Mobile Learning Beyond Tablets and Smartphones: How Mobile and Networked Devices Enable New Mobile Learning Scenarios

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Abstract

There is a growing set of mobile and networked devices, which can be used to design, develop, and implement mobile learning scenarios in schools, enterprises, and public institutions such a museums and libraries. Networked objects with iBeacon, radio-frequency identification (RFID), Bluetooth, and other technologies are located in buildings and communicate with users who approach them. This chapter will give an introduction to this new possibility to create mobile and networked learning scenarios and present a range of examples from schools, enterprises, and public institutions. The chapter is a first glimpse into new applications and possibilities of mobile learning based on an extended understanding, which goes beyond tablets and smartphones. Some ideas are still sketches and

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basic descriptions. The goal is to encourage one's own experience and to explore new ways of teaching and learning with mobile technologies.

Introduction

Mobile learning will expand to other devices, which become part of the daily life. Tablets and smartphones will remain key devices for mobile learning, since they have a display to present information, connectivity to networks, computing power to execute calculations, games and other tasks, and a broad variety of sensors to gather contextual information. However, part of these functions will drift to other devices such as watches, bracelets, clothes, and glasses or become components of buildings, cars, public institutions, stores, etc. Mobile learning will be a commodity the more the Internet of Things becomes a reality. This is good news for educators in public schools and trainers in small or large enterprises. They can design learning scenarios, which are situated in the learning and working context of their pupils and employees. Learning takes part outside of formal settings and becomes an experience with light bulb moments.

Five Decades of Learning Technologies

For the last 40 years, different types of personal computer technology have been developed and evolved which could be used not only for working or leisure time but always also for learning purposes. Over five decades, computers became always smaller, more connected, and more mobile (Campbell-Kelly et al. 2013; Ceruzzi 2012). They moved from the computing center to the palm, which is not just the basis for mobile computing but also for mobile learning.

In order to understand the past development and predict and anticipate the future development, the five decades are briefly described and summed up with a short conclusion regarding the relevance for mobile learning (for more details, see (Crompton 2013)).

First Decade: 1975

When the first personal computer was invented in the mid-1970s, the usage was focused on the built-in features and functions of the machine; it was a stand-alone – almost immobile – engine. It has been used mainly for programming, hardware bricolage, gaming, and certain low-level office tasks (Fig. 1).

Fig. 1 First decade: personal computers, e.g., Commodore 64. (Source: Flickr, Author: Blake Patterson, URL http://bit.ly/dss_mobilelearning_fig1, Retrieve data Nov. 11, 2014, Copyright: Creative Commons BY)

Significance for Mobile Learning

Actually, computers were isolated machines, at least for people outside the universities. Computers could be used to teach programming techniques and to learn with stand-alone programs and early versions of computer-based training (CBT) on floppy disks and later on compact disk read-only memory (CD-ROM). Media-based learning could not be considered as “mobile.”

Second Decade: 1985

With a standardized connection to the Internet in the mid-1980s, computers became a “window” into a huge world of information and communication, but this possibility was still limited to a small group of people, who knew how to use acoustic couplers, mailbox systems, use groups or Internet Relay Chat (IRC), etc. (Fig. 2).

Before the continuous connection to the Internet, the users were mainly satisfied with the local functions of their desktop computers. Now, the focus moved slightly away from the machine to the net, and computers became “access points” to the connected world.

Significance for Mobile Learning

With the first laptop computers, it was possible to change location. In reality, this happened not really a lot since the first laptop computers weighed still a couple of kilos or pounds and were not very “mobile friendly.”

Third Decade: 1995

With the built-in connection to the Internet and the invention of the Hypertext Transfer Protocol (HTTP) and the World Wide Web (www) after 1995, the next

Fig. 2 Second decade: personal computers, e.g., IBM PC. (Source: Flickr, Author MarcinWichary, URL http://bit.ly/dss_mobilelearning_fig2, Retrieve data Nov. 11, 2014, Copyright: Creative Commons BY)

Fig. 3 Third decade: connected computers, e.g., iMac. (Source: Flickr, Author Carl Berkeley, URL http://bit.ly/dss_mobilelearning_fig3, Retrieve data Nov. 11, 2014, Copyright: Creative Commons BY-ND)

big leap occurred. Now, the access to website, online games, and communication with others was in the focus. All of a sudden, thousands of web servers with interesting content were reachable (Fig. 3).

