

Review of Competence Based Education Practices

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Abstract – In the present knowledge economy, technical innovation and information and communication technology are common. Because of their critical added value is gained from the continuous application of knowledge, the concept of lifelong competency education is increasingly important. The main goal of this paper is to review some best Competence Based Education (CBE) practices in different Educational Institutions in some countries. A discussion is also about a variety of worldwide CBE practical application. Because of CBE approach is aimed at outcomes, some aspects of assessment process are given.

Keywords – competence based education, competency, best practices, assessment, lifelong competence development

I. INTRODUCTION

Many researches about educational system point the attention on competency based education is at a crossroads. Traditional syllabus driven models of education are criticised as being too theoretical and for failing to meet the demands of practice, while newer ones based on skills and competency are called into question for being atomistic, controlling and confined to the predictable. The need of changes is extremely urgent in order to meet the rapidly changes in the economy, industry and social environment.

The CBE is a systematic yet flexible approach. It focuses on defining in measurable terms what students are to learn and then evaluating how well they can perform designated tasks after instruction. Expected behaviours or tasks, conditions for their performance, and acceptable standards are shared with students [2]. Some of the main focal points of CBE are: its purpose is to promote learners to achieve a presetting ability, each individual learner's behaviour in the learning process is of concern; its evaluation is to emphasize criterion-referenced. This feature is suitable to be realized on the e-learning environment. Under such an environment learners are able to determine personal learning pace and learning sequence. Therefore, the expectation of application of such a scenario is beneficial to learners in the education organizations [1].

The main reason for CBE popularity is the expected reduction of the gap between the labour market and the school system. CBE has been introduced and used throughout Europe, Asia, United States and New Zealand, although models differ between countries as well as the degree to which competence-based education is used [3]. Today the most highly appreciated and ranked concept for CBE and lifelong competence development is The

European Network for Competence Development (TENCompetence).

II. TENCOMPETENCE APPROACH

In the last years, a variety of tools and learning environments have been created and installed in schools, universities, and cooperates supporting learning. Mostly those tools have been created around learning content and collaborative learning activities like virtual classrooms. In the last two years, the terms competence, competency, skills, and knowledge have seen a renaissance, and the e-learning communities are becoming aware of the importance of competences and competence models as the driver for life-long learning. Competences enable users to work in their job; they enable students to learn and achieve the curriculum goals [4]. The TEN-Competence consortium interprets competence as all the factors for an actor to perform in an ecological niche. Performance includes the specific context that is necessary for the interpretation of competence. Off-course competences include competencies and knowledge that are necessary to put the competence into performance. Besides the specific knowledge, competencies, and skills, the context in the ecological niche has an important impact, and to enable people to act in an ecological niche effectively, meta competences are necessary. To develop competences over time, including the changes of the ecological niche, meta cognitive processes and reflection also play an important role. Competency models in the upper sense as models of interrelated competencies already play an important role in today's educational systems. In school curricula, competences build the basic structure to connect the different school levels and class curricula as well as their content. In organizations, competence-based assessments build the basis for controlling and steering services in the human resources (HR) departments, like staffing, career planning, and personalized training. TEN-Competence supports individuals, groups and organizations in Europe in lifelong competence development by establishing the most appropriate technical and organizational infrastructure, using open-source, standards-based, sustainable and innovative technology. The main challenges are the integration of different levels of knowledge resource, learning activities, competence development, and learning networks. Raising the awareness and enabling a lifelong learning perspective and the integration of formal programmes with social software, informal learning and community building in learning networks. TEN-Competence is designed to solve the problems of lifelong competence development described by providing an advanced infrastructure that integrates the different models and tools in the field of knowledge resource sharing, learning activities, competence development programs and lifelong learning networks. It selected the concept of "competence development" as its core, because it unifies

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all the approaches. In human resource management, knowledge management, training, and regular education the concept is used increasingly. An overview of the different levels of tools and communities can be seen in Figure 1.

