Supporting Teaching Staff in Specifying Learning Outcomes – Scenario and Pattern

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***Abstract*—In this paper we provide a proven curriculum design pattern describing how staff can be supported in the process of specifying learning outcomes. The pattern addresses curriculum design principles derived from Bologna Process documents as well as theoretical and practical contributions referring to topics such as learning outcomes, learner-centeredness, competences, employability, and quality aspects. On the application level we present the particular case example ("case story") of employing the reusable curriculum design pattern in the context of refining the bachelor curriculum of computer science as provided by the Faculty of Computer Science at the University of Vienna. Furthermore, the results of the evaluation of the pattern and case story by selected experts of patterns and curriculum design are discussed.**

***Index Terms*—case story, computer science, higher education, learning outcomes, pattern approach**

I. Introduction

European curricula are being reorganized to fulfill requirements and recommendations set forth by the Bologna Process. Curricula conforming to the Bologna requirements need to be organized into three "cycles" (bachelor, master, and doctorate programs) of modular structure. Module and course learning goals are formulated in terms of learning outcomes considering subject-specific and generic (transferable) competences aimed to ensure employability of graduates. Curricula need to reflect student-centeredness which refers to the presentation of learning outcomes and workload from the perspective of the learners. On a deeper level, student-centeredness refers to an educational philosophy in which the instructor is considered as a facilitator who inspires his or her students for various topics and who supports them to deepen their understanding of particular themes in a self-directed way. In this context, innovative teaching methods and technology-enhanced learning take an important role in curriculum implementation and need to be considered systematically throughout curricula. Curriculum stakeholders should be included in curriculum considerations in order to provide high quality and internationally competitive study programs, and to achieve the intended impact on society, economy and the individual.

The design and implementation of new curricula and the redesign of existing curricula constitute significant change processes to offer coherent study programs, and ask for cooperation and coordination efforts among several stakeholders, most prominently teaching staff and policy makers.

In our work [1] we designed, evaluated and implemented strategic curriculum design patterns that addressed the challenges of:

- identifying, determining and introducing subject-specific and generic learning outcomes in running curricula,
- including curriculum stakeholders in curriculum design, redesign and implementation issues, and
- supporting coordination of instructors in particular and of capturing institutional learning which takes place in the development of a curriculum in general.

Our goal was to provide proven curriculum design activities illustrated in terms of patterns supporting the development of higher education curricula that respond to curriculum requirements of the higher education sector.

In this paper we focus on the challenge of formulating learning outcomes in the courses of (re-)designing academic curricula. In particular we present a reusable scenario (pattern) of supporting teaching staff in specifying learning outcomes for courses in academic study programs. This pattern was implemented at the Faculty of Computer Science at the University of Vienna. We documented our experiences in terms of a case story in order to capture the collected experiences and insights in a well-structured, encompassing, and comprehensible way. The following pattern and the case story are in part shorter versions of the pattern and the case story of offering support in specifying learning outcomes as described in Kabicher's PhD Thesis [1, pp. 231-239, 281-288].

The paper is structured as follows: The next section describes our approach and illustrates our understanding of patterns, as well as case stories and describes the derivation process and the curriculum design principles itself which were addressed by the pattern of supporting instructors in specifying learning outcomes. Furthermore, the conducted expert evaluation is briefly described. Section III presents the pattern – the reusable scenario- description of supporting teaching staff in specifying learning outcomes. Section IV includes the experiential report which resulted from the

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implementation of the pattern in a concrete context. Section V summarizes the lessons learned at the Faculty of Computer Science of the University of Vienna during and after the procedure of supporting instructors in specifying learning outcomes. Section VI provides insights into the result of the expert evaluation and section VII provides a conclusion.