Significance for Mobile Learning

In the 1990s, mobile computers and first tablets were available (such as the Apple Newton, which was never a real success). It was possible to gain first experiences since computers left the desktop and could be carried around. Additionally, the first mobile telephones and the Wireless Application Protocol (WAP) interface allowed limited access to the Internet from a personal mobile device. Mobile learning became an important topic as a research topic in universities and as a new opportunity for corporate training programs in enterprises and public institutions.

Fig. 4 Fourth decade: mobile computers, e.g., iPhone. (Source: Flickr, Author William Hook, URL http://bit.ly/dss_mobilelearning_fig4, Retrieve data Nov. 11, 2014, Copyright: Creative Commons BY-SA)

Fourth Decade: 2005

The fourth decade was mainly characterized by two evolutions (Fig. 4):

First, with the Web 2.0, the behavior, how the Internet is being used, changed again. Now, self-presentation, exchanging personal information, building relations, watching movies, shopping online, etc. became the main reason to start a computer. A disconnected computer from the Internet was almost worthless. It could not serve its main purpose anymore to be the entry point into the "digital world." Actually, not the computer was important anymore, but the access to a connected information space.

Second, the invention of smartphones with touch screens in the mid-2005s made almost the same processing power as a desktop computer available in a mobile device. The window to the connected information space became smaller and could be carried around. Access to everything from everywhere at anytime became a reality – as long as there was a paid connection with a network provider and a charged storage battery available.

Significance for Mobile Learning

The fourth decade is the birth of mobile learning in the pure meaning of the word. With smartphones and touch screens and a broad range of apps, learning became mobile and available for almost everybody. In addition, the understanding of learning expanded from "formal learning" (e.g., in a classroom or a seminar room) to "informal learning," which happens on the road, at the workplace, or even in the personal spare time – with no syllabus, lecturer, or teachers. In that sense, mobile devices expanded our understanding how learning occurs, as a small percentage of formal learning and a large percentage of informal learning, triggered by the needs, the interest, and the curiosity of the learners: With smartphones, it is possible for the first time to answer almost any questions just right away. Especially for rural regions, this is a very important source for education and teaching (UNESCO 2014).

Fig. 5 Fifth decade: wearable computers, e.g., Google Glasses. (Source: Flickr, Author Ted Eytan, URL http://bit.ly/dss_mobilelearning_fig5, Retrieve data Nov. 11, 2014, Copyright: Creative Commons BY-SA)

Fifth Decade: 2015 and Beyond

After computers left our desktops, they will also leave our palms in the fifth decade (Fig. 5). The Internet becomes part of everyday objects and is being integrated into daily commodities. Our mobile devices can communicate with the "Internet of Things" (Madisetti and Bahga 2014), and new displays such as watches, glasses, and lenses are currently being invented. A lot of "things" are collecting or transmitting data without any or just reduced displays such as "wearables" (computers, which are integrated into bracelets, necklace, and rings or which are parts of clothes and shoes). This personalized data gives us information about a lot of parameters about our daily routine: Where have I been? How many calories did I burn? When did my heart rate go up? How was my sleep?

Significance for Mobile Learning

With the "Internet of Things," not only computing but also learning becomes ubiquitous. Mobile learning allows situating learning into the daily life of a person. With new displays in glasses, lenses, and watches and with a broad range of devices that collect and deliver information, new learning scenarios are possible. Some of them will be described in the following chapters.

As an overview, the five decades of computer development and learning are depicted in Fig. 6.

Learning Beyond Tablets and Smartphones

Although mobile learning is still in its infancy and in many schools and enterprises not yet developed, it is already possible to piloting the next generation of mobile learning scenarios, which deal with smart objects (e.g., indoor positioning systems, wearable, or activity trackers).

