



Microsoft® Research

FacultySummit 2011

Cartagena, Colombia | May 18-20 | In partnership with COLCIENCIAS



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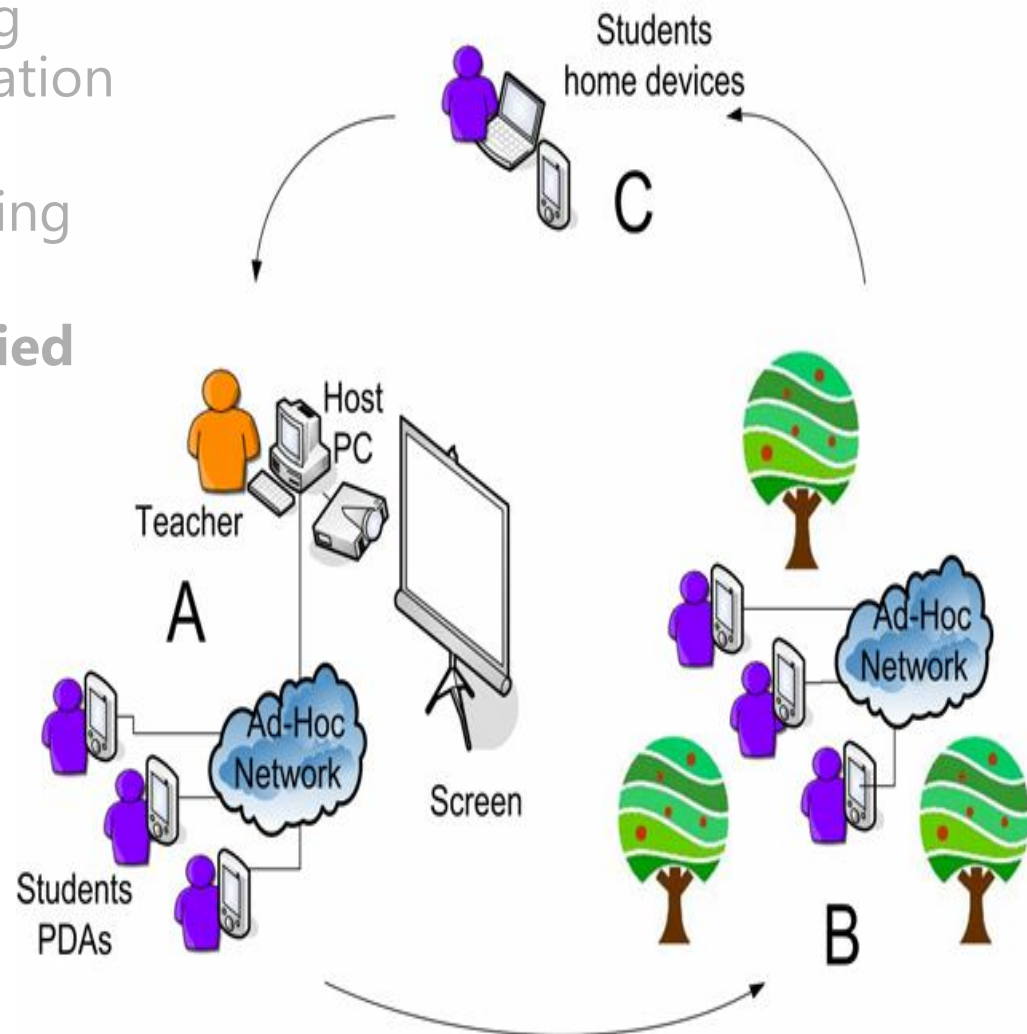
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Nelson Baloian

Bridging the gap between formal and
informal learning: the HCI perspective

Laccir Project: Research Goals

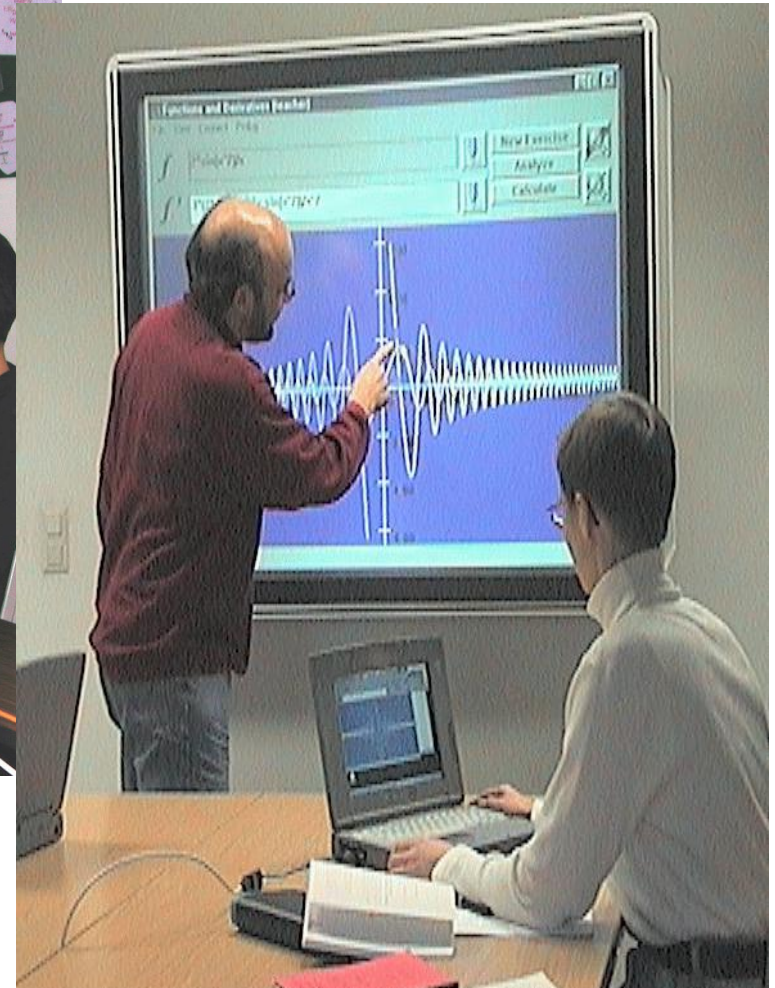
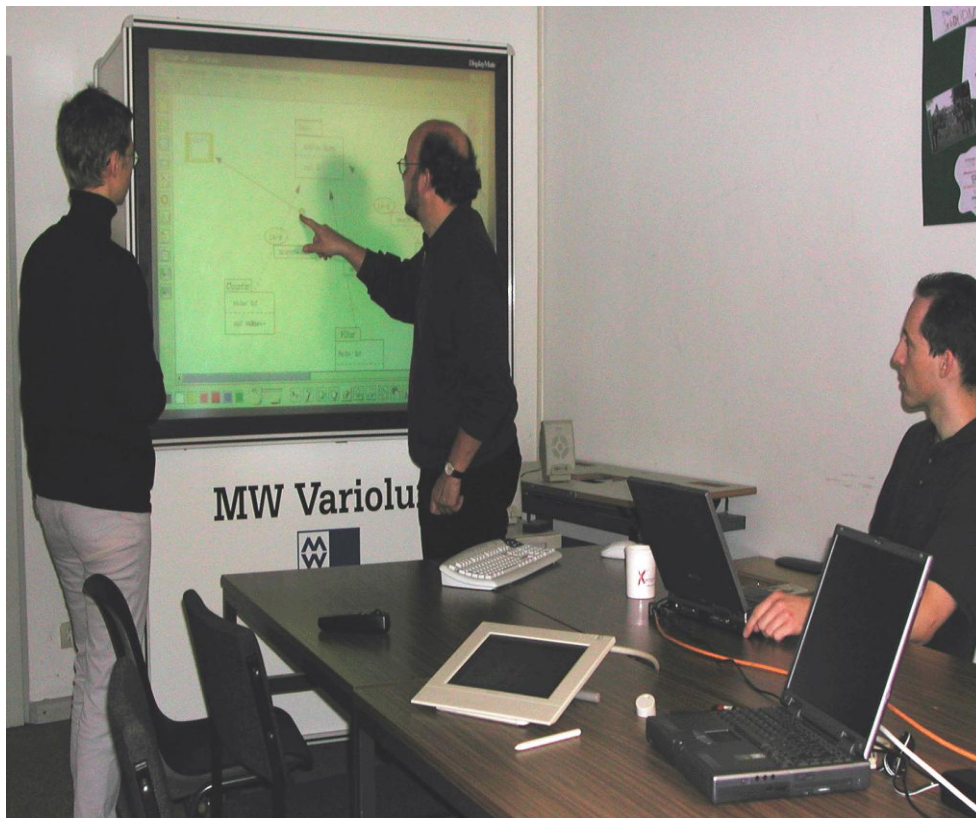
- Discover meaningful learning scenarios where the “information loop” applies
- Develop the necessary learning support tools
- Implement a **coherent, unified** HCI across various platforms/applications



Some “very old” story

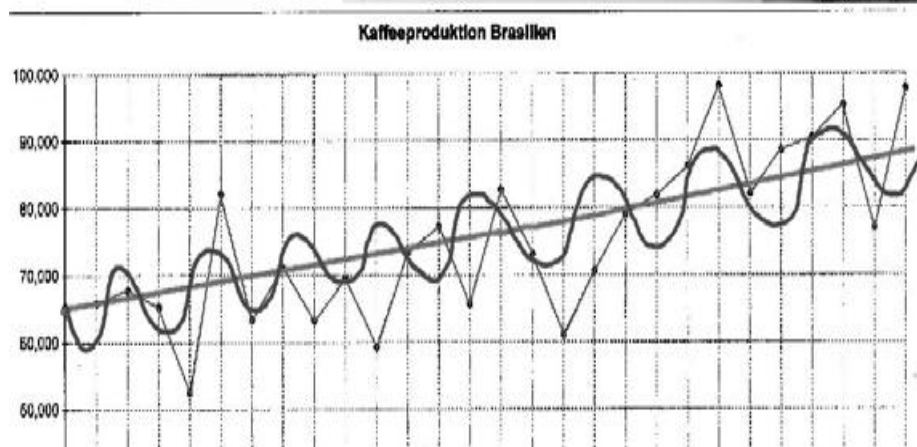
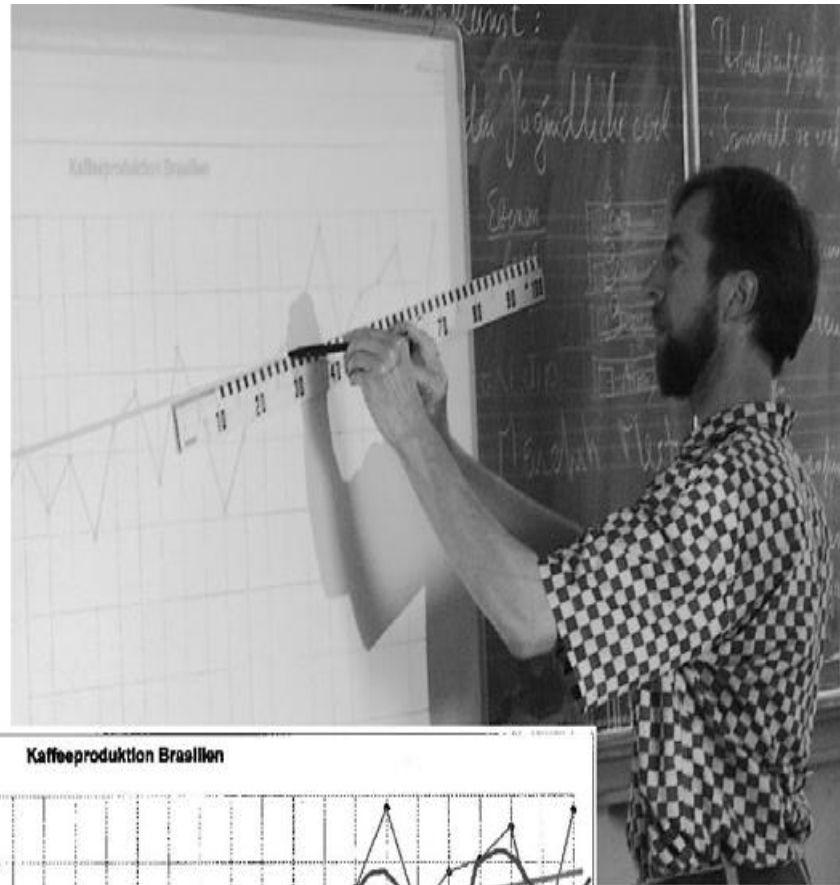
- 1993 IPSI-GMD Darmstadt, (.de) receives 2 electronic boards
- Streit : DOLPHIN
 - Ambiente: the disappearing computer
- Hoppe : Cosoft
 - The Coputer-integrated Classroom
- 1995 : Duisburg, COLLIDE:
 - **C**ollaborative Learning in Intelligent Distributed Environments
- Bring the computer into the classroom

Rich teacher-student & student-student interaction



Hoppe, H.U.; Baloian, N.; Zhao, J.; Computer support for teacher-centered classroom interaction. Proceedings of the International Conference on Computers in Education. Taipei (Taiwan), Dec. 1993. pp. 211-217.