II. The Approach - Curriculum Design Principles, Patterns, Case Stories, and Expert Evaluation

A. Curriculum Design Principles

In a first step we identified and derived curriculum design principles from a literature review. These principles were captured from official Bologna Process documents offered at international, national and institutional level and from selected scientific and practical contributions referring to topics like learning outcomes, employability and competences, inclusion of curriculum stakeholders, quality aspects, gender mainstreaming, and new media in education. Altogether, 36 curriculum design principles were derived. The following 6 were considered particularly relevant for the pattern of supporting teaching staff in specifying learning outcomes:

- *Find an appropriate balance of generic and subject-specific competences.*
- *Reflect on an appropriate integration of competences relevant for graduates' employability in the curriculum.*
- *Integrate these competences relevant for graduates' employability that can actually be assessed.*
- *Consider curriculum stakeholders' perspectives in course implementation.*
- *Formulate learning outcomes of the curriculum in a student-centered way.*
- *Align learning outcomes, instructional approach, assessments and student workload at curriculum and course level.*

B. Pattern

Based on the curriculum design principles the reusable procedure of supporting teaching staff in specifying learning outcomes was elaborated.

A pattern describes a successful solution to a recurring problem at a certain level of abstraction so that the solution can be used and reused many times and in various contexts without ever doing the same way twice. A pattern illustrates the relationship between a certain context, a certain system of forces which occurs repeatedly in that context and a certain sequence of steps that a practitioner should take to transform the initial situation to a desired state. A pattern captures the knowledge of the designers and shares this knowledge with practitioners. Patterns are not prescriptions and do not describe complete contextualized solutions. [2, 3]

The curriculum design pattern will be presented by following the pattern template as proposed by Mor, Warburton, and Winters [4]. It includes six components: problem, forces, context, solution, other cases, and theoretical justification.

C. Case Story

In a third step, we documented the experiences we gathered at the Faculty of Computer Science at the University of Vienna.

In general, case stories are used to document the implementation of the pattern in a particular context. They illustrate a kind of experiential report of the practitioner.

The case stories are described by means of a case story template as proposed by Mor, Warburton, and Winters [4] and include the components: situation, task, actions, results, and lessons learned.

D. Expert Evaluation

The pattern and the case story presented in this paper were evaluated by experts of patterns and curriculum design. The experts were asked to evaluate the importance and usefulness of the pattern, and the usefulness of the case stories for illustrating the use of the pattern in a real-world setting. The evaluation was conducted in March 2010 and eleven experts participated in the survey.

III. Pattern For Offering Support in Specifying Learning Outcomes

The pattern focuses on the support of instructors to specify learning outcomes in their courses. The specification of learning outcomes takes place in face-to-face meetings in which instructors are stimulated to reflect on their courses in order to be able to formulate learning outcomes that are coherent with the design, delivery and measurement of learning. Transparency of the intended interaction of learning outcomes, teaching and learning as well as assessment methods should provide a deeper understanding of how the curriculum is actually implemented and what knowledge, skills and competences are mainly intended to be developed.

A. Problem Specification

In Europe, in particular, the comparison of curricula is supported by national and European qualification frameworks. The European Qualification Framework is a transparency tool developed in the context of the Bologna process and may be described as the meta framework of all national qualification frameworks. National qualification frameworks should be provided by the countries that participate in the Bologna process by 2010. The umbrella framework of the various national educational systems, the European Qualification Framework, specifies an individual's qualification in eight levels; each level is described by learning outcomes. Learning outcomes of the European qualification framework refer to knowledge, skills, and personal and professional competences. Personal and professional competences are defined as the proven ability to use knowledge, skills as well as personal, social and/or methodological abilities. Learning outcomes should also be used in national qualification frameworks in order to facilitate transparency and comparability of diverse educational systems. At the institutional level, the use of learning outcomes in study programs becomes necessary, in

order to facilitate comparing knowledge, understanding and skills and thus to contribute to flexible learning paths in a lifelong learning perspective, and to facilitate mobility (includes not only mobility within various educational systems of other countries but also mobility between vocational education and training and higher education).

B. Forces

There is no one and only way of writing learning outcomes. Too specific learning outcomes might lose the sense of intended student learning. On the other hand, too roughly defined learning outcomes might be too general to guide teaching and assessment.

