

Requirements Documentation

JULY 18, 2012



THE HUMAN LEARNING PROJECT
RESEARCH, DESIGN, DEVELOPMENT, AND DELIVERY



“The goal of the project is to create an Open-source Software code base for a solution that will allow development, implementation and delivery of device, content and network agnostic social m- and e-learning services.”

Pekka Toiminen - pekka.toiminen@aalto.fi
Joonas Ruuskanen - joonas.ruuskanen@aalto.fi
Juha Rantanen - juha.rantanen@aalto.fi

<http://m4ed.com>

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Abstract

This document relates to the development of an open sourced and free mobile accessible microlearning platform and service. The project is called *Human Learning Project* and is led by the Aalto University's Department of Media Technology. The platform is entitled as "m4ed", which is shorthand for *Mobiles For Education*. The source code and relevant documentation is hosted on github @ <http://m4ed.github.com/m4ed> and <https://github.com/m4ed>. The community version of the service is hosted at subdomains of m4ed.com as well as development versions of the platform.

The requirements are not being strictly categorized and labeled in this documentation. The rationale is that this documentation serves as a collection of knowledge gathered from several different sources, and its intention is to provide fertile threads of thought for the actual implementation of the m4ed platform.



Development team

Mr. Pekka Toiminen - Development Lead / Architect / Developer, All-around

Mr. Joonas Ruuskanen - Architect / Developer, Main responsibilities: Server-side

Mr. Juha Rantanen - Architect / Developer, Main responsibilities: User Interfaces and Client-side

You can contact the development team via email: firstname.lastname@aalto.fi.

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License (MIT)

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Strategy

Mission Statement

“To create an open sourced and free, mobile accessible microlearning service and platform, to improve through education the overall quality of life of communities using mobile Internet and mobile devices as a personal learning tool and covering all three learning categories (informal, formal and nonformal).”

Vision

We aim to develop the world’s best mobile based microlearning service and platform, and have active open source developer community supporting its further developments. “Best” being measured by the amount of active users, the actual impact in communities where it is in use, by the amount of content created for it, and by the amount of potential users worldwide. The implemented services should improve the quality of life of the end users and also to enable profitable business around the concepts of microlearning and mobile learning.

Values

Learning as an act of acquiring new information that improves person’s life should be available to all regardless of their social, economical and cultural context. That can be enabled using technological inventions and innovations that harness the mobile and mobile Internet technologies that are widespread across the globe. Our team is committed to utilize the newest and most suited technologies and best practices to achieve this goal.

Requirements as ideas of the system

The following information is provided as a “memory bank” / “stash of ideas” that govern the development process. They’re not listed in any particular order, and there’s no statement about the order or overall implementation of the listed items in the future. It was a conscious decision to have such an unorthodox approach for the requirements of this system as they were gathered from variety of sources and the brainstorming approach seemed like a good option for agile development.

A viewpoint to requirements and requirements engineering

“One thought occurs immediately is that mobile technology and more importantly the way different demographics and cultures adapt and adopt fit changes to rapidly that we can’t afford to freeze the requirement; the development process must have some mechanism for review and revision of requirements

I’m not sure how this would work because I’m conscious of several projects constantly restarting their specification every time new technology was realised. I think however that the social not the technical dimension is more challenging. We’re not very clear about current practices in much detail with much confidence let alone future behaviours.

*So maybe we don’t need methods that are good, just ones that are not too bad, ones that get our systems into society in ways that mean we can quickly make them less bad. The phrase ‘outside-in’ is a good one. Too much edtech has been developed and deployed ‘inside-out’ with the institution defining and developing based on technology and pedagogy. Mobile has got to be ‘outside-in’ because it’s not an institutional/company/college technology, it’s a social, personal technology. **I think the challenge is operationalising that rhetoric.**”*

On development work and iterating features

Content storage and content editor are the most important parts and should be done first. The data structure for the content must contain a lot of metadata information as it seems to play a big role in localization, assessment criteria, content categorization, copyright information etc.

- Before creating user stories to development environment, one should first create the basic principles governing those.
- **Chores:** define data structures, logging, debug data etc. >> Guidelines for coding.

Value should be estimated for every stakeholder individually in the equation

Professor	← →	Student
Organization	← →	Student
Value for ^ ?		Value for ^ ?

Same service, what is the MOST important VALUE for each stakeholder?

Content consumption

- Different kinds of Internet-connected handsets and devices (Feature phones, Smartphones, Tablets, Laptops, Desktops)

- Separate client applications (e.g. PhoneGap HTML5 based using REST API)
- Minimum requirement for browser-based consumption: Opera Mini-level JavaScript
- Typical setup for browser-based consumption: HTML5, CSS3, JavaScript & Fallback
- Access methods
 - Touchscreen
 - Keypad
 - Joystick
 - Mouse
- No fixed rigid structure is enforced
 - “content must be presented in a way that allows the student to relate the information to prior experiences, thus deepening the connection with this new knowledge.” - John Dewey
- Pages can link to other pages even when they’re not under same collection and learning space (linking Reddit posts)

Usability

A good source for usability discussions can be found from here: [Usability 101 \(Jakob Nielsen\)](#)

- The system should create value for its users. It should do what users need, and it should provide the features that the users need.
- System should be easy to learn for users. Common things should be easy to do, other things possible.
- The system should enable users to perform tasks quickly. The system should be efficient.
- The users should be able to learn the system’s usage-patterns easily so that they can recall those when they return to the system after a while.
- Users should not be able to make severe errors in the system, they should be able to recover also from the errors they make.
- Using the system should bring satisfaction for the users.
- Views for users are most important. Users are humans, they operate with their senses and brain, everything visual must start from this approach.
- Logic for learning should follow brain rules.
- “Is there a way to make such technology that BOOSTS learning. How simple algebraic addition can be learned / taught. How these representations can fit into single screen (text, visuals, practices, audio)?”
- Technology must stay in the background at all times.