Merging of Various Media



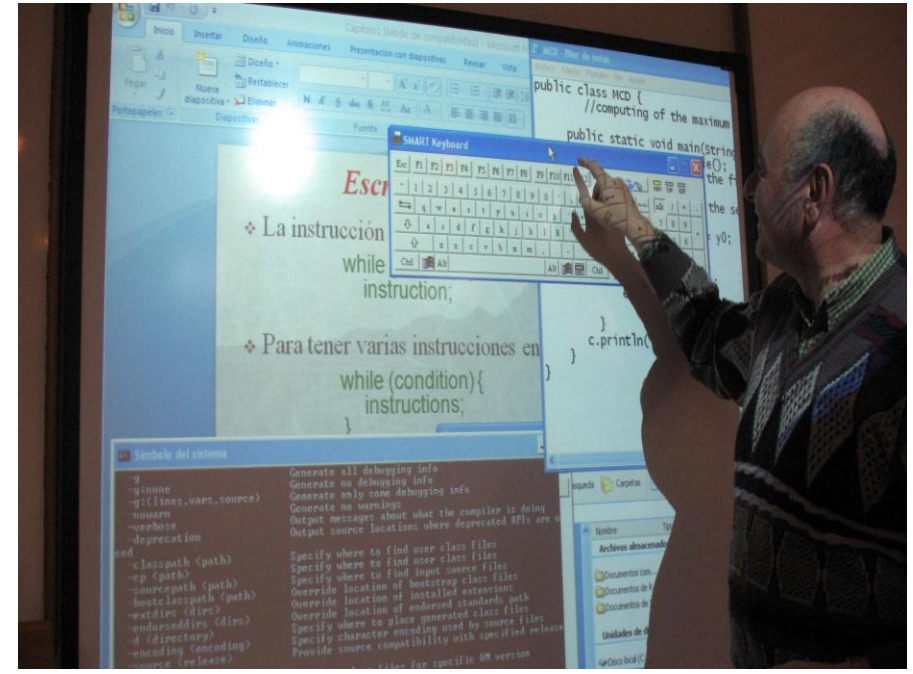
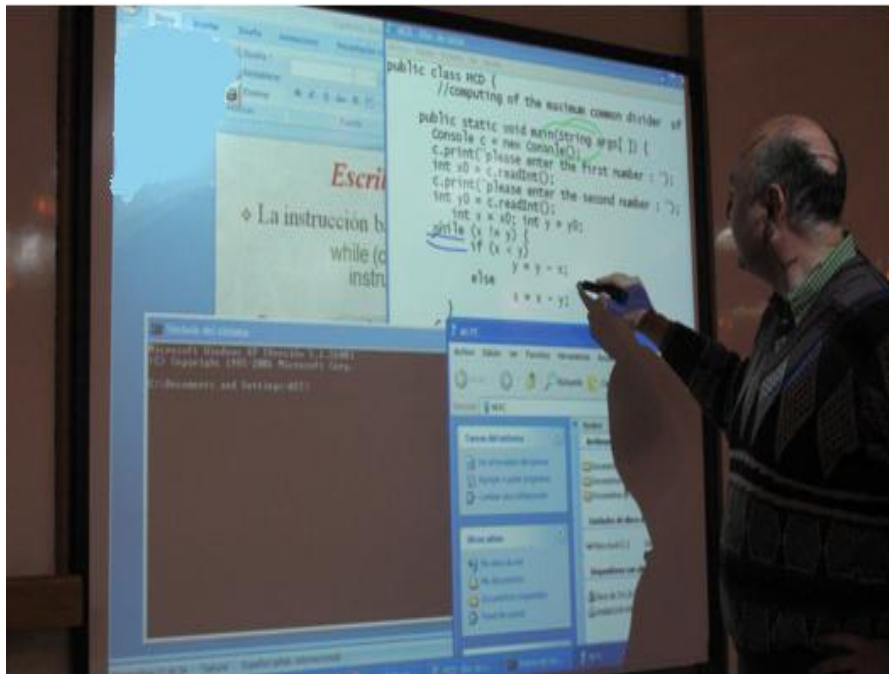
The Nimmis Classroom (1999-2002)

- Goals:
 - Computers supporting reading/writing learning in the classroom
 - Embedded technology
 - “Reading through writing” methodology
- Challenges:
 - File Manager ?
 - Login Procedure ?



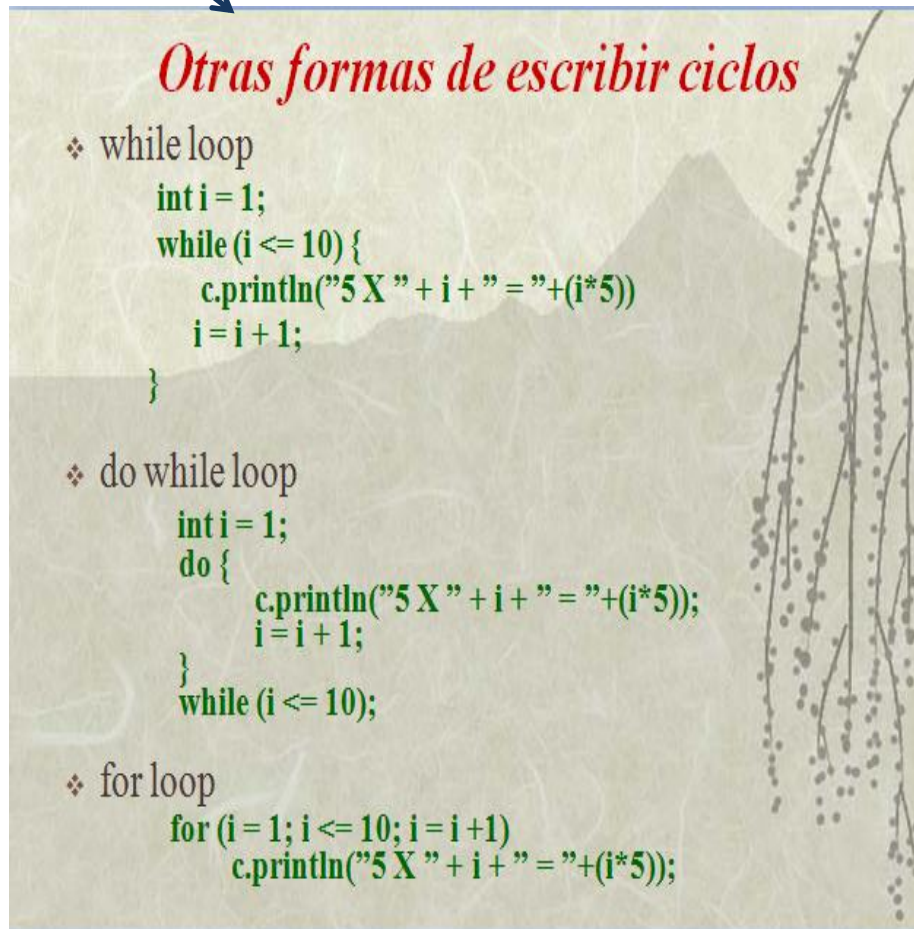
Back in Chile

- 2003 Teaching Java with interactive board
- Using “Off-the-shelf” software



Teaching Java with "Off the shelf" software

Power point presentation



Otras formas de escribir ciclos

- ❖ while loop

```
int i = 1;
while (i <= 10) {
    c.println("5 X " + i + " = " + (i*5))
    i = i + 1;
}
```
- ❖ do while loop

```
int i = 1;
do {
    c.println("5 X " + i + " = " + (i*5));
    i = i + 1;
}
while (i <= 10);
```
- ❖ for loop

```
for (i = 1; i <= 10; i = i + 1)
    c.println("5 X " + i + " = " + (i*5));
```

Teaching Java with "Off the shelf" software

Power point presentation

Text editor

The image shows a presentation slide on the left and a code editor window on the right. The slide, titled "Otras form" in red, lists three types of loops: while, do while, and for. The code editor window, titled "Programm9 - Bloc de notas", contains Java code for a program that reads a number and then a series of numbers to find their maximum, minimum, and average.

Otras form

- ❖ while loop

```
int i = 1;
while (i <= 10) {
    c.println("5 X " + i + " = " + (i*5));
    i = i + 1;
}
```
- ❖ do while loop

```
int i = 1;
do {
    c.println("5 X " + i + " = " + (i*5));
    i = i + 1;
} while (i <= 10);
```
- ❖ for loop

```
for (i = 1; i <= 10; i++)
    c.println("5 X " + i + " = " + (i*5));
```

Programm9 - Bloc de notas

```
Archivo Edición Formato Ver Ayuda
public class Programm9 {
    public static void main(String args[]) {
        Console x = new Console();
        int a , max, min, sum;

        x.print("Ingrese el primer numero: ");
        a = x.readInt();
        max = a; min = a; sum = a;

        int i = 1;
        while (i < 1000) {
            x.print("Ingrese el "+(i+1)+"-esimo numero: ");
            a = x.readInt();
            sum = sum + a;
            if (a > max)
                max = a;
            if (a < min)
                min = a;
            i = i + 1; // you can also write i++
        }
        x.println("The máximo es: "+max);
        x.println("The mínimo es: "+min);
        x.println("El promedio es: "+(sum)/i);
    }
}
```

Teaching Java with "Off the shelf" software

Power point presentation

Text editor

System Console

The screenshot displays a Java development environment with three overlapping windows:

- PowerPoint Presentation:** A slide titled "Otras form" (Other forms) showing a code snippet for a while loop:

```
❖ while loop
int i = 1;
while (i <= 10) {
```
- Text Editor (Programm9 - Bloc de notas):** A code editor window containing the following Java code:

```
public class Programm9 {
    public static void main(String args[]) {
        Console x = new Console();
        int a , max, min, sum;
        x.print("Ingrese el primer numero: ");
        int();
        n = a; sum = a;
        1000) {
            "Ingrese el "+(i+1)+"-esimo numero: ";
            adInt();
            m + a;
            (max)
            = a;
            (min)
            = a;
            1; // you can also write i++
            The máximo es: "+max);
            The mínimo es: "+min);
            El promedio es: "+(sum)/i);
```
- System Console (Símbolo del sistema):** A command prompt window showing the output of a Java compilation and execution attempt:

```
Z:\java>javac fono.java
fono.java:3: Console() has private access in java.io.Console
    static Console C = new Console ();
                          ^
fono.java:9: cannot find symbol
symbol : method println(java.lang.String)
location: class java.io.Console
    C.println("    MENU");
    ^
fono.java:10: cannot find symbol
symbol : method println(java.lang.String)
location: class java.io.Console
    C.println("1 si es busqueda por nombre");
```

Teaching Java with "Off the shelf" software

Power point presentation

System Console

Text editor

The screenshot displays a Windows desktop environment with three overlapping windows:

- File System Browser (jkd1.6.0_24):** Shows the directory structure of the Java JDK installation. The file list includes folders like bin, demo, include, jre, lib, sample, and src, along with files like COPYRIGHT, README, and THIRDPARTYLICENSEREADME.
- Text Editor:** Displays a Java source code file. The visible code includes a while loop and a print statement: `while (i <= 10) {` and `System.out.println("El promedio es: "+(sum)/i);`. A label points to the closing parenthesis of the print statement.
- System Console (Símbolo del sistema):** Shows the output of a Java compilation and execution. The output includes a directory listing of files and folders, followed by compilation errors: `fono.java:9: cannot find symbol` and `fono.java:10: cannot find symbol`. The errors indicate that the `println` method is not found in the `java.io.Console` class.

File system browser

In the best case:

Power point presentation

I.D.E

The image displays two overlapping windows. The foreground window is NetBeans IDE 7.0, showing a Java project named 'AnagramGame'. The 'Projects' view on the left shows the package structure: 'com.toy.anagrams.lib' (containing 'StaticWordLibrary.java' and 'WordLibrary.java'), 'com.toy.anagrams.ui' (containing 'About.java' and 'Anagrams.java'), 'Test Packages', 'Libraries', and 'Test Libraries'. The 'About.java - Navigator' view shows the class hierarchy for 'About::JDialog', including 'About(JFrame parent)', 'closeButtonActionPerformed(ActionEvent evt)', 'initComponents()', 'closeButton: JButton', 'copyrightTextArea: JTextArea', and 'mainPanel: JPanel'. The main editor shows the source code for 'About.java', which includes imports for 'Dimension', 'Point', 'Rectangle', 'ActionListener', 'JDialog', and 'JFrame'. The code defines a 'public class About extends JDialog' with a constructor and methods for initialization and layout.

```
33
34 import java.awt.Dimension;
35 import java.awt.Point;
36 import java.awt.Rectangle;
37 import java.awt.event.ActionListener;
38 import javax.swing.JDialog;
39 import javax.swing.JFrame;
40
41 /**
42  * About dialog of the Anagram Game application.
43  */
44 public class About extends JDialog {
45
46     /** Creates new form About */
47     public About(JFrame parent) {
48         super(parent, true);
49         initComponents();
50         pack();
51         Rectangle parentBounds = parent.getBounds();
52         Dimension size = getSize();
```

File system browser

The background window is a Windows File Explorer window titled 'jdk1.6.0_24'. The address bar shows the path 'C:\Archivos de programa\Java\jdk1.6.0_24'. The file list shows a directory structure with various files and folders. A blue arrow points from the 'File system browser' label to a file named '21 KB Documento HTML'.