Learning outcomes are statements of what learners are expected to know, understand and/or be able to do at the end of a period of learning [5, p. 11]. The courses' learning outcomes need to be in line with module learning outcomes. Learning outcomes need to be assessable in order to ensure the achievement of degree outcomes.

Learning outcomes are expectations of the instructors formulated in a "student centered" way. Thereby the formulation alone is the critical point. It should no longer be described what an instructor intends to transfer to his or her students. Rather, the instructor describes what he or she expects from the learners after completion of the course. Genuine student- or learner centeredness in the context of learning outcomes would as well describe what learners want to know and be capable of as a result of a learning process [6].

Instructors at the university enjoy the privilege of freedom of teaching. Nevertheless, developments, like educational frameworks that aim for transparency and comparability of education among countries, make it necessary to follow, for example, quality standards recommended by accreditation agencies and by particular scientific associations of the discipline.

C. Context

This pattern is useful in curriculum settings in which:

- the curriculum including all its modules is (partly) described in terms of learning outcomes.
- expectations concerning what students should achieve after a course are hardly described by instructors in terms of learning outcomes.
- instructors have to take care of formulating and publishing learning goals or outcomes of a course. Furthermore, the responsibility of the adjustment of learning goals or outcomes, teaching and learning methods as well as the assessment of outcome achievement is taken by instructors.

D. Actions

Figure 1 illustrates the sequence of activities of the pattern "Offer support in specifying learning outcomes in courses". Actions of the procedure are the following:

- Sense experiences and opinions of the teaching staff concerning learning outcomes. Get a picture of what is necessary for the next steps that should bring instructors closer to a particular understanding of learning outcomes.
- Offer adequate support for instructors to be able to specify learning outcomes for their courses. Communicate the importance and necessity of learning outcomes and discuss international and national developments that require the use of learning outcomes. If necessary, introduce instructors to the theme by providing helpful information material and guidelines.
- In order to offer space in which the specification of learning outcomes takes place during a reflection of the whole course, meet the instructors of the curriculum individually. Support the instructor to reflect on learning goals and outcomes, teaching and learning methods and measurements used in the course. Support the instructor to specify particularly intended subject-specific learning outcomes of the course, e.g. by providing information material concerning particular subject-specific course content recommended by international experts of the discipline (e.g. Computer Science Curriculum 2008 [7]) or by offering a list of predefined verbs that all reflect a particular cognitive process dimension (e.g. [8, 9]). Point to the student-centeredness of learning outcomes and optionally introduce the instructor what it would mean to specify genuinely learner-centered learning outcomes. If there is an interest of the instructor of teaching in a learner-centered way according to the humanistic viewpoint [6], then serve instructors with further support in doing so (e.g. by illustrating teaching and learning scenarios based on the Person-Centered Approach [10], providing literature that discusses the Person-Centered Approach in education [11], etc.).
- More on specifying generic learning outcomes of the course is described in the pattern "Consideration of generic competences in the curriculum" [1].
- Record the specified learning outcomes, the teaching and learning methods as well as the assessment methods of the course. The updated course descriptions should be accessible to all instructors of the curriculum as well as to the students. A possibility how to offer faculty-wide access to such information is described in the pattern "Complementation of the formal curriculum document by a web application" [1].
- When all courses of the curriculum are described in terms of learning outcomes and the adjustment of learning outcomes, teaching and learning methods as well as assessment methods of each course is reflected, generate a taxonomy table of the learning outcomes of all courses of the curriculum (compare with e.g. [8]). A taxonomy table helps to categorize learning outcomes according to their knowledge and cognitive process dimensions.
- Analyze the learning outcomes of all courses of the curriculum by means of the taxonomy table and

document findings.

- Discuss results in the teaching staff community in order to e.g. fine tune learning outcomes so that they better achieve intended outcomes of the degree program, or to exchange instructors' experiences with particular teaching and learning as well as assessment methods.
- Provide access to findings by means of publications so that findings can be used to fine-tune curriculum implementation and/or to design new curricula which might partly consider suitable and already available curriculum components focusing on the development of particular competences and learning outcomes.

