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TeacHy

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WP5: Integration onto online e-learning Platform

Deliverable D5.1: Support Team Contacts and Demands, Criteria and Technical Specifications of the TeacHy / NET-Tools interface

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About TeacHy

As the FCHT industry gradually emerges into the markets, the need for trained staff becomes more pressing. TeacHy2020, or short TeacHy, specifically addresses the supply of undergraduate and graduate education (BEng/BSc, MEng/MSc, PhD etc.) in fuel cell and hydrogen technologies (FCHT) across Europe.

TeacHy2020 will take a lead in building a repository of university grade educational material, and design and run an MSc course in FCHT, accessible to students from all parts of Europe. To achieve this, the project has assembled a core group of highly experienced institutions working with a network of associate partners (universities, vocational training bodies, industry, and networks). TeacHy offers these partners access to its educational material and the use of the MSc course modules available on the TeacHy site. Any university being able to offer 20 to 30% of the course content locally, can draw on the other 80 to 70% to be supplied by the project (and its successor entity that will support the platform post-project).

This will allow any institution to participate in this European initiative with a minimised local investment. TeacHy will be developing solutions to accreditation and quality control of courses, and support student and industry staff mobility by giving access to placements. Schemes of Continuous Professional Development (CPD) will be integrated into the project activities. We expect a considerable leverage effect which will specifically enable countries with a notable lack of expertise, not only in Eastern Europe, to quickly be able to form a national body of experts.

TeacHy will offer some educational material for the general public (e.g. MOOC's), build a business model to continue operations post-project, and as such act as a single-stop shop and representative for all matters of European university and vocational training in FCHT. The project partnership covers the prevalent languages and educational systems in Europe. The associated network has over 70 partners, including two IPHE countries, and a strong link to IPHE activities in education.

Deliverables Abstract

This Deliverable summarises the interface and interaction between the projects TeacHy and NET-Tools.

It includes the list of Supporting Team members, along with a report on the development of the NET-Tools structure and NET-Tools / TeacHy interface.

1 Introduction

TeacHy aims to develop European course curricula and adjusted e-learning materials related to fuel cell and hydrogen (FCH) technology and its applications. Both, the developed course curricula at European level and the e-learning material and contents, shall support the education at Universities, High Schools and also Industry, in training students, technicians, and engineers on different levels in FCH technologies. It can be expected - and the tendency is already recognisable - that an increasing demand of work force educated in related FCH technology themes will be key in fostering the energy transition at European level and strengthening the related industry.

Especially complete e-courses, adjusted e-learning materials and contents are essential in supporting European Universities and High Schools in developing their own education status related to FCH technologies. This means, impact and sustainability of TeacHy depends on the implementation and quality of available e-courses and e-learning materials, themes covered, usability, thematic interconnections, arrangements and tools to likewise support students and lecturers.

However, from past activities e.g. HyResponse, HYFACTS, KnowHy, HyProfessionals etc. it can be learned that most of these activities missed aspects of turning their activities into sustainable initiatives. Today, only some of these projects will be recognised as long-term feasible concepts. Analysing the reasons (see below), most obstacles can be identified as follows:

- lack of user-friendliness and transparency;
- incompleteness of course materials:
    - lessons not developed sufficiently to a final version,
    - lack of interrelation of lessons (no interconnections),
    - lack of continuity in quality of lessons (less consequent quality),
    - missing quality control on correctness and actuality of information;
- missing structure to provide the developed e-learning materials;
- missing technical support and feasible infrastructure;
- missing motivation and cooperation with externals,

amongst others.

At least the missing achievements to gain sustainability listed by the bullet points above leads also to a missing traffic on the respective websites, due to missing attractiveness, and actuality, as well as missing willingness in cooperating with external partners (probably not foreseen within the projects and/or activities) and usage of provided e-learning content and materials. TeacHy attempts to overcome these shortcomings by developing and using a different technical structure (including professional LMS and backing of e-learning content by two independent systems Open-edX and CANVAS), by installing a board (supporting team), which shall take responsibility for the provision and development of e-learning materials and contents (quality, completeness, and interrelations) and also take responsibility in the further development of the technical infrastructure, especially concerning user-friendliness and transparency.