On user interfaces

System will probably have following user interfaces:

- administrative
- learning space management
- content editor
- statistics
- end-user interface

Administrative interface is used to create learning spaces (and to decide what type of content is available for learning space managers), learning space management interface is used to select the service structure and available content, define users that can access the space and specify specific access rights, the content editor is used to create and modify the existing content and end-user interface is used to access the service via mobile devices for learning purposes. The statistics interface provides information about the usage of the learning spaces.

Service structure and visualization

Device recognition? Is it important to recognize automatically the dimensions of the device or do users find it too difficult to specify their screen dimensions and input method by using a simple user interface.

- actual content (deck of cards), then structuring the content (constructing service)
- discussions about the depth of “tree”, too deep tree causes problems in visualizing and compositing the learning space
- reddit-approach > path-based access control. max. 3 levels deep (Pyramid access control)
- templates allow different devices to access same path (dot-notation .compact)
- access control requires yet another UI for service building (groups have access to certain areas under the same learning space. Equals to copyrighted content)
- the structured approach seems not to be the best way to convey the big picture. The social service approach seems to be much more fruitful.
- The system should take advantage of the work of Edward Tufte <http://www.edwardtufte.com/tufte/> in all things that relate to visualizing data and representing information. Thus this applies to practically all elements that are represented for users. Mainly the lesson is often: Less is more.

Media content

- Text in various different formats
- Links
- Tables
- Images
- Video
- Audio
- Interactive components (e.g. Javascript based)
- Animated images decomposed as single-frame interactive players

Logging and statistics

- A single user action in the service creates only 1 line of logging data
- Logged data is stored into such storage that expands over time and can hold gathered data for “infinite” period of time.
- Statistical data can be calculated from logged data in order to do scientific research
- Users can see their own statistics
- Service must be monitorable in such way that at any given point an administrator can tell whether the service is running normally.
- At any point of time the service administrator must be able to tell how much physical resources are in use and how much free resources are available.

Content editing

- Every time when user saves content, the previous version doesn't get overwritten so that there's a backlog of old entries available as well (like wikipedia). > And in logging “user answered A” must have a reference to the correct version of the page in question (so that we can get accurate statistics). resembles also time machine on mac.
- Templates: When new content is created the system should be able to offer templates for content creators to get a faster start into content editing. Sample projects and sample pages.

- The system should separate presentation layer from the content layer.
- The content storage should be accessible by external entities (e.g. third party applications) through API

Gamification

- The system should be able to utilize userdata in order to provide communication channels for real-time services
- Badge-system
- Rankings
- Challenge-exercises for more advanced students on same level
- Ranking the students: "To avoid discouraging students that are on the lowest scores, a legend like: You can still make it, solve more exercises to reach your other companions, or something like could appear. For those in the first, lets say, 5 places, could say: you're the best of your classroom, keep up, you're in second place, etc., without showing any actual scores. Showing scores might be good for encouraging the first places, but my discourage the last places."
- Users should be able to sort content e.g. by difficulty level
- System should be able to "scope" content for different users (e.g. easy exercises for poorer learners)
- Sunk-cost fallacy: Many people have strong misgivings about "wasting" resources (loss aversion). In the above example involving a non-refundable movie ticket, many people, for example, would feel obliged to go to the movie despite not really wanting to, because doing otherwise would be wasting the ticket price; they feel they've passed the [point of no return](#). This is sometimes referred to as the sunk cost [fallacy](#). Economists would label this behavior "irrational": it is inefficient because it misallocates resources by depending on information that is irrelevant to the decision being made. Colloquially, this is known as "throwing good money after bad" [wikipedia]

A viewpoint to gamification

What if students could have their own avatar into the system that would evolve while they do exercises and accomplish certain courses/collections? In the same way as in any RPG. That could bring interesting gamification for the system, and also somehow to concretize to the student that he "owns" these skills and this learning level.

- If one passes a course "supergood" then one could earn points that would open new levels or buy you some tips for exercises etc.
 - **NOTE: In general this conflicts the idea of "free learning" and tip should probably be given for poorer learners.**
- Courses and exercises are parts of game levels that can have badge-style rewarding mechanisms.