E. Other Cases

As an example the study [12] can be mentioned which aimed to find out (among other aspects) what assessment methods were used and whether higher order learning was assessed in the context of higher education. In a survey instructors were asked to list learning outcomes of their courses taught which were then categorized and analyzed by means of the taxonomy table proposed by Anderson and Krathwohl [8]. Results show that the most learning outcomes referred to the cognitive dimension "understand" mainly in relation to the knowledge dimension "conceptual". The second most frequently used code was "apply" in relation to "conceptual knowledge". Furthermore, it was analyzed how these outcomes were assessed. The most commonly used strategies were assignments, discussions, essays, and practicals. However, the alignment between the stated learning outcomes and the assessment strategy was not in each case obvious [12].

F. Theoretical Justification

Learning outcomes referring to particular competences that should be developed in study programs are not an "invention" of the Bologna process, rather the concept of learning outcomes has been discussed for many years particularly in the educational scientific community. In the context of curriculum design, the question what educational purposes or learning goals and outcomes should be sought to attain has been for years one of the most important ones to answer. Before Tyler's rational-linear curriculum development approach [13], for example, purposes of instruction were described as general statements about what the instructor should do. In the year 1949, Tyler promoted with his rationale to consider purposes of instruction as specific statements about students' behavior to be used to bring about certain ends [14, p. 78].

Eisner [15, p. 109] argued that "no concept is more central to curriculum planning than the concept of objectives". The most popular contribution in the context of learning outcomes was probably given by Bloom et al. [9] who defined learning objectives as indicators of what instructors want students to learn. Bloom argued that learning objectives were explicit statements of the way in which students are expected to be changed by a learning process. Bloom's work was revised by Anderson and Krathwohl [8] who actually presented a renewed framework for categorizing learning outcomes. The taxonomy table aimed to support, e.g. instructors not only to classify their intended learning outcomes but also to expose educational possibilities by reflection on questions like: What is important for students to learn? How to teach students in terms of learning outcomes to achieve a high level of learning? How to assess students in terms of the specified learning outcomes? And, how to ensure that learning outcomes, assessment, and instructional activities fit together in a meaningful and useful way? [8]

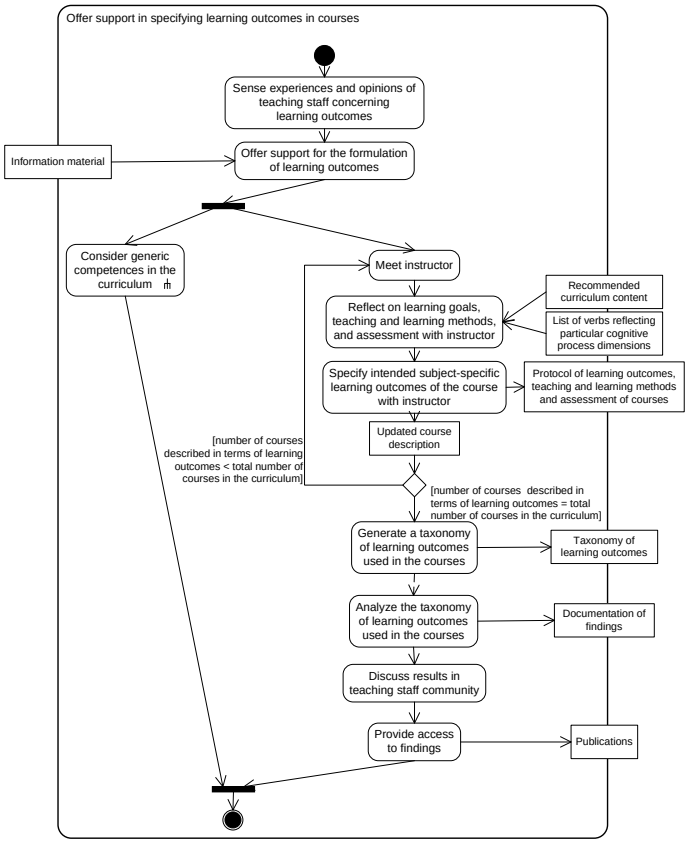

Fig. 1. Offer of support in specifying learning outcomes in courses [1, p. 233]