1.1 Analysis of past Activities and Projects

A small analysis of past and running activities and projects regarding the development and provision of more or less completed e-courses was performed. The analysis investigated mainly following aspects:

- The realisation of technical infrastructure to provide e-learning material,
- Scope and type of e-learning material developed and provided,
- Sustainability of activity and/or project concerning e-learning.

Selected projects and activities investigated were:

	projects/connections	comments
	HyResponse (FCH-project)	
1	http://www.hyresponse.eu/index.php	Download area
	University Lisbon	
2	https://tecnico.ulisboa.pt/en/events/specialisation-course-fuel-cell-basics-hydrogen-safety/	Linked to KnowHy
	Pacific Northwest National Laboratory	
3	https://h2tools.org/training-materials	Download area e-tools (excel based)
	Consultancy	
4	https://www.kiwa.com/nl/en/	LMS (unknown)
	European Fuel Cell and Hydrogen Association	
5	https://www.h2euro.org/	Links to other websites only
	Bulgarian Academy of Science	
6	http://imood.iees.bas.bg/e-learning.html	Slides only
	Hy2Green (Erasmus Program)	
7	http://www.hy2green.org/work-programme	LMS (Moodle)
	http://hy2green.h2athome.net/	Separate Training Platform
	Now GmbH (project management agency)	
8	https://www.now-gmbh.de/en/news/events/onlinekurs-hydrogen-production-and-handling	Linked to KnowHy
	TrainHyProfessionals (HySafe) (FP5 Project)	
9	http://www.hysafe.org/TrainHyProf	Download area
	H2Training (Leonardo da Vinci)	
10	https://www.h2training.eu/index_de.htm	Not alive
	HyFACTS	
11	https://www.h2euro.org/hyfacts/	Not alive anymore
	HyProfessionals	
12	https://www.h2euro.org/hyprofessionals/	Not alive anymore
	KnowHy (FCH-project)	
13	https://knowhy.eu/	LMS (unknown)

It can be identified that only one of the investigated activities or projects uses a so-called learning management system (LMS) fully integrated as it is realised by NET-Tools to provide full open access to users (teachers and students). The KnowHy project, which appears similar to TeacHy targets, uses an e-platform (provision of e-learning materials) combined with hands-on training sessions. The technical implementation of the e-platform could not be investigated completely in detail due to the e-courses now being terminated (activity was ended in 2017). HyResponse uses a simple “download section” on the project website. A LMS was not installed so no online-course available. It is only envisaged to present used teaching materials via download section. Hy2Green as a new project which is actually not finished uses Moodle as LMS. Moodle is a well-known and mature software package but needs to be installed on a single server system. All other projects and activities were either “dead” or did not foresee an LMS for the provision of e-courses or single e-learning material and contents.

To follow up the second point of investigation which was the FCH related content provided, it appears also very different between the single projects. Mostly a specific set of e-learning materials is recognised to tailored themes e.g. ‘Safety’ or ‘Hydrogen Use’. None of the projects and activities provides a set of e-learning material which could be accepted as a “full e-course” concerning FCH technologies. KnowHy appears under specific view as an exceptional case but shall not be discussed in detail at this stage.

Going through the single projects and activities mentioned, the provided thematic content will be introduced briefly.

