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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.

Abstract

The main task of this deliverable is to identify key performance indicators (KPI) to taught module success. Methodology indicators were defined to enable detailed analysis of module quality. Defined indicators serve to assess individual modules defined within Task 2.2. As every module is focused on a specific topic, the KPIs are mainly based on number of attendees and competences they obtain by completing the module. In addition, the compatibility of obtained knowledge to the needs of potential employers is within the scopeof the KPIs. For the module preparation, its delivery and continuous improvement it is crucial for authors to receive feedback from all involved key players (teachers, students, employers). Therefore, three groups of indicators were defined with respect to the evaluator category:

1st group - technical level of the modules and their importance towards training needs evaluated by the TeacHy consortium and Advisory Board.

2nd group - module evaluation by students and teachers.

3rd group - main KPIs including number of graduates, grades distribution etc.

The importance of every indicator for the operation of the course was set. Finally, on the base of these indicators, the protocol for assessment of every module was defined. The main target was to minimise the number of questions in order to increase the probability of obtaining the relevant response by all participating parties.

1 Indicator definition

1.1 Technical level

Every module, before being introduced into the course, will be evaluated with respect to its technical level to equilibrate all parts of the TeacHy course. The main evaluation will be done by consortium members. Additionally, participation of the Advisory Board is important at this stage for success of the approach chosen. Its role is fundamental, especially in comparing the addressed topics with the most important competences required from the graduated specialists on the labour market.

The following module indicators were defined with their corresponding importance level in %:

1. Module content: general / specific 10%
2. Module importance: useless/ unimportant/ recommended / important / very important 40%
3. Module science/engineering level: very easy/ easy/ intermediate/ hard/ very hard 10%
4. Module link with other modules: very low/ low/ adequate/ high / very high 35%
5. Module time demands: very low/ low/ adequate/ high / very high 5%

1.1.1 Module content

The aim of this indicator is to distinguish between the modules focused on fundamental phenomena (mass transfer, reaction kinetics, heat transfer, etc.) and modules focused on issues specific to individual technologies/processes (materials, construction, techniques, specific requirements and constraints etc.). A well-designed course needs an adequate balance between theoretical and practical elements. Furthermore, requirements for the structure and evaluation of these types of courses will differ. The specification of given course is important to evaluate a balance between general and specific modules for entire course structure.

1.1.2 Module importance

This KPI indicator is crucial for consensus of consortium on the course structure. Clearly, this indicator can be strongly influenced by the subjective viewpoint held by an individual evaluator. However, considering the consortium comprises 12 universities and includes Advisory Board members, the final evaluation provides a statistically significant set of data. This will help to objectivise input for further optimisation of the course structure.

1.1.3 Module science/engineering level

This indicator can be influenced by the subjective opinion of every evaluator. The difficulty of the scientific or engineering level in each module is strongly related to the educational background of the students. The different background together with heterogeneous education systems will lead to differences in the individual judgements. In addition, the level can be estimated after completing all teaching material. Therefore, this indicator is mainly related to the module description and should help authors to adapt the module content to generally accepted level.

1.1.4 Module links with other modules

The 2nd KPI from this group is crucial for establishing a complex course with complementary and well interconnected individual modules. The modules have to be evaluated as part of the

complete course. Therefore, the links to the other course modules is crucial. Two main aspects are to ensure effective building of knowledge on principles, thereby providing sufficient prerequisite knowledge for the follow-up modules. At the same time, significant overlapping of contents should be avoided, except brief revisions of previously gained information. This is especially true for linking together fundamental and applied modules. This indicator is significantly demanding with respect to evaluators. It is because basic insight into all modules is required.

1.1.5 Module time demands

The module content has to correspond to the learning time defined by the course structure. It should remain in balance with module importance (see paragraph 1.1.2). The aim of this indicator is to judge the level of agreement prior to introducing the module into the course structure.

