

## Managing Affective-learning THrough Intelligent atoms and Smart Interactions

### D.3.7 Learner's Profile Repository

<b>Workpackage</b>	WP3 Smart Learning Atoms and Graph Tools
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<b>Abstract:</b>	This deliverable describes the implementation of the Learner's Profile Repository as an infrastructure that will be used to store learner-specific profiles (skills, competences, performance) and specific needs (capabilities, preferences). Such information will serve as basis for the personalization and adaptation in MaTHiSiS (WP6).
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## List of Acronyms

Abbreviation / acronym	Description
AIR	Affect and Intent Recognition
ASC	Autism Spectrum Case
CGDLC	Career Guidance Distance Learning Case
CLS	Cloud-based Learner’s Space
DoA	Description of Action
EE	Experience Engine
ES	Experiencing Service
ITC	Industrial Training Case
GUI	Graphical User Interface
IPA	Interaction with Platform Agent
LA	Learning Action
LM	Learning Material
LMC	Learning Material Controller
LRS	Learning Record Stores
MEC	Mainstream Education Case
PA	Platform Agent
PMLDC	Profound and Multiple Learning Disabilities Case
SC	Sensorial Component
TB	TurtleBot robot
TEL	Technology-Enhanced Learning
xAPI	Experience API

**Table 1: Definitions, Acronyms and Abbreviations**

## Project Description

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MATHISIS is a 36-month long project co-funded by the European Commission Horizon 2020 Programme (H2020-ICT-2015) under Grant Agreement No. 687772. It started on January 1st 2016.

One of the core objectives of the MaTHiSiS project is to enhance learning environments and make use of computing devices within learning spaces in a more interactive way, which will provide a product-system to be used in formal, non-formal, and informal education. An ecosystem to assist tutors, caregivers, and both regular learners and learners with special needs will be introduced and validated in 5 use cases: Autism Spectrum Case (ASC), Profound and Multiple Learning Disabilities Case (PMLDC), Mainstream Education Case (MEC), Industrial Training Case (ITC) and Career Guidance Distance Learning Case (CGDLC).

The MaTHiSiS product-system consists of an integrated platform, along with a set of re-usable learning components (educational material, digital educational artefacts, etc.), which will respond to the needs of a future educational framework, and provide capabilities for: i) adaptive learning, ii) automatic feedback, iii) automatic assessment of learner’s progress and behavioural state, iv) affective learning, and v) game-based learning.

Within MaTHiSiS, an innovative structural tool of learning graphs is going to be introduced to guide the learner through the process of learning in the given scenario. To reach a learning objective, the learner will have to “follow the path” of the learning graphs, built up on Smart Learning Atoms, which are specific learning elements that carry defined learning materials.

To ensure barrier-free integration in the market, MaTHiSiS makes use of a range of interaction devices, such as specialized robots, mobile devices and interactive whiteboards. The consortium ensures easy-to-use solutions with e.g. specialized graphical editor-like tool, allowing to easily creating educational materials as well as the reusability within both mainstream education and vocational training setups.

### Objectives of the project

A Cloud-based Learner’s Space (CLS) will be developed to provide a system for adaptation/personalization in learning, interaction, data acquisition and analysis as well as content creation on the fly. This is a core component of the MaTHiSiS system which includes 3 crucial subsystems which create an innovative smart learning ecosystem:

- i) the Experience Engine (EE), a graph-based interactive storytelling engine, that manipulates interactive content which is later sent to a device of the tutor’s/learner’s choice;
- ii) the Learning Graph engine (LGE), responsible for adaptation of the Learning Graph based on learner’s behaviour and interaction;
- iii) The Decision Support System (DSS), providing and collecting learning analytics and controlling synchronous and asynchronous interaction between devices. To ensure constant educational flow and augmented learner engagement, through emotion recognition, context aware and the cognitive/behavioural status extraction tools based on the information gathered by the Sensorial Component (SC).

In order to validate the MaTHiSiS approaches in a learning environment, a set of Smart Learning Atoms (SLA) is going to be created for defined use cases. Such SLAs will adapt to each learner in a different way based on her/his particular needs, profile, cognitive affective state, relevant to specific learning requirements and previous performance. Furthermore, an editor-like tool is introduced to be able to transform educational material into MaTHiSiS Learning Materials usable by SLAs through

Learning Actions. The learning graphs are then going to be deployed to interact with the CLS as well as the front-end tools for tutors and caregivers to enable creation, editing and authoring of the learning contents and learning experiences.

MaTHiSiS will support learning across a variety of learning contexts and, with the use of a variety of devices (robots, interactive whiteboards, mobile devices and desktop/laptop computers), with personalized and adaptable, time and location independent learning paths being transferred between the agents, always taking into consideration the best knowledge and practices learnt from the previous device.

By the end of the project, MaTHiSiS will introduce a marketable innovation, aimed towards the re-usability of educational and training content and fostering the interactivity between technology and learners/tutors/caregivers.



## Executive Summary

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This document presents technical information about the Learner’s Profile Repository (LPR) and User repository (UR).

LPR will be used to store learner-specific profiles in terms of disabilities and interaction preferences, learning styles and learning difficulties as well as previous performances, motivation states, affective states. Section 2 of the document is dedicated to cover all details about the LPR, the methodology followed for its design and implementation, data structures and how are they being implemented on the front end.

On the other hand, the User repository will manage information related to users, used PA, roles and their authentication. Section 3 of this document presents the data structures, API and its documentation.

# 1. Introduction

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## 1.1 Document context

The Learner’s Profile Repository is a cloud-based infrastructure that will be used to store learner’s-specific profiles. The MaTHiSiS platform and the LPR will be exchanging data in a bidirectional way, making it a fundamental element on the MaTHiSiS platform schema to support the personalization and adaptation of the learning experience (WP6), according to the learners’ specific needs. Those specific needs could be because disabilities that the learner may have, interaction preferences, his/her learning style or his/her performance. The LPR will be also update with affective/cognitive status results and performance, according to the Cloud-based computations made by Learning Analytics (WP4).