The focus of the HyResponse project lay mainly on hydrogen safety (use, handling, prevention, hazards, etc.) (fig.1.0)

Educational materials: hydrogen safety basics for First Responders

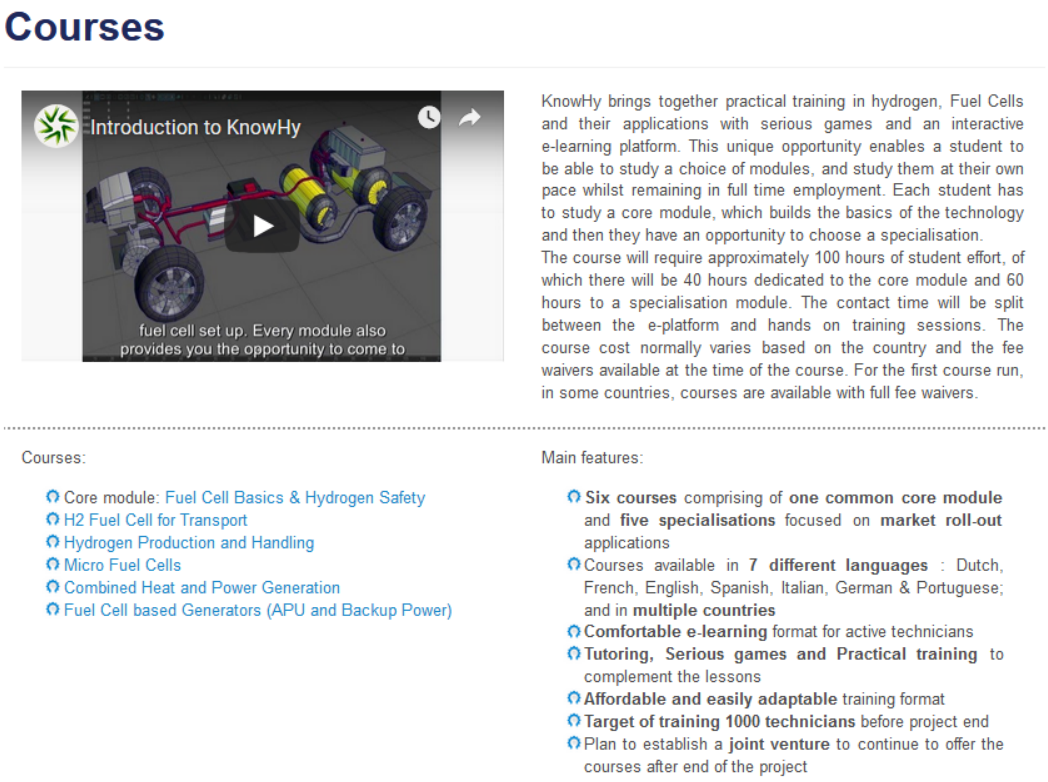
The main objectives of the educational materials are to stress the specificities of hydrogen as a new energy carrier during its production, transport, delivery and use; to teach First Responders about the potential risks and hazards of hydrogen compared to traditional fuels (natural gas, petrol, propane, etc.); and to introduce First Responders to new FCH systems, infrastructures, associated risks, accident and incident scenarios and RCS.

Educational Materials	Link
Introduction to hydrogen and FC applications	Slides Notes
Hydrogen properties relevant to safety	Slides Notes
Safety of hydrogen storage	Slides Notes
Harm criteria for people and environment, damage criteria for structures and equipment	Slides Notes
Unignited hydrogen releases, their prevention and mitigation	Slides Notes
Sources of hydrogen ignition and prevention measures	Slides Notes
Hydrogen fires	Slides Notes
Dealing with hydrogen explosions	Slides Notes
Hazards of hydrogen use indoors	Slides Notes

[fig.1.0] Download area on the HyResponse webpage to provide teaching material via slides

The situation at KnowHy appears different and better compared to all other projects (fig.1.1) (fig.1.2). The website provides different interesting and useful links also to e-learning materials and developed courses that have been completed. Registration is needed to get into the section of e-learning courses to learn in more detail about the course content, procedure and structure. The last scheduled activity happened 2017, when the project ended.