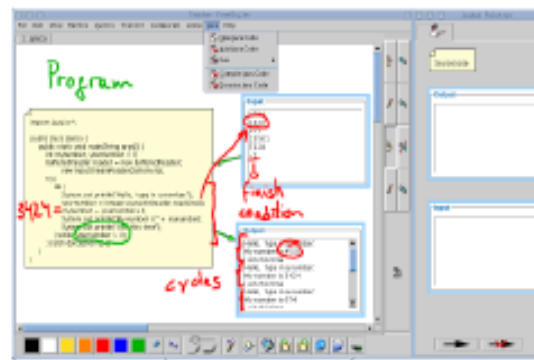
Nombre	Tamaño	Tipo	Fed
		Carpeta de archivos	20-0
		Carpeta de archivos	20-0
		Carpeta de archivos	20-0
		Carpeta de archivos	20-0
		Carpeta de archivos	20-0
		Carpeta de archivos	20-0
		Carpeta de archivos	20-0
	4 KB	Archivo	02-0
	29 KB	Documento HTML	20-0
	26 KB	Documento HTML	20-0
	21 KB	Documento HTML	20-0
	6 KB	Documento HTML	20-0
	7 KB	Documento HTML	20-0
	5 KB	Documento HTML	20-0
	19,256 KB	Carpeta comprimida...	02-0
	1 KB	Documento de texto	20-0

Results of a survey

- “The teacher simply spends **too much time** trying to show us things”
- “We get **easily distracted** in class”
- “I started to take some books with me and began to read them there. Finally **I quit** attending classes”,
- “Why does it take so **much time** to move from one program to another?”
- ***Focus of attention & Students' Distraction*** problems

Motivation for the CIC Project (2004)

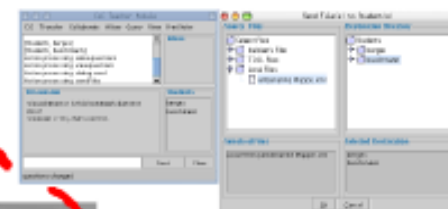
- Integrates presentation, program editing/running and handwriting
- Synchronization
- Automatic distribution & collection of files for most frequent tasks



CiC Principles

- interactive learning experience
- minimizing interruptions
- support for collaboration
- support for different learning styles and activities

Document exchange



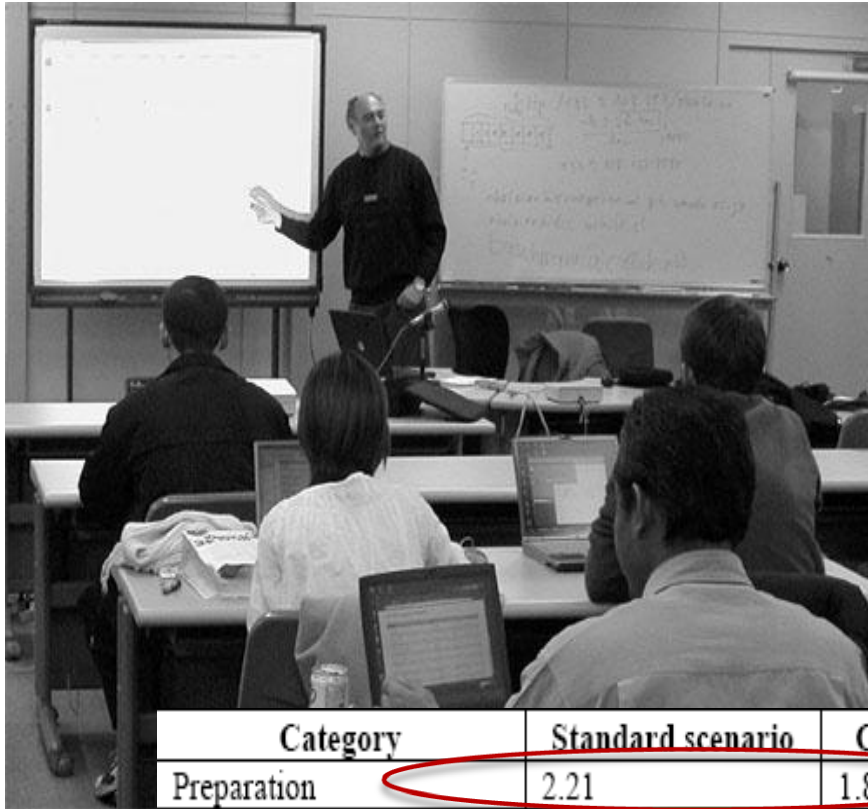
document archive
authentication



Document sharing

Baloian, N., Pino, J. A., & Hoppe, H. U. (2008). Dealing with the Students' Attention Problem in Computer Supported Face-to-Face Lecturing. Educational Technology & Society, 11 (2), 192-205.

Testing in a real scenario (U. of Waseda 2005)



Category	Standard scenario	CiC scenario	Chi-square	Significance
Preparation	2.21	1.81	2.655	0.265
Presentation	1.67	2.33	6.644	0.036
Flexibility	1.67	2.60	14.952	0.001
Highlighting	2.31	2.43	4.079	0.453
Absence of Disruption	1.57	2.24	12.868	0.002
Follow-Up	1.71	2.26	9.172	0.10

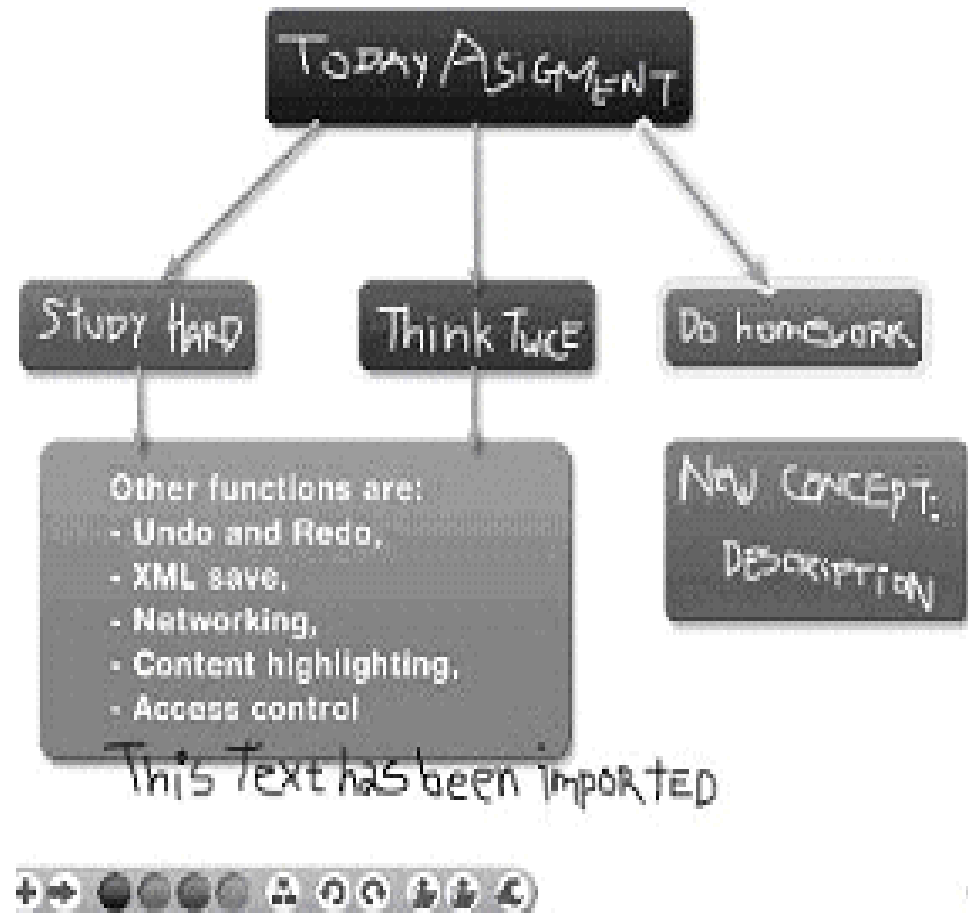
Lessons Learned

- HCI matters in learning scenarios
- Minimize interaction time
- Unexpected collaborative learning situations

- Good for a particular situation -> students' efforts might not be rewarding
- "Set-up" time too long

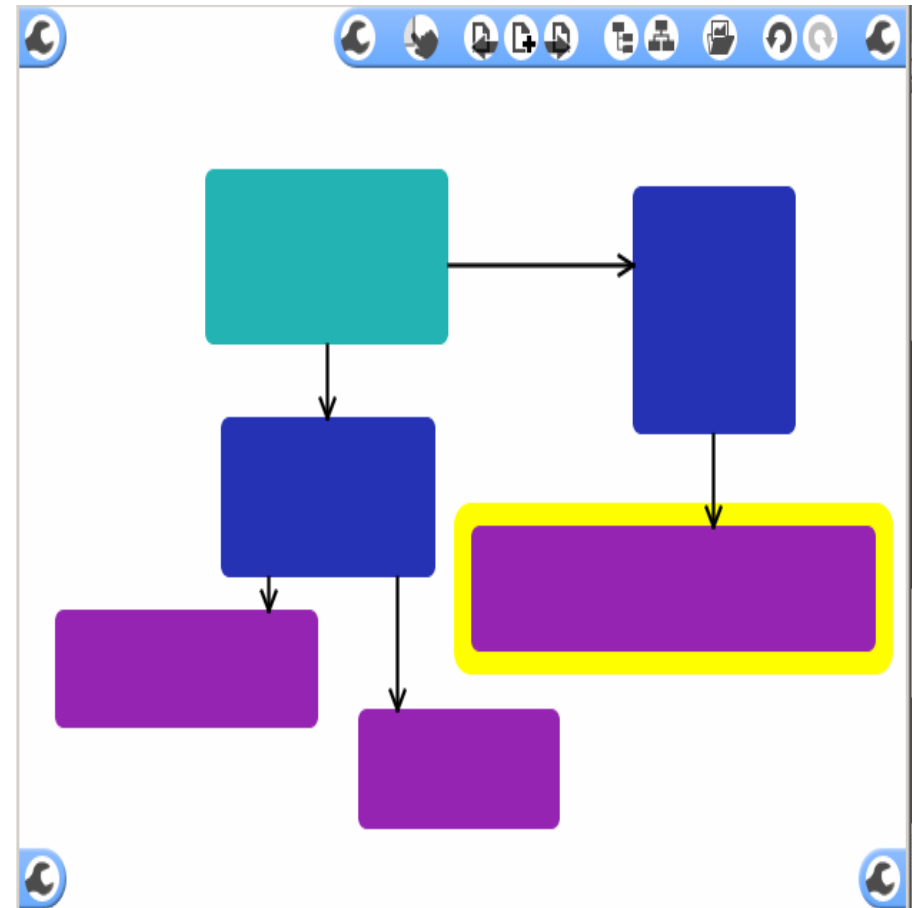
Deep Board: exploring gesture-based interaction

- **Goals:**
 - **Minimize** preparation **time**
 - Keep it **easy** to use, easy to remember
 - Allow **Flexible** creation, structuring & presentation of learning content
- **How:**
 - **Gesture**-based commands
 - Implementing "**depth**" with interactive whiteboards
 - **Web**-based, collaborative



Lessons Learned

- Keep it **simple**
 - Simple structure of material
 - Simple HCI, easy to remember
- Pages are not the only simple, easy to remember information **structure**:
 - **3D** information graphs: **easy** to manage
- Supporting **remote** lectures between two campuses at Waseda Univ. in Japan
- Still **being used** !!



