Smart Learning Systems for Smart Work Centers toward Ubiquitous World

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ICT has changed many things around

People → Appliances + Objects
Locally → Remotely
Fixed → Mobile
Wired → Wireless

From ICT to uT

Ubiquitous Business Model
- Display
- Fresh information services
- Suggestion, Recommendation
- Control & Working

Context Awareness
Sensing, racking, monitoring

Physical space
Real Object
Sensor
Actuator

Electronic space
Virtual Object
Analysis
Synthesis
Mining

(Embedded Computing)

(Web Presence)
Like many of you in this room, I’m a digital immigrant... My two young daughters, on the other hand, will be digital natives. They’ll never know a world without ubiquitous broadband internet access...

We may never become true digital natives, but we can and must begin to assimilate to their culture and way of thinking.

- Rupert Murdoch, April 2005
Progress of the Web

What is a traditional University?

“In general terms a traditional University can be described as an independent body which carries out research without agenda or bias, they also teach students”

University 2.0 is defined as a research and entrepreneurial university which integrates Web 2.0 technologies and applications in all university activities, including ones with all knowledge intensive stakeholders, and implements the features of the Enterprise 2.0.
## Education & Training Environment Change with Social Web

<table>
<thead>
<tr>
<th>Web 1.0</th>
<th>Web 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Britannica</td>
<td>Wikipedia</td>
</tr>
<tr>
<td>Personal Website</td>
<td>Blogging</td>
</tr>
<tr>
<td>Page Views</td>
<td>Cost per Click</td>
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<tr>
<td>Publishing</td>
<td>Participation</td>
</tr>
<tr>
<td>Content Management</td>
<td>Wiki</td>
</tr>
<tr>
<td>Directories (Taxonomy)</td>
<td>Tagging (Folksonomy)</td>
</tr>
<tr>
<td>‘Stickiness’</td>
<td>Syndication</td>
</tr>
<tr>
<td>Maps</td>
<td>Mapping (Mashup)</td>
</tr>
</tbody>
</table>

### Movement of OER (Open Educational Resources):
Opening teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their use or re-purposing by others.

### OA (Open Access):
Opening access to material via the Internet in such a way that the material is free for all users to read and use.

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Source: Tim O'Reilly http://www.oreilly.net
U-City is an intelligent futuristic city where households, schools, offices, streets and buildings are connected through a seamless ICT infrastructure.
Main Services of U-City

U-City services are divided into U-life, U-Business and U-Public which manage all aspects of living, culture, and office spaces within the city using ubiquitous technology.

**U-Life**
- U-Contents, Safety, FMS
- **U-Education**, U-Health
- U-Shopping, U-Finance

An array of ubiquitous services that supports citizens’ life cycle provided through agent technology based on sensor network and integrated broadband network.

**U-Business**
- U-Work/Office
- U-Security, Control
- U-Biz Support

Grounds for economic development provided by cooperation between industries backed by an optimized business environment.

**U-Public**
- Central Information Center
- U-Environment, Traffic, Port,
- U-Public Information Service

An Central Information Center controlling and managing the entire city systematically and compoundly.
Smart Campus for Ubiquitous Education
Ubiquitous Office Platform for Smart Workers

Manageable, Secure & QoS enable Network

- Secure Access Via IPsec and SSL VPN
- Secure Sockets Layer Virtual Private Network
- Secure Connection through the MPLS VPN

Ubiquitous Network

Instant Messaging
Community
Personalized Portal
on Demand Computing
Application Integration

Any Time Any Network
Any Where Any Network
Any Device Any Service

Network

VPN

Multi Protocol Label Switching
Virtual Private Network
2. Smart Work Centers (SWCs) for Smart Work
What is Smart Work?

Smart work, which enables employees to choose the place and time to work most effectively instead of sitting at a desk in the office from nine-to-six, is turning tiresome tasks into something more enjoyable by offering flexibility and freedom.
Smart Workers

- Smart workers collaborate with the surrounding objects (Companions, IT Resources, etc.) to more effectively perform his tasks to increasing productivity and efficiency in a business process.
- Both of the structured IT in the business process and the non-structured activities of a smart worker will be considered.
- Diverse working services based on a worker’s conditions such as role, context information and profile are provided.

