight Key Competences and their transversal nature?
## Focus Areas

<table>
<thead>
<tr>
<th></th>
<th>Communication in the mother tongue</th>
<th>Communication in foreign languages</th>
<th>Mathematical competence</th>
<th>Basic competences in science and technology</th>
<th>Digital competence</th>
<th>Learning to learn</th>
<th>Social and civic competences</th>
<th>Sense of initiative and entrepreneurship</th>
<th>Cultural awareness and expression</th>
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**Legend:**
- **F** = Formative Assessment
- **D** = Diagnostic Assessment
- **S** = Summative Assessment

**Assessment Tools:**
- CBA
- Quizzes/simple games
- ePortfolios
- Peer Assessment
- Self Assessment
- Virtual worlds games
- Simulations
- Intelligent Tutors etc.
PART 1

INSPIRATION
Matching spoken and written language

http://www.familylearning.org.uk/sight_word_games.html
Foreign language learning

Communication in foreign languages

CBA (DS)  Quizzes / simple games (FD)  ePortfolios (FS)

http://www.nickjr.de/games/107-swipers-buchstabier-buch
Mathematical games using simulation for secondary school education

Source: http://hotmath.com/games.html
Peer Assessment for Collaborative Work

Example:
SparkPlus
http://spark.uts.edu.au/
Moodle is a free web application that educators can use to create effective online learning sites.

**Moodle Statistics**
Registered sites: 77,213
Countries: 229
Courses: 7,116,466
Users: 66,349,750
Teachers: 1,292,731
Enrolments: 56,306,274
Forum posts: 118,413,272
Resources: 63,891,942
Quiz questions: 147,057,434

[http://www.youtube.com/watch?v=Tp8v2UBbmN4](http://www.youtube.com/watch?v=Tp8v2UBbmN4)
ePortfolios

1 Communication in the mother tongue
   - CBA (DS)
   - Quizzes / simple games (FD)
   - ePortfolios (FS)

2 Communication in foreign languages
   - CBA (DS)
   - Quizzes / simple games (FD)
   - ePortfolios (FS)

8 Cultural Awareness and expression
   - ePortfolios (FS)
   - Virtual worlds / games (FS)

- CBA (DS)
- Quizzes / simple games (FD)
- ePortfolios (FS)
- Virtual worlds / games (FS)

Creating K-12 ePortfolios Using GoogleApps (GoogleDocs, Blogger, and Google Sites)
©2009. Helen C. Barrett, Ph.D.
<table>
<thead>
<tr>
<th>Level</th>
<th>Topic</th>
<th>CBA (DS)</th>
<th>Quizzes / simple games (FD)</th>
<th>ePortfolios (FS)</th>
<th>Additional Activities</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Communication in the mother tongue</td>
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<tr>
<td>3</td>
<td>Cultural Awareness and expression</td>
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Level 1 - ePortfolio as Storage
Collection:
Creating the Digital Archive (regularly – weekly/monthly)

*A Focus on Contents & Digital Conversion*

Level 2 - ePortfolio as Workspace
Collection + Reflection:
Immediate Reflection on Learning & Artifacts in Collection (regularly)

*A Focus on Process & Documentation of Learning*

Level 3 - ePortfolio as Showcase
Selection/Reflection/Direction (each semester? End of year?)

*A Focus on Product & Documentation of Achievement*

→ A (formative/summative) assessment approach on the basis of artefacts
→ Focus on production and reflection

http://sites.google.com/site/eportfolioapps/overview/levels
Pheon is a multimedia scavenger hunt that tests players' ingenuity through exploring the collection of the Smithsonian American Art Museum, making objects, and texting through the galleries.
Diffusion, Osmosis, and Active Transport: Dynamic equilibrium.

What is equilibrium and how does it relate to diffusion?

Nature always tends to move towards equilibrium. It’s a state of balance where energy is minimized and concentrations remain constant. Equilibrium at the atomic level is dynamic, with atoms and molecules in continual motion. In the diffusion model below you can set up various situations such that the concentrations inside and outside of the cell are either out of equilibrium or in equilibrium.

Try some different combinations and see if you can tell when the model reaches equilibrium. (Hint: You may need to wait for a few minutes, and use the graphs to help you know when equilibrium has been reached.)

Set up the model so that it is NOT in equilibrium. Then use the "snapshot" button below the model to take a picture of your setup. Use the "open" button below to place that image here.

Drag a thumbnail image from the snapshot panel below.

Simulations for mathematics

Sample task from US future New State Tests (2014/15)

Cognitive Tutor (Carnegie)

Mathematical competence

CBA (DS)  Quizzes / simple games (FD)  Simulations (FDS)

Simulations (FDS)

Intelligent tutoring systems (FDS)

http://www.youtube.com/watch?v=RR4HPrGIUz8&feature=related
Example: Quest Alantis

Quest Atlantis (QA) is an international learning and teaching project that uses a 3D multi-user environment to immerse children, ages 9-16, in educational tasks. QA combines strategies used in the commercial gaming environment with lessons from educational research on learning and motivation.
Global Conflicts
http://www.globalconflicts.eu/

Example: Child labour in Bangladesh:
http://www.youtube.com/watch?v=mf9Ju86IVYw

Educational game, designed to help teach concepts in citizenship, geography, and media. Developed by Serious Games International, it has detailed lesson plans and assignments for students.
Examples

PART 2

CRITICAL INSPECTION
CBA for Digital Competence

Internet and Communication Core Certification (IC3) exam sample question

→ Focus on knowledge
Digital Competence: IC3

Internet and Communication Core Certification (IC3) exam sample question

→ Focus on operational skills

Entrepreneurship Questionnaire

Focus on personality/disposition as a static fact

Conclusions

**ICT offers powerful, engaging assessment formats, in particular:**

<table>
<thead>
<tr>
<th>CBA</th>
<th>Quizzes / simple games</th>
<th>ePortfolios</th>
<th>Self / Peer Assessment</th>
<th>Simulations</th>
<th>Virtual worlds/ games</th>
<th>Educational software</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic literacy (foreign/mother tongue)</td>
<td>Creative writing (foreign/mother tongue)</td>
<td>Learning to Learn</td>
<td>Scientific competence</td>
<td>Digital competence</td>
<td>Social and civic competences</td>
<td>Mathematical competence</td>
</tr>
<tr>
<td>Basic mathematical competence</td>
<td>Cultural awareness and expression</td>
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</tbody>
</table>

**Caveat:**
CBA lends itself to simplified, knowledge-based assessment
→ Pedagogy comes first! Careful selection of question formats

**ICT Assessment approaches are underdeveloped for:**

- Learning to Learn
- Sense of initiative and entrepreneurship
- Social and civic competences
The Paradigm Shift

Era of Computer-Based Assessment (CBA)
Focus on: Efficient testing

Era of Technology-enhanced learning
Focus on: Personalised learning

Technology
- CBA (Gen.1)
- Adaptive Tests (Gen.2)
- Automatic Scoring
- Gen. Re-Invention
- Learning 2.0
- Immersive Learning
- Learning Analytics
- Intelligent Tutors

Pedagogy
- Efficient Testing
- Validity of Scores
- Quick Feedback
- Authentic Contexts
- ?
- ?
- ?
- ?
- ?

→ Primacy of Pedagogy:
Pedagogical guidelines for integrated assessment
Thank you very much for your attention!

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Yves Punie

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further information …..

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