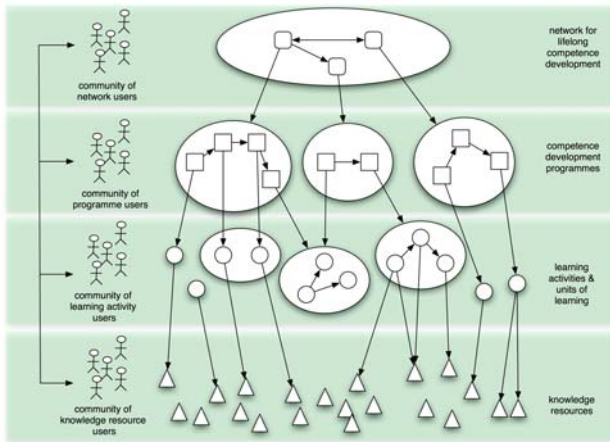


Figure 1 Integrating Different Levels of Learning Support

E-learning platforms have been installed in a large number of schools, universities, and companies, but there are at least three important factors that are driving the need for a new generation of learning technologies that are not taken into account in the first generation:

- New Internet technologies can support completely different kinds of learning than was possible only a decade ago. Ubiquitous access to information spaces and phenomena like podcasting, blogging, or wikis are just some examples.
- Our current knowledge-based society demands a different attitude toward learning and the provision of learning: learning is no longer tied to the school and university context but is lifelong, more integrated into work and other life contexts, and combines different formal and informal learning activities
- The introduction of social-constructivist principles of learning has brought about fundamental changes in the way learning and teaching is conceived. Examples of these new social approaches are collaborative learning, the use of learning communities, use of authentic tasks, scaffolding principles, social tools (friend of a friend, social presence, wikis, syndicated blogs), legitimate, supported peripheral participation in real practice, and new assessment methods (competency-based assessment, peer assessment, collaborative rating techniques, 360 degrees feedback, etc.) based on the principle that assessment should be authentic and integrated into the learning process. These new approaches focus more on the process of learning (the learning activities) than on the content.

Questions of combining informal, non-formal and formal learning processes and the different perspectives become an essential issue in today's computer based learning support. Therefore, TEN-Competence is exploring mechanisms for supporting users in positioning and navigation in learning networks on the one hand but also provides approaches to stimulate active participation of different stakeholders in learning networks. Knowledge resources are basically the containers that store the explicit

knowledge for sharing purposes. Examples are learning objects, articles, books, software programs, informal messages, etc. The project develops models and methods to stimulate and organise pro-active creation, storage, search, retrieval, packaging, and quality rating of knowledge resources.

Beside current ongoing efforts to manage and share knowledge resources, the project especially also looks at the social aspects in the sense of social exchange theory and using a set of rating and recommending mechanisms allowing users of knowledge resources to provide feedback on their quality for the competence development network.

Recent research in technology-enhanced learning has been dominated by learning objects, and the shrink-wrapping of content for delivery in different contexts is becoming mainstream e-learning practice. However, there is a growing feeling that while reusable learning objects are valuable, they do not lead to learning, education, and training as such. A counter approach builds pedagogical processes on top of the learning and knowledge objects. This new learning activities-based approach does not oppose the learning objects approach but integrates it with a higher-level layer. Learning activities in this sense are the designed or performed activities of a person that are directed at the attainment of a (explicit or implicit) learning objective. Designed learning activities are called "units of learning" (UoLs), such as courses, workshops, lessons, and so forth. A unit of learning adds a "learning design" to the knowledge resources; they add pedagogical aids like study tasks, tutoring, mentoring, monitoring communication services, feedback, formative, and summative assessments. Fundamentally, the project ensures that the focus of technology-enhanced learning falls upon innovative approaches to competence development (e.g., learning in communities) rather than underlying technological infrastructure. On the one hand, a TEN-Competence extension is necessary that links learning activities and knowledge resource sharing by integrating the creation of learning designs and the access to shared repositories. On the other hand, learning activities have defined learning objectives that can be linked and classified according to standardized ontology-based competence descriptions. TEN-Competence creates a series of components that are easy-to-use, standards-based and open source, enabling users to create, store, use, support and exchange learning activities and units of learning. Competence development programs crucially depend on a number of services and components.

III. THEORETICAL AND CONCEPTUAL FOUNDATION OF CBE

The research [5] done by the Organization for Economic Cooperation and Development within the framework of the project named Development and Selection of Competencies (DeSeCo) summarizes CBE initiatives and the findings of the 12 Country Reports (Austria, Belgium (Flanders), Denmark, Finland, France, Germany, the Netherlands, New Zealand, Norway, Sweden, Switzerland, and the United States). Most of the project aspects concern CBE: the competencies which are necessary for individuals

to cope with important challenges in the different spheres of life, such as the economic sphere, the political sphere, and family life; the possibility to identify a finite set of competencies necessary for an overall successful life and a well-functioning society and the nature of these competencies; similarity of key competencies across countries and sectors and what are the implications of the concept of key competence for learning and teaching throughout life; the challenges for enhancing and assessing key competencies.