## 1.2 Document structure

This document presents the results of activities conducted as part of Task 3.4 Learner Profile Repository aimed at providing the first version of this repository for the MaTHiSiS first release. In the following sections, we will provide a detailed overview of the Learner’s Profile Repository and the User Repository and fully describe their APIs and documentation.

- **Section 2**  
This section presents the Learner Profile Repository describing it, especially its data structure and functionality.
- **Section 3**  
This section includes information about the User Repository, presenting the API in detail and its documentation.
- **Section 4**  
This section presents the conclusions of the document and the future actions that are going to be taken in the next working period.

## 2. Learner Profile Repository

### 2.1 Objectives and definitions

This cloud-based infrastructure will be used to store learner-specific profiles (demographics and preferences), automatically inferred and/or manually entered specific needs (learning difficulties) and previous performances (final status of learning experiences).

### 2.2 Methodology and dependencies (integration with MaTHiSiS)

Integration with the MaTHiSiS Platform will be done through OpenAPI.

The platform will be exchanging information with LPR in a bidirectional fashion:

- *From platform to LPR:* the platform will push final learner-related information to the LPR, i.e. affective/cognitive status results and performance, profile according to the Cloud-based computations made by Learning Analytics (WP4). Such information will be pulled by the platform for offline adaptation of future interactions.
- *From LPR to platform:* LPR will provide information about the learner’s main features in particular his/her preferences and specific needs based on his/her disabilities or capabilities. Such information will be used by the DSS to ensure the personalization and adaptation of the learning experiences (WP6).

### 2.3 Data structures

The following elements had been considered in the definition of the LPR data structure:

**Accessibility:** The overall set of features that characterizes the adaptation to the learner’s needs as well as his/her behaviour during his interaction with a TEL system.

**Disabilities:** The set of learner special needs that could have some influence on the development of his/her educational process.

**Interaction preferences:** Learner’s preferences regarding interaction with any digital or e-learning system.

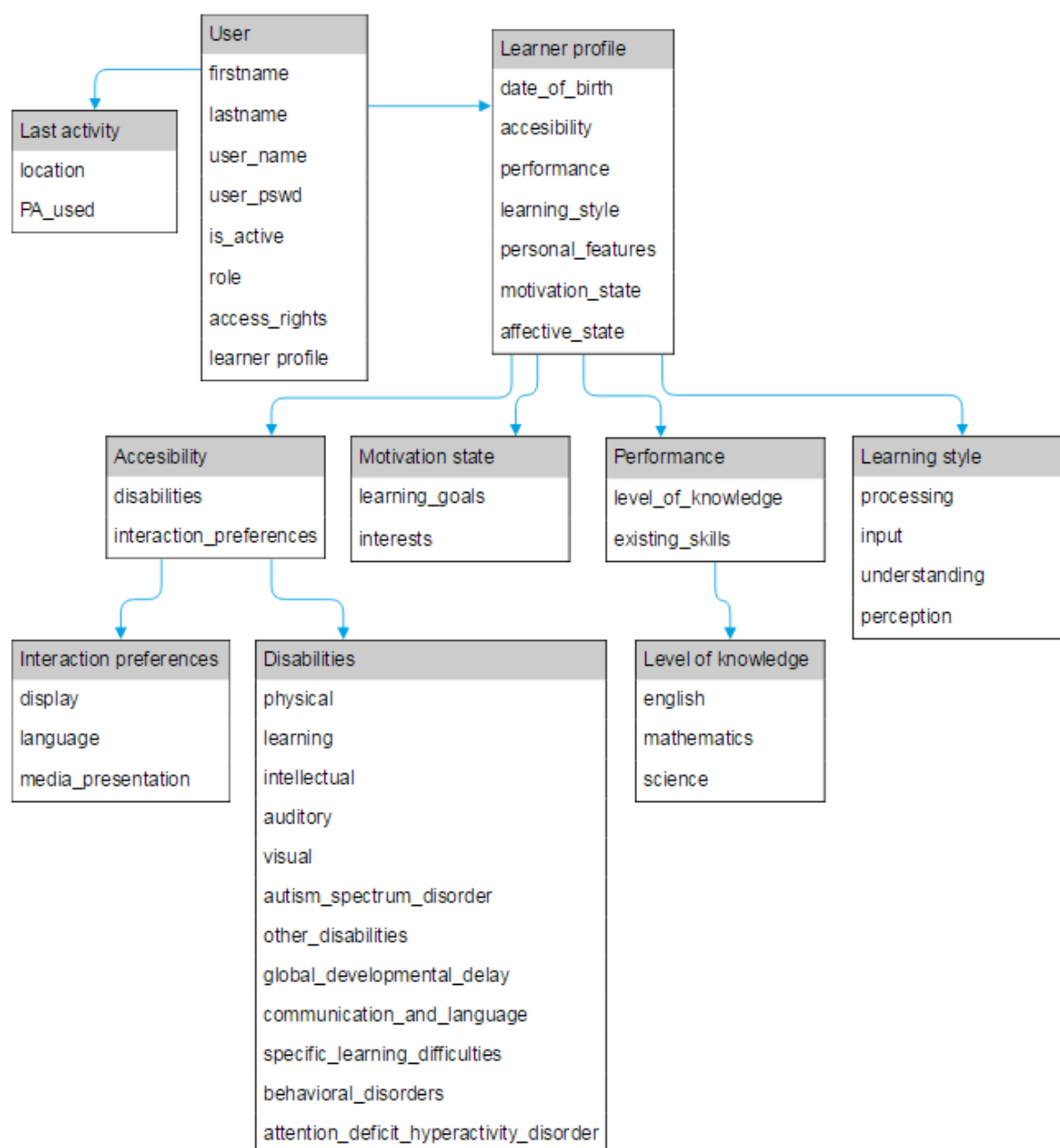
**Learning Styles:** Learner learning style - this class will be further divided into sub-classes according to the Felder-Silverman theory (processing, input, understanding, perception) [3].