1.2 Module assessment by students and teachers

Two types of evaluation outputs are expected here within the first period of the project. It is because only at UBHAM the complete course will be provided in this period. Here the students will have a unique opportunity to evaluate the complete course, including quality of the link between the individual modules etc. Also, new competences gained by students should serve as indicator of the course added value. The second group of evaluation results represent the partners at whose premises only selected modules will be delivered within the framework of their own study programmes. Significant differences in evaluation by these two groups can be expected. Nevertheless, feedback from both groups is important at this stage with respect to further course structure and module content optimisation.

Evaluation by teachers allows receiving a view “from the other side”. Teachers will have the possibility to follow the interaction with students, their ability to absorb the knowledge delivered, and its adequacy to the prevailing background of the students. The need of consultation indicates the unclear parts of teaching materials. The required/gained competences are reflected in the module descriptions. Therefore, they are clearly defined before the module delivery.

Indicators of module evaluation by students with their corresponding importance level in %:

1. Module topic of interest/relevance: very low/ low/ neutral/ high / very high 5%
2. Module content quality: very low/ low/ neutral/ high / very high 30%
3. Module time demands: very low/ low/ neutral/ high / very high 10%
4. Teaching content relevance for exam: very low/ low/ neutral/ high / very high 20%
5. Number of credits in relation to difficulty: very low/ low/ neutral/ high / very high 5%
6. Competences gained: ……. 30%

Indicators of module evaluation by teachers with their corresponding importance level in %:

7. Student’s interest in the module: very low/ low/ neutral/ high / very high 10%
8. Consultancy need: very low/ low/ neutral/ high / very high 45%
9. Students theoretical background needed to understand the course: very low/ low/ neutral/ high / very high 45%

1.2.1 Module topic of interest/relevance

One of the parameters for selection of the course/module by students is its attractiveness. Usually general modules focused on fundamental topics are less popular than descriptive modules focused on practical issues. At the same time, however, the role of the teacher and their skills is indisputable here. This indicator brings the information about students' preferences with respect to their selection of optional course/module. The students' interest in course/module is clearly indicated by their participation in it. Therefore, only limited additional information can be obtained here. Thus, importance level was set to 10%.

1.2.2 Module content quality

Students are the main recipients of study material prepared within the project. Their evaluation of material quality reflects mainly clarity and relevance of the delivered material. Therefore this indicator fall to the KPI category and students' response here is important for module evaluation.

1.2.3 Module time demands

The consortium members estimate the value of indicator 1.1.5 during the course design. The actual time demand for individual students will follow from real experience gained during the course run. This indicator compares individual modules and indicates existing critical differences, if any.

1.2.4 Teaching content relevance for exam

The examination process represents an inseparable part of the course delivery allowing assessing extent and quality of the knowledge gained by the students. Therefore, the relevance of exam questions to the delivered study material is crucial. However, it is closely connected with 1.2.2 Module content quality. Due to this, its importance level is 50%.

1.2.5 Adequacy of the credit numbers to the difficulty of the module

Similarly to indicator 1.2.3, the difficulty of the modules has to correlate to the proposed time demand and credits granted. This indicator, in conjunction with others, allows adequate adjustment of credit numbers. It has relevance mainly for optional courses because it can influence students during their selection.

1.2.6 Student's competences gained

For course success, it is important whether students recognise improvements in their competences in the field of FCH. Also, for their professional career, it is important to define their competences. Despite the competences obtained by attendance for every individual module as provided in the module description, for the module evaluation it is important to reflect attendees' opinion on the competences obtained. It is not possible to pre-set the answers and it is up to the student to identify main benefits of the course. The answers should help the authors to identify strong and weak parts of every module.

1.2.7 Student's interest in the module

The interest in the module can be identified by the teacher on the basis of students' activity during classes. The participation in the education process by asking additional (meaningful) questions and holding relevant discussions will serve to indicate the students' understanding and interest in the module content.

1.2.8 Consultancy need

The difficulty of the module or insufficient background of the students may lead to the request of additional consultancy. Therefore, an unusually high request for consultancy well identifies problems in the module concerned.

1.2.9 Students theoretical background needed to understand the course

This indicator aims to identify differences between levels of education of each student. Generally the proper adjustment of course technical level is crucial for information transfer to students. This indicator will thus help to adjust the structure of the course, especially in terms of fundamental modules, in order to reflect typical levels of the students' educational background.