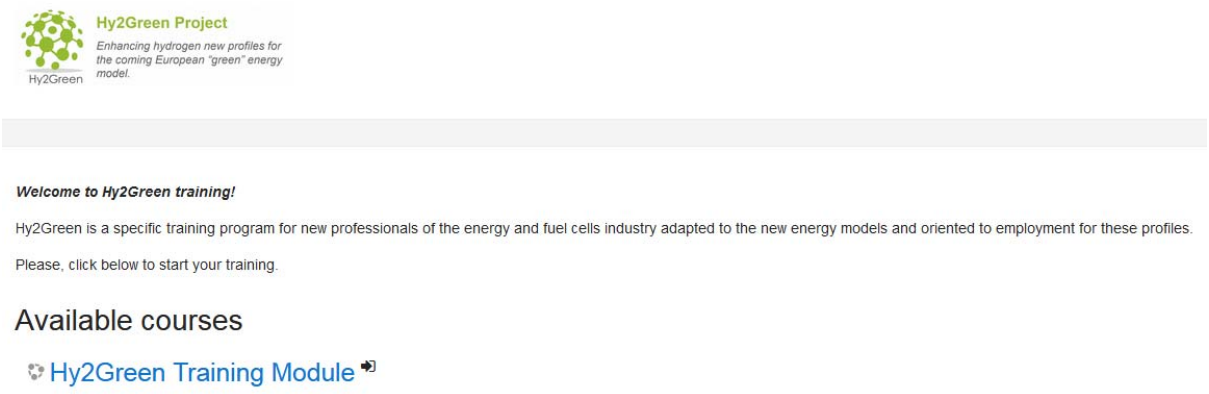
[fig.1.1] Landing page website to the project KnowHy which appears attractive and alive



[fig.1.2] Area at project website introducing the courses and course content including a short information on the courses and links for further information about single courses.

It can be highlighted, that KnowHy announces to have available e-courses in 7 different languages. Also it could be pointed out that KnowHy established a business entity to continue delivering e-courses and/or education in FCH technologies post-project

Hy2Green uses a separate training platform and runs “Moodle” as LMS. Registration is needed to receive more detailed information about the training courses which is announced as ‘e-courses’ (fig.1.3). At this point the specific themes provided by e-learning material could not be identified because of the need for registration, which was closed. However, education on hydrogen and fuel cells appears as a contribution to renewable energy technologies, though not specifically addressed.



[fig.1.3] Separated area to run “Moodle” as LMS for training courses regarding the implementation of hydrogen in energy systems based on renewable energies

Not uninteresting project run under Leonardo da Vinci programme. The project provides slides within a download area (similar to HyResponse) for training in different languages.

[fig.1.4] slides provided by H2Training in different languages for downloading and “free” use (no registration is needed)

1.2 Conclusion of Analysis

By inspecting the specific aspects of:

- realised technical infrastructure to provide e-learning material,
- scope and type of e-learning material developed and provided,
- sustainability of activity and/or project,

it was identified, that the use and inclusion of a functional LMS was the most important issue, along with sustaining the technical infrastructure post-project. The latter will probably be explained by the lack of support for operating costs.

A second issue that was identified was that a well-structured content and interconnections were missing. Most developed content of e-learning material appeared either as a compilation of different lessons, bound together into a more general scope, or very specifically thematically focussed, e.g. on safety.

A third issue was the content itself, this is to say it left open or unclear if the content had been reviewed and thus accuracy of knowledge and information was guaranteed and, last but not least, the quality of e-learning material was sustained.

A forth issue, the lack of inclusion and cooperation with external partners (also motivating external partners to collaborate) seems to be caused by projects not envisaging such cooperation within the description of the project.

To ensure that these issues are addressed and overcome within the TeacHy project, a supporting team shall take responsibility to:

- observe the functionality of LMS and e-portal,
- continuously review the quality of e-learning material,
- review the completeness and transparency of course material.

