Teknologia ja uudet sovellukset mobiiliavusteisessa oppimisessa

TieVie 1.9.2006

http://www.claimid.com/jarilaru

- Dynabook for children (1972)
- Ubiquitous (weiser, 1991) & pervasive (ark & selker, 1999) technologies for learning
  - include laptops, handhelds, smartphones, calculators etc.
  - 1:1 paradigm / One laptop for all initiative (Papert)

⇒In my research: handheld computers (pdas, smartphones)

2

”Starting point” for mobile learning

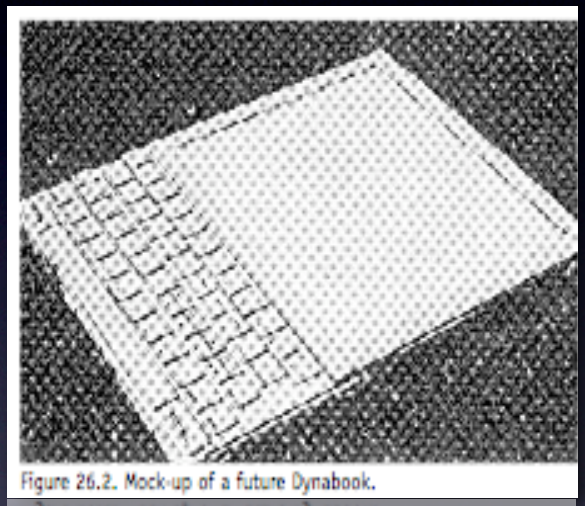


Figure 26.2. Mock-up of a future Dynabook.

Dynabook invented by Allan Kay (1972)

”Most of the extraordinary knowledge generated at PARC never crossed the **boundary between** the scientist in Palo Alto and the development engineers in Dallas or the management in Stamford”..

”The scientists, for their part, regarded almost everyone in the corporation outside their own community as ”**toner heads**” - unable to think of the world beyond photocopiers”

=> Then Steve Jobs came to visit..
=> Desktop models => Apple Newton 1993 (first PDA)

3

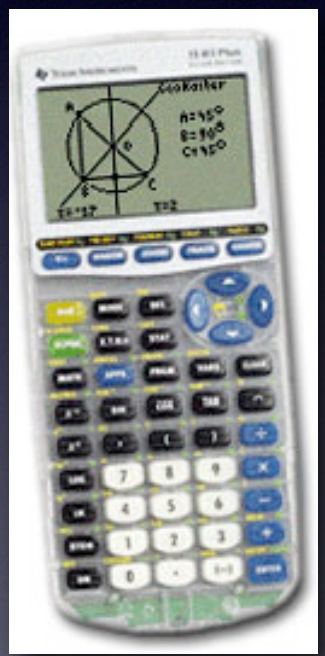
First studies: Focus on providing portable technologies to learners

4

”Mobile learning systems”

”referring to environments where learners and teachers have access dealing with to portable and connected computing capability” (Keefe & Zucker, 2003)

Rockman, 2003 (1997-)



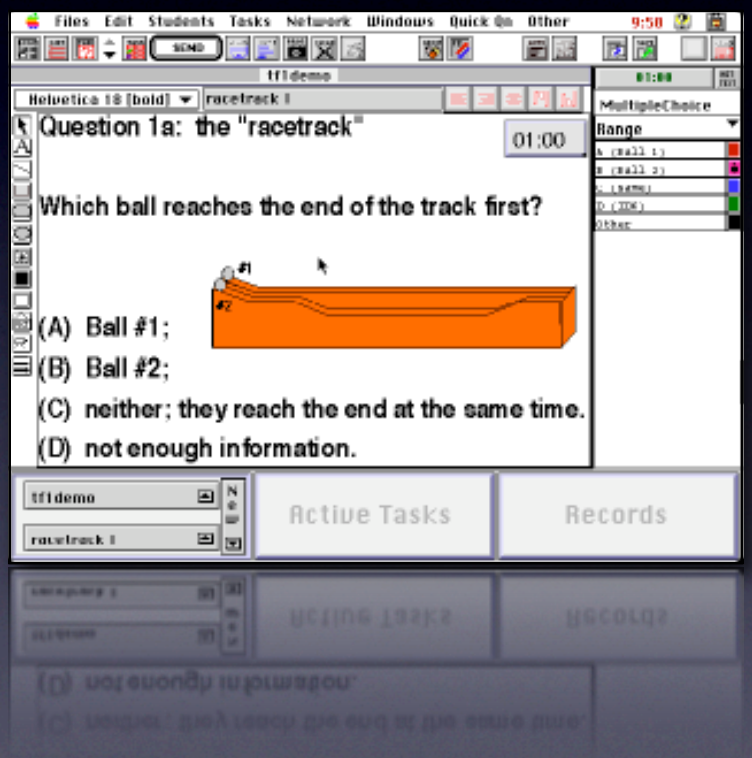
Hennessy (1998)

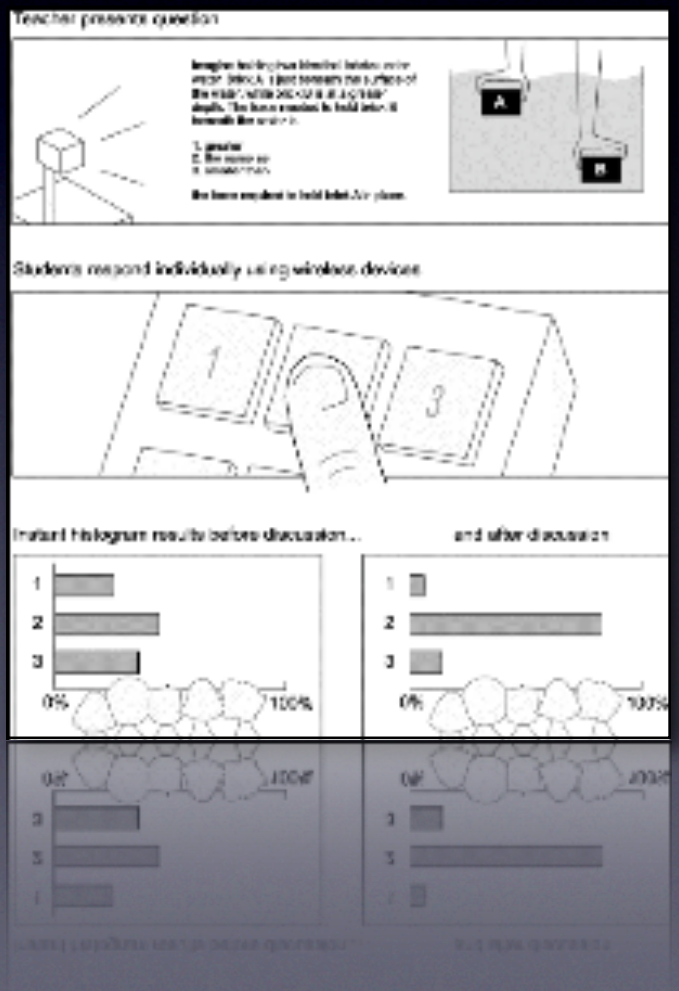
5

Another set of projects:
Benefits and costraints of using handhelds to support learning activities