However, this does not mean that mobile learning takes place without smartphones and tablets, since a display and processing and communication power are still needed. But mobile learning, which is integrated into the daily life and

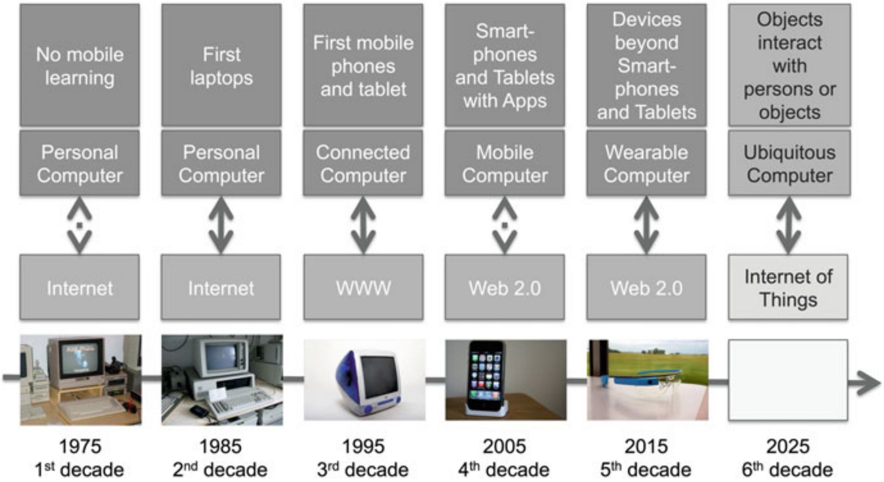

Fig. 6 Five decades of computer technology: from immobile to mobile to ubiquitous. (Source: Author Daniel Stoller-Schai)

smartphones or tablets that interact with additional external devices, generates the possibility to create situated learning situations (Lave and Wenger 1991) or "situated mobile learning" (Pfeiffer et al. 2009).

To create new situated mobile learning scenarios, a two-folded approach is needed.

The Device

First, it is crucial to know the range of available and future devices that can interact with a smartphone or a tablet. Based on this knowledge, teachers, trainers, and learning professionals have to gain their own personal experiences, before they can design situated mobile learning scenarios.

The Setting

Second, a pedagogical attitude is needed to generate a curiosity in learning processes and asking new questions about the personal world of the learner. If a learner has no questions to ask, all the connected learning scenarios are useless, because there is nobody to be interested in the answers. Learning professionals and education designers have the duty to design a setting, which creates new questions and offers the setup to answer them. Connected mobile device offers a broad toolbox of opportunities to cover both aspects.

The Device

The situated setting of mobile learning technology beyond smartphones and tablets has to be divided into four components (Fig. 7):

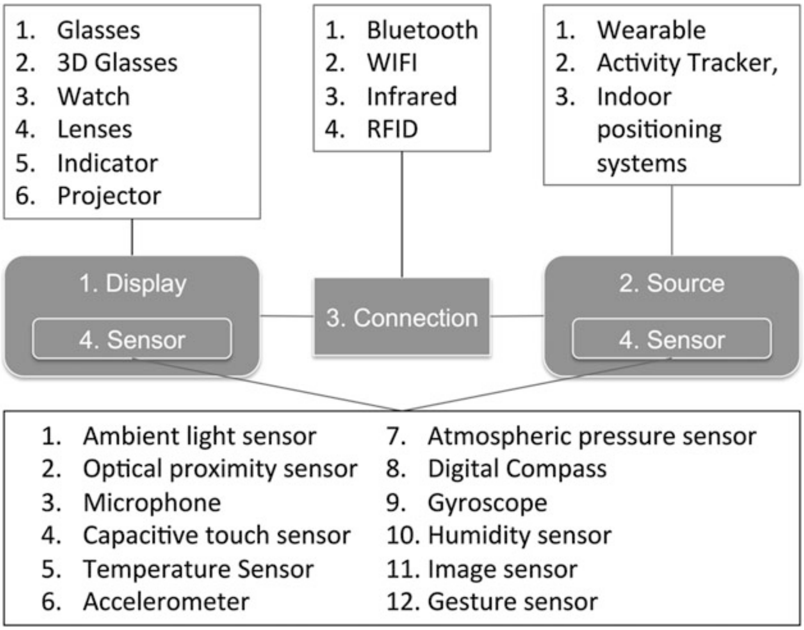

Fig. 7 The device: four components to build the technological ecosystem. (Source: Author Daniel Stoller-Schai)

The first component is the **display**. Normally, the built-in displays of smartphones or tablets are used to read, to hear, or to watch any kind of information. Actually, there are many more displays available, which are built-in in other devices.

The second component is the external **source**. In addition to web servers, which remain one of the main sources of information, it could be an activity tracker, indoor positioning system, etc.

The third component is the **communication** connection between the source and the display. If the source is inside the device, the connection is hardwired. If the source is outside the device, the connection must be wireless.

