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Competence Modelling for Innovations and Quality Development in E-Learning:

Towards learning outcome orientation by competence models

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QLET - The Quality Initiative for Learning, Education and Training

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UNIVERSITÄT
DUISBURG
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by Christian M. Stracke (2011)

Citation:

Stracke, Christian M. (2011): "Competence Modelling for Innovations and Quality Development in E-Learning: Towards learning outcome orientation by competence models"; in: *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunication 2011 [= EdMedia 2011]*. Chesapeake, VA: AACE. p. 1885-1894. [also online available at: <http://www.qualitydevelopment.eu/docs>]

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Abstract: This article points out the special support that competence models can provide for the quality development in learning, education, and training, and in this regard, we can only highlight the main characteristics of this innovative approach called competence modelling and its relevance in E-Learning. A general competence model with a standardized competence structure and levels is introduced and discussed for use cases in E-Learning. It can be shown that competence modelling and the presented competence model lead to an improvement of the E-Learning working places, of the organizational and individual development, to an increase of the mobility worldwide as well as to a higher transparency and recognition of competences and skills.

Introduction

This article deals with the tasks and potentials of the quality development in E-Learning and presents competence modelling as an innovative and very promising approach and competence models as appropriate and comprehensive instruments. The answer on the question: "How to support and improve the quality development in E-Learning?" leads to the innovations and changes which can be realized and provided by learning outcome orientation. Based on the general definition of quality development and of the principles for competence modelling, we will introduce competence models as an appropriate means for quality development. To summarize, this article points out the special support that competence models can provide for the quality development in E-Learning and in this regard, we can only highlight the main characteristics of this innovative approach called competence modelling and its relevance in E-Learning.

Quality Development in Learning, Education, and Training

Quality development is a crucial task for E-Learning and for learning, education and training in general: A long-term debate has focussed the quality development regarding the different quality issues, aspects and approaches (cf. Deming 1982; Juran 1951 and 1992; and for an overview Stracke 2006a). Quality development in its broad sense can be defined as follows (cf. Stracke 2006b):

Quality development covers every kind of strategy, analysis, design, realisation, evaluation, and continuous improvement of the quality within given systems.

Quality development needs a long process to be established and integrated throughout a whole organisation. Once started, it has to be a continuous ongoing circle to be successful (Crosby 1980; Deming 1986). Quality cannot be described and fixed by a simple definition, because in itself quality is too abstract to have any impact. Therefore, quality has to be defined and specified according to the given context and situation considering the perspectives of stakeholders involved (Donabedian 1980). It is important to identify the

relevant aspects and to specify the suitable criteria. It is necessary to find a consensus amongst the different views and perspectives to gain a common understanding of quality for the given context and situation due to different and sometimes contradictory needs and definitions of quality by all stakeholders (for detailed explanations on context determinations cf. Crosby 1980; Deming 1986; Donabedian 1980).

In this way quality awareness is the basic requirement for the adoption of quality development by all stakeholders from any organisation. But quality awareness will also be raised by the implementation of quality development on the other hand. To come to a sustainable integration of quality development within the whole organisation and to ensure the involvement of all stakeholders it is crucial to build a quality strategy and to integrate the quality objectives into the educational and business processes (Stracke 2010). Also the stakeholders' needs and responsibilities need to be integrated into the overall quality development. The process of the adoption, implementation and adaptation of quality development can roughly be divided into three steps based on three different levels that need to be covered and addressed for a sustainable and long-term quality development (for the three level concept of the introduction of quality development cf. Stracke 2006b and Stracke/Hildebrandt 2007):¹

- Level of the individual person;
- Level of the organisation;
- Integration of quality development involving all stakeholders.

Quality Development in E-Learning

First we have to clarify the main terms that we will consider and focus on within the further discussion and argumentation of this article: E-Learning and Quality.

What is E-Learning?

E-Learning means IT-enhanced Learning, Education and Training and is next to traditional face-to-face learning and distance learning the third main type of learning.

E-Learning is growing constantly during the last years and in particular the combination with face-to-face learning and distance learning became very popular and is often called "Blended Learning" even if this English term is misleading. We overcame the E-Learning hype in the years 2000 and 2001 with inflated expectations as well as the following trough of disillusionment, also caused by simple failures in first implementations.