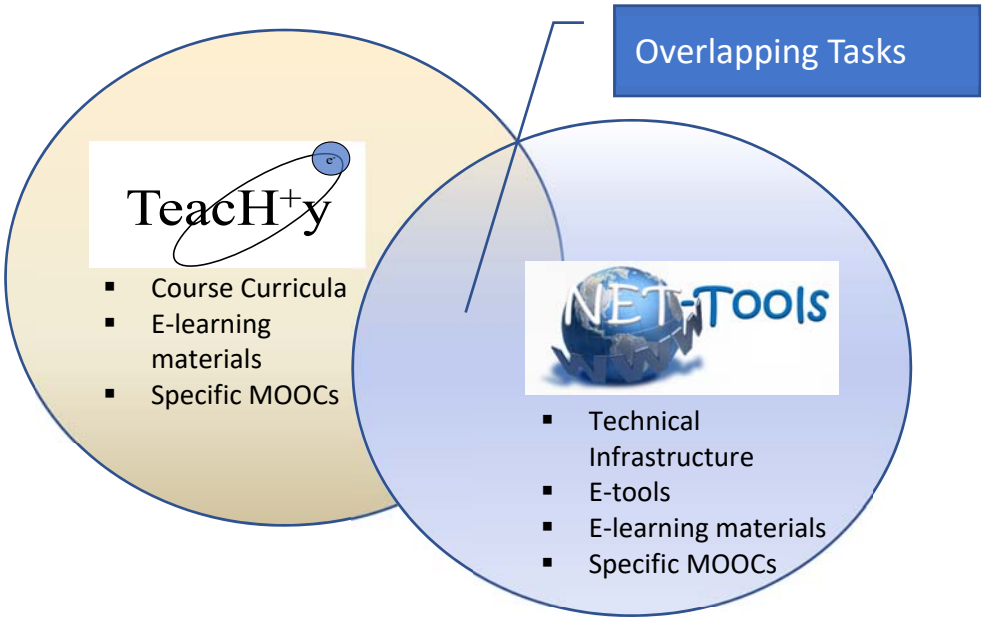
In order to handle and manage all e-learning content (implementation and modification of e-content) as well as review the practical usability and functionality of the LMS (technical functions and installed features) the so-called ‘Supporting Team’ shall observe and monitor the continuous development of both. In more detail this includes compiling recommendations and suggestions for further development, addressing e-learning content and material, as well as technical infrastructure.

2 Structure and Subdivisions

The general structure of the supporting team is based on the overlapping outcome of the two projects TeacHy and NET-Tools. To build synergies and essential impact to each project as well as gaining sustainability for the common activity, a direct collaboration is envisaged.

While TeacHy is developing course curricula and adjusted e-learning contents, NET-Tools is in parallel realising an e-platform (technical infrastructure), e-tools for hydrogen technologies related calculations, and course examples, as well as specific Massive Open Online Courses (MOOCs). It is recognisable that all objectives mentioned are related to didactic aspects and extended education in FCH technologies. By addressing common targets (education in FCH technologies) both projects can unite, especially in technical parts which constitute the direct collaboration.

However, while the NET-Tools project achievements are technically orientated (realisation of e-platform to provide e-tools and e-learning materials for demonstration of functionality and attractiveness of the e-platform), the achievements of TeacHy are more practically orientated (development of course syllabus and complete sets of e-learning content). Thus the general structure (fig.2.0) of a so-called monitoring board must incorporate single but also overlapping demands of both projects which should be addressed by the monitoring board.