The fourth and last component is the **sensor**. Sensors are very important for mobile devices and an important factor for their commercial success. Sensors can be part of the device (e.g., a smartphone) or part of an external source (e.g., the wind sensor of a Wireless Fidelity (Wi-Fi)-enabled weather station).

Display

First, in addition to the standard touch screen displays of smartphones and tablets, there is a broad range of new displays available (Table 1).

Source

Second, the information to feed the devices comes from a variety of sources, which are on or around a person (Table 2).

Table 1 Range of new displays

Display	Definition	Purpose	Examples
1. Glasses	Special glasses with an optical head-mounted display (OHMD). It can display information in a smartphone-like format	Display information to execute tasks directly to the retina. The main benefit that glasses allow is a hand-free handling, which allows using hands for other tasks	Google Glasses DigiLens VuzixWrap iOptik (Innovega)
2. 3D glasses	Open or closed glasses with a display to produce 3D images	Virtual reality headset for 3D gaming or exploring 3D architecture models. Together with data gloves, it is possible to manipulate objects in the 3D world	Oculus Rift ARCHOS VR Glasses Samsung Gear VR Durovis Dive Zeiss Cinemizer Epson Moverio
3. Lenses	Contact lens with built-in light-emitting diode (LED) arrays	Display information to execute tasks directly on the retina. With LED array lenses, the computing power which is available for the user becomes invisible to another person	*There are several research projects in progress* (Parviz 2009)*, but no commercial product is yet on the market*
4. Watches	A small display integrated into a watch to communicate with other mobile devices	Reduction of the display and its integration into a watch free up again both hands for other tasks	Apple iWatch Motorola's Moto 360 Samsung Gear Live LG G Watch Pebble Steel
5. Indicators	A device, which has no visual display but sends signal by vibrations or LEDs	Collect personal activity data, e.g., heart rate, blood pressure, etc., and inform wearer about past, current, or anticipated status	Withings Pulse Fitbit Flex Garmin vivofit Basis Carbon Steel Misfit Shine
6. Projector	A device, which projects the display on a surface, e.g., the arm bed	Displays personal activity data, e.g., heart rate, blood pressure, etc., directly on any surface	Cicret Bracelet

Note: The examples in the fourth column for this and the following subchapters are based on the market situation at the end of 2014 and can change quite rapidly. The purpose to mention concrete products is to give the reader of the chapter the opportunity to continue their own research

Connection

Third, there are different technologies and communication protocols to connect an external source with a mobile device. The most important ones are presented in Table 3.

Table 2 Different sources to acquire information

Source	Definition	Examples
1. Wearable	"Wearable technology (. . .) are clothing and accessories incorporating computer and advanced electronic technologies." (Wikipedia 2014d)	Motion Recognition Clothing/Medibotics Hexoskin
2. Activity tracker	"A device or application for monitoring and tracking fitness-related metrics such as distance walked or run, calorie consumption, and in some cases heartbeat." (Wikipedia 2014a)	See activity trackers above
3. Indoor positioning system	"An indoor positioning system (IPS) is a solution to locate objects or people inside a building using radio waves, magnetic fields, acoustic signals, or other sensory information collected by mobile devices." (Wikipedia 2014b)	iBeacon, Apple IndoorAtlas sensewhere Other applications (Mautz 2012)

Table 3 Connection technologies and protocols

Technology	Purpose
1. Bluetooth	Used to connect mobile devices with audio components and television and to set up indoor positioning systems
2. Wi-Fi	Basic technology to gain access to the Internet
3. Infrared	Basic technology for remote controls
4. RFID	"Radio-frequency identification (RFID) is the wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags contain electronically stored information." (Wikipedia 2014c)

Sensor

Finally, with each generation of new smartphones or tablets, the range of available sensors is being expanded. For special purposes, more accuracy or flexibility, a lot of specialized sensors are made as stand-alone products (Table 4).

The Setting

Pedagogical Starting Point

Before discussing different learning scenarios, it is important to mention that the new learning possibilities are related to the fact whether teachers or trainers as well as pupils or corporate learners are interested about their environment and are able to formulate learning-related questions.

If there are no creative, reflective, and critical questions, all new mobile learning channels are useless (The Critical Thinking Community 2014). Therefore, it is important as teachers or trainers to arouse first the interest of pupils and corporate learners toward their specific world. If there is an interest, learning becomes an ongoing activity, and mobile devices and other objects are powerful tools to design effective learning scenarios, which answer those questions.