Mobile Collaborative Learning

- 2005: Mobile technology is **mature** enough to support learning
- Idea: use **gesture**-based interaction for mobile devices
 - Natural way to interact with a PDA
 - “Expand” screen capabilities (deep board)
- Other opportunities:
 - Keep **rich** face-to-face **interaction** while using computers
 - **Dynamic group** formation/reconfiguration



First Development: Mobile Collaborative Sketching

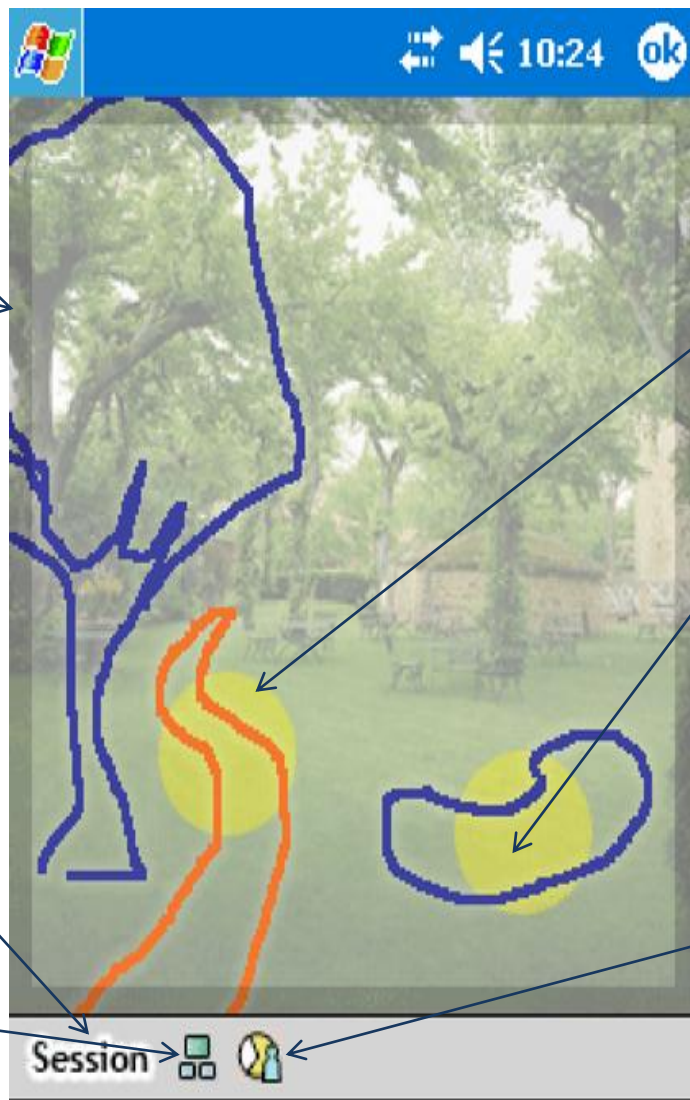
- Supporting **collaborative** design in learning scenarios
- Take a picture and start **generating ideas** by sketching
- Full Synchronized **P2P** application
- Interaction based almost exclusively on **gestures**
 - Maximizing available workspace.
- Content organized as hierarchical **concept maps**
- **No switching** between sketching and gesturing

MCSketcher Screenshot

Dark margin means working in an inner sub-node

Highlighted "Session" Text means work needs to be saved

"Document three" icon

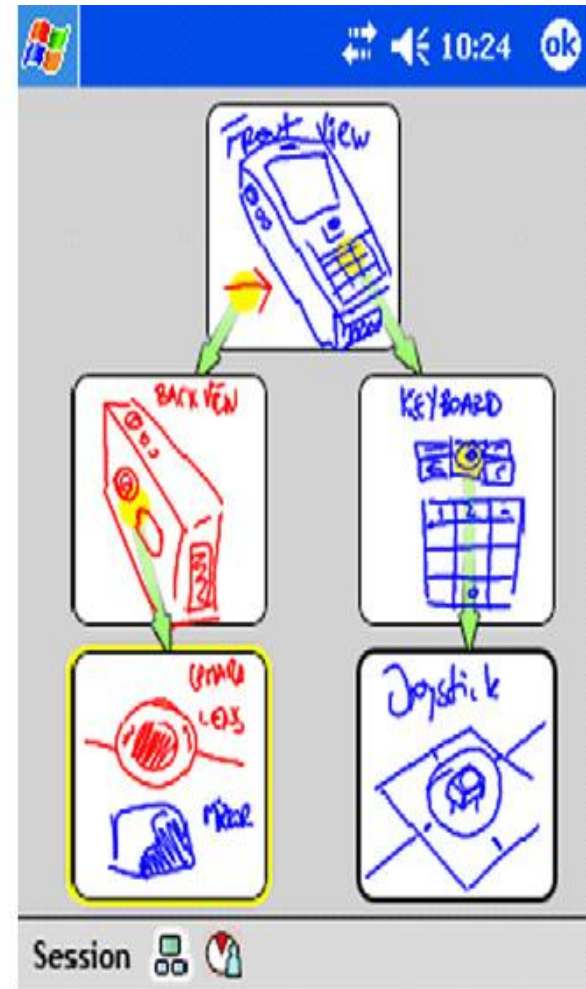
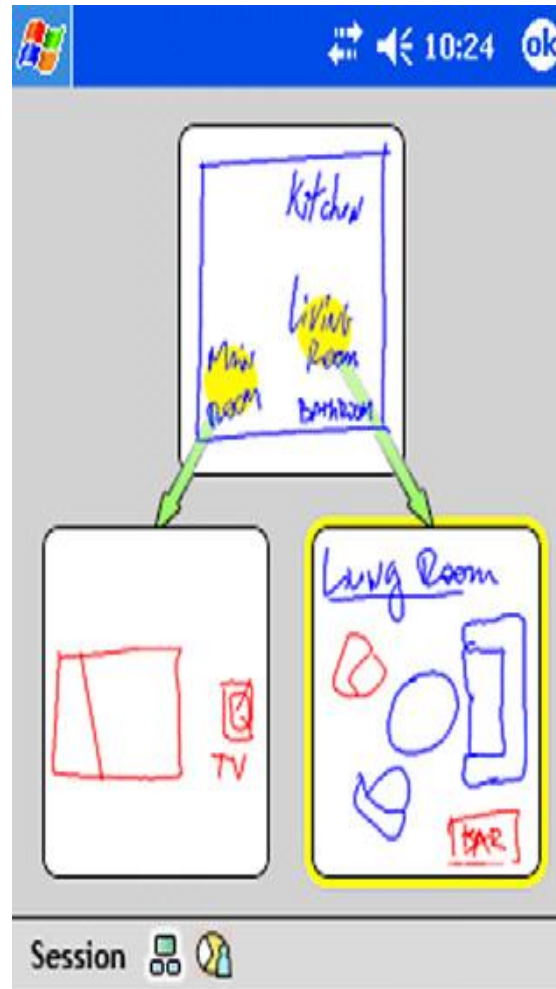


Design spots are anchors to other sketching pages

The "group" icon shows % of users working in this node

MCSketcher's Tree view: 2 Examples

G. Zurita, N. Baloian, F. Baytelman, 2008, A Collaborative face-to-Face Design Support System based on Sketching and Gesturing. Advanced Engineering Informatics. 22 (3). (2008), pp. 340-349.



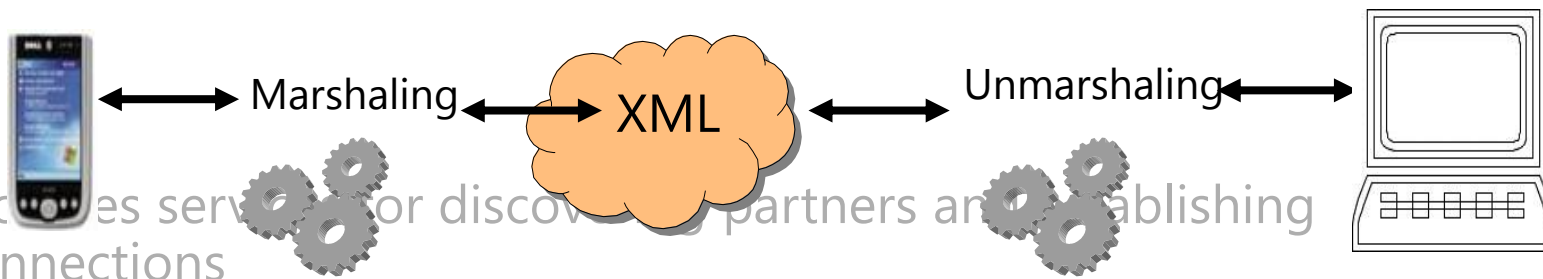
A Framework for developing mobile applications

Many mobile collaborative learning/working scenarios share common characteristics & have similar requirements

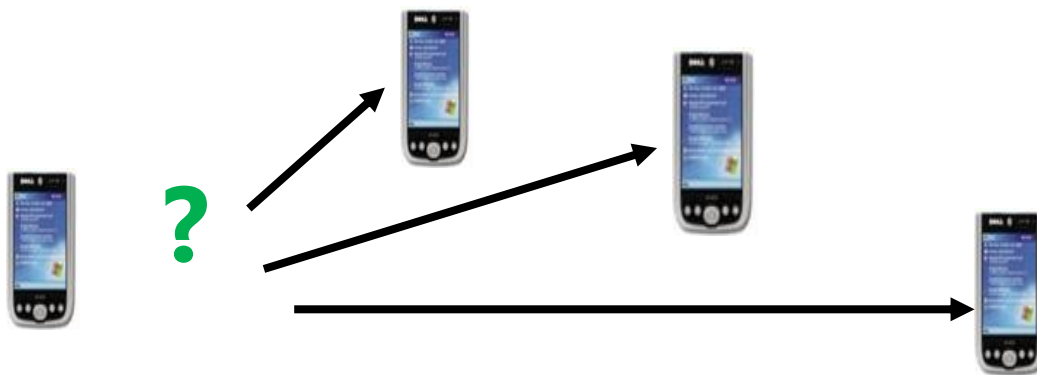
- Gestures recognition module
 - Recognizes some gestures
 - Extendable to add more gestures
- A flexible, lightweight communication platform for peer-to-peer applications

The Middleware

- API for developing distributed P2P applications easily.
- Available in Java and C#
- Implements object conversion:

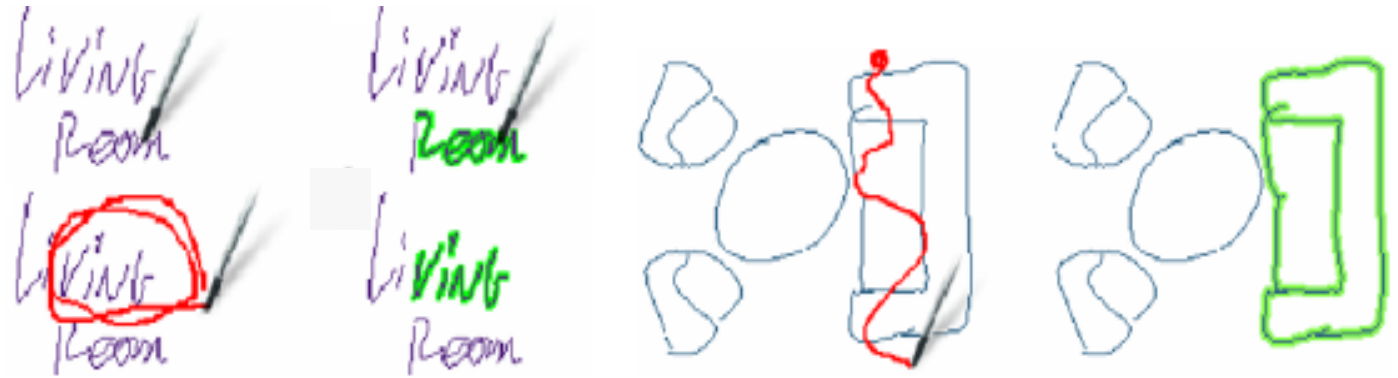


- Processes services for discovery of partners and establishing connections

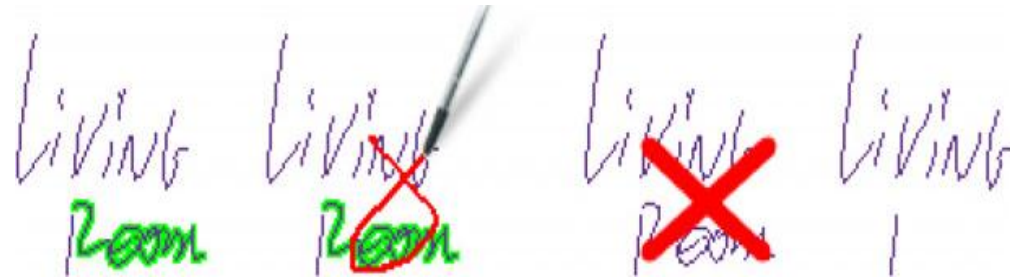


Gesture support (examples)