IV. Case Story

The case example, referred to as "case story", illustrates a process that focuses on supporting instructors in specifying learning outcomes of their courses. Instructors were stimulated to reflect on their courses' goals, on teaching and learning methods that support students in achieving the goals and on assessment methods which should enable instructors and learners to determine to what degree that the goals of the course were achieved.

A. Situation

At the Faculty of Computer Science, learning outcomes were often described by means of learning goals which included that they were formulated from the perspective of the instructors, e.g. "teaching of…". In some courses, statements of the module description were used for describing the goals or outcomes of the courses. The use of module descriptions as

goals of the courses did not support transparency of what was actually expected by students by instructors during the implementation of the curriculum.

The courses' goals or outcomes hardly ever referred to generic competences unless the courses were explicitly integrated into the curriculum with the aim to focus on the facilitation of generic competences, e.g. academic writing courses, communication courses or courses on project management. The main focus laid on teaching of subject-specific topics.

According to the statute of the University of Vienna, instructors were obliged to publish learning outcomes or goals, content, teaching methods, assessment methods and the language used in the course. Courses should support students in achieving the learning goals of the course ([16] Study law, Section 1, §4. (1-2)).

B. Task

The task was to formulate "student-centered" learning outcomes in the form of "Students are able to [verb] [noun]" for courses in the computer science bachelor curriculum. Learning outcomes should reflect subject-specific and generic competences. Instructors should be stimulated to reflect their courses on what they expected from their students after the course, what learning and teaching methods were used in order to achieve the outcomes of the course, and how the outcomes were to be assessed.

C. Actions

As a first step a faculty-wide workshop was initiated in order to "sense" instructors' experiences and perspectives concerning learning outcomes. The workshop was used to communicate developments in the higher education area at that time, e.g. the establishment of the European Qualification Framework as meta framework for recommended national qualification frameworks that should illustrate the levels of education in a country, and the consideration of subject-specific and generic competences in curricula that were relevant for graduates' employability. Furthermore, the workshop offered space to discuss the following questions: Which competences do we want to develop in the curriculum? Do we want to develop a higher degree of maturity of generic competences in the curriculum? The workshop was as well used to initiate the formulation of learning outcomes for particular courses in groups.

A website concerning learning outcomes was elaborated with the aims (1) to provide some orientation concerning learning outcomes (e.g. some definitions, levels of learning outcomes, etc.), (2) to explain why learning outcomes should be used (referring to the Bologna process at international-, national-, and institutional level) and (3) to offer a guideline how to formulate learning outcomes for a course (according to the taxonomy of Anderson and Krathwohl [8]). The website was used as supporting material in personal interviews with teaching staff.

Instructors were individually consulted in order to reflect on their courses according to the following questions: What are the objectives of the course? What do you expect from students after the course? In what activities are students engaged during the course in order to achieve the objectives of the course? How did you assess what you expect from your students? Instructors were asked to formulate subject-specific and, if identified, generic learning outcomes for their courses in the form "Students are able to [verb] [noun]". A list of verbs illustrating particular cognitive process dimensions (e.g. remember, understand, apply, analyze, evaluate and create) was used to support teaching staff during the process of formulation. Furthermore, instructors were stimulated to reflect as well on the adjustment of learning outcomes, teaching and learning methods, as well as the assessment in their courses. The reflection on generic competence development and the indication of intended generic learning outcomes of the courses are described in the pattern Identification of generic competences in the curriculum.

Information was collected in a faculty-wide interactive curriculum environment in order to offer access to course descriptions in general and to learning outcomes in particular to all instructors of the faculty.