The project DeSeCo aimed to meet the demands of an increasingly interdependent and complex world where education is seen as a crucial investment and important asset for both individuals and societies. Important element of DeSeCo is its structure which was around the idea that defining and selecting key competencies relevant for individuals and the society depends on multiple factors – normative, scientific, and political.

Because of the need to compete through the quality of knowledge and skills, rather than the quantity of workers, the specific objectives were to provide information on national efforts to define key or core competencies, to identify, in the national context, the competencies that are considered most relevant to success in important areas of life. Other objectives were to understand how key competencies are embedded in national skill development and evaluation strategies and how these are negotiated among the different stakeholders, to provide views on the assessment of core competencies, nationally and internationally. One of the main conclusions of the research is about competency based curriculum development in education. It involves key competencies that took different forms in the different countries, but generally fell into three main categories. Examples of the first category related to the pedagogical strategy include countries such as Germany and Switzerland, where curriculum reform was rooted in a mixture of a sense of political urgency to improve school quality (and equality) and as a response to research findings. The second category is related to the societal renewal in the Scandinavian countries and New Zealand. Here the reform impulse was broader: the search for a visionary renewal of education. The focus on overall goals for education led to a debate on the purpose of education, which in turn implied a search for key competencies. Reform efforts in the USA illustrate the third category maintain or improve national competitiveness in an increasingly global economy. In the USA, there was an acute feeling that schools were not producing what was needed for the country to be at the forefront of international competitiveness. The debate on national goals for education led naturally to a debate on standards and key competencies in education. A research result is about the competence areas which are emphasized by the education and economic sector (Table 1).

TABLE 1. COMPETENCE AREAS EMPHASIZED BY THE EDUCATION AND ECONOMIC SECTOR

Competence area	Emphasis in education sector	Emphasis in economic sector
Self-management	Autonomous learning, meta – cognitive competencies	Action oriented, responsibility, taking decisions and risks,

		recourse management, planning, shaping the workplace, management of time, assessing the impact and effectiveness of action, flexibility
Communication competencies	Linguistic competencies, foreign languages, cultural identity, intercultural competencies, media competence	IT competence, presentation capabilities, internationalization
Learning competencies	Learning in domain-specific settings, mastering of learning strategies, meta-learning and reflection, evaluative skills	Lifelong learning, motivation to learn, methodological skill, applying knowledge, putting learning into context in the workplace
Social competencies / Teamwork / Cooperation	Social comprehension, positive social attitude	Interpersonal competencies, working in teams, cooperating and negotiating, resolving conflicts
Value orientation	Ethics, social and democratic values, tolerance, awareness of human rights	Personal virtues: integrity, reliability, loyalty, honesty
Creativity (medium weighting)	Aesthetic education, expression (medium weighting)	Innovation and change, entrepreneurship
Health, physical skills, attitude to body	Physical education	Risk behaviour, resilience
Ecological orientation	Attitudes to natural environment	Ecological responsibility at the workplace

IV. COMPETENCE BASED VOCATIONAL QUALIFICATION SYSTEM

Different aspect of CBE is shown by a conducted research concerning Finland Educational System [6]. It is about application of CBE in vocational qualification system. According to the research the main reasons for application of CBE are the requirements from working life and decrease of labour power. Other reasons are: parts of adult persons are lacking formal vocational qualification; there is need to make the training system more effective; official recognition of learning is acquired in different ways and improvement of quality of education and training. The structure of system is shown on Fig.2.

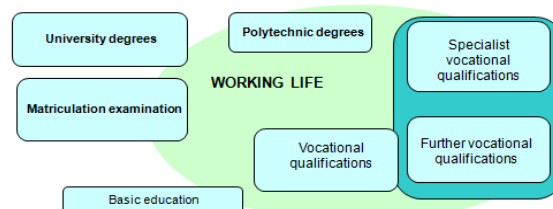


Figure 2 Structure of vocational qualification system

The special characteristics of qualifications were: competence based qualifications are independent of method of acquiring the required skills, prior studies or formal training; there are three levels of qualifications: vocational qualification; further vocational qualification and specialist vocational qualification; qualifications are module-based and qualification are made by competence tests (=

demonstrations of vocational skills) in real working life situations. The path leading to the competency based qualification is concentrated in guidance and accumulated life experience (Fig.3). A competence test of participants has been done in real working life situations which was assessed by tripartite evaluators: representatives of employers, employees and educators.