Biometrics

As the learning system is for humans, the system could benefit from knowing certain biometrical data of the user and adjust itself accordingly. Below are some examples:

- Sleep duration, wake-up time, sleeping time, sleep bookkeeping
 - To calculate the nap-zone of Circadian rhythm
 - To adjust the content according to user's arousal level
- Weight, height
 - To calculate weight gain in pregnancy
- Age, Gender
 - To adjust exercises accordingly
- Amount of physical exercise (see brain rules)
- Stress level

Content localization and awareness

- Content should be contextually aware
 - Different content for males and females
 - Different content depending on biometric variables
 - Different content depending on cultural context
- It should be possible to internationalize and localize content (i18n)
 - Also images and other data to different biometric / cultural / lingual contexts
- Content should be time-aware
 - Certain content displayed in accordance to e.g. national tests (ENLACE-Mexico)
 - Study guides to appear before exams
 - Content presented depending on time of day / semester / even related to worldwide events (e.g. Wikipedia - current events)
- Content should be copyright aware
- Content should be “payable/purchase/subscription” aware
- Content editing process should have an editing and auditing tool
- Content editing process should encourage people to create content for the mobile consumption (tightly packed, only focusing on essentials)

Export and import

- User information, Learning spaces / content, logfiles, pages (textbook versions of content)
- API Bindings to export and import with google docs
- csv export/import
- json export/import
- xml export/import
- plaintext export/import
- excel, word

Semantic content types

- Exercise
- Simulation
- Questionnaire
- Diagram
- Figure
- Graph
- Index
- Slide
- Table
- Narrative text
- Exam
- Experiment
- Problem statement
- Self Assessment
- Lecture

Exercise types and answering mechanisms

Studies have shown that there's a correlation between number of accesses to a learning resource and improvement in learning. Therefore emphasis should be on repeatable exercises and repetition. (See also brain rules related requirements and short term memory)

- Generated on-the-fly with variables (e.g. mathematics) = dynamically generated
- Repetitive exercises
- Interactive exercises
- Challenge exercises for students who are willing to do more advanced ones
- Solutions / Tips for questions
- Solutions / Tips for incorrect answers
- Automatic answer checking
- Manual answer checking
- text+image+questions, video+questions etc.
- random order in questions vs predefined order
- random / sorted order of pages vs predefined order
- voted answers (like stackoverflow)
- flash cards
- Answer Input methods:
 - click, multiple click interactions
 - uploaded / recorded media (audio, images)
 - written text: single word, multiple word (additional markup, e.g. math)
- Multiple choice questions
 - Select one (single correct answer)
 - Select multiple (correct answer = combination of answers)
- Exams
 - User must perform certain amount of exercises in series in order to pass
- Single typed word as an answer
 - Random word missing in question (fill-in)
 - Many correct answers, enough if answer is one of them
- Text as an answer
 - Typically manual checking for correctness
- Upload image as an answer
 - Typically manual checking for correctness
- Memory game: take two lines of text from a subject (first memory trace) -> retrieval = read and rewrite. Wipe entire text and write it again (next memory trace). Repeat.
- select text, select images as answer

Social features

- User-generated learning content
 - math exercises generated by elementary school students
- Commenting
- Upvotes / downvotes for all content
- Answers exposed to communities (e.g. essay answers as comments to an exercise, upvotes/downvotes, others commenting essays)
- User groups (pre-defined) define access levels also
- real-time chat
- Mobile learning system should support cooperation between learners and give users ways to interact and share with other users and to communicate also about different ways to learn things.
- More advanced aspects and algorithms: Links (<http://www.barabasi.com/index.php>), networks (condor, coolfarming etc.)

Access control

- User groups (pre-defined) define access levels also
- copyrighted content

- timed access / other type of access control (e.g. no access before completed certain things)
- Administering users
- Administering content

Security

- All passwords in the system must be hash+salt following good established practices in information security.
- When creating new users (e.g. a randomized batch / import) the password that is created first is stored into the system in clear text (users are able to change their passwords sure, but in the case where 3rd party creates user accounts and delivers them to the end users in stickers or similar, the system must be able to reset their passwords to the one that is on the sticker as the users might not even have an email)
- The identity of the users must be secured when statistical information is provided to 3rd parties.

On user creation process

Inserting user info:

- Username
- Original password/pin (create in batches too)
- Email address / GSM number (for sending invites: “we’ve created you an account”)
- Other user data, related to agreements
- Ready batch process user agreements (lending phones etc. Lessons from Mexico)
- Stickers for usernames + passwords: [avery stickers](#)
- Reset to user’s original “pin” / password (they have their sticker)
- Allow new passwords to be entered
- Think for other documentation that the system prints out automatically

User management and rights

- Superusers have access to everything in the system and can manage every user account in the system (view, create, modify, delete).
- User creating a learning space becomes the learning space *user manager*.
- Users belonging to the group of a learning space’s *user managers* are able to create new users to the system.
- Users belonging to the group of *learning space user managers* **own** the users they have created to that learning space.
- Users are able to access any learning spaces that they are provided access to (public learning spaces are open to all) but they’re always **owned** by specific learning space user managers.
- Learning spaces have different kind of visibility / access settings. (e.g. public or selected users or invite)
- *Learning space managers* are able to block users from their spaces, but not able to delete users. (for that one needs to be *Learning space user manager*).
- Users who have registered themselves into the system through that particular learning space become **owned** by the appropriate learning space user managers.
- *Learning space user managers* are able to select “defaults” to what attributes the users who they **own** are able to modify by themselves and modify the “defaults” and every user’s attributes individually.
- Users who **own** other users are able to manage the users they **own** (view, create, modify, delete)
- User belongs always to a group that has at least the user as member

- User can belong to any number of groups
- Groups can have different permissions in the system
- User who creates another user account

Connectivity of the system

- Websockets (with fallback methods)
- Standard HTTP/HTTPS-GET requests
 - HTTP/HTTPS-REST JSON API
 - XHTML/CSS Content requests
- Separate installations of the system should be able to communicate with each other (like IRC-network) in order to exchange user information and fetch content from several different instances of the system.