Learning outcomes of each course of the computer science bachelor curriculum were collected in an excel sheet for further analysis that focused on the verbs and nouns used in the statements. Results helped to gain a more complete understanding of the objectives in each course as part of the whole curriculum and offered an insight into the actual implementation of the curriculum.

D. Results

During personal exchanges with teaching staff of the computer science bachelor curriculum instructors were asked to reflect on content taught, learning outcomes, teaching and learning methods and assessment methods. Based on these reflections instructors formulated what they expected from the students after the course. The specified learning outcomes were recorded in word files and a faculty-wide interactive curriculum environment which were both sent to the instructors to cross-check results of the personal exchange.

The analysis of the specified generic learning outcomes was separately presented in the case story "Identification of generic competences in the curriculum".

For the analysis of the specified subject-specific learning outcomes of the courses of the computer science bachelor curriculum, the learning outcome statements were collected in an excel sheet. Altogether, there were 354 subject-specific learning outcomes formulated by instructors of 99 of a total of 117 courses of the computer science bachelor curriculum. The amount of subject-specific learning outcomes included learning outcomes redundantly used in different courses. For example, sometimes exercise courses used similar subject-specific learning outcomes as lectures of the same module. On an average 3.6 subject-specific learning outcomes were formulated in each course.

The learning outcomes of the courses of the bachelor

curriculum were specified by 102 different instructors. It was obvious that the formulated statements varied in their degree of concreteness. Some instructors roughly formulated learning outcomes of their courses in order to leave some flexibility to react on, e.g. technological developments and/or particular students' expectations on the course whereas others tried to specify very concretely what they expected from their students after their course.

In order to be able to categorize the specified learning outcomes, the taxonomy table proposed by Anderson and Krathwohl [8] was used. The verbs and the noun phrases of the learning outcome statements served as keywords. Noun phrases were categorized into one of the major knowledge dimensions, namely factual, conceptual, procedural, or metacognitive knowledge. Verbs were categorized into one of the cognitive process dimensions: remember, understand, apply, analyze, evaluate and create. It occurred that the noun phrase reflected knowledge that needed to be categorized into more than one dimension, e.g. "Students are able to interpret data structures, algorithms, programming languages and programs." The noun phrase "data structures, algorithms, programming languages and programs" was categorized into both the conceptual and procedural knowledge dimension. On closer examination, the learning outcome statements did not always mean what they seemed to mean. Therefore, the decisions of assigning learning outcomes to particular categories in some cases included finally assumptions made about the instructors' intentions. The categorization of the learning outcomes was conducted by two coders. Each coder individually categorized all specified learning outcomes by means of the taxonomy table as proposed by Anderson and Krathwohl [8]. Then, results were compared.

The evaluation of the subject-specific learning outcomes by means of the taxonomy table proposed by Anderson and Krathwohl [8] let to the following findings:

Most of the learning outcomes could be categorized into the conceptual and procedural knowledge dimension and most of them referred to the cognitive process dimension "understand". Figure 2 illustrates a detailed insight into findings. It is to be noticed that many learning outcomes specified by instructors included e.g. more than one verb. One instructor formulated, for example, that "students are able to illustrate and apply software development methods." This and similar formulated learning outcomes were counted for each of the identified cognitive process dimension, and for each of the identified knowledge dimension. Findings were not surprising as conceptual knowledge could be described as the knowledge dimension particularly common to be taught at universities. Conceptual knowledge might be described as "everlasting" knowledge which is hidden behind a permanently changing surface. Procedural knowledge might be described as a particularly relevant knowledge dimension of the computer science discipline. Students' ability to "understand" could be as well described as the main intention of what students should be able after completion of their higher education. Graduates should understand concepts, principles and procedures that build the basis of the discipline particularly at the bachelor level.

Furthermore, it was analyzed which subject-specific learning outcomes were particularly often mentioned in various course types in the curriculum, what teaching and learning methods were used to achieve the learning outcomes and how the achievement was assessed. Particularly learning outcomes of lectures, lectures with an integrated exercise part as well as seminars referred to the conceptual knowledge dimension whereas learning outcomes of exercise courses and practical training courses mainly referred to the procedural knowledge dimension.