Optimized working environment that a worker conveniently and efficiently can do his tasks anytime, anywhere
Benefits of Smart Work

Energy Efficiency
- Lower the amount of traffic
- Reduce Carbon Emission

Productivity Improvement
- Provide Creative Working Environment
- Reduce Time and Cost for Business Travelling

Change the way to Work
- Facilitate Distance Working Culture
- More Chances to Interact with other Ubitizen and Customers

Better Services to Customers
- Offerings Services Based on Practical Fields and Locations
- Efficient Service Delivery Enabled by Collaboration Service Platform
Smart Working System is able to work anywhere anytime without restriction of time and place.

A Smart Work Center (SWC) is an office center within a close proximity of a residential community, which provides space to workers in individual or in a group work setting.

Through the use of ICT technologies, all work processes are fully supported and enhanced. The SWC offers basic packages which include workstations, network connectivity and hardware use, with added services which can be offered to the workers by third parties (i.e. child daycare, restaurant, and so on).

Employers are able to take advantage of this collective setting to provide its workers with flexible and scalable working space options.

The use of SWC benefits the worker by providing a physical workspace close to their residence, resulting in reduced transportation demands and increased productivity.
Connected Cities with Smart Work Centers

**AMSTERDAM**  Connected and Sustainable Work and Living Solutions

**SEOUL**  Connected and Sustainable Mobility Solutions

**SAN FRANCISCO**  Smart Mobility and Eco-footprint Monitoring

**LISBON**  IP-based Smart Energy

**BIRMINGHAM**  Connected and Sustainable Homes

**HAMBURG**  Intelligent Traffic Management

**MADRID**  Connected and Sustainable Urban Planning
Amsterdam and Almere Smart Work Centers (SWCs)

An Innovative Connected and Sustainable Work Pilot by the Cisco Internet Business Solutions Group (IBSG) and the Cities.

The more SWCs emerge as part of an SWC “grid,” the larger their intended impact:
- Having many smaller SWCs close to/in residential areas (as opposed to a few larger ones) allows SWCs to function as community centers.
- An SWC grid allows for optimized transportation substitution as the availability of SWCs in close proximity to workers’ residences increases.
- As SWC “coverage” expands in larger urban and suburban areas, employers increasingly view them as viable workplaces for their employees.
Amsterdam and Almere Smart Work Centers
Background

To resolve serious traffic jam issue, mostly from commuters between Amsterdam and Almere

Vision

Massive personal car travels substituted through the chain of SWCs

Key Features of Almere SWC

- The first SWC is part of the Quality Centre in Almere
- Create a pilot with ABN AMRO, Cisco, and Amsterdam Municipality
- Flexible working stations and lounges for employees of ABN AMRO bank and Amsterdam Municipality
- Conference rooms and advanced collaboration tools such as virtual presence
- Link with child day care service
- Restaurant / Business Club / Catering
- Bank / IT Support / Notary & Legal advice / Employment agency
Smart Work Center – Impact Analysis

- Analysis Area: Seoul City
- Input Data: Survey Data from SDI in 2005–2007
  O/D: Passenger Car, Bus, Taxi, Subway, etc
  Network
- Analysis Time Period: Whole Day in the Time (07:00–21:00)
- Analysis Indices: Average Travel Speed, Average Travel Time, VKT, Traffic Volume
- Analysis Scenarios

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Rate of Reduction</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td></td>
<td>Before changing commuting ODs</td>
</tr>
<tr>
<td>Scenario #1</td>
<td>2.08%</td>
<td>Reflection of rate from estimation results when home-working is widespread</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fully (KOTI, 2003)</td>
</tr>
<tr>
<td>Scenario #2</td>
<td>3.56%</td>
<td>Reflection of rate from estimation results when remote working centers are</td>
</tr>
<tr>
<td></td>
<td></td>
<td>set up (Survey, 2007)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transportation</th>
<th>Avg. Speed (km/h)</th>
<th>Avg. Time (min)</th>
<th>VKT (pcu-km)</th>
<th>Total Volume (pcu/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>12.07</td>
<td>26.8</td>
<td>249,744,513</td>
<td>155,005,577</td>
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<tr>
<td>Scenario #1</td>
<td>1.24% increase</td>
<td>1.11% decrease</td>
<td>2.16% decrease</td>
<td>2.17% decrease</td>
</tr>
<tr>
<td>Scenario #2</td>
<td>1.81% increase</td>
<td>2.01% decrease</td>
<td>3.70% decrease</td>
<td>3.68% decrease</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environment</th>
<th>NOx(kg/day)</th>
<th>PM10(kg/day)</th>
<th>CO2(tons/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario #1</td>
<td>-3%</td>
<td>-3%</td>
<td>-3%</td>
</tr>
<tr>
<td>Scenario #2</td>
<td>-5%</td>
<td>-5%</td>
<td>-5%</td>
</tr>
</tbody>
</table>