Table 4 Overview of sensors

Sensor	Purpose
1. Ambient light	Measures the intensity of light in the environment
2. Optical proximity	Measures the distance between an object and the device
3. Microphone	Records sound from an external source
4. Capacitive touch	Notices pressure on a touch-sensitive surface
5. Temperature	Measures the temperature of any material
6. Accelerometer	Measures the movement of an object
7. Atmospheric pressure	Measures the atmospheric pressure for weather forecasts
8. Digital compass	Indicates the direction of the four cardinal points
9. Gyroscope	Measures the position of the device in a 3D space
10. Humidity	Measures the humidity of any material
11. Image	Captures images or movies from a camera
12. Gesture	Visually detects gestures to trigger an action

A mobile device can become a tool to proof our personal scientific hypotheses about our world. With multisensored and connected mobile devices, it is possible to design an experienced-based education as intended by the German physicist and pedagogue Martin Wagenschein.

His goal was to reconnect science teaching with both the developing child and nature. He saw the detrimental effects of theory-based instruction and rote learning that informs so much of science education today. He developed an experience-based approach to science education. For him science classes should be first and foremost an exploration of concrete phenomena – students thereby learn science as a process of inquiry rather than as a body of set facts and theories (The Nature Institute 2014; Wagenschein 2013; Udell 2013).

The setting consists of six steps (Fig. 8):

1. Question: Starting point for a situated mobile learning scenario.
2. Setup: Design of the pedagogical experiment to answer the questions.
3. Experiment: Execution of different actions to go through the defined steps of the pedagogical experiment.
4. Reflection: Personal reflection of the results and observations.
5. Discussion: Social learning activity by discussing and arguing the results with peers or teachers and trainers.
6. Report: Formulate the answer to the question in the first steps. Archive learning results and transfer solution into the daily practice.

In the following chapter, this setting or part of the setting is being applied to basic and advanced teaching scenarios for pupils and employees (Table 5).

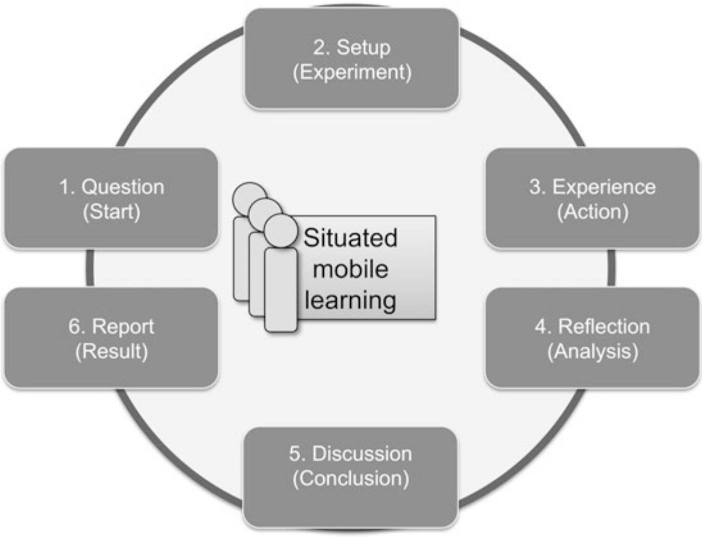

Fig. 8 The setting: six steps for situated mobile learning. (Source: Author Daniel Stoller-Schai)

Table 5 Overview of teaching and learning scenarios

Pupils	Employees
Basic teaching scenarios for pupils in schools	Basic learning scenarios for employees in enterprises
Advanced teaching scenarios for pupils in schools	Advanced learning scenarios for employees in enterprises

Basic Teaching Scenarios for Pupils in Schools

After discussing and introducing the different components of a situated mobile learning scenario, a couple of concrete examples will be presented to demonstrate how these possibilities can expand learning scenarios in a classroom (Table 6).

Basic Learning Scenarios for Employees in Enterprises

Another couple of examples describe different basic (informal) learning scenarios for employees in enterprises (Table 7).

Advanced Teaching Scenarios for Pupils in Schools

In addition to the basic scenarios, there are more advanced teaching scenarios for pupils in schools (Table 8).