Performance and deployment

- The system should be able to scale horizontally (add new server to increase capacity)
- The system must be installable into a cloud-based environment (e.g. Rackspace or Amazon)
- The system must be installable to a standalone computer
- The installation of the base system should take no more than one day from scratch.
- Installation can contain manual editing of configuration files.
- All the installation procedures must be automated to the extent it is possible.

Metadata content

Viewpoints for metadata

“I always worry however with mobile about standards and metadata (not that I'm an expert) because this is a technology in the hands of everyone with static learning (PCs) it is in institutions amongst 'experts', it's feral (adjective (esp. of an animal) in a wild state, esp. after escape from captivity or domestication: a feral cat. resembling a wild animal: a feral snarl.)”

“Community might be ultimately the best way to create the metadata structure when it is coordinated.”

“I think that personal relevance is the most important one. I mean that our cognition is based on relevances and connections so I think that our outside cognition should try to mimic that. I mean that when ever user interacts with a content user puts some kind of relevance related metadata to the content. This metadata needs to be captured and then utilized. It like worlds mental model.”

What standards / specifications exist for metadata associated with any kind of learning content. e.g. difficulty level of exercises, content categories, user ranking, technology related e.g. mimetypes, gamification parameters,

Technical note! If MongoDB is used as the database backend, then one should create a mapper between the database keys and the longer standard keys defined here as such keys will take up extra space for every record.

Dublin Core / Education related

Following metadata comes from Dublin Core Metadata Initiative: https://docs.google.com/Doc?id=dn8z3gs_38cgwkvv

DCMI.subject	The topic of the resource	<p>General Keyword or classification.</p> <p>JACS coding system can be used here for classification: http://www.hesa.ac.uk/dox/datacoll/jacs3/JACS3_20120529.csv</p> <p>A reference to a standard for curriculum, competency or learning objective to which the resource conforms.</p>
DCMI.relation	A related resource	
DCMI.relation.conformsTo	<p>A reference to an established standard to which the resource conforms.</p> <p>"Prerequisite", "Educational Objective", "Skill Level", "Competency"</p>	<p>"Specific, unambiguous references to achievement standard statements issued by formal standards bodies such as national, state, or provincial governing bodies or recognized organizations. Such standards include the many state K-12 achievement standards in the U.S. that define what students should learn at specific educational levels. The English National Curriculum is another example of such standards. See, for example, the Achievement Standards Network (http://www.jesandco.org/asn/viewer/default.aspx) repository of state and national U.S. standards."</p>
DCMI.type	<p>the nature or genre of the resource</p> <p>Vocabularies: https://docs.google.com/Doc?id=dhbfq9m_0f6mdc2</p>	<p>exercise, simulation, questionnaire, diagram, figure, graph, index, slide, table, narrative text, exam, experiment, problem statement, self assessment, lecture</p>
DCMI.audience	<p>A general statement describing the education or training context. Alternatively, a more specific statement of the location of the audience in terms of its progression through an education or training context.</p>	<p>school, higher education, training, other</p>
DCMI.audience.educationLevel	<p>Typical age range or a specific classification for educational level or skill level</p>	<p>Should be taken from a controlled vocabulary, but such vocabulary does not exist.</p>
DCMI.audience.mediator	<p>A class of entity that mediates access to the resource and for whom the resource is intended or useful</p>	<p>Teacher, Author, Learner, Manager</p>

DCMI.instructionalMethod	Comments on how this learning object is to be used Vocabularies: https://docs.google.com/Doc?id=dhbfq9m_0f6mdc2	nstructional Method will typically include ways of presenting instructional materials or conducting instructional activities, patterns of learner-to-learner and learner-to-instructor interactions, and mechanisms by which group and individual levels of learning are measured. Instructional methods include all aspects of the instruction and learning processes from planning and implementation through evaluation and feedback.
DCMI.LifeCycle.Contribute.Role	author, publisher, unknown, initiator, terminator, validator, editor, graphical designer, technical implementer, content provider, technical validator, educational validator, script writer, instructional designer, subject matter expert.	
DMCI.Educational.Difficulty	very easy, easy, medium, difficult, very difficult	Map these to values
DMCI.Educational.TypicalLearningTime		
DMCI.Educational.Language	human language used by the typical intended user of this learning object	Resource may be primarily in French but be intended for German speaking learners of French.

Some platform specific metadata ideas

- M4ED.language
- M4ED.tags
- M4ED.score
- M4ED.difficulty
- M4ED.dateAdded
- M4ED.dateModified
- M4ED.content
 - content
 - version
- M4ED.content.previousversions
 - content
 - version

Brain functions related requirements

These requirements were inspired by a developmental molecular biologist and research consultant John Medina, who has written a book entitled "Brain Rules": <http://www.brainrules.net/>

Short term memory

Short term memory needs lots of short repetitions. Short term memory has limited temporal and spatial capacity. It's capacity is about 30 seconds and 7 independent things, for example 7 random numbers. The nature of memories in the short term memory are temporary and they change or disappear easily. Internal repetition of things stored in the

short term memory improves the transition to long term memory. For example learning multiplication tables is a good example of this. It is very important that the repetition happens in the limits of the short term memory.