6

Classroom communication systems

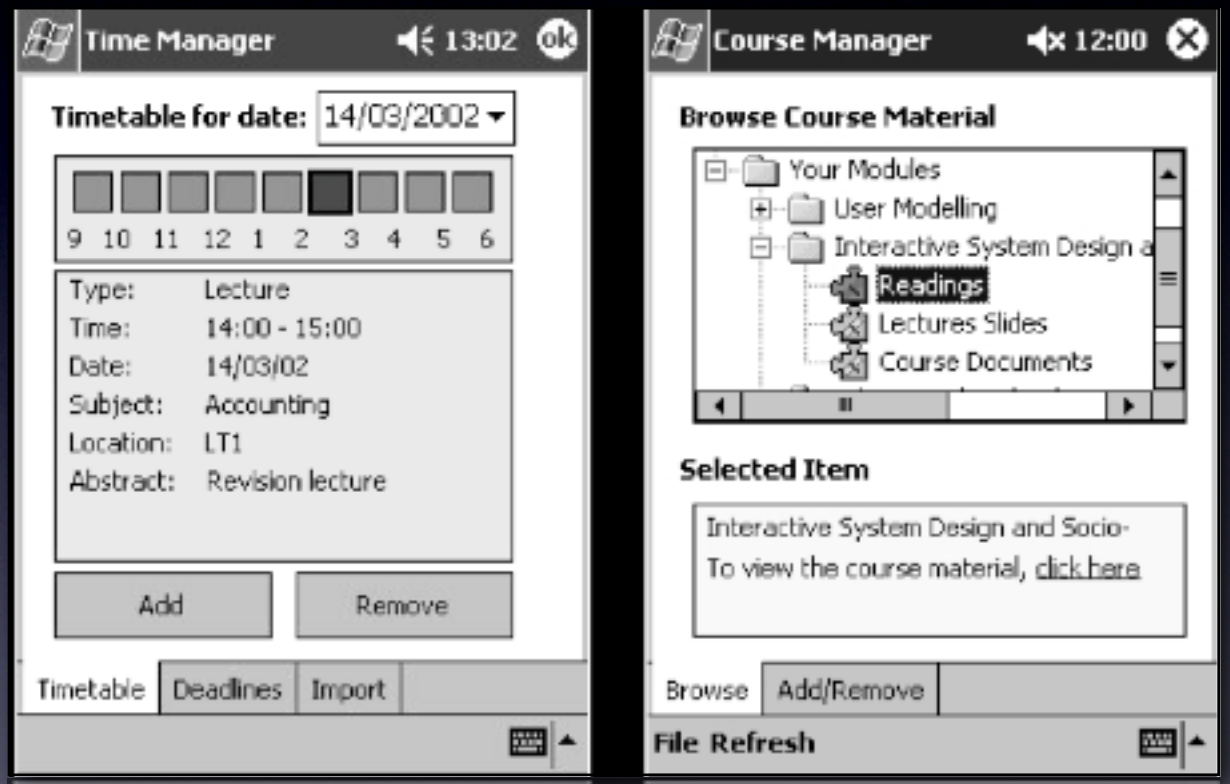




Abrahamsson et. al, 1989; Dufresne, 1996;

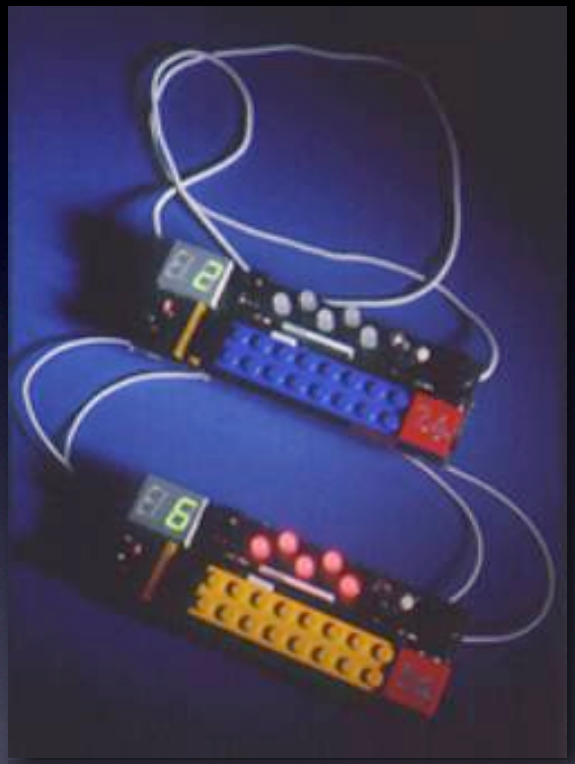
7

Learning & teaching support



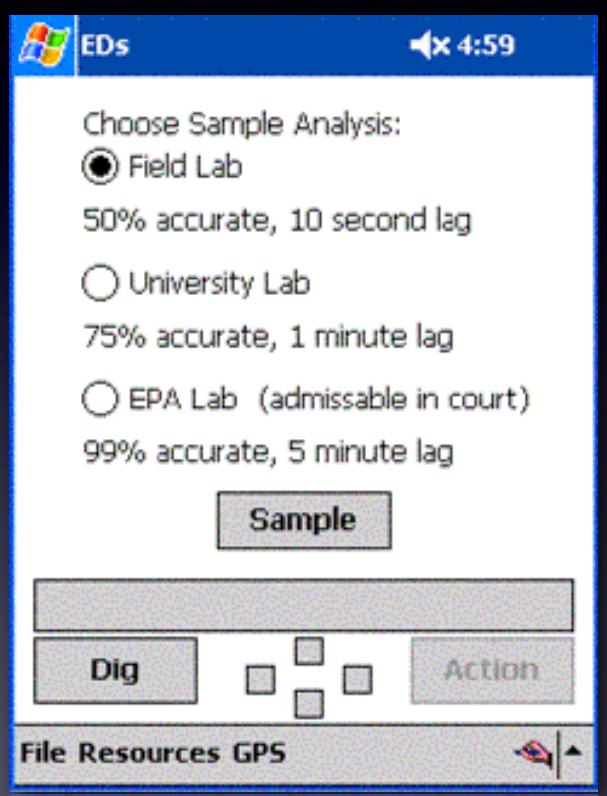
Mobile learning organizer
(Corlett, Sharples, Bull & Chan, 2005)

Participatory simulations

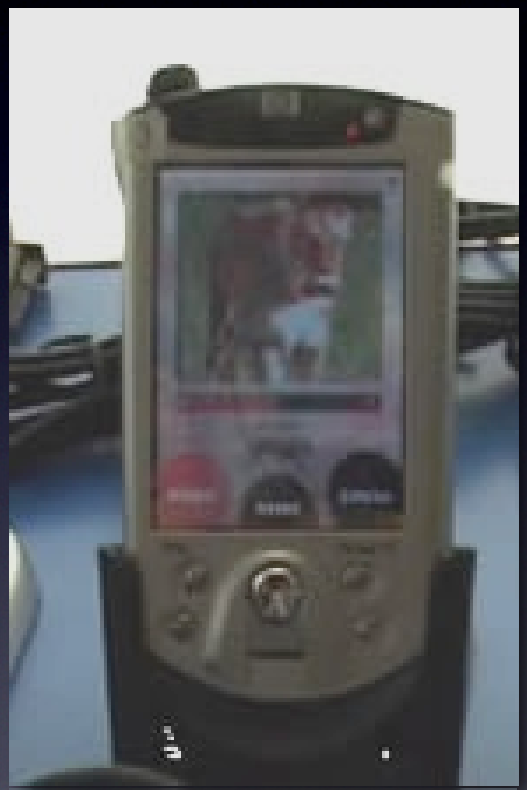


Colella, 2000

Situated learning & Context-aware tech



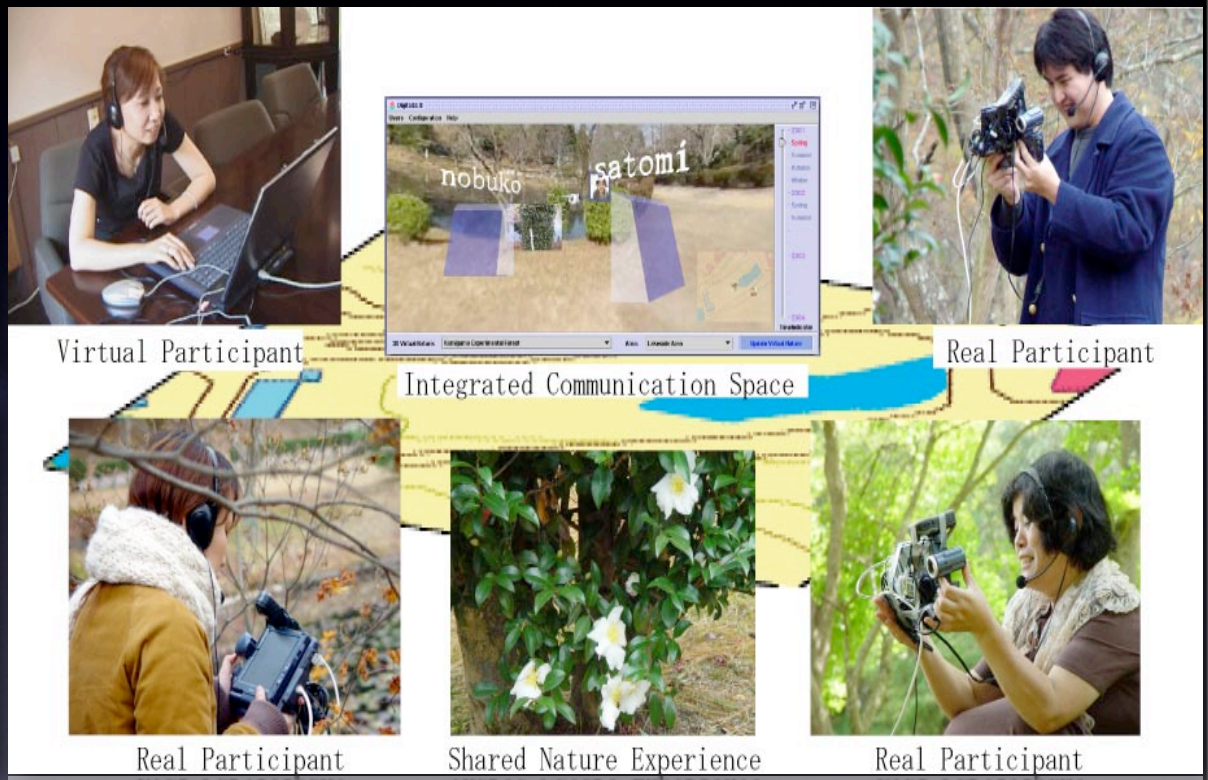
Environmental Detectives
Klopfer & Squire (in press)