Network, Example 1: A Quest Through an Old "Château"

With an indoor positioning system such as iBeacon and with a platform provider who delivers the appropriate development package (application programming

Table 6 Basic teaching scenarios for pupils in schools

Learning question	Setup	Experience
How cold is water when it turns to ice?	Temperature measurement with smartphone and thermometer (e.g., Kinsa, Thermodo, etc.)	Cool down water in a bucket and continuously measure the temperature until ice building starts
How loud is my music speaker? When does the music volume become unhealthy?	Loudness measurement with internal or external microphone and decibel app (e.g., apps like dB Volume Meter, TooLoud?, DeCibel, etc.)	Let one group play their favorite music on their preferred volume level. Let another group measure the decibel and compare it with references for ear protecting
How far is it from my home to school? What is actually the shortest way?	Distance measurement with GPS/maps and activity tracker app (e.g., apps like Moves, Argus, Endomondo Sports Tracker, FitBit, etc.)	Start with estimating certain distances and suggestions for shortest way. Proof these hypotheses by walking the defined route
How fast does a flower open its blossom?	Camera: take pictures every 30 s (or less, or more) with a stop motion app (e.g., StopMotion Recorder, Stop Animator, Frameographer–Stop Motion & Time-Lapse, iMotion HD, etc.)	Put a camera on a tripod and activate the app to take pictures with a predefined frequency
How do I jump over a hurdle?	Camera: take pictures with a slow motion app (e.g., Coach's Eye, PotPlayer full HD media player, Slow Motion PRO, Slow Motion Video, etc.) and analyze it	Put a camera on a tripod and activate the app to take a movie. Analyze and compare style, accuracy, etc. of different people

Note: The example will start with the question; describe briefly the setup and end up with a sketch of the experience. Other steps like reflection, discussion, and reporting cannot be described, since they are part of a concrete learning process. The examples are just starting points to trigger own teaching scenarios

Again, product examples reflect the market situation at the end of 2014 and can change quite rapidly. The purpose to mention concrete products is to give the reader of the chapter the opportunity to continue their own research

Note: A couple of the described scenarios require special equipment or a special environment. Both may not be available for a specific school class. In this case, it is often enough just to use the built-in technologies and sensor of a standard mobile device

interface, API; software development kit, SDK; content development network, CDN; web panel and admin. app, e.g., from Kontakt.io), it is possible to build your own quest through a museum, a shopping mall, or a school building.

The following example shows part of a quest through an old "Château" – the "Schloss Birlinghoven" in Sankt Augustin, Germany – which is the headquarter of the "Fraunhofer Institute for Applied Information Technology FIT" (FIT 2014). The quest was part of a conference to demonstrate current and future mobile technologies, which took place in October 2014 (Fig. 9).

Table 7 Basic learning scenarios for employees in enterprises

Question	Setup	Experience
How can I stay in contact with my colleagues/ customers?	Solution approach: see who is currently in your neighborhood with an app, e.g., Swarm by Foursquare	Especially in projects where all the members of a team are dispersed geographically, a visual map of all the locations can help to solve ad hoc problems and foster informal learning
Who knows what and who can help me to solve a problem?	Solution approach: Intelligent networks which connect people, competences, and location, e.g., Starmind. "Starmind matches your questions with real solutions from direct human input. Give your team access to know-how that is stored inside a corporate brain. Always up-to-date, always in real time." (Starmind International AG 2015)	The learning organization as described by Peter Senge (1990) is based on human interactions and networks. To access this "corporate brain" is now possible with technology and apps, which are integrated in personal smartphones and tablets

Table 8 Advanced teaching scenarios for pupils in schools

Network	Equipment	Body	Perception
Example 1 A quest through an old "Château"	Example 2 A personal weather station	Example 3 Body measurement	Example 4 Augmented reality

As users walk through the rooms of the "Château," they see on a map their position and get information about the rooms and the objects on their tablet. It is even possible to place an iBeacon on a specific person. If a user is in the neighborhood of the equipped person, the appropriate information is displayed again on the tablet. Since the application can be expanded, it is possible to add own comments and photos and share them with a community. In a collaborative action, a dense net of information about the "Château" can be weaved together.

Equipment, Example 2: A Personal Weather Station

A second advanced example covers the analysis of weather data and challenges the weather forecast on television.