- System must encourage users to repeat the things in their mind that they just learned (remember 30 seconds, 7 independent things)
- System can guide users to try to remember things immediately in their minds after the initial memorization and system could test the memorization immediately after the initial learning so that users would need to perform repetitions in their short term memory.
- System should explain to users the rationale behind this behavior so that the users could maintain their focus and avoid becoming bored in the repetitive tasks.

Long term memory

Long term memory needs periodical repetitions happening on a longer time scale. Process of remembering things is to recall memory images from long term memory into short term memory and consciousness. The memories are vulnerable to change when they're fetched into short term memory. It can take years for memories to consolidate into long term memory and the memories can change in ways that the learner is not aware of during this process.

The best result can be achieved when following repetition intervals are put into use:

1. First repetition in 90-120 minutes from initial learning
 2. Next repetition in 1-3 days
 3. Next repetition in 1-3 weeks
 4. Next repetition in 1-3 months
 5. Last repetition in 1-3 years
- These repetition intervals should be included into the learning system, and the system should enforce these intervals for users by bookkeeping the moments when user have learned the things in question.
 - User should not need to remember the repetition intervals by themselves. The system should inform user about the rationale behind the repetition intervals.

Sensory integration

Sensory integration means stimulating several different senses at the same time during the learning event. Our senses cooperate. Our brains combine what they see, hear, taste, smell and sense/feel into one experience and if the environment stimulates the same senses the same way during recalling as was the case when user tried to memorize new things, the recalling process is more robust and it is easier to recall things from memory. Such multisensory environments should be taken into account in the mobile learning system via visual, hearing and sensing based cues (Sensing can be affected via the vibration capabilities of the devices.).

- Learning system needs to offer content that stimulates as many senses as possible (visual, auditory, vibrating) and guide for example users to smell certain distinctive smells in their environment while trying to remember new things. This applies especially to the things that one must commit things to long term memory.
- Learning system can have a cue-system (visual, auditory, vibration) that users can invoke to help them in learning.

Things that affect learning

Humans are by nature curious learners and investigators. Brains do not stop learning new things at any stage of life. Babies learn new things through active trial-and-error when their

linguistic capabilities are not sufficient enough to transfer information. Human learns better as an active experimenter than passive receiver.

- The learning system should not impose artificial limitations to the consumption of the content that might affect the learning process negatively.
- Transitions inside the learning environment should be built free to navigate instead of an enforced linear or other similar stiff hierarchical model. It is understood that curriculums pose some restrictions for this.
- Users should be able to retry different things in the service as many times as they see necessary for them.
- System should harness the natural curiosity of the learners to serve the learning instead of enforcing them to learn in just one particular way.
- The system should be able to automatically offer certain kind of content (text based / image based) based on the individual learning abilities of the users.

Stress affects learning. Brains have evolved to tolerate about 30 seconds of continuous stress. Prolonged stress does harm to normal brain functions and affects negatively to immune system. A person who has been suffering from stress for long periods of time gets sick more easily, sleeps poorly and is in danger of getting depressed. Maintaining emotional balance in all contexts is crucial for dealing with stress. It is quite difficult to come up with reasonable contributions to stress relieving in the context of an m-learning system.

- The system could try to measure the stress level of the user and educate the user about the harmful effects of stress.
- The system could contain some kind of exercises that are designed to relieve stress.

People don't pay attention to boring things. Our memories affect very much to things that we pay attention to. The importance of things is regulated on individual level by our earlier experiences and related cultural contexts. On general level we pay attention to emotions, possible threats and reproductive functions (including sex). Our brains have wired to answer quickly to questions: Can I eat it? Can it eat me? Can I mate with it? Will it mate with me? Have I seen it earlier? Alongside this brains are able to focus only on one thing at a time. We're able to multitask only in limited functions such as walking and talking at the same time. Every time when we switch our focus from one thing to another, we must also do a full context switch in our brains. This requires fetching new material to sensory memory and short term memory. If the context switches are rapid, then the processing capacity of the brains is wasted to these switches instead of focusing on the current context and things related to that which are already in our processing units.

- Mobile learning system should avoid context switches and maintain user's focus and interest in such way that it affects emotions, creates threats that can be avoided by learning, or combines learning context with reproduction related emotional triggers.
- The system should offer rewarding systems (e.g. badge-based) to create emotions in the users and maintain interest towards the use of the service.
- The system should include user into the served content (e.g. include user's name into exercises) in order to make the content more personal.

Vision is the most important sense. People recall images the best. Information that is transferred through text has narrower bandwidth than pictorial information. This is mostly due to fact that humans read text by interpreting every word as an image. Instead of interpreting a single large image, humans interpret many smaller images in a text. This kind of processing is slow and inefficient. Also when a person receives conflicting information from a target (e.g. orange juice that has been dyed as green) the brain sets visual cues always to the highest priority. Green orange juice tastes initially odd if a person doesn't know beforehand how he is cheated.