Savannah
(Facer et.al, 2004)

Collaborative learning 1/2

Ambient Wood I & II
(Price et. al, 2003)



DigitalEE I & II
(Okada et. al, 2002)

Collaborative learning 2/2

FLE3mobile
Goman & Laru (2003);
Laru & Järvelä (submitted)

mCSCL
Zurita & Nussbaum (2004-2006)

Third set of projects

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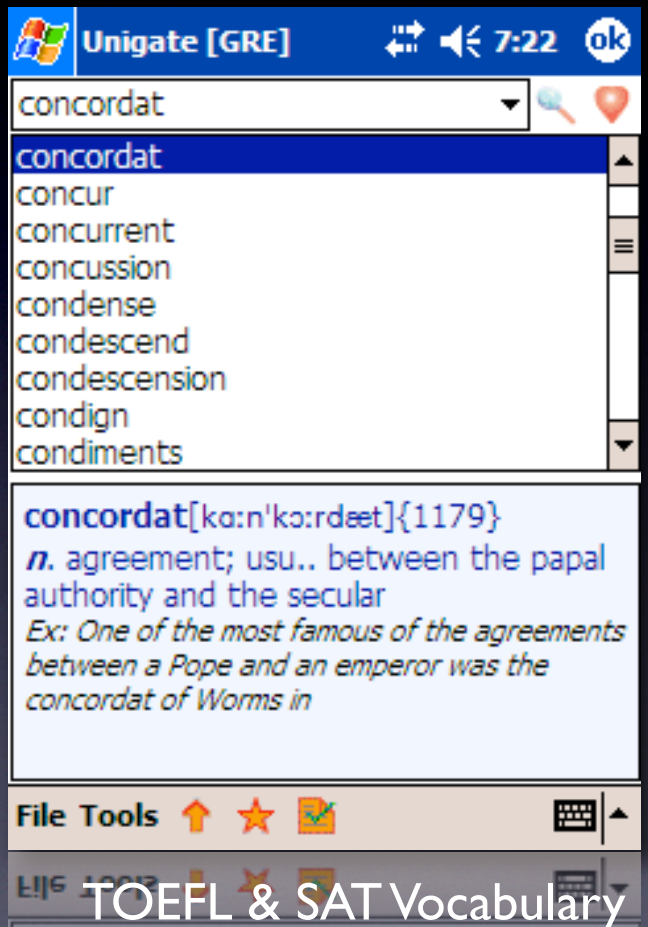
Learning bites

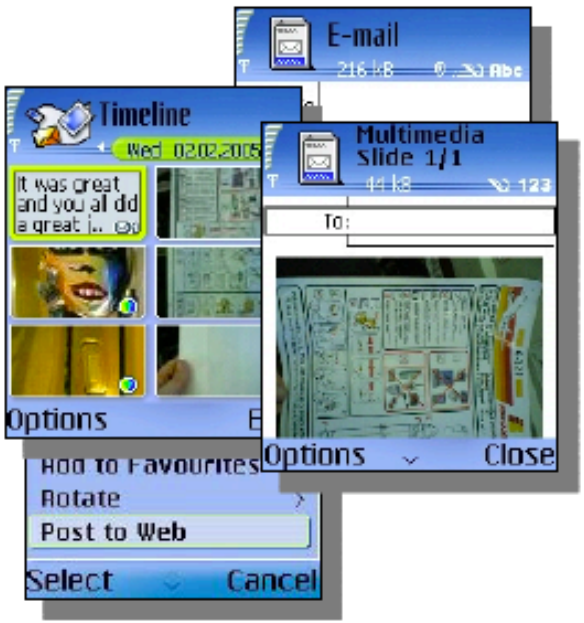
BBC Bytesize



TOEFL & SAT Vocabulary

Prensky, 2004; Thornton & Houser, 2004

MoBlogging / LifeBlogging



http://en.wikipedia.org/wiki/Moblog

(Nokia, 2005; Pea & Maldonado, 2006-in press)

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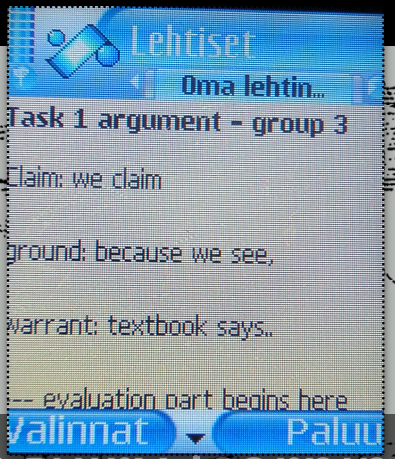
P2P networks & learning

p2p scaffold: F2F collaboration

mobile scaffold: shared fliers + sentence openers

teacher/tutor scaffold: teacher lead discussion + tutoring during F2F collaboration