1.3 Level of achievement

The indicators introduced within the framework of the two previous groups were based on the subjective opinion of the evaluators, although in most cases significant level of agreement is expected. The present group of indicators is based on measurable parameters and direct outputs from the module teaching. It also contains KPI to measure course success. The grades obtained by attendees enable comparison between individual courses with respect to their difficulty and thus provide feedback for the design of subsequent modules.

Module indicators with their corresponding importance level in %:

1. Number of attendees <5 / 6-10 / 11-20 / >20 30%
2. Number of graduates <5 / 6-10 / 11-20 / >20 35%
3. Student grade distribution in intervals: 0-24% / 25-49% / 50-74% / 75-100% 15%
4. TeacHy materials usage: very low/ low/ neutral/ high / very high 10%
5. Gender of attendees: male %/female% 10%

1.3.1 Number of attendees

This KPI is the main parameter for evaluation of course attractiveness and its publicity towards potential candidates. For optional modules, it is an indicator for their attractiveness over other modules.

1.3.2 Number of graduates

This is the main KPI for the entire course success determination. In combination with previous indicator 1.3.1, Number of Attendees indicates the course/module attractiveness.

1.3.3 Students grades distribution in intervals

Grades should obey a Gaussian distribution. Any difference indicates imbalance between module content and examination.

1.3.4 TeacHy materials usage

Today, large amounts of study material are available. Despite directly prepared material for the module, it is possible to find other suitable study material. Low usage of TeacHy material indicates need for further improvement.

1.3.5 Gender of attendees

The gender issues are monitored by the EU and national institutions. It is expected that there will be a need for information of class composition from a gender point of view. This parameter will help to identify potential problem in this aspect and to take corresponding measures.

Moreover, the main activities towards ‘equal opportunities’ (also including other aspects than gender) start with a data analysis of the status quo, to which the indicator contributes.

2 Protocols

For every group of module indicators the dedicated form will be created to obtain the desired feedback from participants. Based on the answers the final assessment protocol will be generated to identify weak and strong points of every module and finally the entire course.

Future changes in module content, time schedule, credits etc. should reflect the results reported in the protocols.

3 Forms

The following forms will be used for module assessment by each group of evaluators. Due to simplification only indicators with importance higher than 5% were used. A web interface will be created for easier processing.

3.1 Technical level questionnaire

This form will be completed by Consortium and Advisory Board members before a module delivery.

Module content	General ☐	Specific ☐

Module importance	Very unimportant ☐	Unimportant ☐	Recommended ☐	Important ☐	Very important ☐

Module science/ engineering level	Very easy ☐	Easy ☐	Intermediate ☐	Hard ☐	Very hard ☐

Module link with other modules	Very low ☐	Low ☐	Adequate ☐	High ☐	Very high ☐

Additional comments

3.2 Student and teacher assessment

This form will be completed by students after the module examination

Module content quality	Very low ☐	Low ☐	Neutral ☐	High ☐	Very high ☐

Module time demands	Very low ☐	Low ☐	Neutral ☐	High ☐	Very high ☐

Teaching content relevance to exam	Very low ☐	Low ☐	Neutral ☐	High ☐	Very high ☐

Competences gained:

Additional comments

This form will be completed by teachers after the module examination

Consultancy need	Very low	Low	Neutral	High	Very high
	☐	☐	☐	☐	☐

Students theoretical background for course understanding	Very low	Low	Neutral	High	Very high
	☐	☐	☐	☐	☐

Additional comments

3.3 Level of achievement

This form will be completed after the module examination on the basis of real outputs

Module attendees	0-5 ☐	6-10 ☐	11-20 ☐	>20 ☐	
Module graduates	0-5 ☐	6-10 ☐	11-20 ☐	>20 ☐	
Student grade distribution in intervals	0-24% ☐	25-49% ☐	50-74% ☐	75-100% ☐	
TeacHy material usage	Very low ☐	Low ☐	Neutral ☐	High ☐	Very high ☐
Gender of attendees		Male % …….	Female % …….		
Additional comments					