- Learning system should incorporate as much visual information as possible. Videos are the best as they stimulate also auditory system. In multisensory environment remembering and recalling is more efficient.

Improving the performance

Physical exercise boosts brain performance. This is based on the improvement of oxygen circulation in the brain. It in turn lessens the amount of free radicals in the brain. The effect is not permanent and brain will fall back to the starting level of oxygen if regular physical exercising is terminated.

- Learning system should encourage users to perform physical exercises on regular intervals.
- Learning system should also contain publicly available instructions on physical exercises as part of the learning content.

Sufficient amount of sleep improves brain performance. It is not yet fully known why people must sleep. Many studies have proven that humans learn also while in sleep. Brain imaging methods have verified that brains are in highly active state during our sleep. The EEG data gathered from sleep studies prove that the brain patterns in sleep resemble very much the ones that we have while we're awake. Sleep deprivation affects negatively to our ability to focus and concentrate, short term memory, mood, logic, reasoning ability and motor functions. The systems that participate in the sleep-arousal cycle (Circadian rhythm) are in balance about 12 hours after the midpoint of last sleep cycle. It is common that people feel the need to nap during this equivalence point. NASA has proven in their studies that 26 minutes of napping at this phase improves performance 34%. Nobody has yet to come up with exact amount of sleep required for humans and it varies among individuals.

- Learning system could take into account the weakening of cognitive level of the users after 12 hours of the midpoint of her last sleep by asking from the user the last go-to-sleep and wake-up times and counting 12 hours from that and adjusting the content accordingly (easier tasks).
- Putting the above to the extreme the system could even stop functioning and would advise user to have a nap.
- The system should bookkeep the amount of sleep the user gets and adjust the content according to that and also remind the user about the importance of sleep relating to learning.

Physiological differences and similarities

There are anatomical differences between male and female brain. The frontal lobe is usually larger and more complex in females. Men tend to have larger occipital lobe. The corpus callosum is structurally different between genders. Pineal gland is larger in males and hippocampus is larger and its neurons faster in women. The role of these anatomical differences is not yet fully understood, but for example there are statistically significant differences between genders in certain mental disorders. Anorexia and narcotic addictions as a good example. Males and females process certain kinds of emotions differently and different kinds of targets for affection can be measured on both genders. Stereotypical example is males affection towards cars when compared to females affection towards cars.

- Learning system could use different kinds of visualizations for males and females, and try to take different emotional responses into account when delivering content for learners and in this way contribute also to maintaining the user's interest towards the learning material and challenges at hand.

Everybody's brains are different and develop in unique way. The brain development happens on different time and different way in every individual. Not even identical twins share the same brain structure and wiring. Many current learning methods and contexts use student's age as the factor to divide them into different levels.

- Learning system should categorize and group learners based on their learning level instead of their age, and possibly could tailor personal learning material for every individual user based on their level.

Brain has developed into solving problems that relate to survival in an unprecedented environment that's full of threats. Human body is not the most effective one in the animal kingdom, but our brains are the most developed ones. In order to survive, it is important to learn to work in a social context and to understand others.

- Mobile learning system should support cooperation between learners and give users ways to interact and share with other users and to communicate also about different ways to learn things.

Some discussions from planning phase

The logic should be left out from the markup data, but instead the different logical components should be in metadata and separate keys in the data structures. All of these elements can contain markup data that is then rendered, but no "programmable logic" inside markup. The markup is only to have semantics for the content that can be directly converted into XHTML. (direct conversion).

The editing process needs to be thought of. Some ideas for Reddit-style "own content" were thrown. It shouldn't be too tightly bound to "projects" but instead encourage to more open editing and community-like features.

What comes to metadata, dublicore seems to be just keys for our data. Mediaelement.js is good audio library and it's impossible to support audio (except links) in proxy based browsers (Opera Mini, Bolt=discontinued, UCBrowser, QQBrowser). We have a way to support latex math data with markdown+misaka+matplotlib.

Todo: Figure out whether OVI-browser supports audio (deviceanywhere). Explore what you can do with IVR / SIP / USSD (e.g. Skype API + Python or Asterisk etc.)

Blaast is not going to support audio for a while (not in Q3 as they originally said) which means that the focus is on phonegap. Discussions about moodle and its role crystallized our own vision of producing really a mobile targeted social learning system instead of formal-learning-university-grade-yet-another-LMS.

Relating to content markup

Suggestion: One good candidate for the content markup language is Wikitext from mediawiki and its possible extensions.

Rationale: Wikipedia has successfully been able to render the highly heterogeneous information-rich content to multiple devices and multiple languages by using the Wikitext markup language as the content language. The language itself doesn't make assumptions about the rendering of the content and thus fits fine for the project also based on that. The language is also extensible and there are already some parsers and content editing tools for

it that can be used to facilitate the process of creating a content editor for the platform.

Suggestion: Markdown might be preferred over Wikitext.

Rationale: Markdown seems to have less issues than Wikitext and it's more compact. The language is currently used only to map elements, not logic.

Suggestion: reddit's snudown (markdown renderer) could be used as part of the rendering process. The data is stored into mongodb as markdown and then picked by mako templates and the markdown is rendered using the snudown variant.