Today we have an increase in implementations and in satisfaction with E-Learning, in particular compared to face-to-face learning and distance learning that are losing reputation and shares in the overall learning market. I'm convinced that in a few years there will no learning, education and training without E-Learning parts and IT support so that E-Learning will become the most frequently chosen and applied learning solution! In this sense E-Learning is a hot topic and most relevant for the future of learning, education and training in schools, universities, enterprises and life-long learning for adults, employees and seniors.

Currently there are two main challenges for E-Learning (cf. Stracke 2009):

1. To ensure interoperability and
2. To improve the quality.

In this article we will focus on Quality in E-Learning as it is the key and major aspect for us. We have to underline: Quality in E-Learning is the most important challenge and objective: High quality in E-Learning is needed to achieve best learning outcomes.

Without a satisfying quality you cannot achieve the planned learning outcomes and results of any kind of learning, education and training including E-Learning. The quality is the key factor for the acceptance by the learner and for the learning success. That is valid and true for all kinds of learning, education, and training and in particular for E-Learning:

¹ Former research has shown that Support Systems especially designed for these purposes could be a strong and valuable help for all three levels and for the involvement of all stakeholders (cf. Hildebrandt/Stracke/Jacovi 2006 and Stracke/Hildebrandt 2007). The research findings presented here are partially results of Q.E.D., the flagship initiative for quality in learning, education, and training in Europe and worldwide, see: <<http://www.qed-info.de>>.

In E-Learning, many learners are facing new, unknown learning environments, learning designs, technologies and requirements. Thus we have to request and realize specific demands concerning the quality of E-Learning. In one sentence: Quality is most important for learning outcomes!

And what is quality?

This simple question is not easy to answer: Let us take an example and think about the best Russian soup "Borscht" (борщ): How would you define and characterize it? There are many receipts and much more opinions about the best Russian soup borscht (борщ): Some like it very spicy, others prefer a milder aroma, and some like it very sour, and for others the red colour is most important.

As you can see, there is not a single definition for the high quality of the soup borscht (борщ) but many different. You can focus the process (How to cook?), the result (the taste) and the potential (the ideal soup). We are facing the same situation in learning, education and training and in particular in E-Learning. There is not one single definition for high quality in E-Learning worldwide but many different definitions depending on your situation, organization, target group and learning objectives.

Quality always depends on your given situation and context including your individual preferences and objectives. Therefore quality development is the crucial task for E-Learning combining quality management, quality assurance and evaluation for best learning outcomes.

Competence Development and Competence Modelling

The term "Competence development" is used in a broad sense here and covers all processes that are relevant and dealing with the planning, modelling, strengthening, evaluation, and the continuous improvement of the competence of learners and learning organizations. By this definition the Competence development includes as the general term the competence modelling, the competence building and the competence management.

Competence development is based on the important and influential theory on cognitive development by Jean Piaget. He called his theory "genetic epistemology"² to explain the cognitive development of children (Piaget 1969). The competence development in E-Learning is not yet discussed for a long time and basic theories and approaches are still lacking at the moment. In particular a harmonized and integrated reference model for the adaptation and implementation of quality and competence development is missing: This article provides first and general proposals for this ambitious task.

Competence development consists of four processes that are building a continuous improvement cycle in the philosophy of the Total Quality Management plus the analysis and definition of the context conditions and competence strategy³:

0. Competence context and analysis;
1. Competence description;
2. Competence measurement;
3. Competence building;
4. Competence evaluation.

The competence modelling combines the two processes competence description and competence measurement but not completely as the first definitions of the competence description are related to the general structure and thus they are not dealing with competence modelling.

The relations between the four processes and the context analysis are shown in the following diagram:

² Piaget and Inhelder are using the term 'genetic' in the broadest sense (without any implication of a simple genetic theory; cf. Piaget/Inhelder 1972).

³ The concept of the four processes for competence modelling and their results is adapted from the official German Specification DIN PAS 1093 that was developed and approved by around 60 enterprises and experts for competence modelling during a two-year national workshop (cf. PAS 2009).