**Performance:** Score obtained by the Learner in different knowledge areas or learning fields. It is used for taking into account the learner’s background when communicating learning objects to the learner. These reference values are used according to the Pvalue (Performance - P Scale - attainment targets for pupils with special educational needs) (see Annex 1).

**Motivation state:** Learner’s motivation during the educational process.

**Affective state:** Learner’s types of affective state: frustration, arousal, flow, boredom.

Below is the diagram of the structure of the User data model. A table with a full description each of the above presented data is included in the Learner Profile can be found in Annex 1.



**Figure 1 User data model**

### 2.3.1 User data in detail

The data structure has been created taking into account different accessibility sources, the contribution of MaTHiSiS experts in pedagogy and accessibility from WP8 and having in mind the compatibility with the IMS Learner Information Package specification. The Learner profile information in JSON format is presented in Annex 2.

### 2.3.2 Relation to the IMS Learner Profile Information

IMS Global is a nonprofit organization specialized in the creation of learning technology standards. Its goal is to make education institutions to be more innovative, provide better user experience and reduce the cost of integrating products in the educational systems.

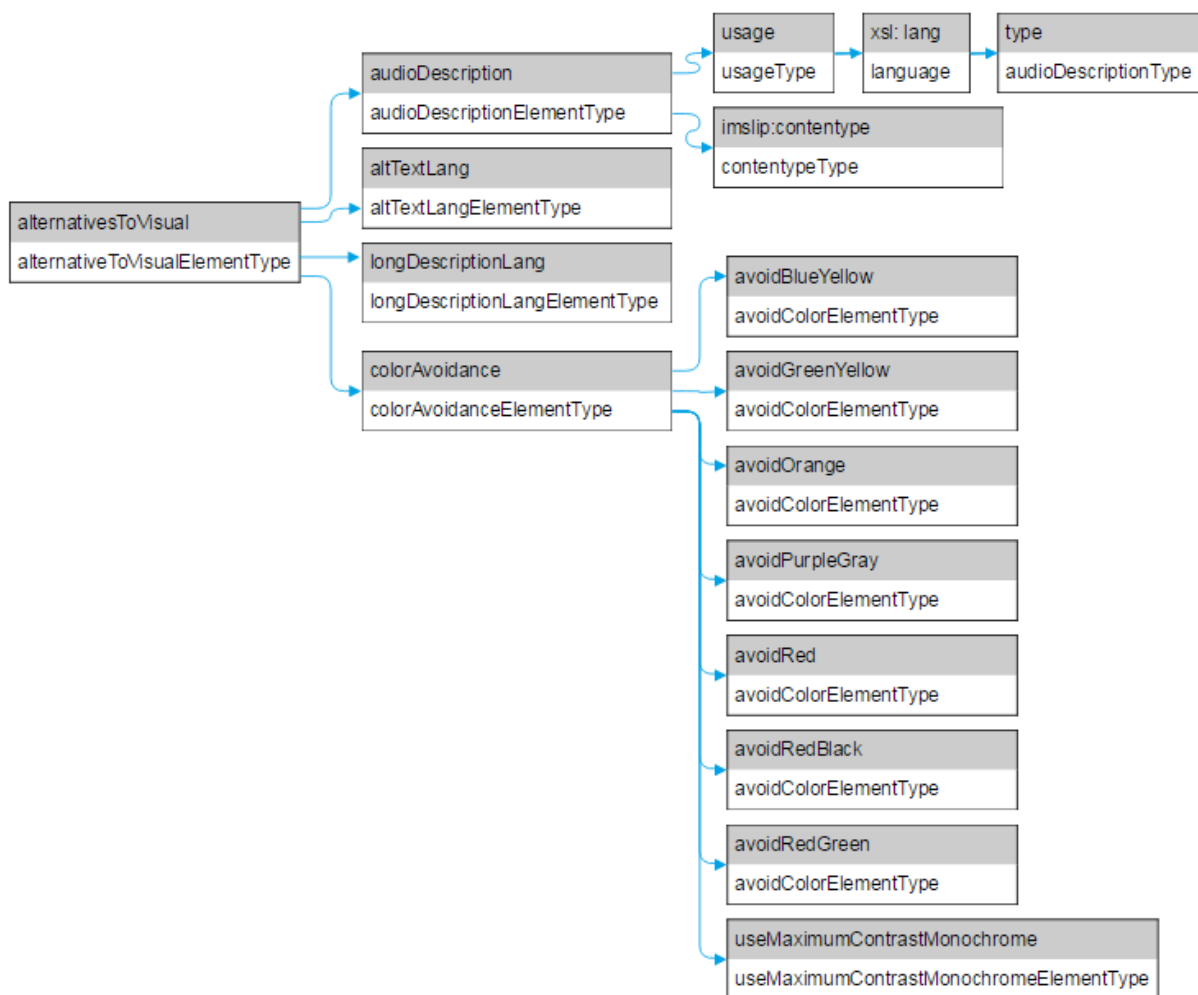
The acronym IMS means ‘Instructional Management Systems’ which is the original project name that ended being something much larger.

IMS Learner Information Package (LIP) is based on a data model that describes those characteristics of a learner needed for the general purposes of:

- Recording and managing learning-related history, goals, and accomplishments;
- Engaging a learner in a learning experience;
- Discovering learning opportunities for learners.

The specification supports the exchange of learner information among learning management systems, human resource systems, learner information systems, enterprise e-learning systems, knowledge management systems, resume repositories, and other systems used in the learning process. In this document such systems will be called learner information systems regardless of any other functionality they possess or roles they fulfil. The IMS Learner Information Package specification does not address requests for learner information or the exchange transaction mechanism.

Here is an example of an IMS LIP section that we could adopt in the “display” section of our JSON:



**Figure 2 IMS LIP alternatives To Visual schema**

The purpose of adopting this specification is to ensure the interoperability of the MaTHiSiS LP information, allowing to transfer the MaTHiSiS-related information to other educational systems.