Collaborative inquiry learning in the wild

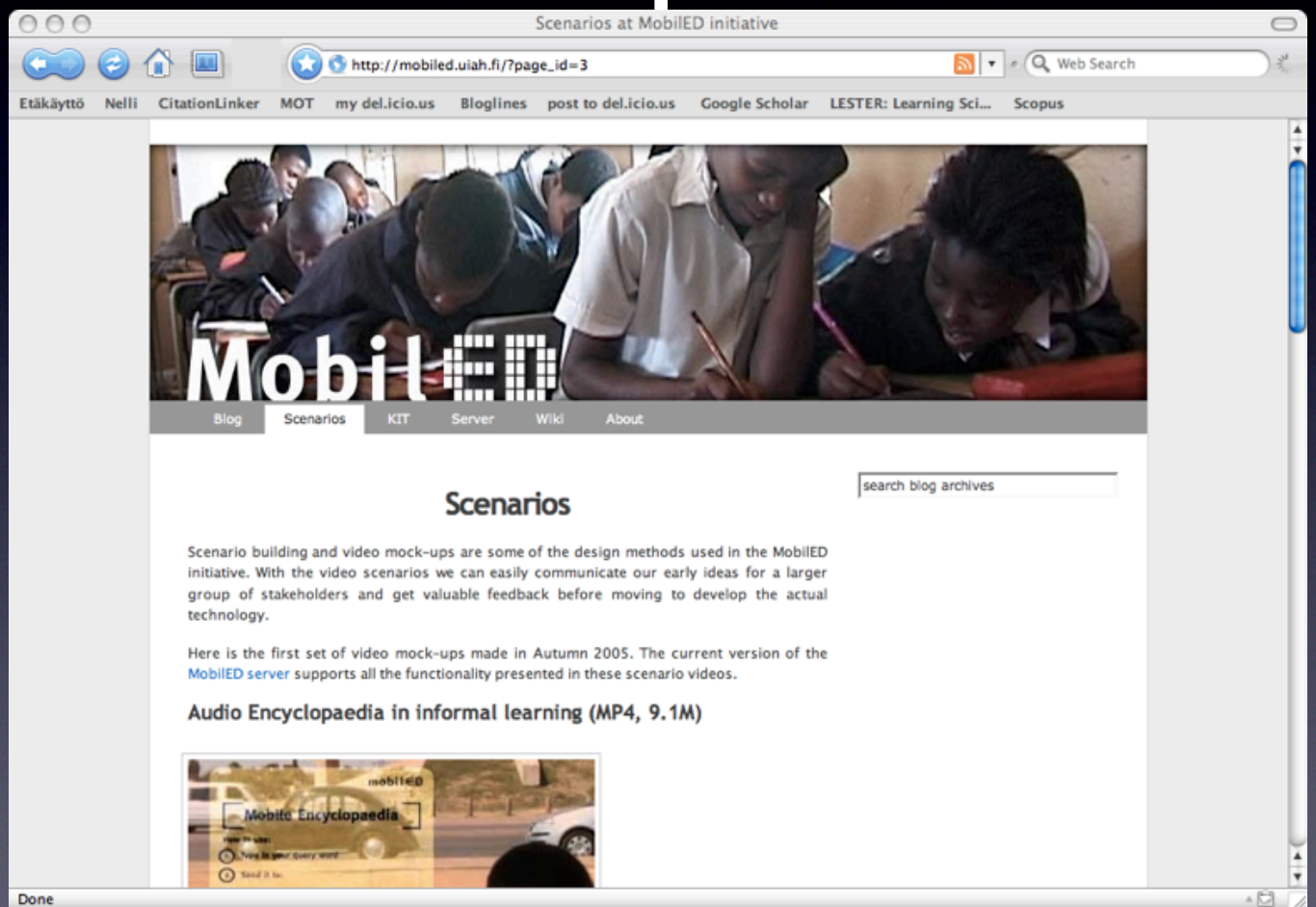
NOKIA FLIER; Laru & Järvelä, 2005

iPodding / Podcasting

http://www.apple.com/education/ipod/

(Pea & Maldonado, 2006)

MobilED - Mobile Wikipedia



Leinonen et. al, 2006; UIAH

”Mobile learning”

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mobile technologies for learning

- Early research have suggested positive effects on learning with handheld computers (Vahey & Crawford, 2003; Crawford & Vahey, 2003)
- Research is driven by the technical cababilities of new devices and application of theory to the use of these been sparsely explored (Naismith et. al, 2005)

⇒ Notions of m-learning & mobile learning can be considered as a leftover from ”providing technologies to learners” phase <=> but still widely used.

⇒ Deep-rooted theoretical view(s) is(are) required

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Why handheld computers are increasingly attractive?

- **PDA functions**
- Desktop productivity applications (e.g. word processors)
- the functions of application task spesific-devices (e.g.calculator and basic mobile handsets)
- versatile modular hardware (e.g.cameras, keyboards, gps)
- complex interactions with other networked computers

Pea & Maldonado (2006, in press)

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Technological affordances of mobile technologies for learning

- portability –can take the computer to different sites and move around within a location
- social interactivity – can exchange data and collaborate with other people face to face
- context sensitivity– can gather data unique to the current location, environment, and time, including both real and simulated data
- connectivity – can connect handhelds to data collection devices, other handhelds, and to a common network that creates a true shared environment
- individuality – can provide unique scaffolding that is customized to the individual's path of investigation.

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“Wild” & learning

- Roschelle and Pea (2002) have found that mobile technologies:
  - augment physical space with the information exchanges
  - leverage topological (or physical) space
  - aggregate individual’s participation into group reflection opportunities
  - situate the teacher as a conductor of activity
  - use students’ actions as artifacts for discussion

  => Wireless Internet Learning Devices (Wild)

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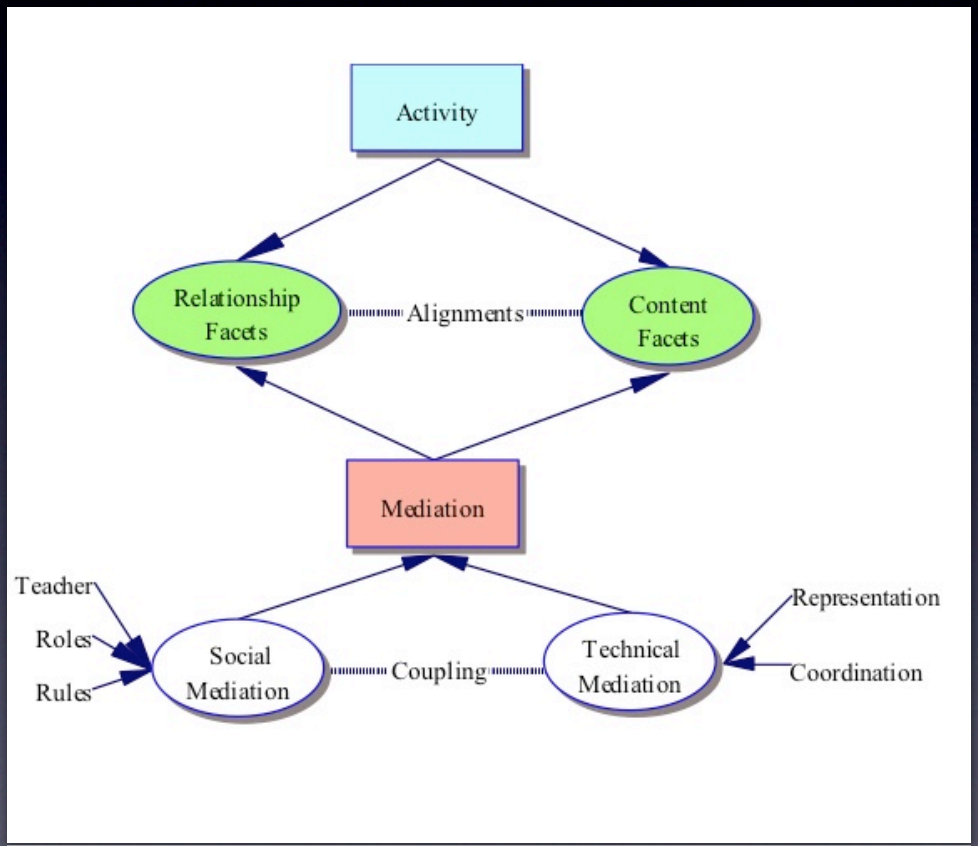
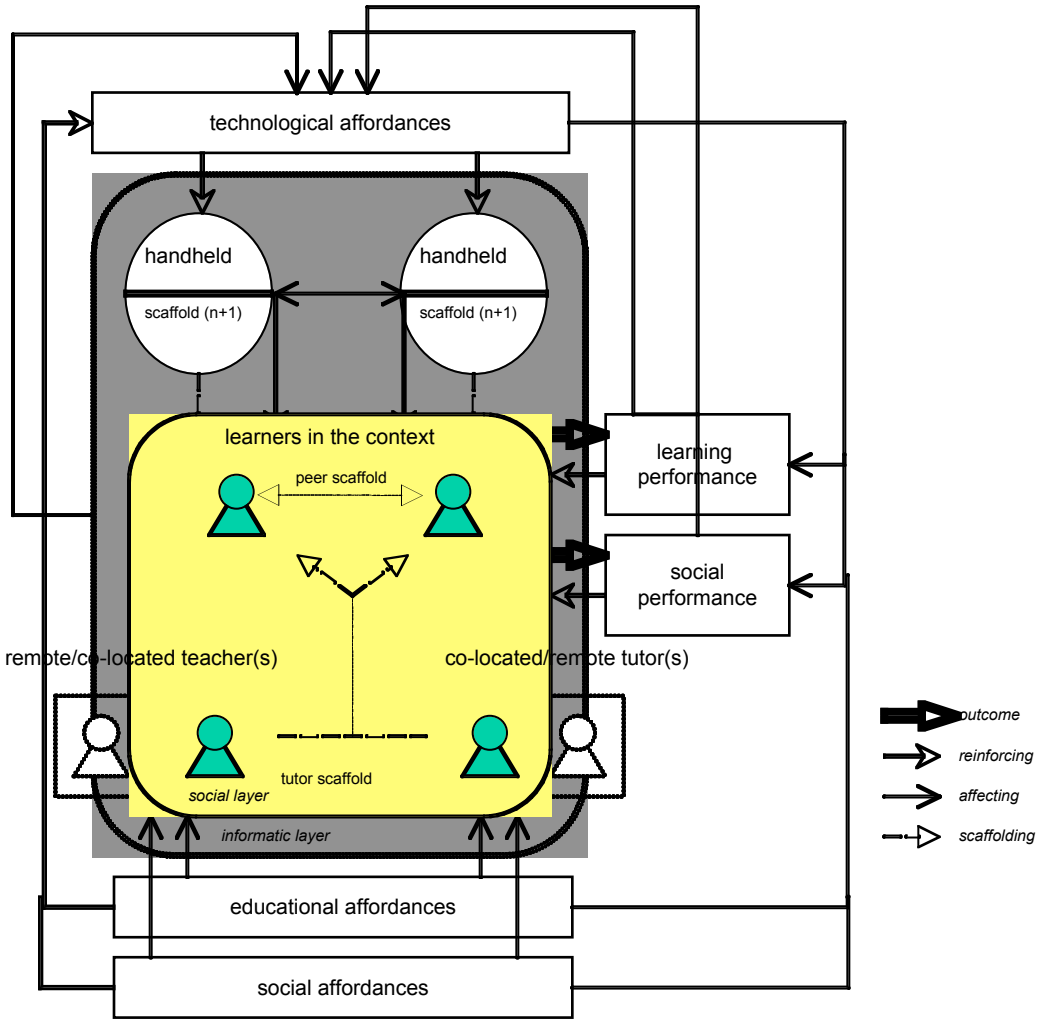
Towards a framework of Mobile learning