Rationale: research was made among different kinds of markdown / wiki markup methods, the available parser libraries for them, and the stability of such implementations. So far the most intriguing solution based on such criteria seems to be the combination of Markdown + Sundown (or snudown depending on the need of the modifications) with Python integration (Misaka).

Customer Segments and stakeholders

Customer segment: Private Schools, Public Schools (Government), Internet (cell or land based)

- Students
- Teachers
- Developers
- Universities
- School directors
- Parents
- Children
- Companies involved in delivering internet service or phones
- Server hosts
- People who sell the solutions
- "Organizers" who make it actually happen

Customer segment: Formal education system in first world

- Officials and administration
- teachers
- pupils

Customer segment: In-formal education system in the first world

- Coordinative, administrative and operative personnel.
- People working with marginal groups, youngsters with social or individual learning challenges those that cannot participate to the formal education system.
- Managed by government funded organizations or in many cases by NGO's

Customer segment: Universities willing to do scientific research on mobile learning.

- organizing party (university)
- teachers
- students
- researchers
- content creators
- administrative personnel (for permissions to conduct the study)

Customer segment: A health care organization wants to provide a maternity guidance system.

- organizer (health care association)
- end-users: pregnant women
- end-users: husbands
- staff of the organization (statistics)
- content creators (health care professionals)

Short user stories

- As a student I will use the platform because I need to study for my exams
- As a teacher i will use the platform because I need to teach in different and updated ways.
- US1: As a safe house therapist I will use the find your way features, because I need good ideas how to inspire young moms.
- US2: As a safe house client I will use whatever content that will give me small, but concrete steps to get back on track with my life.
- US2: As a coordinator for the safe houses I follow how customers adopt new ideas and why is the impact of our work to society.
- As a pregnant woman I will use guides for different pregnancy stages because I need to be aware of how to act if something unexpected happens and to learn what I shouldn't do while I'm pregnant.
- As a nurse I will use statistical data (weight, pregnancy months, etc.) collected through the service because I need to follow the progression of the pregnancy and react to problematic situations.
- As a husband I will use the service to educate myself so that I understand better my wife's needs during the pregnancy.
- As a content creating healthcare professional I will use the service's content creator tool to create helpful guides for pregnant women .
- As an organizer I will use user management interface to create user accounts for the users and deliver instructions on how to take the service into use.
- As an organizer I will use user export and printing functionality to print out user accounts as flyers and deliver them to pregnant women.

What it is?

- Fun
- Easy to use
- Practical
- Fast
- Convenient
- Different
- New
- A way to find what is the theme for my intention and tool to manifest my becoming.
- A system where new learning content can be introduced and distributed to a wider audience
 - This sounds like an ongoing QA system (iTunesEd?)
- A system where learning can be tracked
 - Is this purely private, part of the next point?
- A system where learning can be divided into meaningful parts and directed to certain user groups
 - Is this a recommender system?

- Social environment for learners.
 - This is intriguing. Can learner behaviour, part of a recommender, link learners together?
- Platform to provide formal, non-formal and informal learning
 - this may be problematic partly because it's too multi-purpose and partly because the three different purposes have put mobile learning into very different ecosystems
- A mobile learning platform
- A way to learn anywhere, anytime, using only a basic mobile device
- A system where new learning content can be introduced and distributed to a wider audience
- A system where learning can be tracked
- A system where learning can be divided into meaningful parts and directed to certain user groups
- Social environment for learners
- Mobile Internet based service
- Platform to provide formal, non-formal and informal learning

What it is not?

- Buggy
- Mistakes on exercises or solutions
- Slow
- "More of the same that I learn at school".
- Paper exercises in fancy machines.
- Boring!
- Just another m-learning platform
- I'm generally a bit wary of solutions in search of a problem, especially if they are framed as platforms. They tend to be too broadly scoped to be competitive.
- A ready made learning system full of quality learning content
- A system for some certain teaching purpose
- A publishing system that can be used to publish all kinds of mobile content with any imaginable format
- A collection of mobile applications

Why it is done?

- To help "me" understand concepts in a new and updated way
- To give "me" access to resources I didn't have before
- To develop digital competencies
- To be a part of the digital revolution that's changing the world.
- No earlier large scale mobile learning systems exist
- A clear need for a mobile learning system, especially for feature phones
- All people don't have access to quality teaching material or can't afford a smartphone or a computer
- Learning by doing -guy (John Dewey) would have done it if he would have had internet.
 - Dewey considered two fundamental elements—schools and civil society —as being major topics needing attention and reconstruction to encourage experimental intelligence and plurality. Dewey asserted that complete democracy was to be obtained not just by extending voting rights but also by ensuring that there exists a fully formed public opinion, accomplished by effective communication among citizens,