## 2.4 OpenAPI

Here there are the actual OpenAPI calls currently available and related to the learner’s profiles. We have the possibility of getting every profile, getting a specific one or edit/create a new one for a specific user.

profiles_controller		Show/Hide   List Operations   Expand Operations
GET	/profiles	Profiles
GET	/profiles/{id_user}	Gets a Profile by its identifier
PUT	/profiles/{id_user}	Update profile

Figure 3- Profile controller view in Swagger UI view

## 2.5 Documentation

Here we have in detail the calls that we presented in Figure 1 User data model

Method	GET lpr/profiles		
<b>Description</b>	Get a list with all the Profiles in the system		
<b>Responses</b>	If Success return LearnerProfile list data model 200 application/json <pre>[{"_id":{"\$oid":"3836b7485cfb41e7cb71078"},   {"learner_profile": {...}} ],{...}, {...}]</pre>		
	If Error return an error response JSON 400 application/json <pre>{ "errors": [{   "description": "Error. Couldn't find any profile",   "location": "body",   "name": "password" }], "status": false}</pre>		
<b>Parameters</b>	<b>Name</b>	<b>Location</b>	<b>Data Type</b>
	X-User-Path	body	string
	X-User-Token	body	string

Table 2 GET lpr/profiles

Method	GET lpr/profiles/{id_user}
<b>Description</b>	Gets a Learner Profile by using the user identifier

<b>Responses</b>	<p>If Success return LearnerProfile data model</p> <p>200 application/json</p> <pre>{ "_id": {"\$oid": "3836b7485cfb41e7cb71078"},   "learner_profile": {...} }</pre>		
	<p>If Error return an error response JSON</p> <p>400 application/json</p> <pre>{ "errors": [{   "description": "Error. Couldn't find the specified profile",   "location": "body",   "name": "password" }],   "status": false}</pre>		
<b>Parameters</b>	<b>Name</b>	<b>Location</b>	<b>Data Type</b>
	X-User-Path	body	string
	X-User-Token	body	string

Table 3 GET lpr/profiles/{id\_user}

<b>Method</b>	<b>PUT lpr/profiles/{id_user}</b>		
<b>Description</b>	Updates the profile found by its user id		
<b>Responses</b>	<p>If Success return Success feedback</p> <p>200 application/json</p> <pre>{ "access": true,   "message": "Profile updated successfully",   "permissions": {     "collection": "users",     "method": "PUT",     "statusCode": "200"   } }</pre>		
	<p>If Error return an error response JSON</p> <p>400 application/json</p> <pre>{ "access": false,   "statusCode": "400",   "message": "There is no such Profile" }</pre>		
<b>Parameters</b>	<b>Name</b>	<b>Location</b>	<b>Data Type</b>

	X-User-Path	body	string
	X-User-Token	body	string
	user_id	header	string
	learner_profile	body	schema: LearnerProfile{}

Table 4 PUT `lpr/profiles/{id_user}`

## 2.6 LPR Front-end

The specifications of the Learner profile described in Chapter 2 are being implemented on the MaTHiSiS front end as part of the User manager section. In the Learner Profile management tab, for every user in the list there is a Details button as shown in Figure 3. This button will show a popup with the complete profile of that learner, where it is possible to update every field as it is presented in Figure 4.