Roschelle, Rosas & Nussbaum, 2006

Framework for distributed scaffolding



Laru, 2005

My research

My theoretical background

- Main theories:
  - Cognitive tools (Lajoie, 1993; Jonassen & Reeves, 1996) & Distributed cognition (Hutchins, 1995; Norman, 1993; Pea, 1993; Wertch, 1998)
  - Scaffolding (Wood, Bruner & Ross, 1976) enhanced with critique (Pea, 2004) to fading (Collins, Brown & Newman, 1989) & Distributed scaffolding (Puntembekar & Kolodner, 1998; Tabak, 2004)
  - Collaborative learning (Dillenbourg, 1999; Koschmann, 2002, Roschelle & Pea, 2002)
- Other:

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Cognitive tools (1/2)

- The concept of *cognitive tools* is used to refer to any tool that can support aspects of learner's cognitive processes (Lajoie, 1993).
- Jonassen and Reeves (1996) broaden Lajoie's view of the term, using it to refer to any tools "that enhance the cognitive powers of human beings during thinking, problem solving, and learning" (p.693).
- The theoretical foundation of cognitive tools comes from theories of the distributed cognition (Hutchins, 1995) and distributed intelligence (Pea, 1993), which regards cognition residing only in person's head, but distributed among people, artifacts and symbols.

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Cognitive tools 2/2

- At present, an exciting aspect is that cognitive tools that first existed only on expensive desktop machines are now being made available on inexpensive handheld computers.
- Example: The graphing calculators are in many mathematic and science classrooms ubiquitous (Keefe & Zucker, 2003).
- With more generalized handheld computers, cognitive tools for mapping concepts, running simulations, gathering data, structuring discussions, etc. are also appearing in handheld computers in conjunction with novel technological affordances. (Roschelle,2003; Naismith et. al, 2005)

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Scaffolding 1/3

- The concept of *scaffolding* was first introduced by Wood, Bruner & Ross (1976) in order to define what kind of instructional processes enables novices to carry out tasks that are beyond their unassisted efforts, thus helping them achieve independent task competence.
- The theoretical foundation of scaffolding comes from ideas concerning the zone of proximal development (ZPD) and sociocultural perspective (Vygotsky, 1986; Wertch, 1998).
- Scaffolding techniques have been used successfully in a number of desktop tools (Quintana, Reiser, Davis, Krajcik, Fretz, Duncan, Kyza, Edelson, Soloway, 2004)

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Scaffolding 2/3

- Idea of scaffolding was originally based on individual tutoring situations, which was disproved by Puntembekar & Kolodner (1998) by arguing that models of individual scaffolding are not necessarily applicaple to educational settings in which a group of learners is pursuing a common goal.
- Other up-to-date notions on scaffolding emphasize that it can take a variety of forms - it can be extended to cover physical artifacts and representations, which can serve as cognitive tools that mediate action (Palincsar, 1998; Wertch, 1998), but also to consider peers and social roles as scaffolding agents (Tabak, 2004; Puntembakar & Kolodner, 1998).

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(Distributed) Scaffolding 3/3

- Puntembekar & Kolodnner (1998) coined the term *distributed scaffolding* to refer to such instructional designs that sequence and integrate a variety of social and material supports.
- Tabak's (2004) extension added three dimensions (redundant, synergetic ja..)
- Tabak (2004) proposed that these various scaffolding components in a complex learning environment should be in synergy with one another, addressing the same learning goals, and reinforcing one another to produce stronger support

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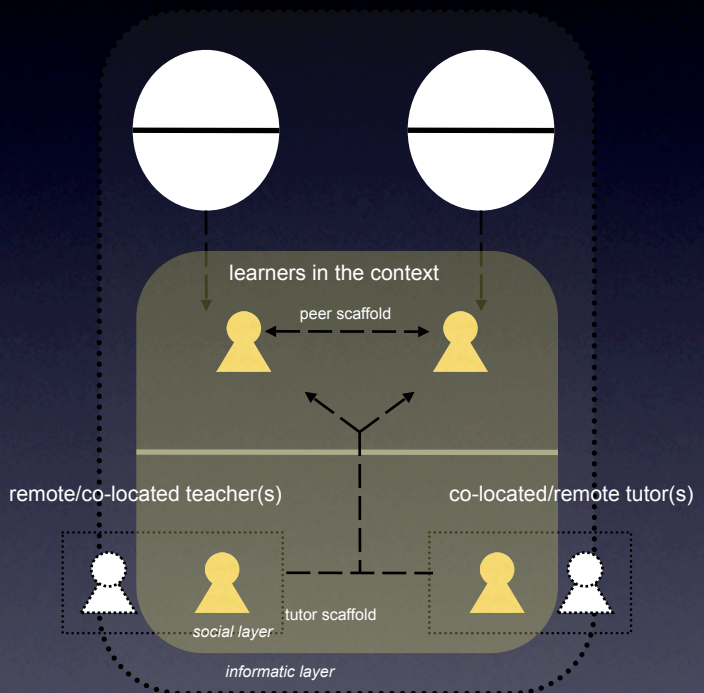
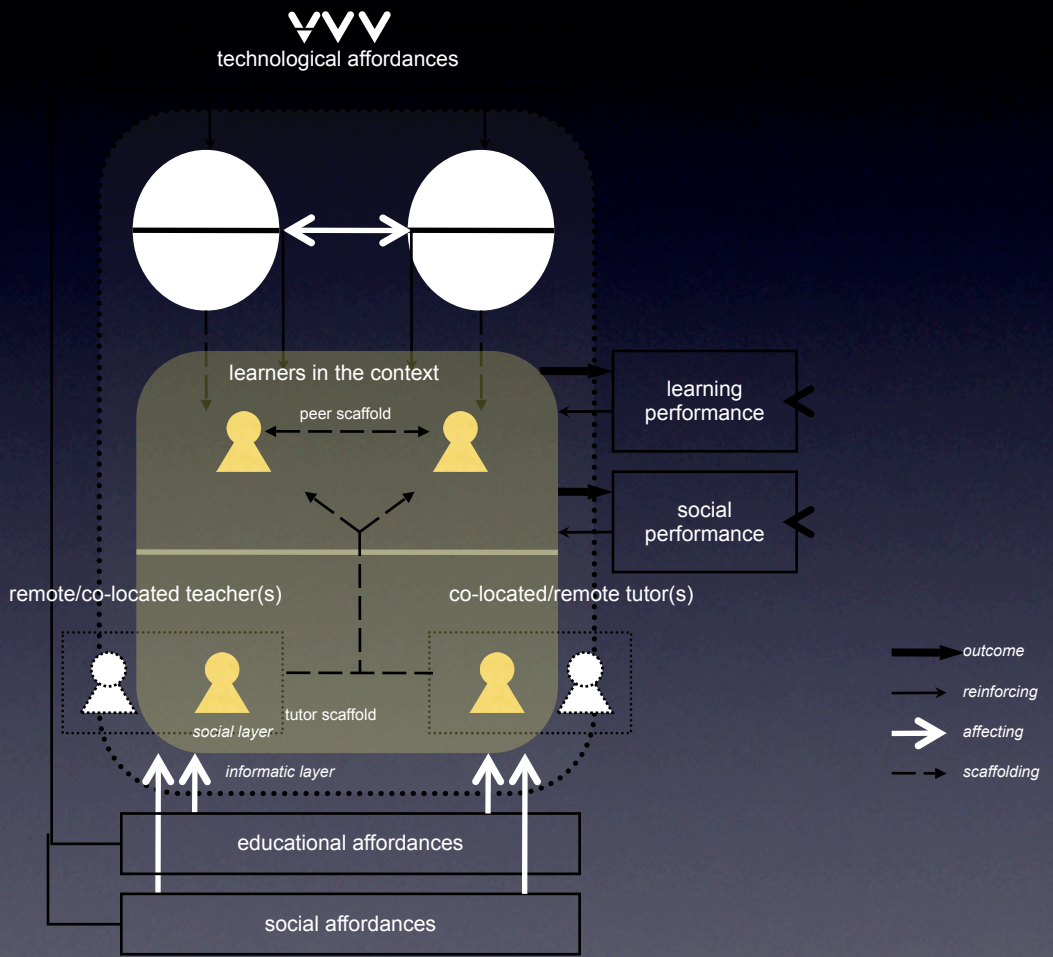
Framework for distributed scaffolding in situated and technology augmented learning



33

Framework for distributed scaffolding in situated and technology augmented learning



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Q-1: What are the social, educational and technological affordances, which either constrain or promote such scaffolds to interact and work in concert?