Phases of Competence Development

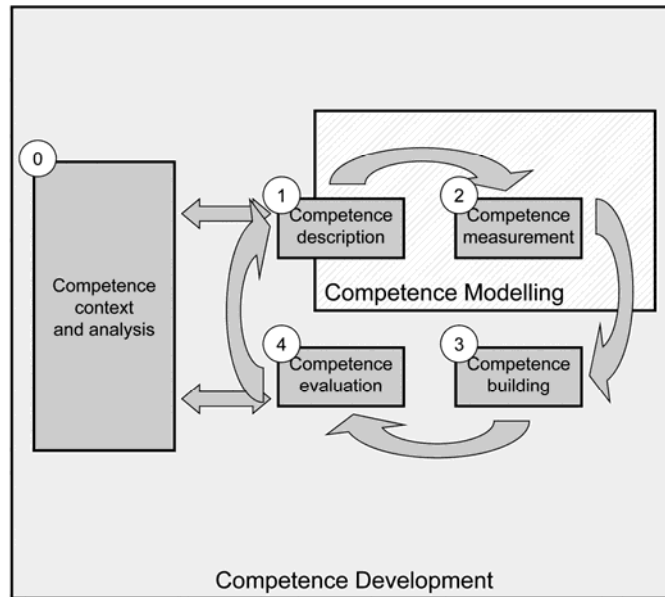


Diagram 1: Phases of Competence Modelling

In the Phase Competence Context and Analysis the general conditions will be identified and a needs analysis with all responsible stakeholders including the decision makers (the top management, the department leaders, etc.) is realized. Thereby the strategic goals and the requirements for the Competence Modelling are investigated and the result is defined and documented in the Competence Strategy.

In the Phase Competence Description the (organization-specific) Competence Model is developed that contains the definitions of the three dimensions of the Reference Framework and the Competence Catalogue next to the Competence Strategy (from the Phase Competence Context and Analysis before). The Competence Catalogue consists of the (organization-specific) definition of competences and activities that can be developed through top-down processes (e.g. strategy workshops with the management, rating by experts, core competence investigation, prospective orientation, or a combination thereof, etc.) as well as bottom-up processes (e.g. Critical-Incident Technique, rating by experts, structure work-analysis consultation (objective or subjective), employee suggestion scheme or a combination thereof, etc.).

In the Phase Competence Measurement the Competence Profile (target and current status) is created. To this end an organizational level (individual, group, or organization) is chosen and its relevant goals, tasks and situations are determined and described. Thereafter the methods for the observation and measurement of activities are chosen and described. Subsequently, the relevant competences and the activities that constitute them as well as the necessary Competence Levels from the Competence Catalogue are determined for the chosen organizational level. These selections and determinations are documented in the so-called Competence Profile (target status) for the selected organizational level. Afterwards the measurement of the competences (indirectly achieved through the observation and measurement of activities) is carried out, with which their current status are investigated. The analysis of the Competence Measurement is then documented in the so-called Competence Profile (current status) for the chosen organizational level.

In the Phase Competence Building the activities for building the competences are created for the chosen organizational level from the basis of the Competence Profile. For this purpose the Competence Development goals are determined first and prioritized on the basis of a target-performance comparison. Finally appropriate activities for Competence Building in the form of opportunities for human resource development and for learning, education, and training are developed and carried out. The desired result is a Competence Change in the chosen organizational level.

In the Phase Competence Evaluation the activities for competence measurement and building for the chosen organizational level as well as the Competence Model and Competence Management as a whole are evaluated. The evaluation of activities for Competence Building is based on a second Competence

Measurement (indirectly achieved through the observation and measurement of activities). This is particularly aimed at the analysis, assessment and optimization of the opportunities for human resource development and for learning, education, and training for the chosen organizational level. The analysis and evaluation of the competence development and measurements in total, along with the continuous improvement of activities for competence building, particularly serves to create a Competence Balance Sheet on the basis of a target-performance comparison along with the assessment of the development itself. Furthermore, the organization-wide Competence Management is evaluated on this basis of these results; this serves particularly to analyze, assess and optimize the organization-wide Competence Model (including the organization-wide Competence Strategy). The central goal of the Phase Competence Evaluation is therefore the optimization of the entire Competence Development and the Competence Model.