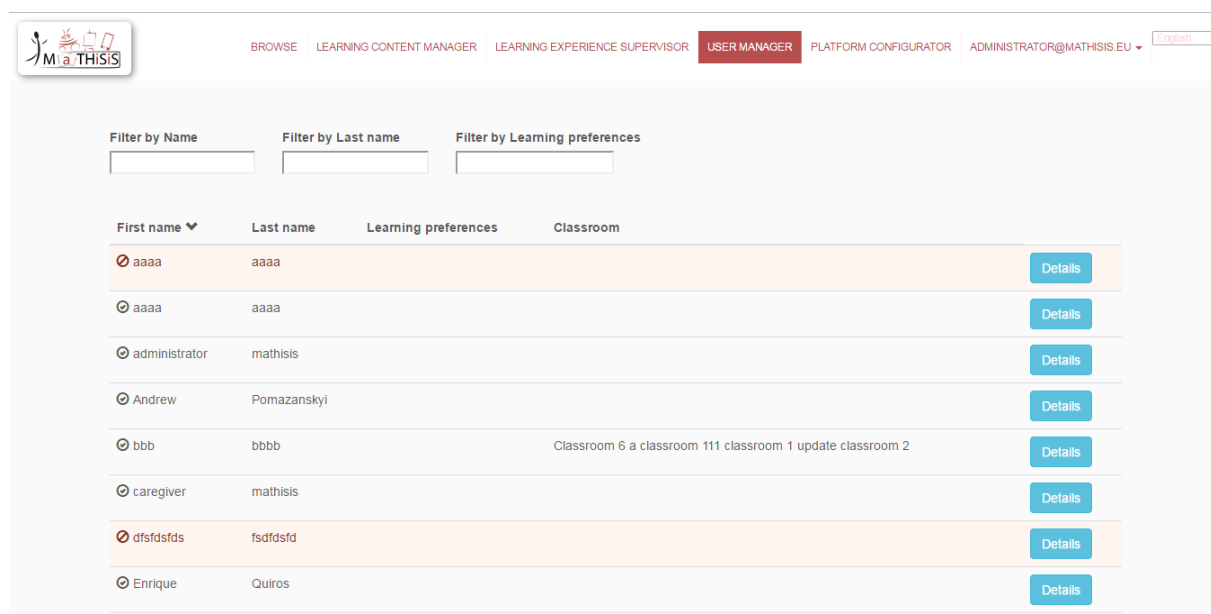


Figure 3 Learner profile management screen



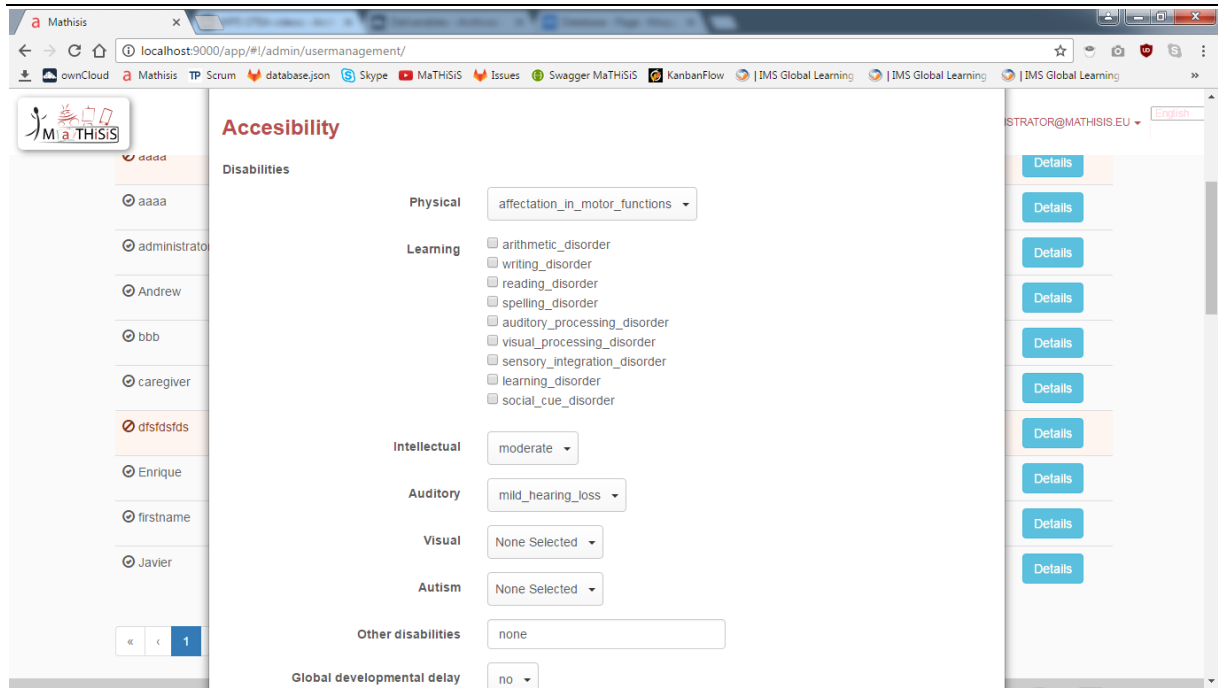


Figure 4 User profile’s details

## 3. User Repository

In the User repository, we will store, for each MaTHiSiS user:

- His credentials;
- A reference to the Learner’s Profile if the role is “Learner”;
- His role(s) (Tutor, Caregiver/Parent, Learner, Administrator)
- The social groups in which he participates;
- A reference to the last activity conducted by the user.

For each role, following the definitions included in Section 3.3 of the deliverable D2.3[1], the set of all privileges associated with it are included (a full list will be prepared containing e.g. creation of graphs, creation of material, creation of social network group, adaptation/modification of graphs, access to content).

### 3.1 Data structures (UR schema)

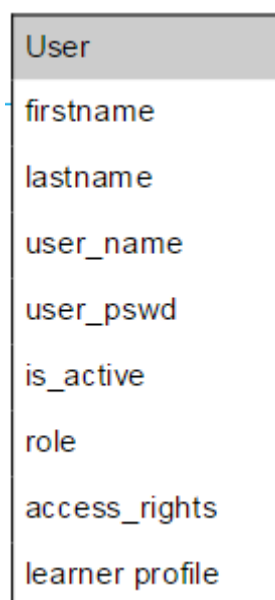


Figure 5 User data model (detail of user)

*id*: unique identifier of this user

*firstname, lastname*: real name of the user

*user\_name*: Identifier chosen by the user that is going to be used to log in

*is\_active*: flag that determines if the user is active in the system. If the value is false the user won't be able to log in.

*role*: The role of the user. A role is a set of permissions and the app may act differently depending on this.

## 3.2 API

Below are the actual available API calls related to users management. They are divided in auth, roles, and user operations. Auth are authentication and permissions operations; roles are operations to check what permissions have any role and the complete list of roles; users are operations to query users, edit or delete them.

It is possible to access every profile, getting a specific one or edit/create a new one for a specific user.

auth_controller		Show/Hide	List Operations	Expand Operations
POST	/auth/			Auth user
POST	/checkpermissions			Check user permissions
GET	/validatesession/{id_user}			Validate user session
roles_controller		Show/Hide	List Operations	Expand Operations
GET	/roles			Roles
GET	/roles/{id_role}			Gets a Role by its identifier
users_controller		Show/Hide	List Operations	Expand Operations
GET	/users			Users
POST	/users			Add a user to the list
POST	/users/requestnewpassword/{user_name}			Update user password
DELETE	/users/{id_user}			Remove a user by its identifier
GET	/users/{id_user}			Gets a User by its identifier
PUT	/users/{id_user}			Remove a user by its identifier
POST	/users/{id_user}/updatepassword			Update user password

Figure 6 User controller view in Swagger UI view

## 3.3 Documentation

Below are the details of the calls presented in Figure 2. There are basic operations related to users, authentication, and roles. The created code for this Open API is available at the GitLab repository and has been referenced in the table 6 of the deliverable D7.2 [2].

<b>Method</b>	<b>POST /api/users/auth/</b>
<b>Description</b>	This API enable users to login in MaTHiSiS
<b>Responses</b>	<p>If Success return the Auth details of the login</p> <p>200 application/json (content)</p> <pre>{   "status": true,   "user_path": "xYxxxxYSASe4rer",   "user_token": "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9",   "username": "teacher@MaTHiSiS.eu" }</pre>

	If Error return an error response JSON 400 application/json (content) <pre>{   "errors": [     {       "description": "User doesn't exist or password is wrong",       "location": "body",       "name": "password"     }   ],   "status": false }</pre>		
Parameters	Name	Location	Data Type
	X-User-Path	body	string
	X-User-Token	body	string
	credentials	body	schema: Auth {}