- experts, and politicians, with the latter being accountable for the policies they adopt.
 - Dewey continually argues that education and learning are social and interactive processes, and thus the school itself is a social institution through which social reform can and should take place. In addition, he believed that students thrive in an environment where they are allowed to experience and interact with the curriculum, and all students should have the opportunity to take part in their own learning.
 - Dewey makes a strong case for the importance of education not only as a place to gain content knowledge, but also as a place to learn how to live. In his eyes, the purpose of education should not revolve around the acquisition of a pre-determined set of skills, but rather the realization of one's full potential and the ability to use those skills for the greater good.
 - He notes that "education is a regulation of the process of coming to share in the social consciousness; and that the adjustment of individual activity on the basis of this social consciousness is the only sure method of social reconstruction"
 - Content must be presented in a way that allows the student to relate the information to prior experiences, thus deepening the connection with this new knowledge.
 - The teacher is not in the school to impose certain ideas or to form certain habits in the child, but is there as a member of the community to select the influences which shall affect the child and to assist him in properly responding to these influences. Thus the teacher becomes a partner in the learning process, guiding students to independently discover meaning within the subject area. This philosophy has become an increasingly popular idea within present-day teacher preparatory programs.
- [Wikipedia]

Detailed user stories

Scientific research / m-learning in elementary school

The background for this detailed user story comes from a mobile learning study conducted in Mexico City, Mexico in the year 2011.

Context and goals

A university in Latin America decides to study mobile learning impact in math studies with 5th graders in country's public schools. They want to arrange a mobile learning environment for 200 kids in two schools and then study the effects with control and experimental groups. They have feature phone level devices arranged for the students and provide SIM-cards for them that have data access. The kids have not necessarily used Internet or mobile devices before and their teachers are assumed to have little knowledge of technology. Alongside the learning goals the service's goal is also to introduce the mobile devices as part of the education process and take them into the classroom, and the access to the service and devices is not limited with school hours as the kids are able to take them home and use the service on their free time as well.

Stakeholders

- organizing party
- content creators
- teachers
- students
- researchers

User stories by stakeholder (Organizing party)

Agrees with the schools that the study will take place in the school environment and informs the school's council and national governing body that this kind of event is going to take

place. The organizing party then sets up the learning space in the mobile learning platform and inserts manually the student information to the system. After the student registry is created to the system, the organizer prints out stickers from the system and delivers the devices and instructions on accessing the service. The organizing party also creates agreements that students' parents sign in order to receive the device. Throughout the use of the service the organizing party monitors that the service is in use and explores live statistics.

User stories by stakeholder (content creators)

Creates the content for the service by using the content creation tools provided by the service. These are several experts in pedagogy who participate in the content creation process as everybody has their own area of expertise. They all contribute to the same pool of knowledge. The content creators have also the possibility to modify the content they've created even after the service has been "launched".

User stories by stakeholder (teachers)

Receive training from the organizing party on how to use the service and what parts belong to the scientific study. The teachers are not necessarily experts in mobile technologies so they will also receive training regarding that. The teachers have received a schedule from the organizer under which they teach every topic. The teachers let the students to access and use the service during classes when they're studying mathematics, during recess and after school. The teacher is able to monitor how well the kids are doing with their studies through a teacher interface that has been bound to their user accounts.

User stories by stakeholder (students)

Receive devices that have access to the service. The students are instructed on how to take care of the device and how to use it. Then whenever they have a math class they're allowed to use the device. The devices are given to them so that they're able to use it also off-school hours. The students go into the service and navigate to the appropriate topics or to topics that interest them. The service provides them theory and exercises relating to their current curriculum. The exercises consist of multiple-choice questions and the theory portions contain text, images and animations.

User stories by stakeholder (researchers)

Conduct the actual study and interpret the results. The researchers have planned the study so that there is a pre-test and post-test and they've divided the kids into control and experimental groups. The researchers have set up a schedule when teachers should teach particular subject so that all the kids are participating at the same time and are studying the same topic. The researchers gather the statistical data from the system and are able to perform queries to the gathered data. All users' actions have been logged into the system and they're able to track every single users' path in the service. The data provided for the researchers has been anonymized so that they only know the gender and class of the student.

Teacher looking to make learning content mobile

Content and methods

- Text, Image, Table

- Questions: multiple, freely verbal
- Needs to enable Q&A in “essay” –form; not as long as normal essays, but freely produced.
- Answers sent via: form in site / e-mail / ?
- Answers reviewed and commented by teacher in user management tool / ?
- Sent back to students’ inbox in service / ?
- Answer forms need to support comments on top of original text. Side notes?

Process

Is set up for user management and admin. Imports existing theory material (text and images) into publish using Editor. Using templates makes question forms. Creates a group of users (a class) into user management. Publishes certain content to certain group. Answers sent to group specific folder in inbox, linked to the student who sent them. Notes and review can be made while reading the answer, and submitted back to students, going in their inbox.

Freelance trainer looking to add mobile to their service portfolio

Content

- Video, Image, Text

Process

Personal trainer wants to enhance their service with easily-always-with general work-out tips as well as personalized training program. (mobile always with -> go to site, sign in, have your own workout with you all the time)

- updates by trainer after meetings (admin, user management)
- mobile notes tool ! compile a draft for the training program on the fly
- a library of sets (flashcard type) from which to create a full program
- possibility to edit said library (add, edit, remove, arrange, categorize)
- possibility to edit items in library
- users notes during training
- collects user data: training progress, weight changes, etc (charts)

Goes to create new user. Inserts personal data, goals, notes (to self, not visible to user?). Compiles a set of items from library that fit the customers planned training program. Mobile notes tool for making the draft for the program while meeting with the client! Edits items to match the users needs / capabilities.