Knowledge Dimension	Number of learning outcomes
Factual knowledge	46
Conceptual knowledge	255
Procedural knowledge	226
Metacognitive knowledge	5

Cognitive Process Dimensio	Amount of learning outcomes
Remember	19
Understand	187
Apply	97
Analyze	52
Evaluate	30
Create	28

Fig. 2. Subject-specific learning outcomes of courses of the computer science bachelor categorized according to [8]. [1, p. 285]

Particularly in lectures and seminar courses most concentration was put on the ability of students to "understand" mainly conceptual knowledge. This was facilitated in lectures by face-to-face activities like frontal talks, discussions in groups, excursions and guest lectures, and by online activities like forum discussions, reflections in electronic diaries, reaction sheets, and the elaboration of online case studies. Supporting materials were offered, e.g. audio- and video streams of e.g. lectures, self-assessment tests and questions catalogues. Due to legal regulations, students' achievement of leaning outcomes in lectures had to be assessed by a final (oral or written) exam. In seminars, students' ability to understand conceptual knowledge was facilitated by elaborating and discussing seminar works to a particular topic. These seminar works were then assessed.

In lectures with integrated exercise part, most of the learning outcomes referred to the students' ability to "apply" and "analyze" to some degree a balanced mix of conceptual and procedural knowledge. Methods of supporting these learning outcomes were partly frontal lectures and partly the elaboration and discussion of exercises by students including short presentations, discussions in groups and peer-reviews.

Frontal lectures were enriched by experiments and demonstrations, factory tours and analysis of case studies and examples of use. Assessment methods included assessment of exercise solutions and their presentations, as well as written or oral tests in midterm or at the end of the courses.

In exercise courses and practical training courses, a

balanced concentration was put on both the abilities of students to "understand" and to "apply" a mix of procedural and conceptual knowledge. Teaching and learning methods of exercise courses were: the elaboration and discussion of exercise solutions or projects (individually or in teams), participation in tutorials, and/or the analysis of scientific contributions. Online learning activities were partly provided, e.g. discussions in forums and chats, online tutorials, reflections in electronic diaries, peer-evaluations, and the development of e.g. a Wiki for formula.

Practical training courses included teaching and learning activities like the elaboration of exercise solutions or projects (individual or in teams), ad-hoc elaboration of tasks, participation in tutorials, as well as the analysis of case studies. Online activities that should support students to achieve intended learning outcomes of the practical training courses were, for example, discussions in forums and chats, reflections in blogs, and online tutorials.

V. Lessons Learned

In the following, the lessons learned from the experience of implementing the pattern of supporting teaching staff in specifying learning outcomes for courses in the bachelor curriculum of computer science at the Faculty of Computer Science are summarized:

- *Space to reflect on courses led to an added value for instructors and the faculty.* Even if it took time to meet each instructor of the course individually, the space created for course reflection during the meeting offered an added value for the instructors and the faculty as a learning organization. Instructors benefited from the meetings in such a way as they received support for specifying learning outcomes and for reflecting on teaching and learning practices and assessment methods. Instructors could use learning outcomes in particular and their course descriptions in general as basis for the next course iteration. The faculty learned in the sense of a learning organization. Knowledge of curriculum implementation was collected and stored in a faculty-wide interactive learning environment.
- *A list of verbs illustrating particular cognitive process dimensions helped instructors to specify learning outcomes.* A list of verbs emerged to be very helpful for instructors to specify what they expected from their students after completion of the course. However, some verbs asked for clarification. For example, often instructors wondered why the verbs "understand", "know" or "can" should not be used as verbs in the learning outcome statement. Often, it appeared to be helpful to explain the theoretical considerations behind the formulation of the learning outcome. Addressing to the above mentioned questions of the instructors this would mean to explain that particular verbs were too unspecific in order to describe what was actually expected from students.
- *Instructors were responsible for learning outcomes of their courses.* Instructors might be supported to formulate learning outcomes and many instructors enjoyed this support from the faculty. A few instructors feared control or some kind of inspections by the faculty. Therefore it was important to both clearly communicate the pretension why instructors were consulted as well as to deal with learning outcomes of courses in such a way that instructors were the only ones responsible for their formulation, their achievement and their adequateness as part of the whole curriculum.
- *Findings asked for discussion in teaching staff community.* The evaluation of the learning outcomes might be considered as foundation for further discussion among teaching staff concerning innovative ways of teaching and assessing students in terms of the formulated learning outcomes of courses.