Q-2: What is the role of handheld computers and other ubiquitous and pervasive technologies in such context?

Q-3: How distributed scaffolds affect on both learning and social performance?

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the participants' performance on learning and social activities

- In each design experiment appropriate tools for handheld computers, collaboration scripts and other instructional material and pedagogical arrangements will be designed in multidisciplinary collaboration to ensure that both technological, social and educational affordances are taken into account.

- Outcome of the design phase will be taken into the field where it will be used and evaluated in real, situated

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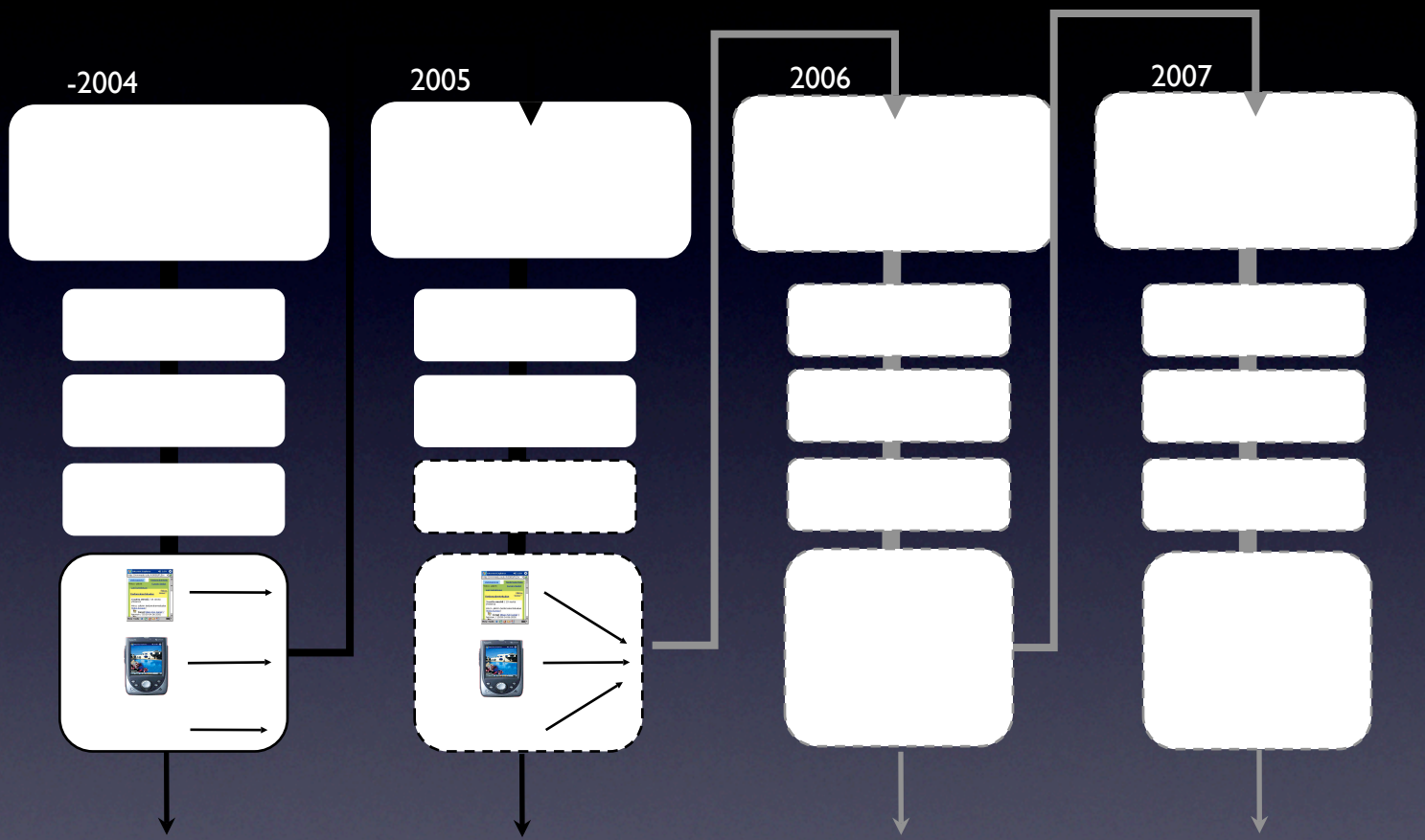

a) journal articles, scientific papers and presentations

b) scaffolds, instructional design principles, technological tools and components

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kaleidoscope
concepts and methods for exploring the future of learning with digital technologies

MOSIL

RATUAARI

virtuaalikampus

4. developed to support collaboration and knowledge building among university teachers [n=10]. All subjects had a joint goal for collaboration and an authentic need to plan and coordinate a virtual Master's programme in Information Sciences. Status: inactive. Outcome: The data and experiences from that study create basis for all other experiments. (Goman & Laru, 2003; Laru & Järvelä, 2003; Laru & Järvelä, 2004).

2. ***Selection of mobile tools for supporting citizens' everyday practises.*** [2003-2004]. In this design experiment wide selection of mobile tools was developed for ordinary citizens. These mobile tools enabled city dwellers to e.g. both read topical information about current events and engage in anonymous collaboration with unknown peers. Contexts where these tools were used and evaluated varied from pedestrian street to ice-hockey arena. Status: inactive Outcome: readymade tools and technological components needed in third and fourth experiments. (Laru & Järvelä, 2004)

3. ***Selection of mobile tools for scaffolding university students' learning.*** [2004-2006]. In spring 2004 students of University of Oulu were asked to answer to online questionnaire [n=715] whose aim was i) to find out such mobile tools that students wanted to use to scaffold their learning activities ii) students' personal and collaborative learning strategies, goals and habits to inform design of future mobile tools. Status: active. Outcome: (Laru, Tolonen & Järvelä, 2004; Liukkunen, Tolonen & Laru, 2005; Tolonen, Salovaara & Laru, 2005)

4. ***Supporting collaborative inquiry learning in nature context.*** [2004-2007]. This design experiment was started in late autumn 2004 in Pudasjärvi National Park, Finland. In first phase of that design experiment group of school children [n=22] participated in study where they used tailored software in autumn 2004. This tool enabled students create, receive and modify flyers with their mobile phones in inquiry-based learning project. Status: active. Outcome: (Laru, Stegmann, Järvelä, 2005; Laru, Järvelä, Clariana, 2005a, Laru, Järvelä, Clariana 2005b)

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The participants who participated in this study were members of three distributed teams (N=10, 9 males and 1 female). The participants worked as managers, coordinators, teachers and designers in their local offices, situated in two sites in Finland.