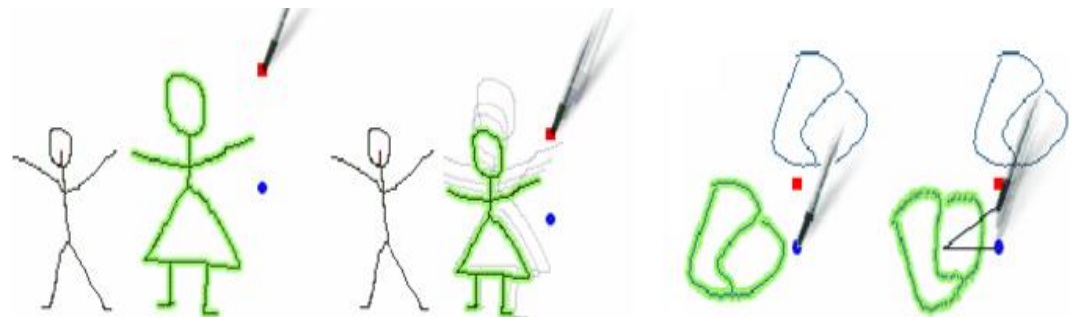
Selecting



Deleting



Resizing, rotating



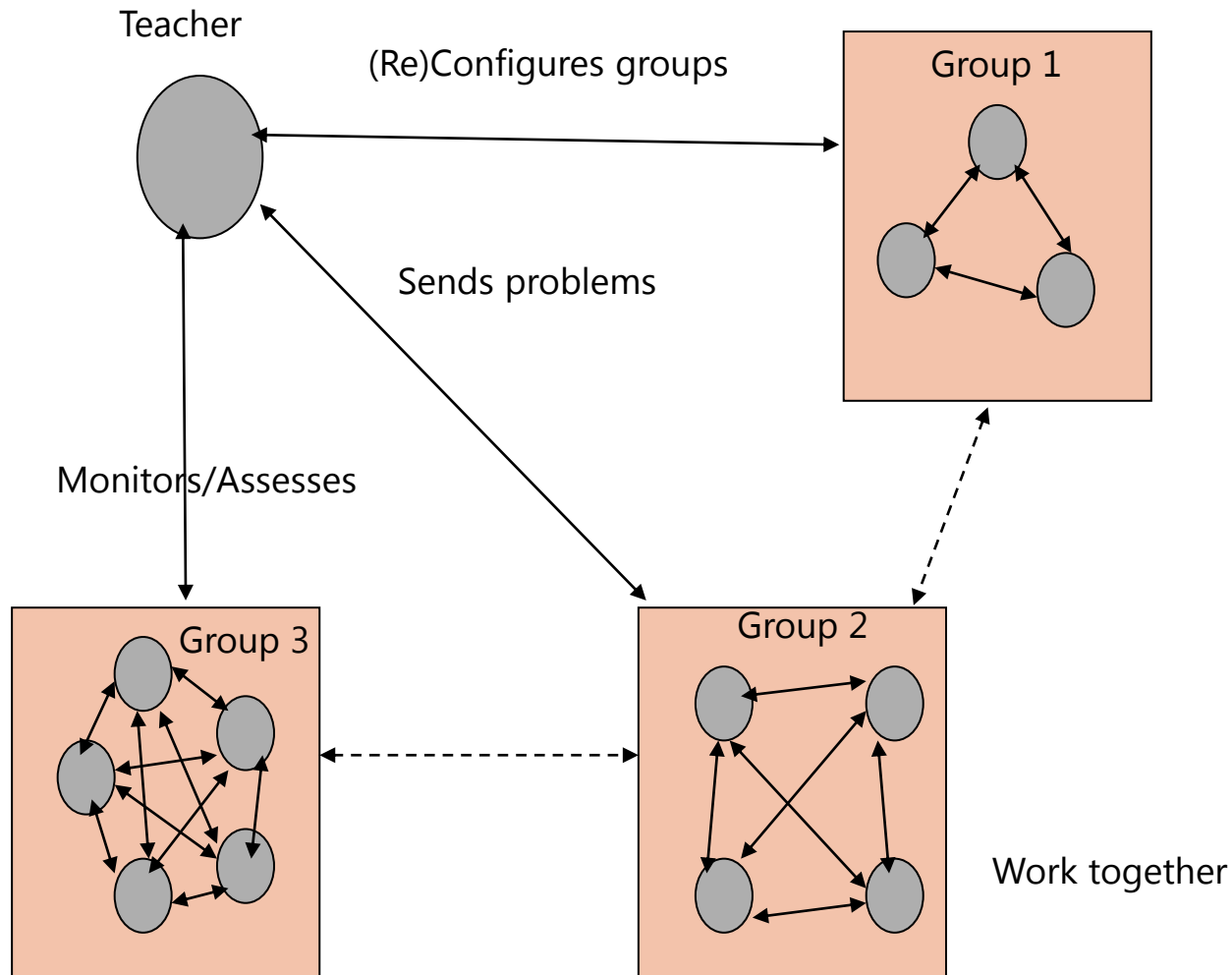
Example 1: MCPresenter

Supports:

- Configuring various working groups
- Creating/modifying & sending problems to the groups
- Open answers or options
- Students collaboratively solve problems & send answers back
- Real time monitoring and assessment



System Architecture



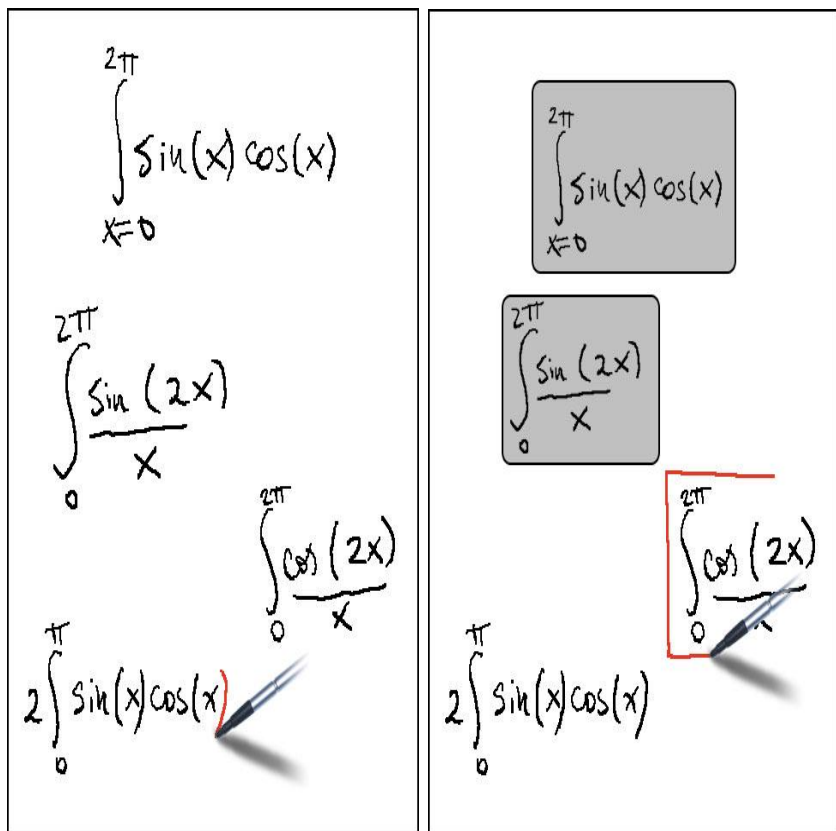
Group Configuration

- Dragging user Nelson to group 2
- Users are displayed automatically when discovered
- Groups are defined by teacher
- The group icon shows updated content of the group's shared workspace

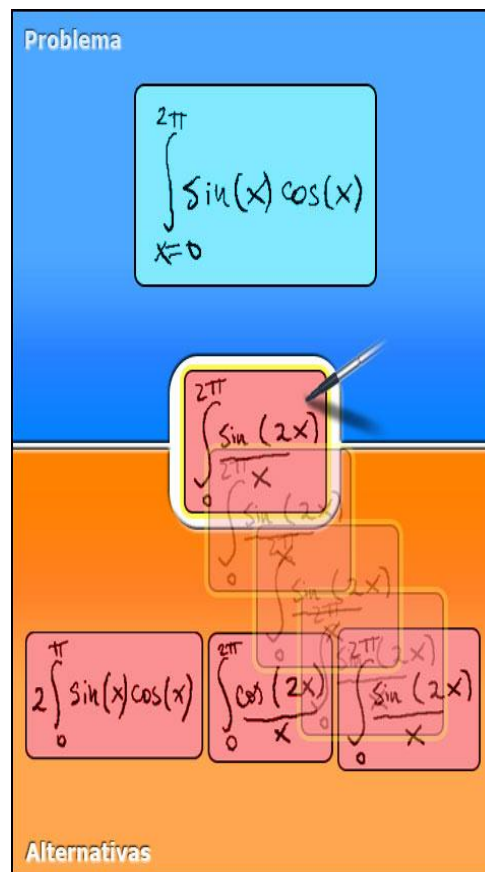


Problem creation

Freehand writing/sketching & delimiting elements by a rectangle gesture

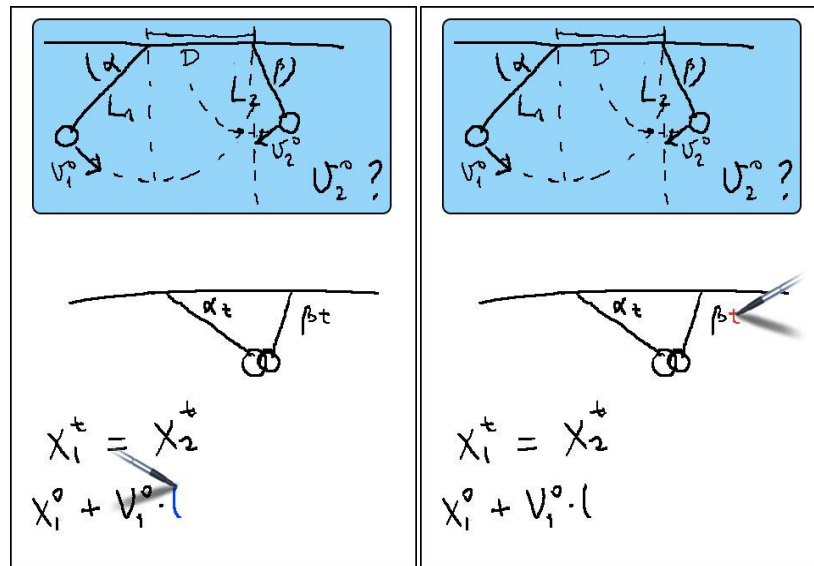


Dragging elements to corresponding areas: problem, solution, wrong options



Synchronized work

- Students work synchronously preparing open answers
- Teacher may join a group to help or propose new problems
- Students must agree on an option as the correct answer before sending it



Assessment

The teacher's view of results

- **Group 1:** 2 correct answers (1 open , 1 with options)
- **Group 2:** 1 wrong and 1 correct, both with options
- **Group 3:** 2 correct answers (with options) 1 wrong answer (open)

G. Zurita, N. Baloian, F. Baytelman, Supporting rich interaction in the classroom with mobile devices. Proceedings of the Fifth IEEE International Conference on Wireless, Mobile, and Ubiquitous Technology in Education, Beijing, China, March 2008, IEEE Press. pp. 115-122, 2008.

Group 1

Group 2

Group 3

The image displays a grid of screenshots from a mobile learning application, organized by group. Each group's results are shown in two columns. The left column shows handwritten work on a whiteboard, and the right column shows the mobile device interface. Green checkmarks and red X marks indicate the correctness of the answers.

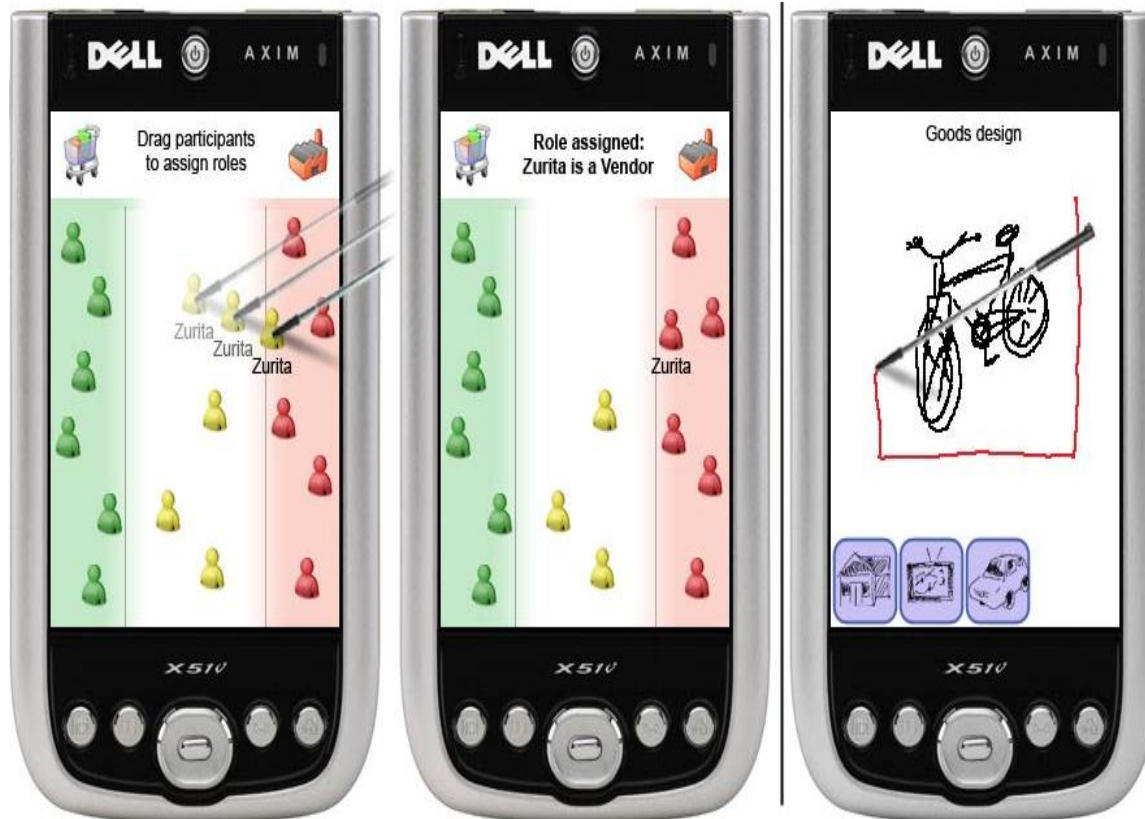
- Group 1:** The left screenshot shows handwritten work for a system of equations: $x+2y=5$, $-5x-y=2$, and $x=?$. Below it, the elimination method is shown: $y=-3x-2$ and $x+2(-3x)$. A green checkmark is present. The right screenshot shows the mobile interface with the same equations and a calculator keypad. A green checkmark is present.
- Group 2:** The left screenshot shows a mobile interface with a blank whiteboard area and a red X mark. The right screenshot shows the mobile interface with the equations and a calculator keypad. A green checkmark is present.
- Group 3:** The left screenshot shows the mobile interface with a calculator keypad and a green checkmark. The middle screenshot shows handwritten work for the system of equations and the elimination method, with a red X mark. The right screenshot shows a mobile interface with a whiteboard area and a green checkmark.

