INAF

ISTITUTO NAZIONALE DI ASTROFISICA
NATIONAL INSTITUTE FOR ASTROPHYSICS

"Experiences of mobile learning in science: technological solutions for wireless network and content delivery

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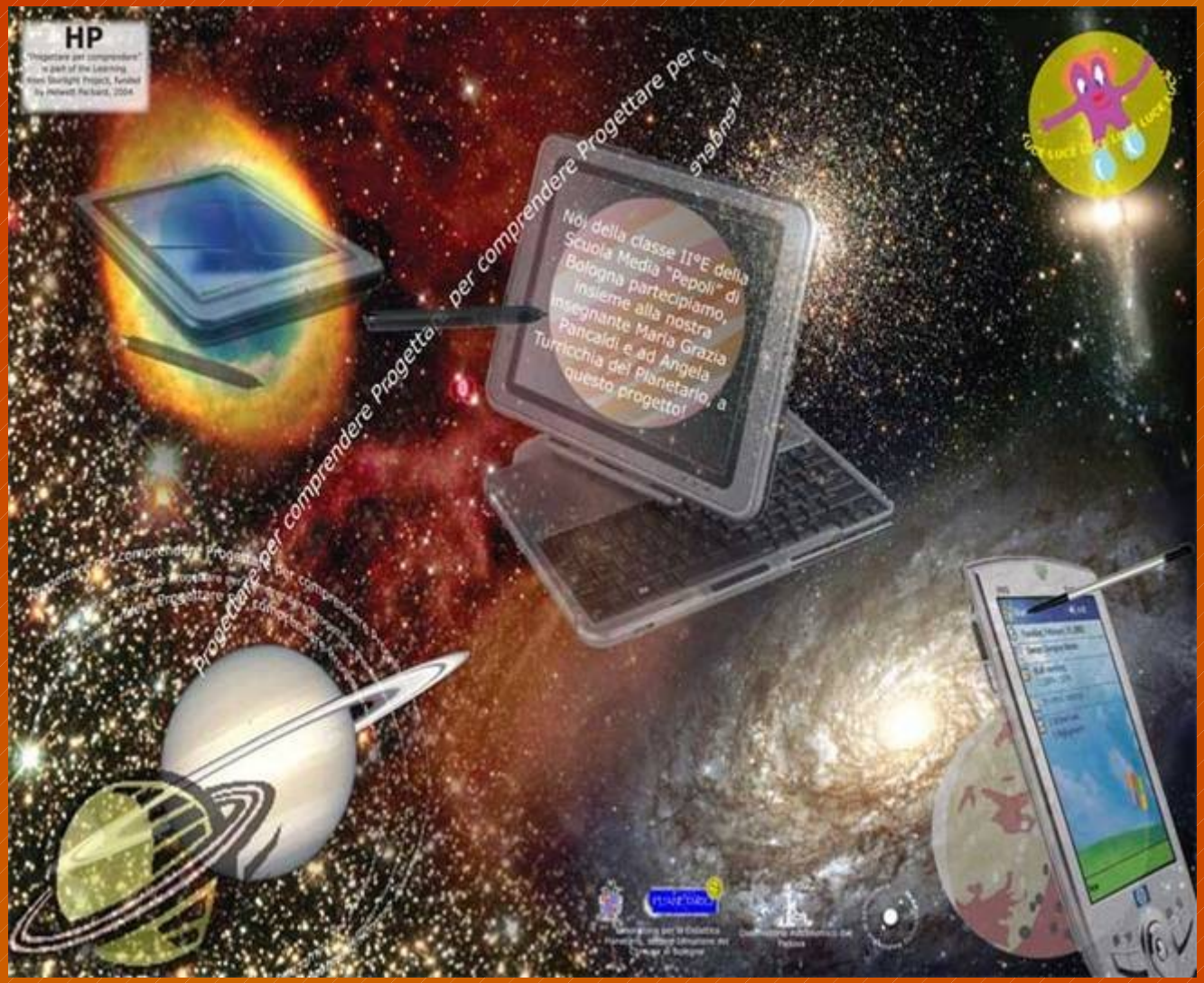
Case study objective



Providing a course

- using mobile devices;
- different format of digital content;
- make use of wireless trasmission