The topic of teamwork dealt with practical problems in planning, such as how to set-up new virtual master's programme and how to keep existing programmes running. The three teams worked for 4 week in this task

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shared collaboration platform (FLE3mobile)

personal organizer (PDA)

peer to peer collaboration (F2F)

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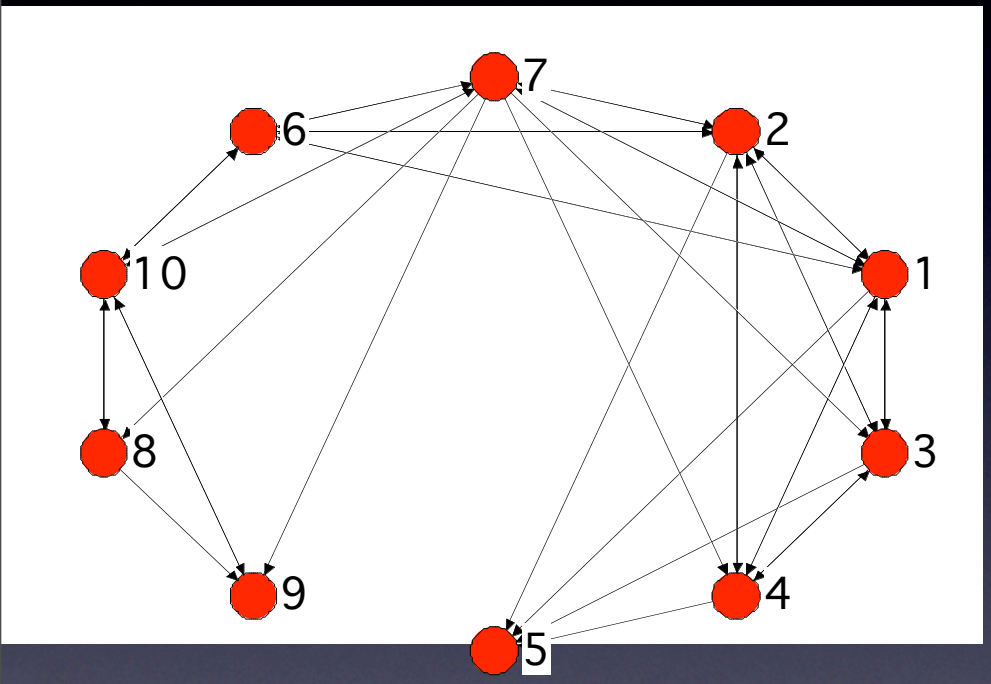
Team(s)	n	Density (sd)	Centralization In	Out
Teams A+B	7	0.55 (0.49)	16%	20%
Teams B+C	5	0.56 (0.49)	37%	37%
Teams A+C	8	0.31 (0.46)	16%	16%
Teams A+B+C	10	0.43 (0.50)	12%	49%



Auth. user	Page views		Visits		Total time spent		Last visit
P1	348	18,5 %	6	13,0 %	01:18:54	20,9 %	13jun
P2	410	21,8 %	10	21,7 %	00:47:54	12,7 %	17jun
P3	237	12,6 %	10	21,7 %	02:09:27	34,4 %	18jun
P4	313	16,7 %	8	17,4 %	01:00:45	16,1 %	17jun
P5	13	0,7 %	1	2,2 %	00:01:48	0,5 %	17aug
P6	143	7,6 %	3	6,5 %	00:23:34	6,3 %	4jun
P7	47	2,5 %	2	4,3 %	00:07:13	1,9 %	4jun
P8	89	4,7 %	2	4,3 %	00:10:43	2,8 %	13jun
P9	49	2,6 %	2	4,3 %	00:03:04	0,8 %	7jun
P10	229	12,2 %	2	4,3 %	00:13:25	3,6 %	11jun
total	1878	100,0 %	46	100,0 %	6:16:47	100,0 %	

ID	Topic	First post by (read by)	Replies by (read by)
1	How FLEmobile is running?	4jun P2 (1,2,3,4,6,7,8,9,10)	4jun P3 (1,2,4,6,7,10) 4jun P1 (2,3,4,6,7,10) 4jun P6 (1,2,3) 5jun P2 (1,3,4)
2	About gprs-connection	6jun P2 (1,3,4)	6jun P1 (2,3,4) 7jun P2 (1,3,4)
3	Version of powerpoint?	4jun P3 (1,2,4,6,7,8,10)	4jun P1 (2,3,4,6) 4jun P6 (1,2,3,4) 4jun P3 (1,2,4,6)
4	about new master's programme	4jun P1 (2,3,4,6,8,10)	5jun P2 (1,3,4) 17jun P4 (3)
5	Network connection between Oulu and Kuusamo	4jun P3 (1,2,4,6,8,10)	-
6	FLE3mobile	7jun P9 (1,2,3,4,8,10)	13jun P8 (2,3,4) 14jun P4 (2,3)

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situated and technology mediated collaborative learning that augment each other

- Generic Q-1: How to design effective scaffolds for combinations of humans and artifacts?
- Generic Q-2: How handheld computers and other ubiquitous and pervasive technologies can be used to scaffold collaborative learning processes as part of distributed scaffolding framework?
- Generic Q-3: What are the social, educational and technological affordances, which either constrain or promote collaborative learning when scaffolds are distributed

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”Bluetooth is an industrial specification for **wireless personal area networks (PANs).** Bluetooth provides a way to connect and exchange information between devices like personal digital assistants (PDAs), mobile phones, laptops, PCs, printers and digital cameras via a secure, low-cost, globally available short range radio frequency” (Wikipedia, 2005)

Common Arguments:

1. Bluetooth networks must be setup, installed and configured by the user.
2. These technologies, particularly Bluetooth, have not yet matured to the point where they are a transparent medium for the end user.

Bluetooth Grid: (as used in our study)

1. Autoconfiguration of the networks (no need for ANY setup)
2. Totally transparent, middleware is responsible for BT communications
3. Devices are BT nodes of the self-organizing BT grid (BT range depends on mobility of people carrying devices or amount of fixed, hidden devices)

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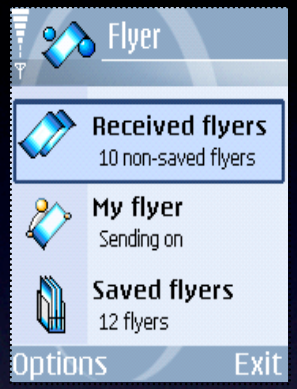
NOKIA

Flier



”The Nokia Flier application **allows you to create and locally distribute short messages containing text and a picture**. When you have created your own flier you can publish it to other Nokia Flier users, who are close by (about 10 m) and have activated Nokia Flier application on the phone. Nokia Flier uses Bluetooth wireless technology for communicating with other phones.” (www.nokia.com)

Download the software: http://europe.nokia.com/nokia/0,,58683,00.html for (Nokia 7610)