Table 5 POST /api/users/auth/

Method	POST /api/users/checkpermissions/		
Description	Check user permissions		
Responses	If Success return Success message 200 application/json <pre>{   "access": true,   "message": "Valid user",   "permissions": {     "collection": "users",     "method": "GET",     "user": "string"   } }</pre>		
	If Error return an error response JSON 400 application/json <pre>{   "access": false,   "message": "Invalid token" }</pre>		
Parameters	Name	Location	Data Type
	X-User-Path	header	string
	X-User-Token	header	string
	permissions	body	schema: Permissions{}

Table 6 POST /api/users/checkpermissions/

<b>Method</b>	<b>GET /api/users/validatesession/{id_user}</b>		
<b>Description</b>	Check user data by id		
<b>Responses</b>	<p>If Success return user data model</p> <p>200 application/json</p> <pre>{ "_id": {"\$oid": "3836b7485cfb41e7cb71078"},   "firstname": "test",   "is_active": true,   "lastname": "MaTHiSiS",   "role": "Administrator",   "user_name": "test.MaTHiSiS@atos.net" }</pre> <p>If Error return an error response JSON</p> <p>400 application/json</p> <pre>{ "access": false,   "message": "Invalid token" }</pre>		
<b>Parameters</b>	<b>Name</b>	<b>Location</b>	<b>Data Type</b>
	X-User-Path	header	string
	X-User-Token	header	string
	id_user	path	string

Table 7 GET /api/users/validatesession/{id\_user}

<b>Method</b>	<b>GET /api/users/roles</b>		
<b>Description</b>	Get a list of all the roles		
<b>Responses</b>	<p>If Success return Roles list data model</p> <p>200 application/json (content)</p> <pre>[{   "_id": {"\$oid": "5825b436d4adf7750a027b58"},   "description": "Admin",   "name": "Administrator" }, {   "_id": {"\$oid": "5825b4b6d4adf7750a027b59"},   "description": "Tutor",   "name": "Tutor" }, {   "_id": {"\$oid": "5825b4bed4adf7750a027b5a"},</pre>		

	<pre>"description": "Caregiver", "name": "Caregiver" }, { "_id": {"\$oid": "5825b4c8d4adf7750a027b5b"}, "description": "Learner", "name": "Learner" }]</pre>		
	<p>If Error return an error response JSON</p> <p>400 application/json</p> <pre>{ "access": false, "message": "Error getting the role list" }</pre>		
Parameters	Name	Location	Data Type
	X-User-Path	header	string
	X-User-Token	header	string
	search	query	string
	sort	query	string

Table 8 GET /api/users/roles

Method	GET /api/users/roles/{id_role}		
Description	Get a role by id		
Responses	<p>If Success return Role data model</p> <p>200 application/json</p> <pre>{ "_id": {"\$oid": "5825b436d4adf7750a027b58"}, "description": "Admin", "name": "Administrator" }</pre>		
	<p>If Error return an error response JSON</p> <p>400 application/json</p> <pre>{ "access": false, "message": "Error getting the role" }</pre>		
Parameters	Name	Location	Data Type

	X-User-Path	header	string
	X-User-Token	header	string
	id_role	path	string

Table 9 GET /api/users/roles/{id\_role}

<b>Method</b>	GET /api/users/users		
<b>Description</b>	Get the complete list of users		
<b>Responses</b>	<p>If Success return User list data model</p> <p>200 application/json (content)</p> <pre>[{  "_id":{"\$oid":"582ef5611d56e44ba1b2c5a8"},   "classrooms":[],   "firstname":"user",   "is_active":true,   "lastname":"test",   "role":"Administrator",   "user_name":"user.test@matisisi.com" }, ... ]</pre> <p>If Error return an error response JSON</p> <p>400 application/json</p> <pre>{"access":false, "message":"Error getting the user list" }</pre>		
<b>Parameters</b>	<b>Name</b>	<b>Location</b>	<b>Data Type</b>
	X-User-Path	header	string
	X-User-Token	header	string
	search	path	string
	sort	path	string

Table 10 GET /api/users/users

<b>Method</b>	POST /api/users/users
<b>Description</b>	Creates a new user

<b>Responses</b>	<p>If Success return the id of the new User</p> <p>200 application/json</p> <pre>{ "description": "User added successfully.",   "id": { "\$oid": "585284aaf1d465067764f6ce" },   "success": true }</pre>		
	<p>If Error return an error response JSON</p> <p>400 application/json</p> <pre>{ "access": false,   "message": "Error creating user" }</pre>		
<b>Parameters</b>	<b>Name</b>	<b>Location</b>	<b>Data Type</b>
	X-User-Path	header	string
	X-User-Token	header	string
	user_properties	body	schema: UserPost {}

Table 11 POST /api/users/users

<b>Method</b>	<b>GET /api/users/{id_user}</b>		
<b>Description</b>	Get a user by id		
<b>Responses</b>	<p>If Success return User data model</p> <p>200 application/json</p> <pre>{ "_id": { "\$oid": "582ef5611d56e44ba1b2c5a8" },   "classrooms": [],   "firstname": "user",   "is_active": true,   "lastname": "test",   "role": "Administrator",   "user_name": "user.test@matisisi.com" }</pre>		
	<p>If Error return an error response JSON</p> <p>400 application/json</p> <pre>{ "access": false,   "message": "Error getting user" }</pre>		
<b>Parameters</b>	<b>Name</b>	<b>Location</b>	<b>Data Type</b>



	X-User-Path	header	string
	X-User-Token	header	string
	id_user	path	string

Table 12 GET /api/users/{id\_user}

<b>Method</b>	<b>DELETE /api/user/users/{id_user}</b>		
<b>Description</b>	Delete a user by id		
<b>Responses</b>	<p>If Success return Success confirmation</p> <p>200 application/json</p> <pre>{ "description": "User deleted successfully.",   "success": true }</pre> <p>If Error return an error response JSON</p> <p>400 application/json</p> <pre>{ "access": false,   "message": "Error deleting user" }</pre>		
<b>Parameters</b>	<b>Name</b>	<b>Location</b>	<b>Data Type</b>
	X-User-Path	header	string
	X-User-Token	header	string
	id_user	path	string

