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Transfer of Innovation Project **Modules for Vocational Education and Training for Competences in Europe**

The European Credit system for Vocational Education and Training (ECVET) is being increasingly tested in practice. This system is intended to facilitate students' periods spent abroad as part of their training, and above all enable recognition of learning outcomes attained abroad. Through its instruments, the LEONARDO DA VINCI transfer of innovation project MOVET II (Modules for Vocational Education and Training for Competences in Europe II) offers the possibility of having technical competences – which have been acquired within the scope of professional training abroad – recognised by the home training institution. After having acquired from the forerunner-project MOVET initial insights and informative progress reports concerning exemplary implementation of mobility in the training sector of mechatronics technicians, the focus in MOVET II is on recognition and transparency of vocational competences in skilled occupations in the metals sector.

Initial situation

The development of personal and social competences of future skilled employees from work-related periods abroad (mobility) is a significant factor when companies decide to send their students abroad. The gain in the technical expertise sector has been somewhat neglected up to now, but it harbours in addition enormous potential for further developing European mobility in the vocational training sector. It is necessary to present these vocational-field specific technical competences transparently, in order to enable a subsequent recognition by the home training institution.

MOVET II takes this as its starting point and develops modules and recognition instruments for the transnational qualification of professions within the metals sector. For the participants concerned, there is moreover a particularly European value in linking the elements of ECVET to the structures of the European Qualifications Framework (EQF). It will therefore be specified at the beginning of MOVET II that all modules are to be aligned to EQF level 4. Setting the niveau at level 4 corresponds to the categorisation of the three to four year metals training programmes of the participating countries.

MOVET II – Procedural method

Two approved approaches are selected for module development. Firstly, analysis of the curricula is undertaken for mechatronics technicians from Germany and the participating partner-countries of Denmark, Finland and Slovakia, in order to find suitable content for transnational modules. Secondly, the project relates to the VQTS-model (Vocational Qualification Transfer System) and utilises the competence matrix for mechatronics technicians and the matrix for mechanics in industry analogous with the one developed in the MOVET II project. The VQTS-model utilises a systematic process for the description of work-related competences and benefits the vocational schools from the four participating

countries as a common starting point for the development of modules. The English-language modules are specially conceived for transnational exchange and uniformly structured according to learning outcomes. The target group for the three-week learning units in each case are students in their second and third year of training. The six qualification modules for automation technology, which have been tested within the scope of transnational mobility, are:

- BUS SYSTEMS IN COPENHAGEN, DENMARK
- BUS SYSTEMS IN PORI, FINLAND
- CAD/CAM (COMPUTER-AIDED DESIGN AND MANUFACTURING) IN WEIDEN, GERMANY
- CNC (COMPUTER NUMERICAL CONTROL) IN SPIŠSKÁ NOVÁ VES, SLOVAKIA
- E-PNEU (ELECTRO-PNEUMATIC CONTROL) IN MUNICH, GERMANY
- HYDRAULICS IN COPENHAGEN AND PLC (PROGRAMMABLE LOGIC CONTROL) IN MUNICH, GERMANY

MOVET II stands out particularly by having tested these results in practice within the project's duration. Students from all four participating countries take part in the modules and the final

examinations. Specially designed guidelines for the validation of learning outcomes, for formulating a Memorandum of Understanding as well as for the development of help in the implementation of mobility. The Memorandum of Understanding, recognised as a declaration of intent between the training institute partners, sets out agreements on competences which are to be achieved during the period of training abroad, on the training programme offered during this period, the names of contact persons, as well as responsibilities of the participants. The framework conditions for mobility according to ECVET criteria are thus transparent for all participating partners.

Recognition through transparency

A recognition by the home training institutions of technical competences attained abroad can only take place if the content of the learning path, as well as of the examination entitlement are sufficiently transparent, and thus at the same time reasonable. Here, MOVET II takes a further step towards realising an ECVET. Specially developed and multi-staged competence defining processes are therefore necessary. The examination process is coordinated with the learning outcomes and can be evaluated via the taxonomy table developed by the Department of Pedagogy at the Technische Universität München. Course assessment is subdivided into a theoretical and a practical examination part, as well as a final technical discussion between students and their supervisor. After successful completion of the modular unit, the participants receive a certificate as a means of verification for their home training institute.