Background: Learning from Starlight project

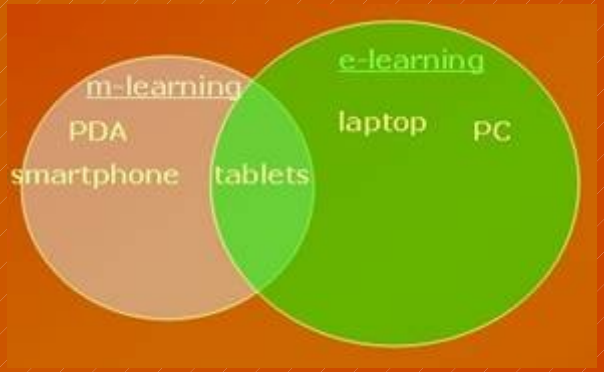
Funded by Hewlett Packard Foundation (giving hardware equipments), the project is realized by the Italian National Institute of Astrophysics (INAF), a research institute that in collaboration with universities and other organizations in an international environment coordinates researches in all fields of Astrophysics.

How new technologies and devices could improve learning and teaching of Astrophysics as a science based on observations

Project goals

"An astrophysical course for students of different ages deployed in a wireless context by using mobile devices"

The project becomes a practical application of mobile learning field (intersection of mobile computing and e-learning solution): learning actors should access digital content wherever they are



- transformation of every wireless room into a flexible laboratory
- collaborative activities realized in different physical locations
- collaboration, communication and exchange of information in several format (device independent delivery)

The use case scenario

COURSE

Observation and analysis of astrophysical phenomena: how to learn the difference about luminous and not luminous celestial bodies of our solar system observing physical parameters (distance, wave, etc).

Intended to

Students from 8 to 18 years old and their teachers (1 primary school, 1 secondary school, 1 high school)

Deployed as

The course is structured into three modules that take place in different physical locations: each student uses a personal digital assistant (iPAQs) and a special laptop (TabletPC)

Held by

Teachers of each schools, experts in didactics and outreach of Astronomy and astronomers

First module

TYPE: Series of lectures

CONTENTS: Observation of sun and moon characteristics

WHERE: In classroom/laboratory context and at home

LENTGH: about four months (7th january – 18th April 2005)

Activities of the first module

- Taking notes with PDAs about sun (in the morning at school) and moon (in the evening at home)
- Elaboration of observations in classroom with TabletPCs and iPAQs
- Each student partecipates in individual and group based activities sharing her/his work with others;
- Strict relationship with the teacher that gives materials in different format, assists students in their work and monitors the knowledge through test on-line

Second module

TYPE: Series of activities

CONTENTS: A day with Mars (knowing its characterists through the studies of this body in the past and nowadays)

WHERE: In an astrophysical reasearch institute context (specifically the Astronomical Observatory of Padova)

LENTGH: one day

Activities of the second module

Divided into morning and afternoon activities

- Morning: work with iPAQs to make calculation about mars distance, explore content in the web and take notes about activities (use of several physical locations: different rooms and outside)
- Afternoon: use of iPAQs and tabletPCs to work in collaboration for make a presentation about an argument related to the past activities and all the knowledge acquired through the first module
- Possibility to interact directly with astronomers.

Morning activities

Knowledge of Mars in the past

Calculate Mars distance

Interviews with astronomers

Afternoon activities

Write about an argument

Presentations of the work to others

Third module

TYPE: Summary lessons

CONTENTS: How to classify every celestial object

WHERE: In classroom

LENTGH: about one month (29th April – 10th June 2005)

Activities of the third module

- Discussion of the experience in the research institute (for example with picture made by pupils)
- Final review of the acquired knowledge
- Final verification tests

Technologies & issues involved

The practical realization of the course modules has required a focus on two main aspects:

- Technological solution adopted
- Content delivery aspect for the provided materials

- design and implementation of different wireless local area networks (WLAN) to be deployed in different physical locations (in classroom, at home, in several rooms of the astrophysical institute, etc.) where activities took place.