With a weather station, a weather app, and the transfer of weather data to a social community (Fig. 10), it is possible to create a weather observatory to answer questions as the following:

What is the saturation of O_2 and CO_2 in our classroom (when the windows are closed or opened)?
How fast is the wind currently blowing?
How much did it rain since yesterday?

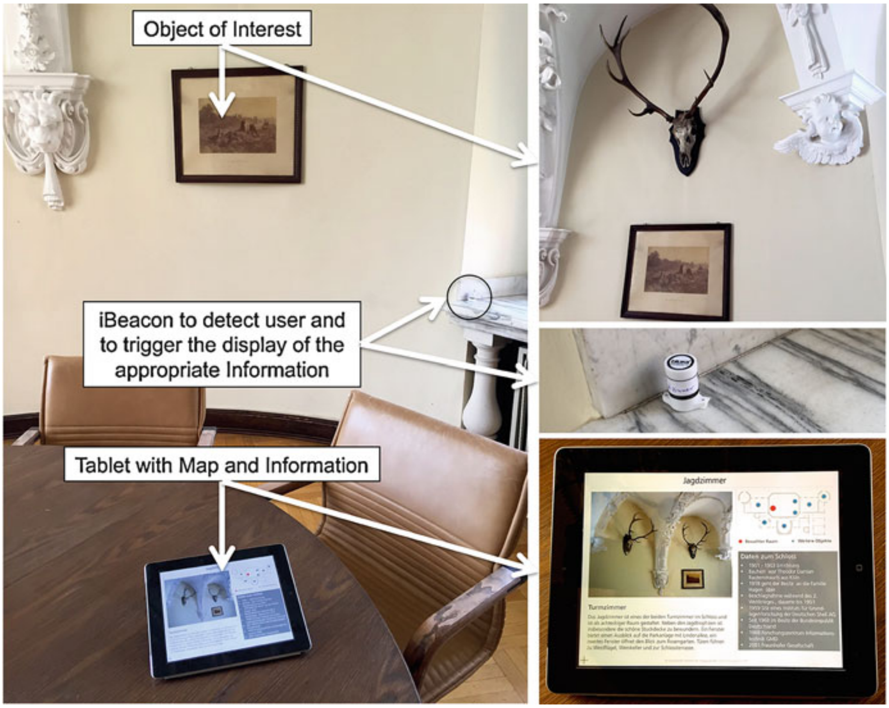

Fig. 9 Example of a quest on an iBeacon platform. (Source: Author Daniel Stoller-Schai)

The collected weather data can be shared on a community platform. As in the example before, these data are again a contribution to a dense net of information about the weather situation in the region or in other parts of the world.

Body, Example 3: Body Measurement

A similar example can be built up with activity trackers, apps, and webpages to answer these questions:

How does my heart rate go up when I step up a stair?
How many calories do I burn if I walk on a hill?
How do I collect personal data (big data awareness) with activity trackers?

Perception, Example 4: Augmented Reality (AR)

In case that a class can afford the purchase of 3D glasses for 3D visualization and tackles the challenge of programming a 3D environment, it is possible to explore historical facts about a building or a city with a head-mounted display or an AR Browser.

Advanced Learning Scenarios for Employees in Enterprises

There are some advanced learning scenarios for employees in enterprises (Table 9).

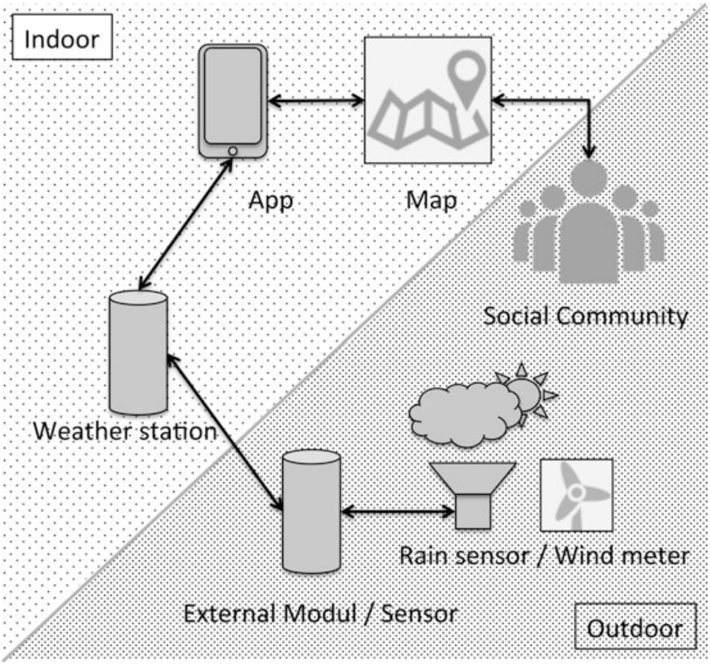

Fig. 10 Example of a weather observatory based on a weather station platform. (Source: Author Daniel Stoller-Schai)