Example 2: Participatory simulations (3)

- **Role-playing** activity oriented towards learning complex & dynamic systems
 - Mapping real world problems to simulated context & behaviors
 - Knowledge & patterns emerge from local interactions
- Highly **effective** in large groups
 - Simple to set up & interact with
 - Analyze information, exchange information, make decisions, see outcomes
 - Allows to relate actions & their consequences
- Highly **motivating** even in large groups
 - Participation & collaboration increase the understanding
 - Whole classroom?

a) Trust building scenario

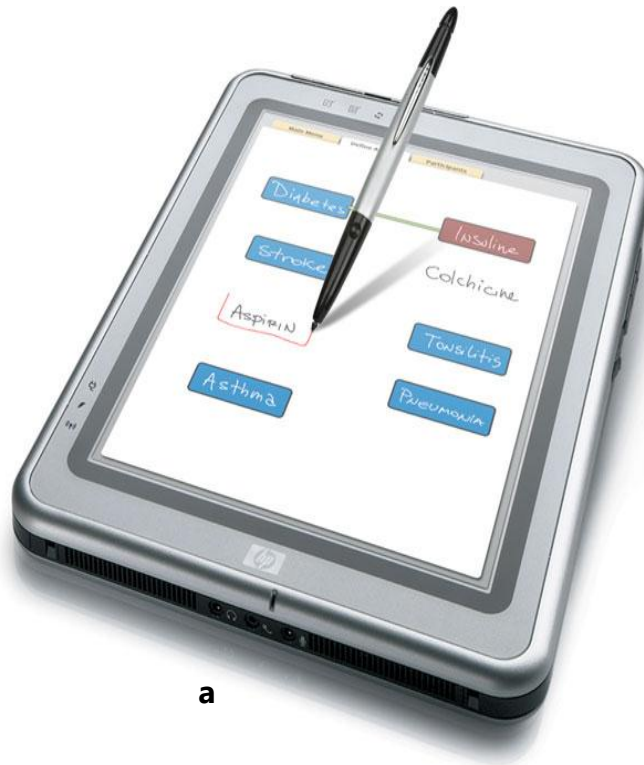
- Roles: Buyers and sellers
- Exchanging goods with random failures
- Vendor might decide its replacement (maximize revenues!)



Assigning roles & creating items

b) Medical scenario

- Roles: doctors and patients
- Items: diseases, symptoms and treatments (medicines)



Exchanging Items: Proximity + IrDA



c) Stock Market scenario



Buyer's device



Seller's device



So far, so good ?

- Not quite:
 - Fragmentation of learning experiences with different tools in different contexts
 - Different interaction rules in each application
 - Briggs:
 - “potential users will adapt technology if its benefits outweigh its disadvantages (notably, the cost of learning how to use it), adjusted by the frequency of use”
- LACCIR Project proposal:
 - integration of classroom activities (structured, formal) & learning “in the wild” (unstructured, possibly informal and/or unexpected)

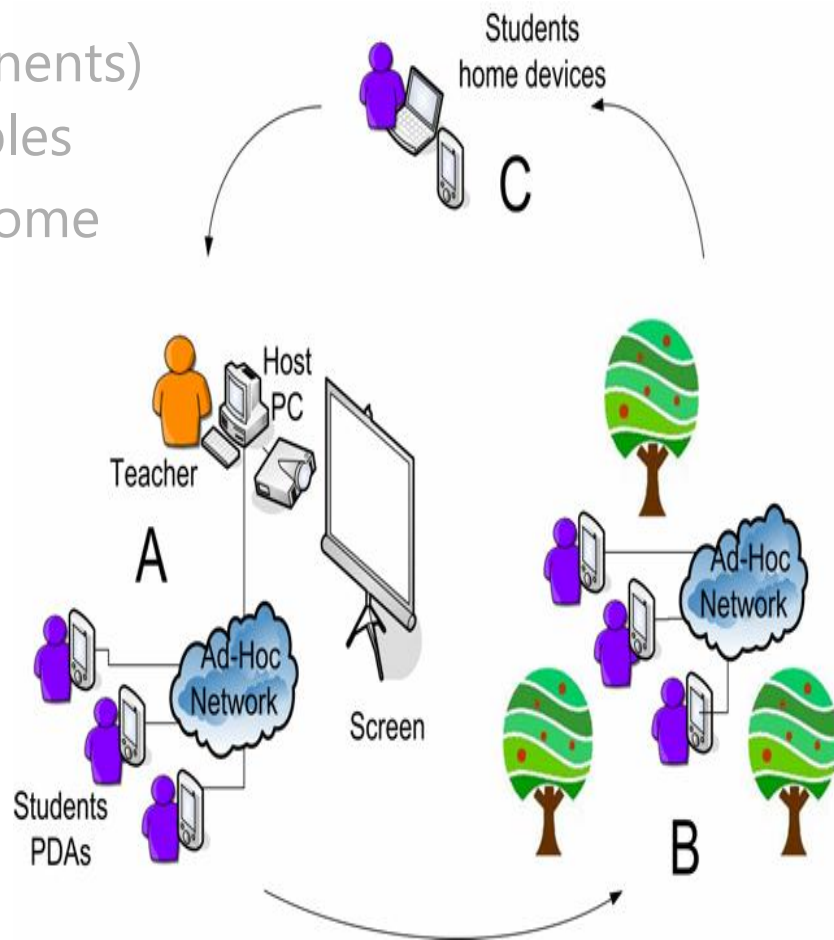
Research Questions

- Can we implement meaningful learning activities with this model ?
- Can we develop an integrated HCI model across platforms ?
- Can we (should we) use widgets ? gestures ? both ?
- Can we describe them with a pattern language ?



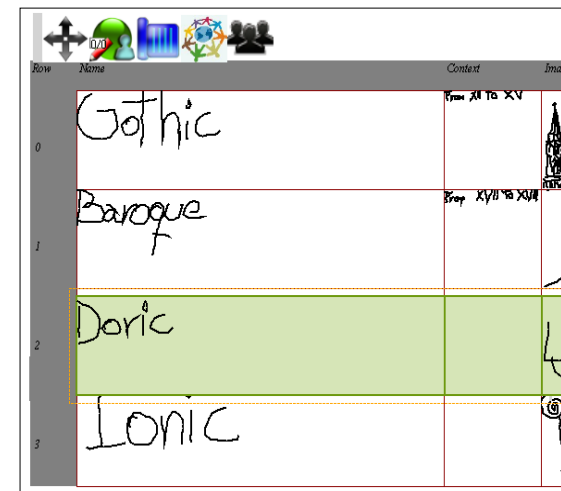
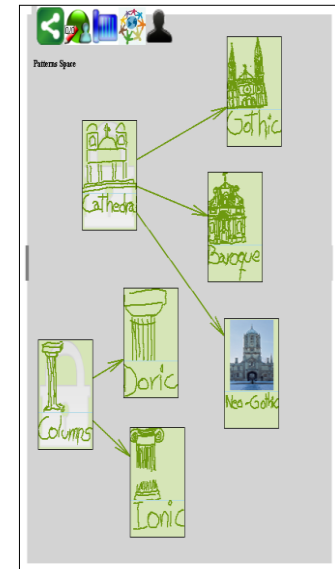
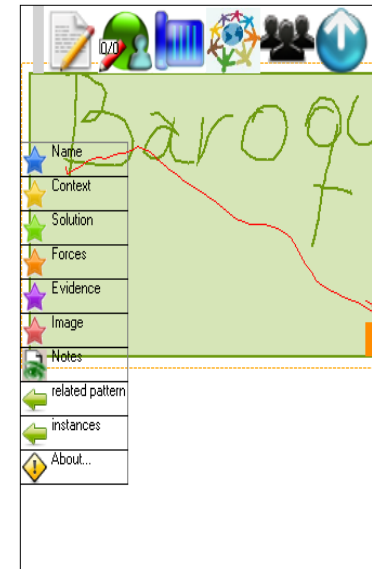
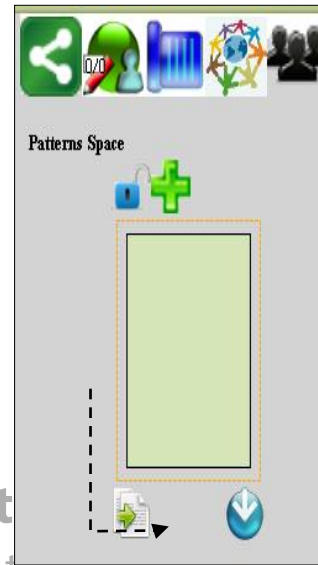
Example 3: Learning with Patterns

- Pattern: a typical solution for a recurrent problem
- Teacher explains a pattern (components)
- Students go „out“ to collect examples
- Process the gathered material at home
- Show, share their findings in the classroom.
- Motivates new “field trips”

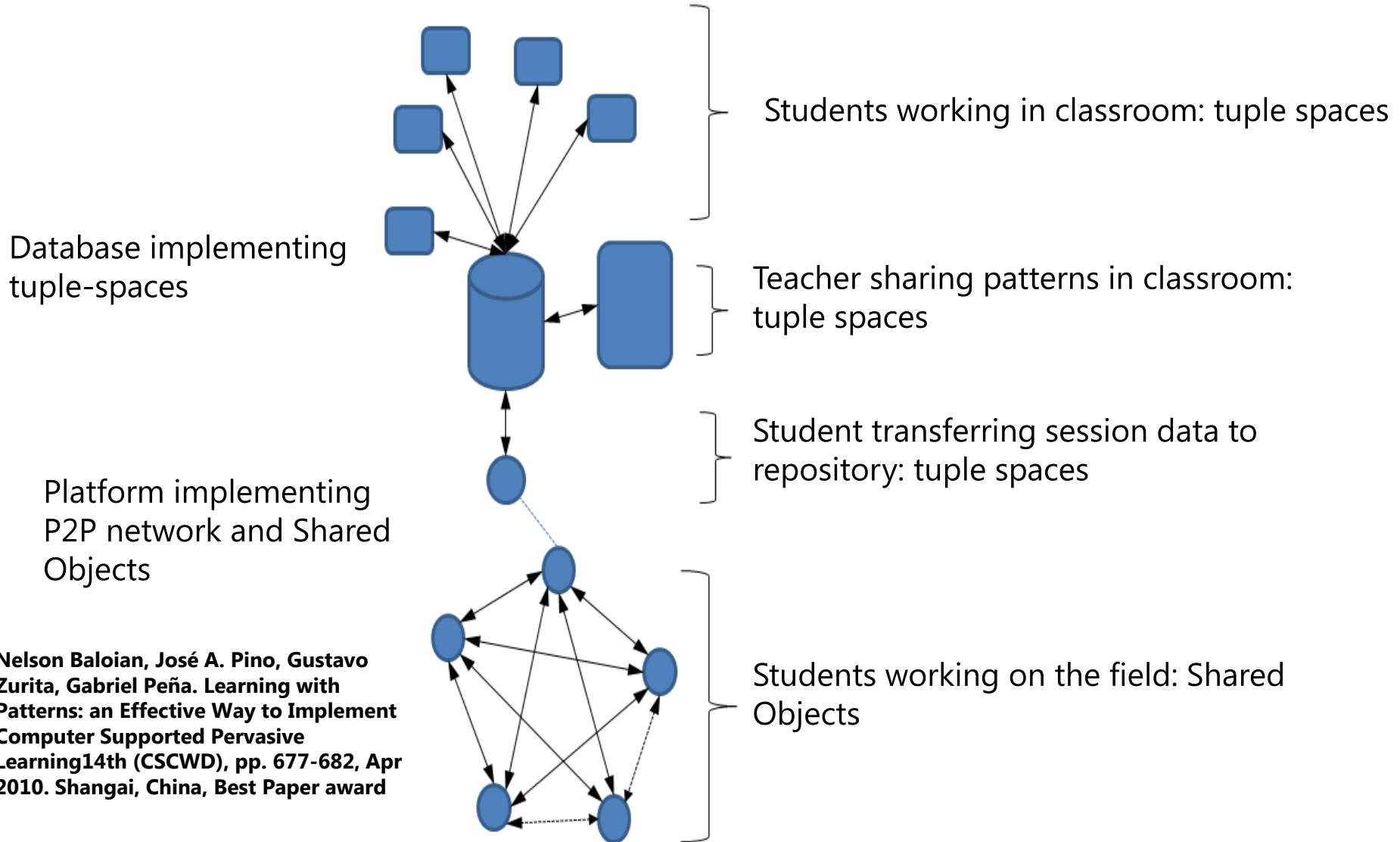


System Functionality

- **Creating Patterns:**
 - Teacher, classroom
- **Instantiating patterns:**
 - Students, outside
- **Linking patterns:**
 - Students, anywhere
- **Sharing patterns and instantiating:**
 - Teacher, classroom, students on the field
- **Comparing patterns:**
 - Students, teacher anywhere