- content should be as much as possibile device-independent even if information is presented using different formats (text, formatted documents as doc or pdf, video, animation, etc)

Wireless Technological solutions

A mobile learning systems needs an appropriate wireless infrastructure since mobile handheld devices trasmit information through the radio waves: every WLAN could be connected to the internet by the means of a wired line.

iPAQs and TabletPCs implement network functionalities (through a Microsoft Windows operating system i.e respectively Windows PocketPC and Windows XP) to support:

- Infrared
- Blueetooth
- Wireless 802.11b (es. Wi-Fi)

Example of WLAN deployed in different contexts

CLASSROOM/LABORATORY CONTEXT

Solution: Use of Wi-FI technology to deploy a local WLAN (no internet connection possible)

- Students' iPAQs and TabletPCs form a client-server system with the teacher's TabletPC (equipped with a web server) that provides also file server, print server and digital proiector services.

WLAN at home

AT HOME CONTEXT

Solution: Use of Infrared or Bluetooth tecnology to exchange materials between the two devices.

- Student transfers files to his/her tablet for elaboration (limited software in iPAQs)

WLAN connected to Internet

IN THE RESEARCH INSTITUTE CONTEXT

Solution: Use of Wi-Fi to deploy a WLAN integrated with the institute wireless LAN (same SSID)

Principal characteristics

- Use of all HP access point to extend wireless range in all the rooms;
- use of institute web services (web and ftp server, etc) to provide web pages, file services and so on.
- Wireless LAN connected to wired infrastructure and by the network of italian research and university institution (GARR) to internet

Content delivery solution

- Digitized contents in several formats (text, animation, slides, web pages, presentation, on-line quizzes and so on) to be provided both in classroom context and outside (for example at home);

- All actors should be able to read and write contents of all the types

In this first experience we don't choose any particular learning system (due to lack of internet connectivity in school and home context)

SOLUTION: Content developed privileging open-source software (i.e document written with Open Office suite and transformed by the same program in pdf)

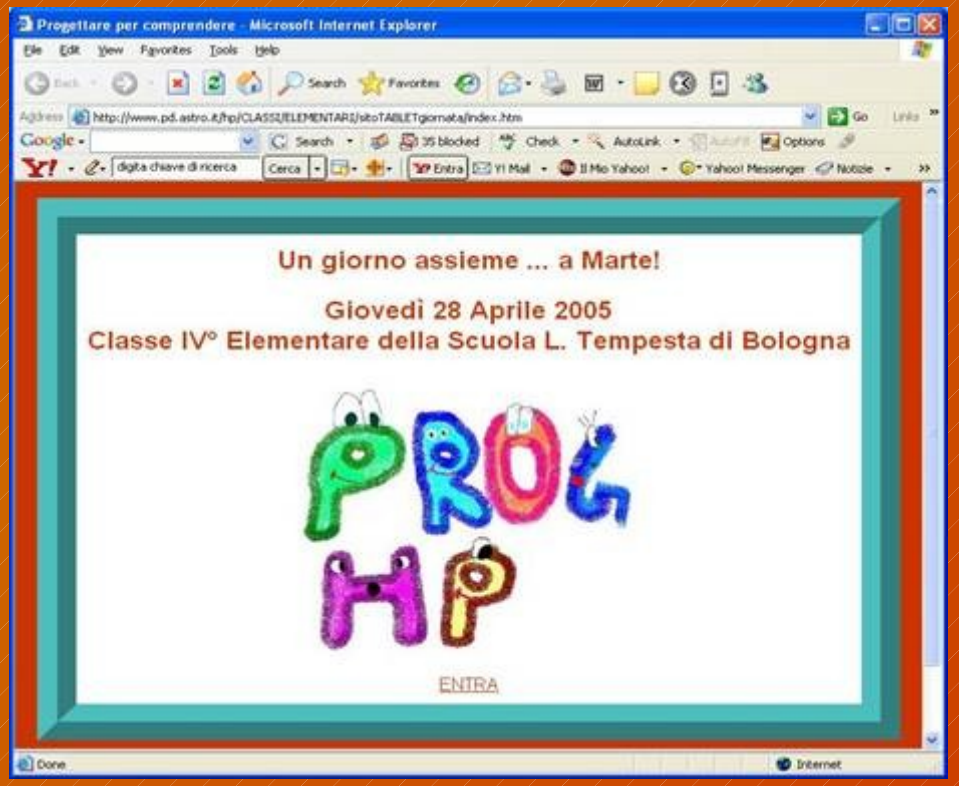
Examples of content

- Animation made in Flash (but visible in iPAQs only through a web page)
- Presentation as PowerPoint
- Lectures as doc, pdf, and text files

A web site for some activities (i.e in the reaserch institute) where pages could be realized by use of Cascade Style Sheet (CSS) and viewed with iPAQs and Tablets.