The following diagram shows the relations between the processes of competence modelling and development and their results:

Results of Competence Modelling and Development

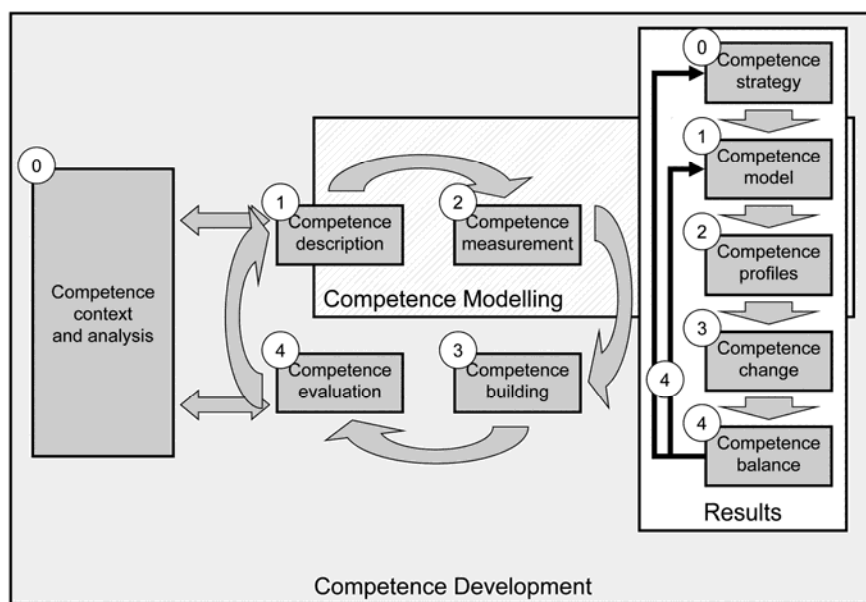


Diagram 2: Results of Competence Modelling and Development

What is a Competence Model?

Competence in our broad understanding is defined as:

Competence is the ability (that cannot be observed directly but only by activities) to adequately and successfully combine and perform necessary activities in any contexts to achieve specific tasks or objectives.

Using this definition we distinguish between potential (non-observable) competences and (observable) activities performing the competence. That means:

- Competence: = Knowledge + Skills (+ individual ability)
- Activities: = Performance of Knowledge + Skills + Competences (+ individual ability)

Competences can be built and exist without being demonstrated and performed. They are non-observable; they are only shown and observable by acting, i.e. by performance and activities. Activities can be observed and measured.

In E-Learning there are the following four main target groups using competence models:

Managers who are involved in hiring new employees or responsible for human resource development are interested in enlarging existing and developing needed qualifications. Therefore they are depending on finding out a balance between these two tasks to fix training needs for their employees. When writing job advertisements managers have to define requirements for specific working places to make sure only those candidates apply for a job who are most comply with the needed requirements.

On the other side there are the E-Learning providers. They adapt themselves to the needs of enterprises, national institutions and other organisations for a suitable offer.

The third target group are the learners: The same adaptation goal applies for individuals (= the learners) planning their personal development at any age.

Finally there can be organisations developing their own competence model and competence profiles because of very specific and extraordinary needs.

The two main components of a Competence Model are:

1. the competence structure and
2. the competence levels.

With a selection and detailed description of all competences and the definition of the levels it is possible to adapt and implement a Competence Model.

The following table shows the criteria that have to be fulfilled for the standardized description of competences and skills to achieve a consistent and comparable competence structure within Competence Models:

The Competence Structure	
Action Verb	[e.g., "to develop"]
Object	[e.g., "project management plan"]
Optional elements	[e.g., "for E-Learning projects"]

Diagram 3: The Competence Structure

It is possible to use the competence structure to (1) introduce competence modelling and a competence model for the first time or to (2) integrate it into existing competence models and their pool of competences.

For the levels, the European Qualification Framework (EQF 2008) issued and supported by the European Commission has introduced eight levels which are defined by a set of descriptors indicating the learning outcomes relevant to qualifications at that level in any system of qualifications. We propose to reduce and adapt the eight levels of the EQF to five levels for easier application and implementation into practice following the recommendations of PAS 1093 and according to the outcomes of our further research⁴.