System Architecture: Synchronization



Nelson Baloian, José A. Pino, Gustavo Zurita, Gabriel Peña. Learning with Patterns: an Effective Way to Implement Computer Supported Pervasive Learning14th (CSCWD), pp. 677-682, Apr 2010. Shanghai, China, Best Paper award

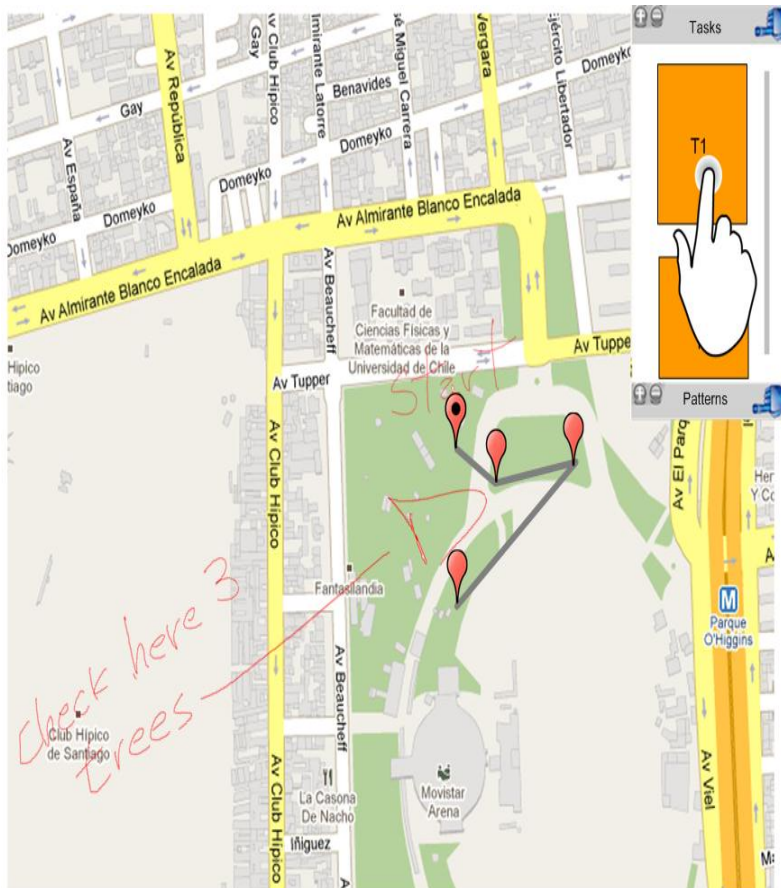
Including Geo-collaboration

- Geo-referenced data plays an important role for completing the task:
- Learning Scenarios:
 - Geology
 - Botany
 - Architecture
 - Languages
 - Social sciences
 - etc.

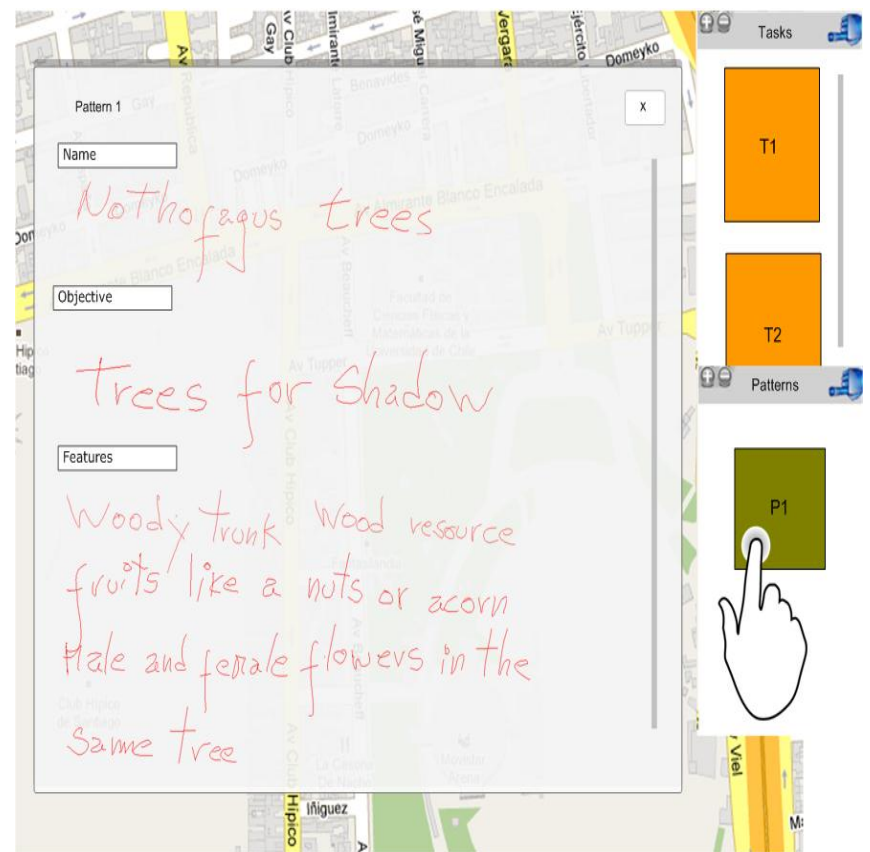


Screenshots Geocollaboration (under construction)

Task Creation: follow a certain path

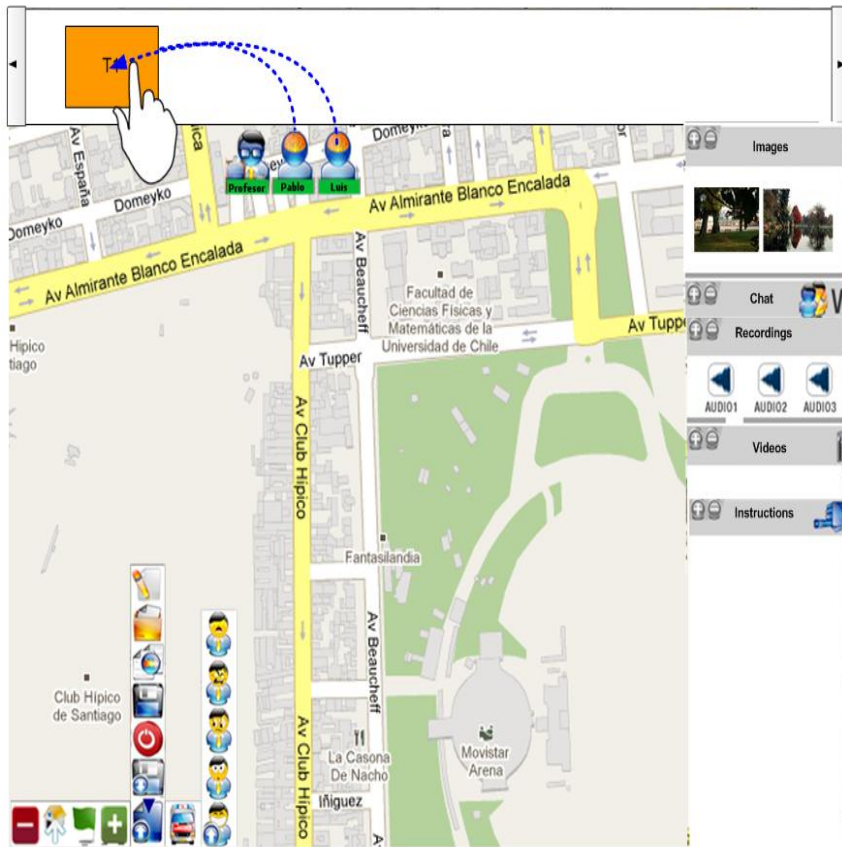


Pattern creation: define components

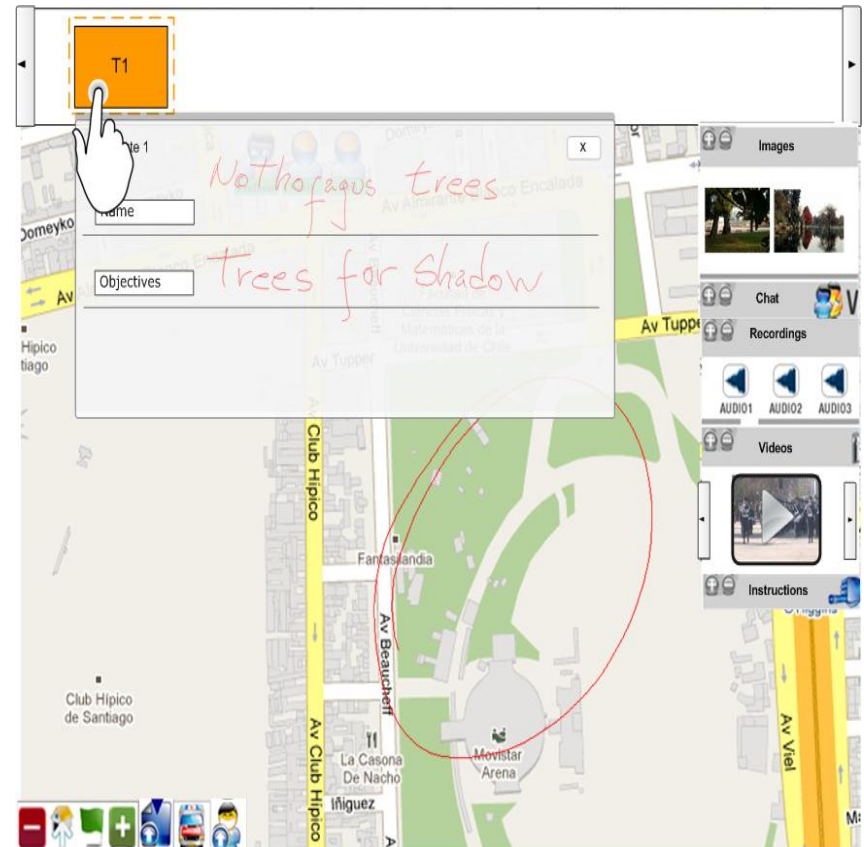


Screenshots Geocollaboration (cont.)

Assigning tasks to students



Student's view of the task



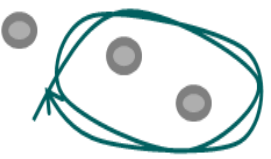




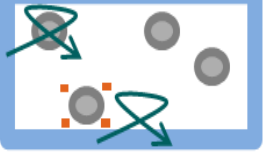




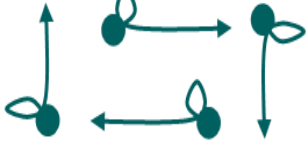
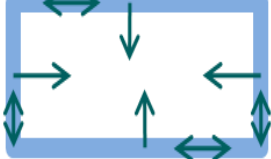
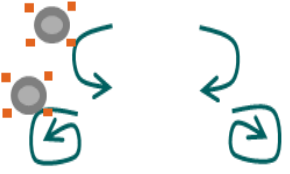
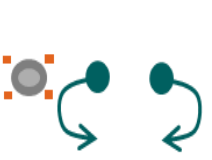
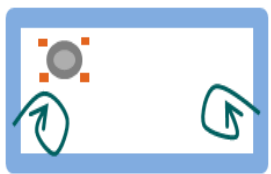
Pedro Antunes, Claudio Zapateiro, Gustavo Zurita, Nelson Baloian. Integrating Spatial Data and Decision Models in a E-Planning Tool. Proc. 16th CRIWG, Sep 2010. Maastricht, The Netherlands.