How web site is seen from the two devices

iPAQ "version"



Tablet "version"

Issues

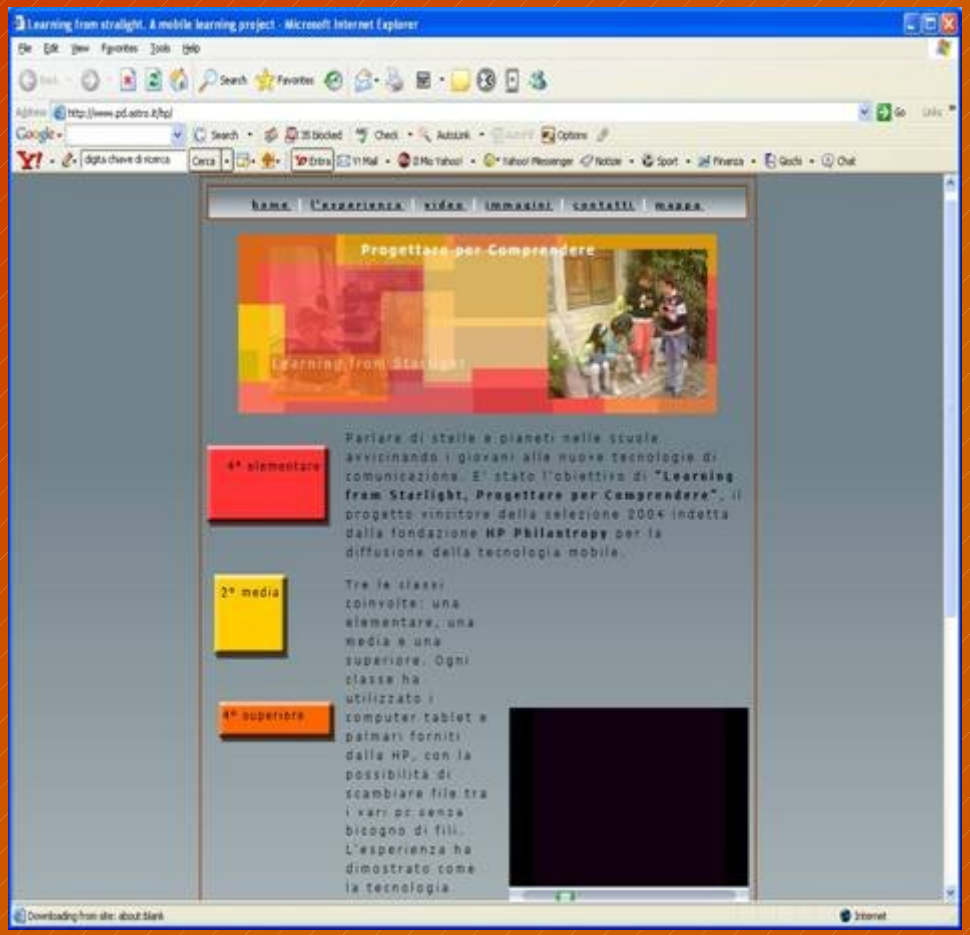
Initial problem with the little knowledge of computers especially in the first phase of the project, then students were happy to use these tools for learning

Efficacy of wireless network environment	→	**Some problems only in the classroom context (limited band)**
Content delivered	→	**Specific content developed for palm devices**
Handheld devices	→	**-Limited software and technical problems in exchancing files between iPAQs and tablets**

Lesson learned

- Students was excited to use these computers for doing their lessons and they also continued the learning process outside (at home for example): this encourauges the use of wireless technologies and handheld devices in education
- Course material used with palms and tablets indifferently allow to exploit such devices;
- Wireless networks based on Wi-Fi standards are a good solution for implementing an infrastructure for mobile learning;
- Problems could arise in the maximum limited band on simultaneous exchange of files;
- Great effort in providing device-independent content since the lack of software (i.e two different pdf for the two devices)
- Specific user interface should be deployed to exploit all iPAQ functionalities since content deployed for this devices could be useful also for other handheld communication devices (i.e mobile phones)

In the end



Website of the project

http://www.pd.astro.it/hp

A short video

IntroWeb_small.wmv

THANKS!!