45

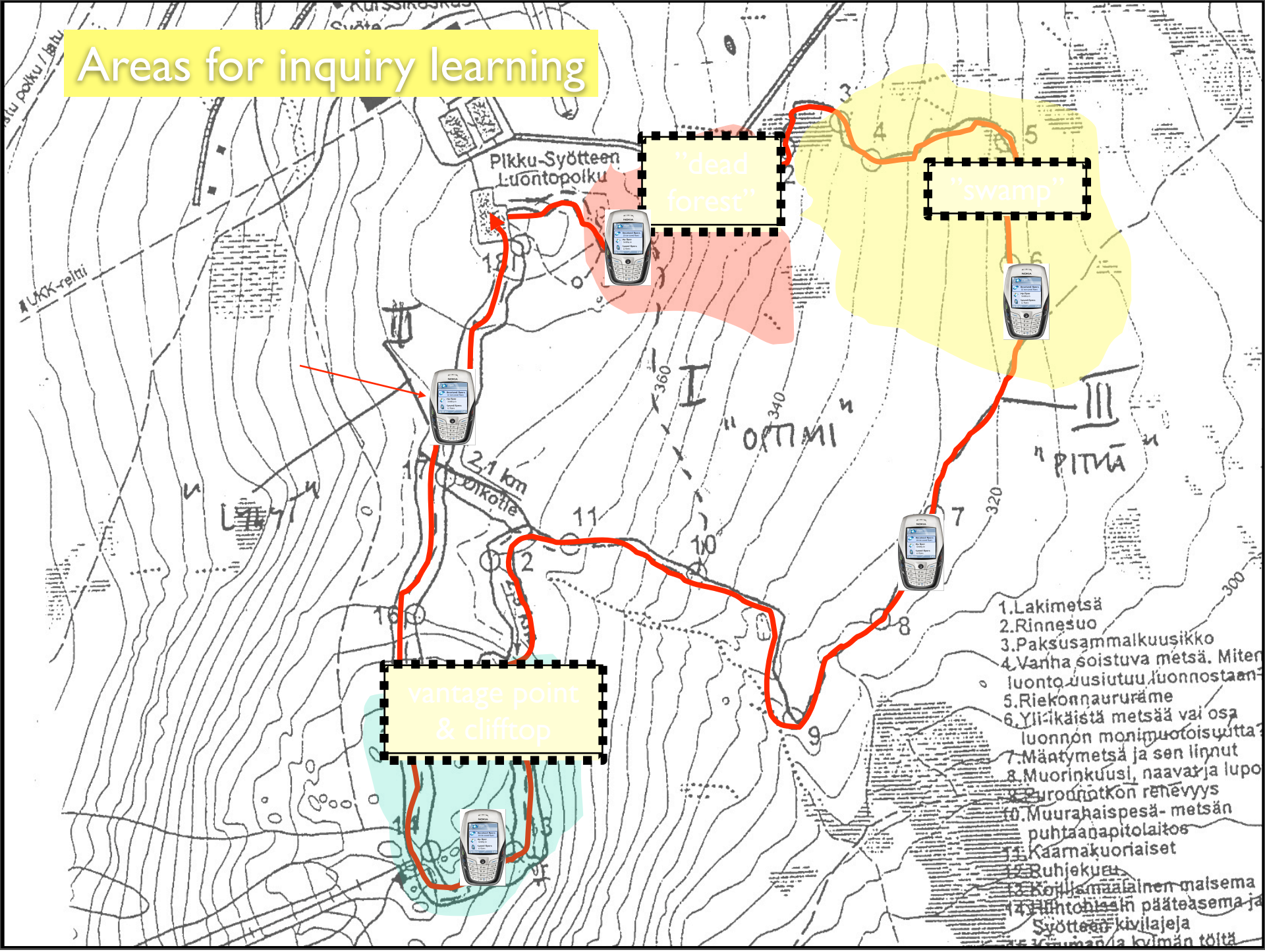

- **Design Rationale:** To found newt methods and technologies for enhancing situated nature experiences

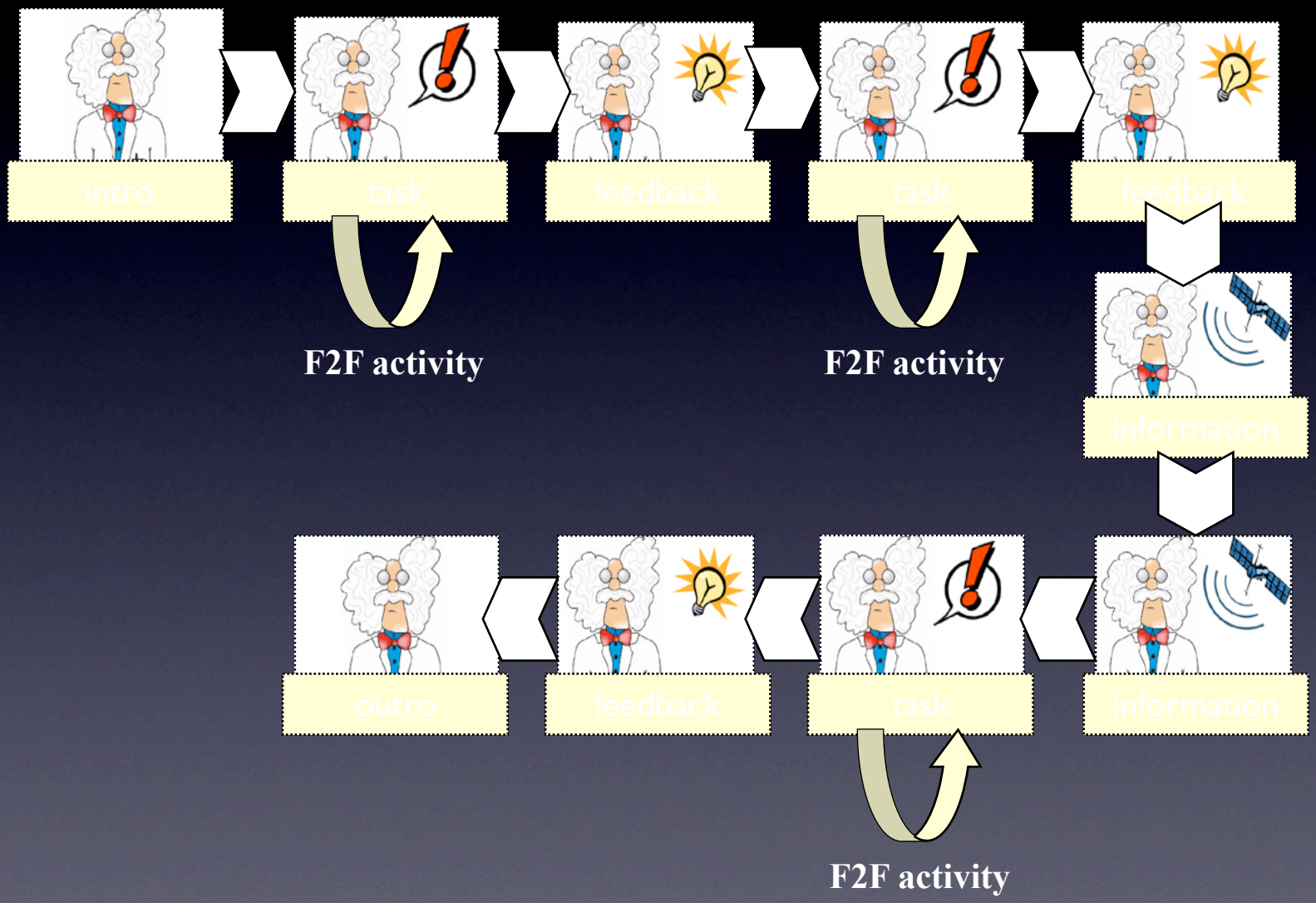
- **Tryout:** to explore how mobile technologies can be used to scaffold collaboratative inquiry learning in the nature trail

  - Activities were designed around topic of old forest, focusing on the traces of the animate and inanimate nature

  - The participants (N=22) were 12-year old primary school students participating a nature school in Northern Finland.

  - They were assigned to groups of eight triads and two dyads.


Areas for inquiry learning
Pikku-Syötteen Luontopolku
”dead forest”
”swamp”
vantage point & clifftop
UKK-reitti
2,1 km
”OPTIMI”
”PITKÄ”
1.Lakimetsä
2.Rinnesuo
3.Paksusammalkuusikko
4.Vanha soistuva metsä. Miten luonto uusiutuu luonnostaan
5.Riekonnaururaame
6.Yli-ikäistä metsää vai osa luonnon monimuotoisuutta?
7.Mäntymetsä ja sen linnut
8.Muorinkuusi, naavat ja lupot
9.Puronnotkon renevyys
10.Muurahaispesä- metsän puhtaanapitolaitos
11.Kaarnakuoriaiset
12.Ruhjekuusi
13.Kolilsmaalainen maisema
14.Ulkohuussin pääteasema ja Syötteen kivilajeja


intro
task
feedback
task
feedback
F2F activity
F2F activity
information
outro
feedback
task
information
F2F activity

48

Task flier

Exploring Nature & Creating Arguments

Each group had to found arguments to support hypotheses offered in the task flier

Creating Own Flier

Following sentence openers were available (arguementation script)

- claim (we claim that)
- warrant (because we see) + picture
- ground (we know)

Exchangin Fliers With Peers

Discussion

Feedback flier

part of the storyboard's fixed content

49

pre- and post tests were done

- questionnaires involving general questions
- mind-map task to measue domain spesific knowledge

(b) the content created was collected

(c) audio recordings were collected

- students' verbal interactions were recorded with digital recorders during the

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	Pretest		Posttest		Gain	
	Animate	Inanimate	Animate	Inanimate	Animate	Inanimate
Group 1	-1.3	-1.0	-0.7	-0.7	0.7	0.3
Group 2	-1.3	-1.0	0.3	0.3	1.7	1.3
Group 3	-1.3	-1.0	-0.7	-1.0	0.7	0.0
Group 4	-1.0	-1.0	0.5	0.5	1.5	1.5
Group 5	-2.0	-2.5	1.0	1.0	3.0	3.5
Group 6	-1.0	-1.3	1.0	0.7	2.0	2.0
Group 7	-1.7	-1.3	-0.7	-0.7	1.0	0.7
Group 8	-2.0	-1.7	-0.7	-0.7	1.3	1.0
Total						
X	-1.45	-.05	-1.32	-.14	1.5	1.3
sd	(1.10)	(.95)	(.89)	(.99)		

metsä

kar

52