VKT (Vehicle Kilometers Travelled)
Seoul Smart Work Centers
Before and After

**Before**
Administration service oriented municipal dong-office building

- Mobile working is available with limited accessibility only in private sector: Starbucks, Kinkos
- Short-distance transit: Private car, taxi, limited bus line

**After**
City-wide neighborhoods work center increased accessibility

- Municipal campaign with pilot mobile or tele-working program
- Short-distance transit: Public bicycles
Samsung Electronics opened remote working centers for employees, called “Smart Work Center”, in June 2011 to provide locational advantages for those with indispensable family duties such as childcare. While thousands of Samsung workers already enjoy the freedom to work at their most efficient time under the flexible working schedule program, these centers enable employees on telecommuting to handle their assignments without travelling all the way to the main office.
02.
Why Smart Work?

Jeju Smart Work Center
A Scenario of Assistant Services for Smart Workers

1. 7:00 AM
   Healthy start to the day, connecting to yoga school via Personal Education Assistant through home telepresence.

2. 8:00 AM
   Arrive at Smart Work Center guided by Personal Travel Assistant (PTA).

3. 9:00 AM
   Enter a Smart Office using Personal Work Assistant digital passport feature embedded in your smartphone.

4. 1:30 PM
   After lunch, attend global meeting at Smart Work Center hub supported by Personal Work Assistant.

5. 4:00 PM
   Connect to after-school classes to share social agenda with family using Personal Education Assistant.

6. 6:30 PM
   Check regular health condition via Personal Health Assistant, and use PTA mobile AR tour service to access a new restaurant.

7. 9:30 PM
   Check daily schedule and energy consumption (carbon footprint) at home using TV / tablet PC with Personal Energy Assistant.
3. Smart Learning Systems for Smart Work
u-Learning (smart Learning) = e-Learning + m-Learning

- Electronic (e-)Learning: offered access to many resources anytime
- Mobile (m-)Learning: included the concept of anytime and anyplace
- Ubiquitous (u-)Learning: can be accessed anywhere and anyone (any situation) can carry out information transactions anytime, without special awareness or skills
- Smart Learning is a kind of u-Learning when we use smart devices for learning as an intermediate way.
Smart Learning: Learning activity that results in changes in behavior demonstrated by people implementing new knowledge, skills, or practices acquired through independent, intelligent action during both formal and non-formal education and training by the use of smart devices if available.
The smart learning center as a part of u-education system in u-city is a new virtual learning environment with highly innovative, interactive, intelligent learning activities that will enhance the ability to support learning and improve outcomes of learners by use of smart devices under ubiquitous sensor networks.

Especially the services of the smart learning center are extended to all of learning contents for life-long learning including live online, face-to-face, self-paced e-learning and blended learning for a personal learning environment.
An Example: Smart Learning Center

Web browser & whiteboard

People with cameras and mics

People with mics

Text Area
Virtual Ubiquitous Classroom
Ubiquitous Lifelong Learning scenario for Smart Workers

1. Hyeri registers to a multimedia contents development course using her PDA.

2. Hyeri's personalized academic material is downloaded (one for the car, one for her tablet and one for her graphical environment).

3. Her wallet (in the form of her PDA) receives the receipt and automatically forwards it to her company to pay.

4. Hyeri receives a recorded session in her laptop while she is on the plane.

5. As she reviews the material, information is automatically generated into her assessment monitor.

6. She identifies the contents and aligns the information with her current projects using the auto-generated goal map.

7. E-mails are automatically generated and sent to her co-workers, clients and teachers to update them on new ideas.

8. A notification from her professor was sent to her cell phone with discussion for her research project, online project and analysis of her project.

9. A couple of days later, Hyeri sends e-mail to her boss with some suggestions for a decrease in resources for their project.

10. Hyeri is quickly able to advance to a simulated work experience via shared applications from real-world 3-dimensional toolkit accessible from all her computers.

11. Hyeri already demonstrated a level of skill to advance her career potential through her fully customized learning experience.