Towards a formal evaluation of gestures

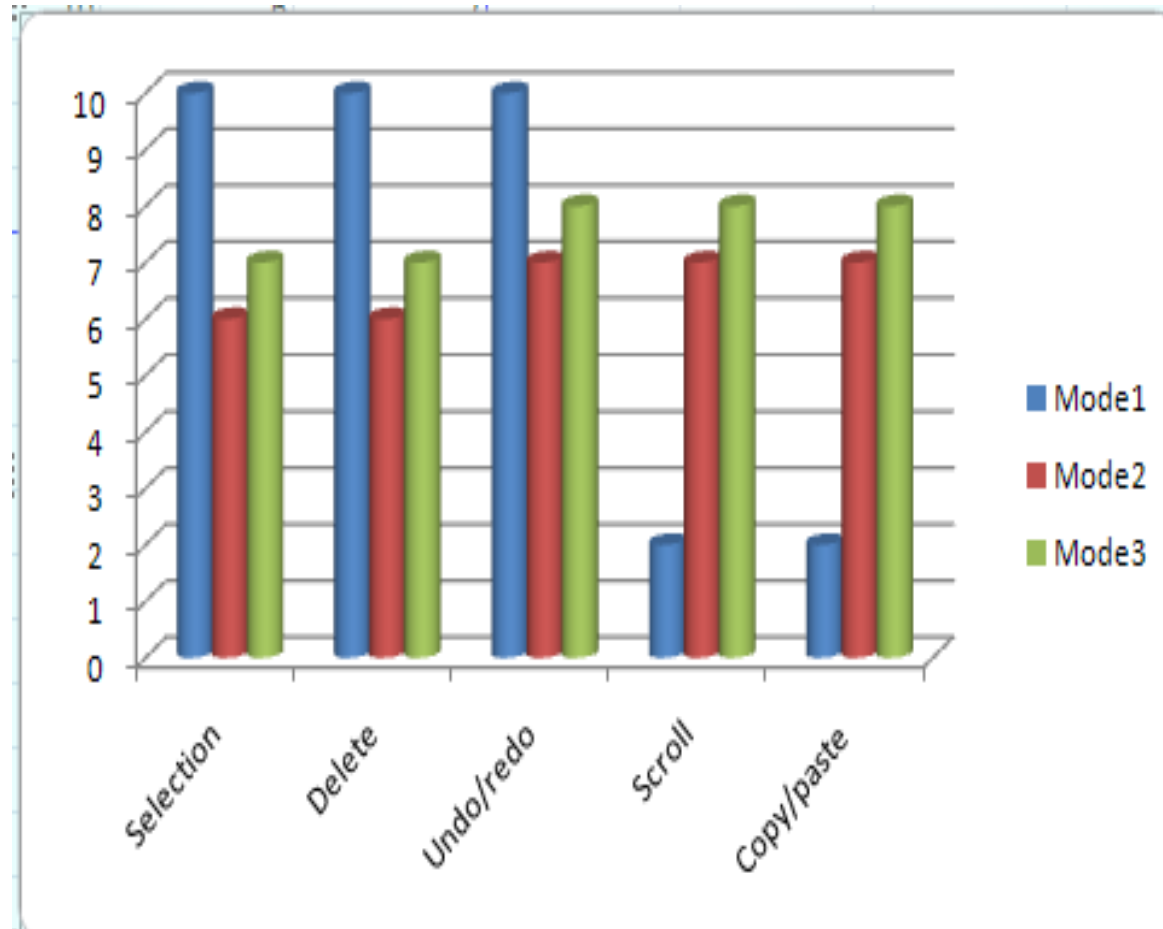
- Which gesture is **good** on which platform ?
- **Diverse** Platforms: diverse screen sizes, interaction sensitivities
- What is **good** : easy to learn, easy to remember, robust



Various modes for gesture-based commands

	Mode 1: certain sketches are recognized as commands	Mode 2: using a pre-gesture (could be double-click)	Mode 3: Depend on starting absolute position
Multiple selection	 A green oval sketch encircling three grey dots.	 A green sketch starting with a blue dot, moving to a grey dot, and then forming an oval around two other grey dots.	 A blue rectangular frame containing a green oval sketch around three grey dots.
Delete	 A green sketch starting with a grey dot and ending with an arrow pointing to another grey dot.	 A green sketch starting with a blue dot, moving to a grey dot, and then forming a loop around another grey dot.	 A blue rectangular frame containing a green sketch starting with a grey dot and ending with an arrow pointing to another grey dot.
Undo/Redo	 Two green curved arrows, one pointing left and one pointing right.	 Two green curved arrows, one pointing left and one pointing right, each starting from a blue dot.	 A blue rectangular frame containing two green curved arrows, one pointing left and one pointing right.
Scroll	 Four green arrows pointing up, down, left, and right from a central point.	 Four green arrows pointing up, down, left, and right, each starting from a blue dot.	 A blue rectangular frame containing four green arrows pointing up, down, left, and right.
Copy/Paste	 A green sketch starting with a grey dot, moving to another grey dot, and then forming a loop around a third grey dot.	 A green sketch starting with a blue dot, moving to a grey dot, and then forming a loop around another grey dot.	 A blue rectangular frame containing a green sketch starting with a grey dot, moving to another grey dot, and then forming a loop around a third grey dot.

Which type of result should we look for ?

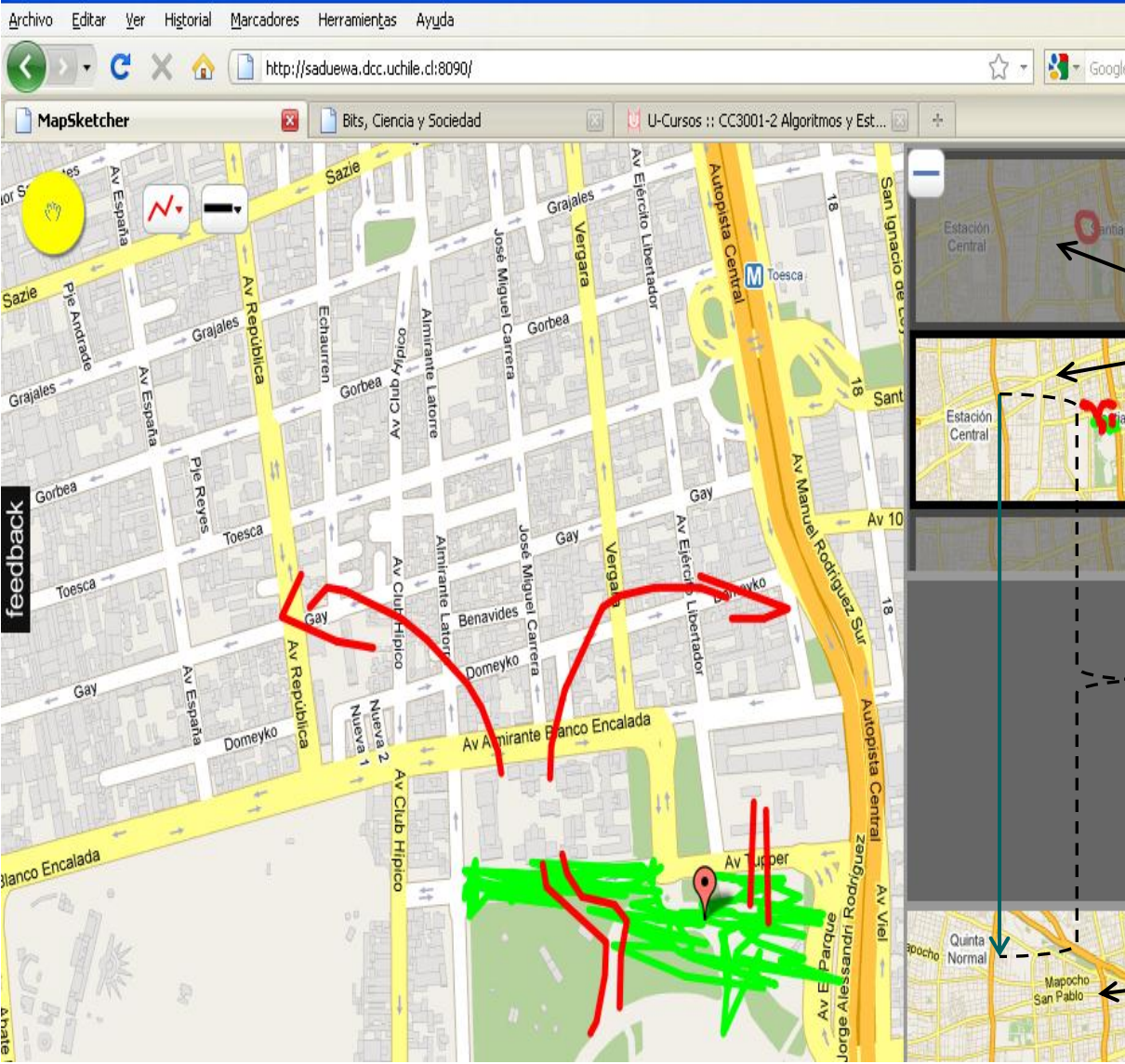


- This just for **one** touch sensitive device

Where do we go from now ?

- Even more diverse mobile and non-mobile devices appear every day in the market
 - They differ in shapes, sizes & OS
 - How to develop one platform for **all** ?
- Is 100% P2P really necessary nowadays ?
 - Internet is **everywhere**, and fast
- We are trying HTML5

Example 1: Web-based Geo-collaboration



Private pages

Drag to add

Public Page

Example 2: Modeling TV signals propagation

- Various models, various purposes
- Which model fits better to which situation ?
- Which arrangement of antennas covers more population ?

3- present results
correct assumptions



1- Prepare data
Make simulations
Store results

2- Retrieve data
Measure signal strength
Compare results



Classroom, home or laboratory work (Desktop)

Position of antennas, chose model

Online Signal coverage Analysis (OSCA)

Online Signal coverage Analysis... +

Online Signal Coverage Analysis (OSCA)

Sign in with a [Google Account](#)

Add Transmitter Radiation Pattern Edit Transmitter Evaluate Signal Coverage Population Density

Add Transmitter

Transmitter's Name:

Degrees: Reception Model:

Transmission Tower Height (mt): Transmission Power(Watt):

Transmitter Gain (Dbi): Receiver Gain (Dbi):

Frequency (Mhz): Radio:

Resolution: Shadow Model:

Reception Limit (dbi): Receiver Height (m):

Step 1: Search in the 2D Map the position of the transmitter and set it in the 3D Map (double click).
Step 2: Set parameters.
Step 3: Add the transmitter, select it and evaluate on 360°

Add Transmitter

Simulation of covered area

Coverage map

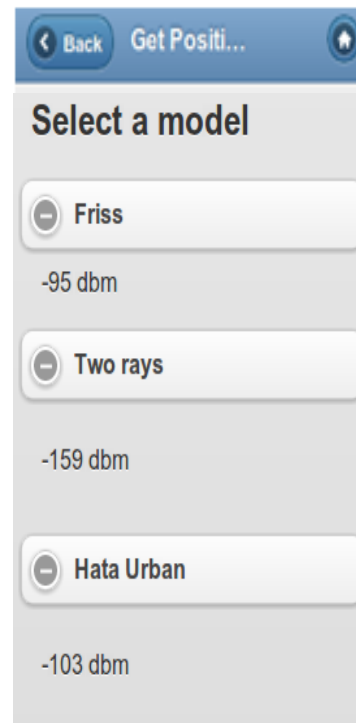
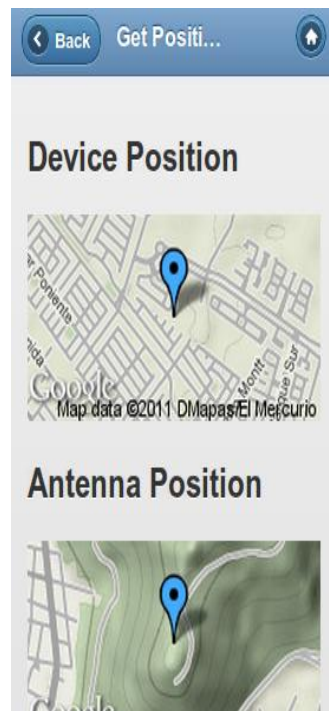
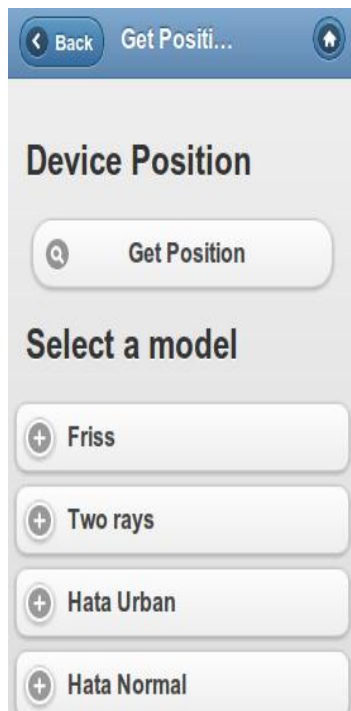
3d Map and progress

Image © 2011 DigitalGlobe
Image © 2011 GeoEye
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Perfil

Working on the field

- HTML5-based web page allows :
 - Get device position (GPS)
 - Get the signal strength according to each selected model
 - Compare it with the actual length measured with ad-hoc equipment



Conclusions:

- Can we implement meaningful learning activities with this model ?
 - Yes, we can !
- Can we (should we) use widgets ? gestures ? both ?
 - Yes, we can !
- Can we develop an integrated interaction model across platforms ?
 - Yes, we can (it seems) !
- Can we describe them with a pattern language ?
 - Well, we still have to work on this



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Thank You

Bringing the gap between formal and informal learning