The MOVET taxonomy table – a transparency- enhancing instrument

By breaking down the entire learning path into concrete learning outcomes, the content of the six above-named modules becomes quite transparent for the partner institutions. In order to be able to perform an optimized classification of the technical level of the modules offered by the foreign vocational schools, MOVET has developed the taxonomy table. This represents the foundation for the collaboration of the participating educational institutions. It prepares the way for the recognition of content in nationally varying training courses and for

mutual trust in the individual examination procedure in each case. Indeed, each individual learning outcome can be located in this table and identified through its numerical code. The visualisation of the level of complexity thus obtained, offers the transnational education partners an optimised insight into the educational aspirations of the module. The degree of recognition follows according to the assessment of the home educational institutions.

Outlook

From October 2012, the continuation of the acquired approaches and instruments from both of the LEONARDO DA VINCI transfer of innovation projects MOVET and MOVET II follows via the regular application of mobility at the relevant national agencies of the participating countries. The current partners are presently involved in discussions with further vocational schools in various countries in order to consider expansion of the existing network. The opening up of the scheme to further job profiles would be desirable. The competence matrix could thus be expected to render considerable support. In the same way, the effectiveness and inter-professional application of the taxonomy table will be further scientifically examined. The central aim is still to facilitate recognition through transparency in European vocational education. Go MOVET!



MOVET TAXONOMY TABLE

Recognition through transparency

Learning outcomes acquired abroad will only be recognised by domestic educational institutions if the contents of the module as well as of the examination are sufficiently transparent and therefore understandable. The taught contents and acquired skill sets will be made transparent for the partner institutions by a breakdown of the entire learning course into precise learning outcomes. In order to make a valid classification of the level of offered modules of vocational schools possible, the taxonomy table (TaxTab) will be employed. This instrument is the foundation for the cooperation of the participating educational institutions. It paves the way for the recognition of coinciding contents of training components, which differ between the participating nations, and for the trust in the individual test procedure. Every single learning outcome can be allocated to a specific place in the table and is identifiable by a numerical code. This facilitates the visualisation of the complexity level and permits the transnational educational co-operators to gain an optimised insight into the educational demand of the module. This allows the domestic educational institutions to assess the scope of recognition.

Organisation of the taxonomy table

The TaxTab is a two-dimensional three by six matrix combining the cognitive process categories with the theoretical construct of the knowledge types. The dimension of the cognitive processes corresponds to the hierarchical structure up to class VI. The categories are arranged along a complexity continuum and increase in complexity from left to right. At the same time the taxonomy is constructed in such a way, that each higher-ranking class includes the content of all the lower-ranking ones. This taxonomy is now expanded by the vocational knowledge types

Category I: Remember

Reproducing facts and information.

Category II: Understand

Explaining and interpreting of information and ideas.

Category III: Apply

Applying acquired knowledge to solve problems in a new context.

Category IV: Analyse

Examination and subdivision of information, drawing of conclusions, finding of proof, generalization of problems.

Category V: Evaluate

Connecting information to a new context, formulation of alternative solutions.

Category VI: Create

Presenting and accounting for a opinion by evaluating information. Presenting and accounting for the quality of a job based on specific criteria.

Using the four knowledge types, one evaluates the level of abstraction:

1. The first level is **factual knowledge**. It represents declarative-actual knowledge, which is addressed by questions asking »WHAT?« when approaching a problem. It comprises terms, objects, events and situations. For example, terminology and isolated detailed knowledge belong to factual knowledge.
2. Knowledge about relations and causality of circumstances, addressed by questions asking »WHY«, is identified as **causal knowledge** or as declarative-causal knowledge. It serves as deepening, explaining, supplementing, expanding and systematisation of stored facts and terms.
3. **Procedural knowledge** includes subject-specific courses of action, techniques and methods and is directed towards the »HOW« of a process. Conditional knowledge is excluded from the TaxTab because it represents »knowledge about knowledge« can as such be disregarded when dealing with the classification of learning outcomes of hands-on-learning education.

What are learning outcomes?

Learning outcomes are statements about what learners know, understand and are capable of doing after completing a specific learning process. Learning outcomes consist of knowledge, skill and competence. Within the European qualifications framework they are described as follows:

-Knowledge is the entirety of facts and fundamentals, theoretical and practical aspects in a vocational or educational field.

-Skill is the ability to harness knowledge to accomplish responsibilities and to solve problems. Skills are cognitive skills (logical, intuitive and creative thinking) as well as practical skills (application of methods, material, tools and instruments).