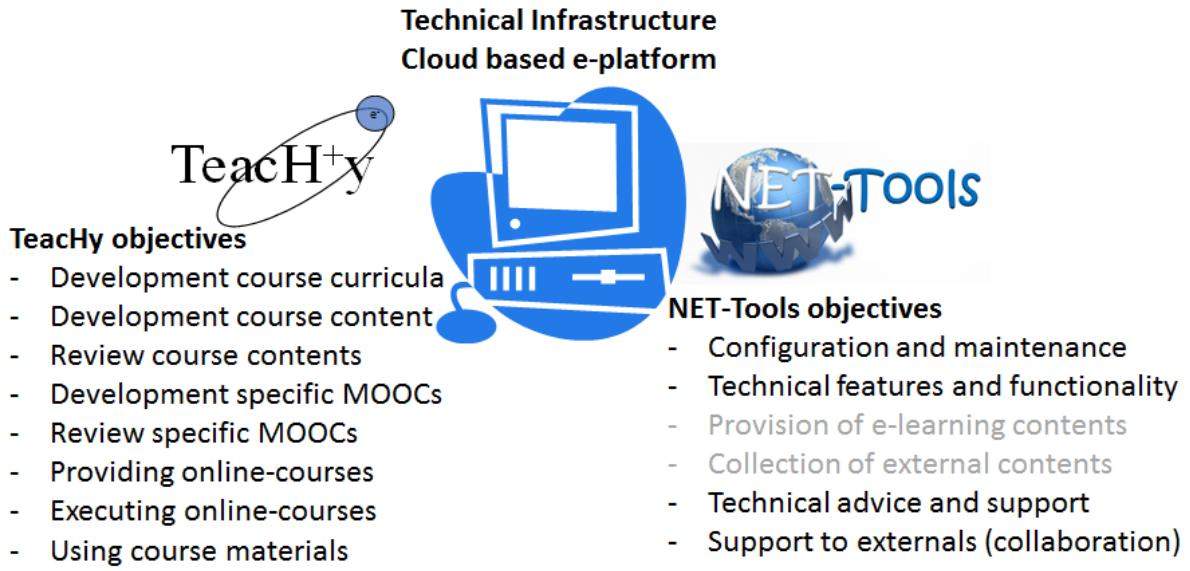
[fig.2.0] Major project achievements (shortlist) and overlaps of TeacHy and NET-Tools.

The basic idea on structuring the monitoring board is that it shall consist of TeacHy members (project members and associates), NET-Tools members but also external partners (lecturers and students). To allocate members to the correct envisaged monitoring tasks, a substructure was developed as mirrored in fig.2.1 according to the overlap identified in tab.2.0.

[tab.2.0] Major objectives of the single projects and overlaps in concern that both projects could profit from each other by sharing their achievements and contents constructively by direct collaboration.

TeacHy achievements	Overlap	NET-Tools achievements
FCH-online courses on different levels		Technical infrastructure
Course curricula		e-infrastructure
e-learning material dedicated to the specific course (Bachelor, Master, PhD, others) →	Usage of e-platform (LMS) to store and provide e-learning material	e-learning (LMS)
Additional e-learning material and content (MOOCs) →	Usage of e-platform to store and provide MOOCs	e-learning (LMS)
e-learning material dedicated to the specific courses (Bachelor, Master, PhD, others)	Incorporation of e-tools into the e-learning material ←	e-laboratory (e-tools)
	Additional and supporting e-learning material (MOOCs) ←	Specific MOOCS
	Additional and supporting e-learning material (MOOCs) ←	Example e-lessons (short courses)
Development of further and very specific e-learning material →	New e-learning material ←	Technical and practical instructions to the development of e-learning material and MOOCs
	Development of specific e-tools ←	Technical and practical instructions to the development of e-tools
Execution of courses (independent of location) →	Usage of content provided through e-platform (students and teachers)	e-learning (LMS)
	Usage of content provided through e-platform (students and teachers) ←	Execution of courses (independent of location)
	sharing of e-learning content developed in other projects ←	e-repository e-learning (LMS)
	sharing of specific information (e.g. project information) ←	e-repository

The structure of the supporting team is built around the technical infrastructure, the so-called NET-Tools e-platform which provides all e-learning content developed internally by TeacHy or NET-Tools and collected from externals to students and teachers.



[fig.2.1] Structure of the monitoring board distinguished by the different objectives within the single projects.

The main targets of the monitoring board are to keep the more general conspectus and observe the ongoing (development) concerning the practical objectives arising in TeacHy:

- Quality control of e-learning material (*TeacHy members*),
- Accuracy, completeness, and usability of e-learning material (*TeacHy members*),
- Design and structure of e-learning material (*TeacHy members*),
- Provision of MOOCs to support e-courses (*TeacHy members, NET-Tools members*),
- Respond to gaps concerning e-learning material and potential MOOCs.