Table 13 POST /api/user/users/{id\_user}

<b>Method</b>	<b>PUT /api/user/users/{id_user}</b>		
<b>Description</b>	Update a user by id		
<b>Responses</b>	<p>200 application/json</p> <pre>{ "description": "User updated successfully.",   "success": true }</pre> <p>If Error return an error response JSON</p> <p>400 application/json</p> <pre>{ "access": false,   "message": "Error updating user" }</pre>		
<b>Parameters</b>	<b>Name</b>	<b>Location</b>	<b>Data Type</b>

	X-User-Path	header	string
	X-User-Token	header	string
	id_user	path	string
	user_properties	body	schema: UserPut {}

**Table 14** POST /api/user/users/{id\_user}

## 4. Conclusion

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This document details how the APIs of the Learner Profile Repository and User Repository have been designed, their data structures as well as how their back-end and front-end initial versions are implemented for the first release of the MaTHiSiS platform. These are key components in the MaTHiSiS platform since they provide information to ensure the adaptation and personalization of the learning experiences. We also take into consideration the IMS specification to ensure the interoperability of the MaTHiSiS LP information, allowing the transfer of MaTHiSiS-related information to other educational systems.

The learner Profile Repository described in this document is the first version that is going to be tested during the first phase of pilots to be conducted as part of WP8 and WP9 in M14-M16. As result of such testing, most probably will be modifications in order to adjust the current design to the actual needs of the pilot participants. All documentation about the refinement process of the LPR according to the results of the pilots will be included in the next deliverable D3.8 to be submitted in M24.

## 5. References

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- [1] DXT (eds.). D2.3 Full system architecture M6. Deliverable of the MaTHiSiS project, 2016
- [2] DXT (eds.) D7.2 MaTHiSiS platform, 1st release M12 Deliverable of the MaTHiSiS project, 2016
- [3] Felder-Silverman learning style resources available at [http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Learning\\_Styles.html](http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Learning_Styles.html). Retrieved October 2016.

## 6. Annex 1

Most of the Profile data structure is based on the initial data modelling presented in D2.3. Below is presented an updated version which includes the descriptions of learner’s special needs in order to ensure the adaptation and personalization of the learning process.

### 6.1.1 Modelling accessibility data for the Learner profile

The main idea for modelling accessibility data is to partially use information of Learning standards and specifications to ensure a common language to describe the learner’s special needs information and to facilitate the adaptation and personalization of learning processes. Next is presented a possible list of the data necessary to correctly profile the special needs of learners. The information on each column of the following table includes: **Class of information** as the general concept of learner’s feature that will be modelled. **Specific information** further describe which are the specific concepts related to the general concept. Meanwhile, **Description** provides more details about the specified learner feature

Class of Information	Specific Information			Description
<b>Accessibility</b> (The overall set of features that characterizes the learner’s behaviour during his interaction with a TEL system)	<b>Disabilities<sup>1</sup></b> (The set of learner’s special needs that could affects the educational process)	<b>Physical disability<sup>2</sup></b>	<b>Affectation in motor functions</b>	Limitation on a person's physical functioning, mobility, dexterity or stamina
			<b>No affectation in motor functions</b>	
	<b>Learning disability</b>	<b>Arithmetic disability</b>	<b>Arithmetic disability</b>	Learning special needs refer to a number of conditions that might affect the acquisition, organization, retention, understanding or use of verbal or nonverbal information. Learning disabilities are due to genetic and/or neurological factors or injury that alters brain function in a manner that affects
			<b>Writing disability</b>	
			<b>Reading disability</b>	

<sup>1</sup><http://www.disability.net/page4.html>

<sup>2</sup><http://www.disability.net/conditions.htm>

			<b>Spelling disability</b>	one or more processes related to learning
			<b>Auditory Processing disability</b>	
			<b>Visual Processing disability</b>	
			<b>Sensory Integration (or Processing) disability</b>	
			<b>Organizational Learning disability</b>	
			<b>Social Cue disability</b>	
		<b>Intellectual disability</b>	<b>Mild</b>	Types of intellectual disabilities considered in MaTHiSiS
			<b>Moderate</b>	
			<b>Severe</b>	
		<b>Auditory disability</b>	<b>Mild hearing loss</b>	Types of auditory disabilities considered in MaTHiSiS
			<b>Severe hearing loss</b>	
			<b>Total hearing loss</b>	
		<b>Visual disability</b>	<b>Visual impairment</b>	Types of auditory disabilities considered in MaTHiSiS
			<b>Blindness</b>	
		<b>Autism spectrum disorder</b>	<b>Autism</b>	Types of autism disorders considered in MaTHiSiS
<b>High functioning autism</b>				
<b>Other disabilities</b>		Open field to include other disabilities		
<b>Global</b>				

		<b>developmental delay</b>		
		<b>Communication &amp; language</b>	<b>Aphasia</b>	Types of communication and language disabilities considered in MaTHISIS
			<b>Selective mutism</b>	
			<b>Disarthria</b>	
			<b>Stuttering</b>	
			<b>Language delay</b>	
			<b>Dyslalia</b>	
	<b>Dysphonia</b>			
	<b>Specific learning difficulties</b>	<b>Writing</b>	Types of specific learning difficulties considered in MaTHISIS	
		<b>Maths</b>		
<b>Reading-Writing</b>				
<b>Behavioural disorders</b>		Open field to include behavioural disabilities		
<b>Attention deficit hyperactivity disorder</b>		Open field to include attention deficit/Hyperactivity disorder		
<b>Interaction Preferences</b> (Learner’s preferences regarding interaction with any digital or e-learning system)	<b>Display</b> (Aesthetic factors such as the use of highly interactive sensory and visual communication)	<b>Color schemas</b>	High contrast/low contrast	
		<b>Color filter</b>	Normal, red/green, green/red, blue/yellow, grayscale	
		<b>Font size</b>	Clear print = 12pt Large print = 16pt	
		<b>Font type</b>	Arial	