Lifelong Learning of the Future
4. Integrative Service Platform for Smart Learning and Smart Work Centers
Smart learning for smart work is a new and emerging learning system integrating e-learning of cyber space and mobile learning (m-learning) of physical space by smart workers at anyplace and anytime when they use smart devices.
The integrative service platform for smart work and smart learning enables the integration of diverse services for working and learning by using business process management and learning management systems. Smart workers/Smart learners in the place such as car, home, street or hot spot area can collect, store, manage, and analyze data for works and connect, select, play out, and interact with learning contents through smart mobile devices such as PC, PAD, or Smart Phone among various smart work and smart learning services which are the major components of the integrative platform.
5. Conclusion
1. **Smart work**, which enables employees to choose the place and time to work most effectively instead of sitting at a desk in the office from nine-to-six, is turning tiresome tasks into something more enjoyable by offering flexibility and freedom.

2. Recently the **smart work centers** are establishing in many cities and suburbs for **smart workers**. A **Smart Work Center (SWC)** is an office center within a close proximity of a residential community, which provides space to workers in individual or in a group work setting. Employers are able to take advantage of this collective setting to provide its workers with flexible and scalable working space options.

3. The use of SWC benefits the worker by providing a physical workspace close to their residence, **resulting in reduced transportation demands and increased productivity.**
4. **Relationship between working and learning** has been fundamentally changed by rapid expansion of knowledge and information. In the concept of work-based learning, work environment is becoming the primary source for learning.

5. **Knowledge workers** have to integrate information and knowledge and learn more for their works under CSCW environment with co-workers group to find solutions for new problems they encounter in their daily work.

6. By advent of ubiquitous technology, **knowledge workers have become smart workers**, and have to learn for their works by service of smart work with smart learning systems.
7. With the advent of smart learning and smart work centers as the emerging technological environment changes with ubiquitous technology, we have been recognized that the needs of integration of smart learning systems and smart work centers are rapidly increasing to support more efficient and effective functions to work and learn anywhere anytime without restriction of time and place for the smart workers and learners.

8. There will be a shift from fixed traditional to flexible innovative teaching and learning methodology and tools, multidimensional control and monitoring processes by identification systems, and self-paced learning. In a way, the learning environment becomes borderless with adaptive and collaborative learning in ubiquitous world.
Thank you for your attention!
The 4th Wave of Human History

…"a new way of thinking about computers in the world, one that takes into account the natural human environment," Mark Weiser (1952-99, Palo Alto Research Center of Xerox Co.) hoped to create a new world in which people interacted with and used computers without thinking about them.…

1st Wave
Primitive Society

2nd Wave
Agricultural Society

3rd Wave
Industrial Society

4th Wave
Information Society

Ubiquitous Society

Intelligent Integration of Physical Space and Cyber Space by Ubiquitous Technology
“Ubiquitous” (Latin)  
Being or seeming to be everywhere at the same time; omnipresent:

“Ubiquitous Computing”: Computing environment that access will be anywhere and anytime by anyone:

Wherever we go and whenever we want to use it, whoever can access the computing network and acquire the necessary information.
CSCW systems are often categorized according to the time/location matrix using the distinction between same time (synchronous) and different times (asynchronous), and between same place (face-to-face) and different places (distributed).

Now CSCW is transforming from the telework (e-work) to ubiquitous (u-)work with new information and communication technologies which support people working cooperatively. This means that CSCW is demanding the optimized (smart) working environment that any worker conveniently and efficiently can do his task anytime, anywhere by use of smart devices.
The concept of smart (u-)Work that makes it possible to work anywhere anytime have transformed the conventional concept of time and space in which household work was possible only by use of smart devices.

The smart (u-)Work environment refers to a new mode of work circumstances under which workers, taking advantage of sophisticated wired and wireless information communication technologies, can conduct their routine business works at any time and any place with mobility by use of smart devices.
CSCW (Computer Supported Cooperative Work) holds great promise for the organizations through **infusion of teamwork**, **effective networking** and **creating multilateral work environments**.

- Now, learning might be considered as a **direct consequence of working**.
- Knowledge-based work, in which workers have to combine and interpret information and knowledge under CSCW environment to find solutions for new problems they encounter in their daily work, is replacing conventional work.
- Knowledge workers who demand **cooperative work** cannot get their job without learning and add value without **collaborative and adaptive learning**.
Wireless and mobile technologies influence the evolution of current *e-learning* use

Press forward the development of new mode of education enabling *anytime, anywhere and anyhow learning*

*u-learning* provides an even greater freedom and its applications will provide students with facilities for creating *personalized learning environments*