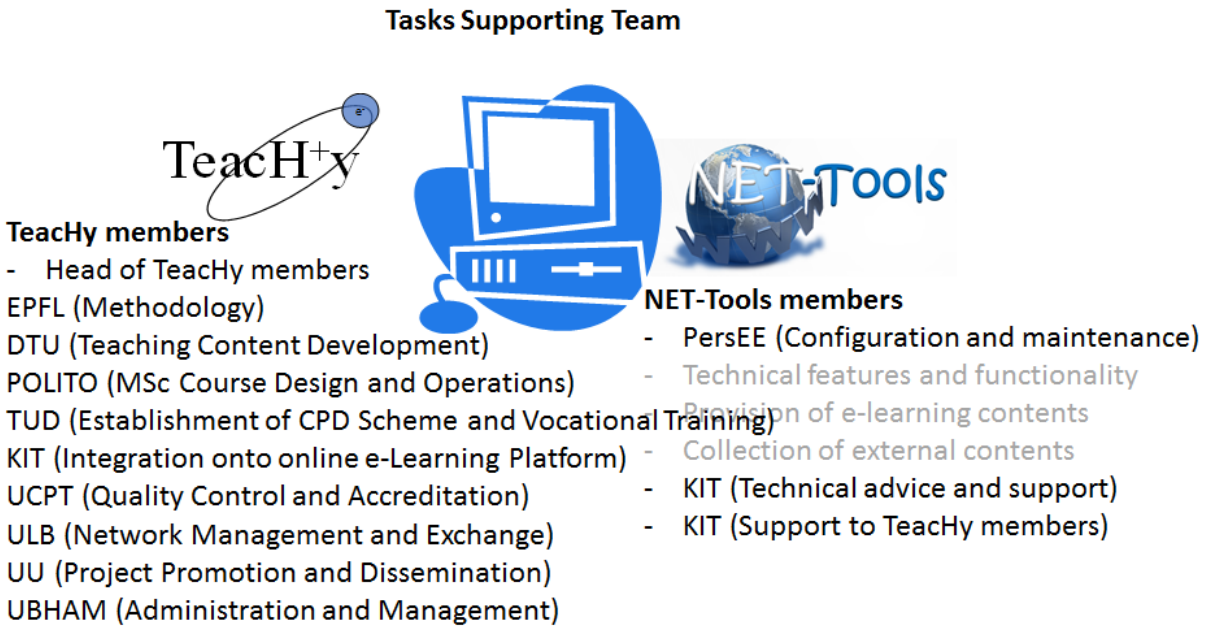
…and concerning the technical objectives arising by NET-Tools:

- Functionality and operational features concerning e-platform and LMS,
- Technical advice and support to the LMS (also to the practical development of e-lessons and e-courses, and MOOCs),
- Availability of instructions and further information for the use of the LMS,
- Intellectual Property Rights,
- Applicability and usability of the LMS.

In general, the supporting team observes and monitors the interconnections of both, the practical incorporation of e-learning content and material, and the structure built to provide the e-courses, including the technical functionality and features.