In general it is possible to describe all required competences according the competence structure to set up a "pool of competences": In a specific use case you have only to select these competences that are most important in the case of a job description, preparing specific E-Learning or the like. These selected competences have to be defined by the following table for competence descriptions that has to be completed for each selected competence:

⁴ The reduction of the levels for the competence model is based on the results of the leading European research initiatives for competence modelling WACOM (www.wacom-project.eu) and eCOTOOL (www.ecompetence.eu) which were developed out of personal interviews with experts and practitioners as well as from analysing process of the relevant standards, policies, concepts and approaches reviewed and refined by the outcome of national workshops, internal meetings with decision makers and online surveys. Both projects are currently working on the refinement of the competence model.

Competence "XXX" [e.g., E-Learning PM Planning]		
Structure of the competence "XXX"	[according the competence structure: e.g., "to develop project management plan for E-Learning projects"]	
Definition of the competence "XXX"	[any written plain text, i.e. free text field]	
Target group of the competence "XXX"	[e.g., group of employees, single working place]	
Knowledge contained in and required for competence "XXX"		
Name of Knowledge	Definition of Knowledge	Minimum required level
[e.g., PM Basic Knowledge]	enter your definition here	enter the minimum required level (1 to x) here
	enter your definition here	enter the minimum required level (1 to x) here
Skills contained in and required for competence "XXX"		
Name of Skills	Definition of Skills	Minimum required level
[e.g., Drawing of Plans]	enter your definition here	enter the minimum required level (1 to x) here
	enter your definition here	enter the minimum required level (1 to x) here
Competences contained in and required for competence "XXX" (optional)		
Name of competence	Definition of competence	Minimum required level
[e.g., E-Learning Design]	enter your definition here	enter the minimum required level (1 to x) here
	enter your definition here	enter the minimum required level (1 to x) here

Diagram 4: Template for Competence Descriptions

A competence model includes all competence descriptions of all selected and defined competences for a specific organisation. Thus, the competence model can easily be derived from those existing competence descriptions. In addition a job profile can be developed as the application of the table for competence descriptions for a specific job at a working place within a specific organisation. In this way, job profiles can easily derived from those existing competence descriptions.

How to support innovations and quality development by competence models?

A Competence Model describes the competences required to successfully perform in a particular job and organization. This set of competences is then used as basis and standard for the description of the specific jobs, the selection of new staff, the evaluation of the on-going performance of the whole staff, the analysis of training needs, and the classification and provision of tailor-made vocational education and training for competence development. The use cases of the Competence Model are in E-Learning:

1. International and regional institutions for harmonized competence descriptions
2. National authorities describing competences in policies
3. (HR) Managers for describing training needs of their employees
4. Managers for describing working places (job descriptions)
5. (HR) Managers for measuring their employees (competence gap analysis)
6. E-Learning provider describing their training solutions
7. National institutions harmonising E-Learning (professional framework)
8. Individuals planning their personal development
9. Organisations developing own competence model profile (includes the use cases no. 3 to 8 above)

The presented Competence Model is completely in line and compliant with the unique ISO quality standard for E-Learning ISO/IEC 19796-1 (ISO 2005) as well as with the international quality management principles of ISO 9001 including the TQM philosophy and the PDCA cycle: Thus it ensures both, international interoperability as well as flexibility for organizational and individual adaptations (cf. Stracke 2006a).

Conclusions

The presented concept of competence modelling has demonstrated the importance to focus competences and activities and introduced the competence model. It describes the competences for individuals such as employees, trainees, pupils, students, lifelong learning and adult learners and groups of them and can be applied to all sectors and branches. Currently competence models are not used by many organizations and there is a lack of and need for a standardized and harmonized competence model and structure. The presented competence model is closing this demanding gap: In particular all E-Learning stakeholders can benefit in many use cases from the introduction and adaptation of the competence model. In E-Learning, the objectives and application scenarios for competence models are to achieve:

- Standardized definition of existing and needed competences;
- Clear descriptions of working places;
- Gap analysis of target and current state of competences;
- Preparation and providing E-Learning solutions;
- Harmonizing E-Learning solutions by a professional framework;
- Better comparability and mobility worldwide.

In this way the new and innovative concept of competence modelling leads to an improvement of the E-Learning working places, of the organizational and individual development, to an increase of the mobility worldwide as well as to a higher transparency and recognition of competences and skills.

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