VI. Expert Evaluation

The pattern "Offer support in specifying learning outcomes in courses" was evaluated by eleven experts. On an average, experts evaluated the pattern (by means of a scale from 1= not at all important, 2=slightly important, 3=moderately important, 4=very important and 5=extremely important) as very important for curriculum (re)design activities (mean = 3.82, SD = 1.17) and implementation (mean = 4.27, SD = 1.01) of curricula in order to develop and deliver higher education curricula that respond to curriculum requirements (mean = 3.82, SD = 1.17) and trends (mean = 3.82, SD = 0.87) of the higher education sector. Experts perceived the pattern as extremely important for teaching staff (mean = 4.73, SD = 0.47) and very important for curriculum designers (mean = 3.91, SD = 1.14), directors of study programs (mean = 3.64, SD = 1.36) and for their own course/curriculum design and/or redesign activities at universities (mean = 4.0, SD = 1.12). The pattern was considered to be very important for achieving Bologna requirements (mean = 3.55, SD = 1.13), and very important particular for achieving a shift from teacher- to student-centeredness (mean = 4.1, SD = 0.94), for considering students' needs (mean = 3.91, SD = 0.7), for providing internationally comparable degree programs (mean = 3.73, SD = 0.79), and for supporting graduates' employability (mean = 3.64, SD = 0.81). Furthermore, the experts rated the pattern on an average as very useful for its reuse for other higher education curricula (mean = 4.36, SD = 0.81). The experts perceived the template (mean = 3.82, SD = 0.87), the textual (mean = 4.0, SD = 0.77) and graphical description (mean = 4.27, SD = 1.01) of the pattern as very useful for understanding the problem and the solution. The case story was experienced as very useful for illustrating the use of the pattern in a real-world setting (mean = 4.13, SD = 1.13).

Here some examples of experts' statements that referred to the importance of the pattern. One expert formulated, that the "*[d]efinition of learning outcomes is necessary for any course. This pattern should define a mandatory process for any curriculum design process and [serve] as a control*

instrument for teaching staff." Another expert mentioned that "*[e]veryone working in the Higher Education Area has to work through this pattern.*" "*The formulation of learning outcomes at international level (EQF), national level (NQF) and at institutional level (reflecting faculty research priorities) is necessary to guarantee comparability of study programs across Europe and within each country. […]*". And another expert considered that "*[t]he pattern seems to require lots of human resources and therefore runs the risk not to be implemented.*"

VII. Conclusion

This paper offered a reusable scenario of supporting teaching staff in specifying learning outcomes throughout the curriculum. The pattern is particularly useful for Bologna-conform curricula which are designed to conform to a set of learning outcomes that define a particular level of educational qualification. The challenges addressed by the pattern were the support of learning outcomes at curriculum level (the so called program outcomes) throughout the whole curriculum and the concise formulation of learning outcomes at course level. The task called for strong involvement of the teaching staff in the procedure of formulating learning outcomes of the courses.

The case story illustrated our experiences which we collected at the Faculty of Computer Science at the University of Vienna during the procedure of supporting our teaching staff in specifying learning outcomes. We experienced, among others, that the personal meetings with instructors helped them to elaborate learning outcomes (great support offered a predefined list with verbs) which they could use for the course description and to reflect on the design of their courses. Last but not least, the teaching staff grew as a community and contacts between instructors were strengthened.

The results of the expert evaluation supported our assumption concerning the importance and usefulness of the pattern and the case story for developing and implementing curricula in the higher education sector.

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