-Competence is the ability to apply knowledge and skill plus individual, social and methodical aptitude to a vocational or educational situation. Competence may also be interpreted as autonomy or the acceptance of responsibility. It is beneficial for vocational and personal progress.

Formulation of learning outcomes

The learning outcomes are described clearly and concisely. Complicated syntax and technical terms are to be avoided. Ideally learning outcomes are verbalized in a single sentence:

Example: The student is able to carry out and organize the programming of the necessary networks for the modes of operation.

Each learning outcome is designated with a number which is written into the TaxTab, e.g. »6.4«.

Handling of the taxonomy table

The learning outcomes are allocated in the TaxTab. They can be assigned to one or multiple knowledge types. For this placement technical experts consider which knowledge type has to be called upon by the student to fully achieve the learning outcome. Classification of the learning outcome in the cognitive process dimension is only necessary within the highest applicable column, because each category/class comprises the lower ones. The numerical code of each formulated learning outcome is placed within the corresponding fields of the TaxTab. In this way the level of complexity of a learning path can be visualized.

Goal of the taxonomy table

The completed TaxTab allows interested third parties a practical assessment of the level of difficulty of a module. Thus, transparency can be achieved through the learning outcomes of a module. The selection of suitable candidates and their secondment to a transnational training module is therefore based on a clear and transparent basis for decisionmaking. This transparency is the basis for the recognition of learning outcomes which were achieved abroad.

How to Phrase Learning Outcomes Fitting into the Taxonomy Table

Learning outcomes should be short and specific phrased. Unnecessarily convoluted wording and excessive use of technical terms should be avoided. Normally, a learning outcome can be phrased in just one sentence.

Example: "The student is able to explain the CPU-cycle". **2F, 2Ca, 2P**

The following are suggestions for possible verbs for the phrasing of learning outcomes with a possible classification.

Remember may be defined as the ability to recall or recognize information without necessarily understanding them.

Arrange, collect, define, describe, duplicate, enumerate, examine, find, identify, label, list, memorize, name, order, outline, present, quote, recall, recognize, recollect, record, recount, relate, repeat, reproduce, show, state, tabulate, and tell.

Understand may be defined as the ability to understand and interpret learned information.

Associate, change, clarify, classify, construct, contrast, convert, decode, defend, describe, differentiate, discriminate, discuss, distinguish, estimate, explain, express, extend, generalize, identify, illustrate, indicate, infer, interpret, locate, paraphrase, predict, recognize, report, restate, rewrite, review, select, solve, summarize, and translate.

Apply may be defined as the ability to use learned material in new situations, e.g. put ideas and concepts to work in solving problems.

Apply, assess, calculate, carry out, change, choose, complete, compute, construct, demonstrate, develop, discover, dramatize, employ, examine, experiment, find, illustrate, implement, interpret, manipulate, modify, operate, organize, practice, predict, prepare, produce, relate, schedule, select, show, sketch, solve, transfer, and use.

Analyze may be defined as the ability to break down information into its components, e.g. look for inter-relationships and ideas.

Analyze, appraise, attribute, arrange, break down, calculate, categorize, classify, compare, connect, contrast, criticize, debate, deduce, determine, differentiate, discriminate, distinguish, divide, examine, experiment, identify, illustrate, infer, inspect, investigate, order, organize, outline, point out, question, relate, separate, subdivide, and test.

Evaluate may be defined as the ability to judge the value of material for a given purpose.

Argue, arrange, assemble, categorize, checking, collect, combine, compile, compose, construct, criticize, design, develop, devise, establish, explain, formulate, generalize, generate, integrate, invent, make, manage, modify, organize, originate, plan, prepare, propose, rearrange, reconstruct, relate, reorganize, revise, rewrite, set up, and summarize.

Create may be defined as the ability to reassemble and supplement existing elements, so that a new, consistent product is created.

Cast, cause, construct, contrive, discover, effect, engineer, erect, evolve, fabricate, grow, inaugurate, initiate, innovate, introduce, invent, machine, manufacture, multiply, originate, prefabricate, process, produce, propagate, raise, and set up.

Cognitive Process

	Remember 1	Understand 2	Apply 3	Analyse 4	Evaluate 5	Create 6
Factual Knowledge						
Causal Knowledge						
Procedural Knowledge						