		<p><b>Language</b></p> <p>(Learner’s preferences regarding the language of the learning objects)</p>	<p><b>Language Preferred</b></p> <p>Language that the learner prefers for the presentation of learning objects</p>
			<p><b>Language Spoken</b></p> <p>Learner’s native languages</p>
		<p><b>Media Presentation</b></p>	<p>Video/Audio/All</p>
	<p><b>Learning Style</b></p> <p>(Learner’s learning style - This class will be further divided into the sub classes following the <b>Felder-Silverman theory</b>). This information can be retrieved by a questionnaire (<b>INDEX OF LEARNING STYLES (ILS)</b>)<sup>3</sup></p> <p>Based on <b>stereotypes</b></p>	<p><b>Processing</b></p> <p>(It indicates how the learner prefers to process information: actively through engagement in physical activity or discussion, or reflectively through introspection)</p>	<p><b>Active or Reflective</b></p> <p><b>Active learners</b> learn by direct interaction with the material; prefer group communication.</p> <p><b>Reflective learners</b> like to think about the material; prefer individual or very small group communication.</p>
		<p><b>Input</b></p> <p>(It indicates sensory channel through which external information is most effectively perceived by the learner: visual pictures, diagrams, graphs, demonstrations, or</p>	<p><b>Visual or Verbal</b></p> <p><b>Visual learners</b> are better able to remember images they have seen (charts, graphs, pictures).</p> <p><b>Verbal learners</b> are better able to remember written or spoken words.</p>

<sup>3</sup><http://www.engr.ncsu.edu/learningstyles/ilsweb.html>



		auditory words, sounds and tactile input)		
		<p><b>Understanding</b></p> <p>(It shows how the learner progresses towards understanding: sequentially in continual steps, or in fits and starts)</p>	<b>Sequential or Global</b>	<p><b>Sequential learners</b> prefer learning linearly, with logical steps.</p> <p><b>Global learners</b> prefer a holistic approach and seem to learn almost randomly by fitting pieces together into a big picture.</p>
		<p><b>Perception</b></p> <p>(Type of information the learner prefers to receive: sensory (external) such as sights, sounds, physical sensations; or intuitive (internal) such as possibilities, insights, hunches.)</p>	<b>Sensing or Intuitive</b>	<p><b>Sensing learners</b> are detail-oriented and practical with a preference for concrete facts and real world applications.</p> <p><b>Intuitive learners</b> have a creative disposition and are drawn to the theoretical and abstract.</p>
	<b>Performance</b>	<b>Level of knowledge</b>	<p><b>Beginner (p1– p3)</b></p> <p><b>Intermediate (p4-p6)</b></p> <p><b>Advanced (p7-p8)</b></p>	It is used for taking into account the learner background when communicating learning objects to the learner. These reference values are used according to the Pvalue (Performance - P Scale - attainment targets for pupils with special educational needs, Education Department,UK, 2014)
		<b>Existing skills</b>	<b>List of already acquired skills</b>	
<b>Motivation State</b> (Learner’s motivation	<b>Learning goals</b>			
	<b>Interests</b>			Learner’s interests/hobbies

during the educational process)	<b>Time study</b>			The average time per day that the learner can use for studying
<b>Affective state</b>	<b>Frustration</b>	Affective state determined by the MaTHiSiS platform. All details about the theoretical background of such determination will be included in D6.1 Adaptation and Personalization principles based on MaTHiSiS findings		
	<b>Arousal</b>			
	<b>Flow</b>			
	<b>Boredom</b>			

## 7. Annex 2

LP inJSON format . Some of the content has been removed in order to improve readability.

```
{
  "date_of_birth": "2016-02-12",
  "accessibility": {
    "disabilities": {
      "physical": ["affectation in motor functions"],
      "learning": ["Arithmetic disorder", "Writing Disorder", "Reading disorder"],
      "intellectual": ["mild", "moderate", "severe"],
      "auditory": ["mild hearing loss", "severe hearing loss", "total hearing loss"],
      "visual": ["visual impairment", "blindness"],
      "autism_spectrum_disorder": ["autism", "high functioning autism"],
      "other_disabilities": "none",
      "global_developmental_delay": "none",
      "communication_and_language": ["aphasia, selective mutism", "dysarthria"],
      "specific_learning_difficulties": ["writing", "maths", "reading-writing"],
      "behavioral_disorders": "none",
      "attention_deficit_hyperactivity_disorder": "none"
    },
    "interaction_preferences": {
      "display": {
        "color_schemas": ["high_contrast", "low_contrast"],
        "color_filter": ["normal", "red_green", "green_red", "blue_yellow"],
        "clear_print": {
          "font": "Arial",
          "font_size": "12pt",
          "space_between_lines": "1,15"
        },
        "large_print": {
          "font": "Arial",
          "font_size": "16pt",
          "space_between_lines": "1,5"
        },
        "font_options": "clear_print"
      },
      "language": {
        "language_preferred": "English",
        "language_spoken": ["English, Spanish"]
      },
      "media_presentation": ["video", "audio"]
    },
    "performance": {
      "english": {
        "score_p1_p3": "",
        "reading_p4_p8": "",
        "writing_p4_p8": "",
        "speaking_p4_p8": "",
        "listening_p4_p8": ""
      },
      "mathematics": {
        "score_p1_p3": "",
        "number_p4_p8": "",
        "using_and_applying_maths_p4_p8": "",
        "shape_space_and_measures_p4_p8": ""
      },
      "science": {
        "score_p1_p8": ""
      }
    },
    "learning_style": {
      "processing": ["Active learner", "Reflective learner"],
      "input": ["Visual learner", "Verbal learner"],
      "understanding": ["Sequential learner", "Global learner"],
      "perception": ["Sensing learner", "Intuitive learner"]
    },
    "level_of_knowledge": ["Beginner", "Intermediate", "Advanced"],
    "personal_features": ["specific needs", "specialneeds", "advanced learners"],
    "motivation_state": {
```

### D3.7 –Learner’s Profile Repository

---

```
"learning_goals":["Goal1","Goal2"],
"interests":["Interes1","Interest2"],
"avg_time_study":10,
"skill":["Skill1","Skill2"]
},
"affective_state":["Frustration, Arousal, Flow, Boredom"]
}
```