2.1 Exchange of Information

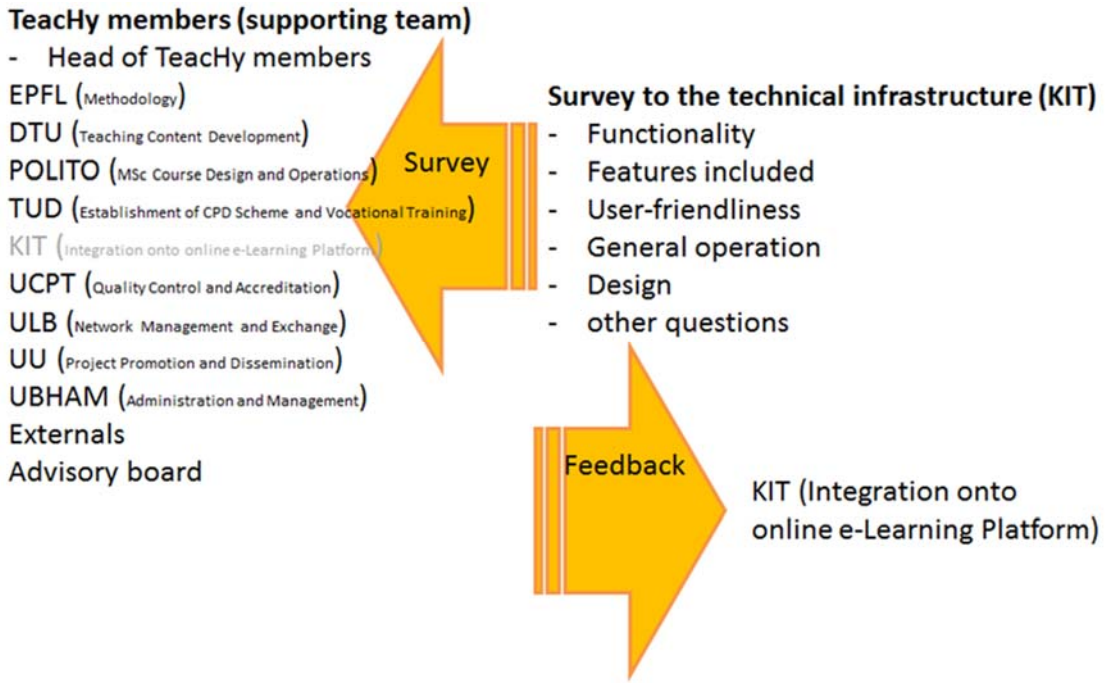
The exchange of information between the supporting team and responsible persons is essential. It is envisaged to build the exchange of information on surveys (to be completed by the supporting team) and direct contacts. The surveys include demands, criteria, design, status of e-learning material and technical specifications. The surveys will be developed by KIT as responsible partner, and will be distributed to the supporting team (fig.2.2).



[fig.2.2] Structure of the monitoring board distinguished by the different objectives within the single projects.

2.2 Communication Strategy

The communication strategy developed shall operate as follows, with KIT as WP leader and also NET-Tools member compiling different surveys to receive opinions, requests and suggestions on aspects covered by the survey as a feedback from the supporting team. The feedback will be used for improvements, corrections or modifications of the technical infrastructure as far as possible.



Surveys will be developed and disseminated to the supporting team by KIT according to the necessities which appear as follows:

1. Operational and technical infrastructure (NET-Tools LMS) (month 18),
2. Integration of e-learning material (design, transparency of content, instructions, advice, completeness, quality, etc.) (month 20),
3. Feedback from users (teachers and students) (assumed months 32),
4. Sustainability and business concepts (month 34).

The collection and analysis of surveys will be arranged by KIT and results communicated to the members afterwards including the list of suggestions and requests which were addressed.

In principle, a short-cut communication with work package leader is envisaged, when technical issues or missing information is discovered by the supporting team.

2.3 Basic Member List of Supporting Team

The basic member list of the supporting team consists of the work package leaders of the TeacHy project.

- EPFL (Methodology)
- DTU (Teaching Content Development)
- POLITO (MSc Course Design and Operations)
- TUD (Establishment of CPD Scheme and Vocational Training)
- KIT (Integration onto online e-Learning Platform)
- UCPT (Quality Control and Accreditation)
- ULB (Network Management and Exchange)
- UU (Project Promotion and Dissemination)
- UBHAM (Administration and Management)

In addition to these internal members, external partners could also be foreseen, e.g. taken from the Advisory Board or Associated Members or even single external persons who show willingness and interest to cooperate or support the development of an e-course or technical infrastructure (e-portal).

2.4 Basic Contacts of Supporting Team

Due to the fact, that all work package leaders should be member to the supporting team, persons must get nominated instead of institutions. Therefore the project member list will be used.

Name: Vladimir Molkov - Professor, Director of the HySAFER Centre
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WORK PACKAGE LEADER

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CHAIR OF SUPPORTING TEAM

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