Table 9 Advanced learning scenarios for employees in enterprises

Network	Equipment
Example 5 Onboarding learning path with iBeacon	Example 6 Onboarding learning path with action camera

Network, Example 5: Onboarding Learning Path with iBeacon

Newly hired employees get a tablet and explore on their own the main building and the campus of their new enterprise. Similar to the example above ("Network, Example 1: A Quest Through an Old 'Château'"), there are a series of iBeacons dispersed in rooms, on persons, and in the environment of the main building which trigger information and tasks on the tablets of the employee. With this approach, the employee follows a journey (learning path) and gathers personal information about people, processes, and products.

Equipment, Example 6: Onboarding Learning Path with Action Camera

Another way for new employees to explore their enterprise, the people, processes, and products is to film the personal way of the first 1 or 2 weeks. For this purpose, an action camera (e.g., GoPro Camera) is attached to the clothes or the back bag of the employee, and he/she decides when to start/stop the camera. This source material is the basis for a personal onboarding diary. Multimedia producer has to give assistance on how to cut, to assemble, and to finish such a movie.

Tips and Tricks How to Start

In order to start situated mobile learning scenarios, it could help to follow the suggested steps:

1. **Personal curiosity**: If a teacher or a trainer does not ask questions, the pupils or employees won't. Teacher and trainers should train themselves how to ask questions about the world.
2. **Particular experience**: It starts with personal experience such as the following:
   To download a couple of interesting apps
   To buy some activity trackers or other devices and test them in the daily life
   To start equip a home, a school, or a building with an indoor positioning system and play around with the new possibilities
3. **Collaboration with others**: Teachers or trainers should collaborate with institutes and students from their neighbor university to set up more advanced mobile learning scenarios, which require programming effort, webpages, or even the integration of a content development network (CDN) partner.
4. **Available devices**: It is not necessary to wait until special devices or the subscription of an expensive service is affordable. The built-in sensors and functions of a smartphone or a tablet are already a good starting point.
5. **Best practice sharing**: As soon as some personal experiences are gathered, these personal insights and related questions should be shared with a community. A lot of trainers, teachers, and researchers have the same questions and problems. A person, who starts to share, will often get back a multiple.

Future Directions

The sixth decade will bring a lot of smart objects, which can communicate with a person who triggers the communication or autonomously with other objects.

Mobile learning is and will become the main manner on how we learn with media. Every media-based learning scenario has to start with a "mobile-first" approach. Typical eLearning scenarios such as learning with a web-based training, which is stored on a learning management system (LMS) and proofs your knowledge by conducting an eTest, will slowly fade out. Media-based learning must be situated in our daily life.

Since the "Internet of Things" is a growing topic, which affects every part of our life, it is obvious that situated mobile learning scenarios will be an integrated part of teaching and learning in school or training in enterprises. Computers will leave not only our desktop, but also our palms and will be part of other equipment such as glasses, clothes, and watches. The next future steps are to integrate devices into our bodies. The LED array lenses are just first steps. Authors like Bruce Sterling (1986) and William Gibson (1986) have foreseen this development since a long time.

As William Gibson once pointed out, "The future is already here – it is just unevenly distributed" (Wikiquote 2014).

Cross-References

▶ Advanced Image Retrieval Technology in Future Mobile Teaching and Learning
▶ Apps in the Field: Prototyping HyperSite for Describing Work Practices in Workplaces
▶ Augmented Reality and 3D Technologies: Mapping Case Studies in Education
▶ Exploring the Virtual Learning Experience
▶ Learning to Teach with Mobile Technologies: Pedagogical Implications In and Outside the Classroom
▶ Mobile Learning via Voice and SMS for Learner Access and Teacher Empowerment in Primary and Secondary Education
▶ SMS Enriched Student Support: Transforming the Culture of Learning at University of the South Pacific

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