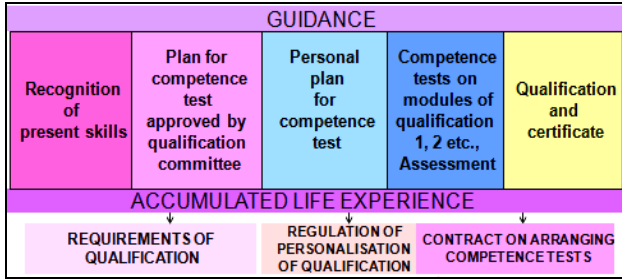


Figure 3 Path leading to CBQ

V. COMPETENCE BASED HIGHER EDUCATION IN USA

The study presented in [7, 8] gives explanation of USA postsecondary education and competency-based models in higher education. It is about pre-postsecondary education, within postsecondary education and after postsecondary education. The CBE is discussed as a learning revolution. Some of the reasons for conducting of the research are: intense competition from organizations whose sole purpose is to deliver learning anytime and anywhere – e/m-learning; employers and employees want the shortest route to results; the fact that performance-based outcomes will drive the assessment of quality in fundamental ways. A model of assessment of the college student learning and cognitive development has been created (Fig.4). The main conclusions are summarised around the two types of institutions: educational and other organisations.

King’s College embeds competencies across courses in all academic programs; Northwest Missouri State University links competencies with a strategic planning process; at Sinclair Community College focus on competencies and how they are assessed; Hagerstown Community College modules for technical programs and career transcripts; Community Colleges of Colorado incumbent worker project and builds competency-based curricula in conjunction with employers for delivery in electronic formats; Western Governors University mapping of degree programs from other providers to produce total competency-based degrees.

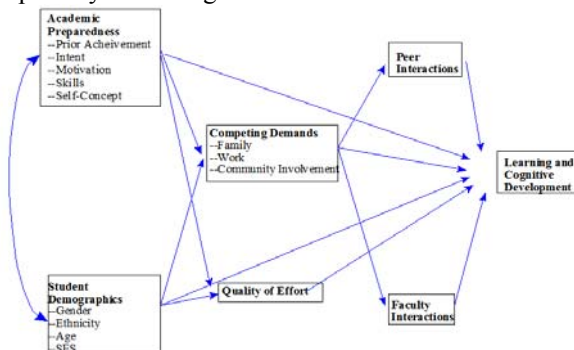


Figure 4 Model for Assessment

The second group is about other than educational organizations, they are: Proficiency-Based Admission Standards System in Oregon made articulation between secondary and public postsecondary institutions; Ford Motor Company made performance-based assessment of new hires and throughout their careers. The research gives some notes about creating and implementing of competence based models concerning workplace. The competencies in this model are grouped in attitudes and personal characteristics, essential skills, integrative applied skills and premium skills. End point is that CBE educational initiative is embedded within a larger institutional planning process and the assessments of competencies are directly linked with the goals of the learning experience.

VI. HARD AND SOFT COMPETENCIES IN CBE

Another aspect of CBE is grouping competencies into two types: hard and soft. This is a research conducted at University of Greenwich, England [9]. Hard competence is the ability to perform activities within an occupation or function to the standards expected in employment, but soft competence is the possession and development of sufficient skills, knowledge and appropriate attitudes and experience for successful performance of life roles. The advantage of CBE is shown in Table 2 by comparison between academic and competency model.

TABLE 2. A COMPETENCY MODELS COMPARISON

ACADEMIC MODEL	COMPETENCY MODEL
Subject boundaries	Specified outcomes
Norm referenced	Criterion referenced
Recorded grades: p/f	No failure / no grades
Assessment at one time and place	Assessment any time independent of place
Secret assessment	Open assessment
Weaknesses are compensated by strengths	No compensation, all outcomes must be met
Training is often theoretical/ classroom based	Training is work-based and employer-led
Emphasis on knowledge recall	Emphasis on observable performance

The five levelled model of competencies consists of recognise of competency in: the performance of routine work activities; a broader range of work-based activities; skilled non-routine activities; the performance of complex, technical and specialised activities including supervision and management; the pursuit of senior occupational or professional tasks including the ability to apply a significant range of fundamental principles and techniques.

VII. CERTIFICATION APPROACH BASED ON CBE

The research done by Inter-American Centre for Knowledge Development in Vocational Training[10] present the advantages of CBE in comparison between traditional and competence based certification approach. The attention is over the certification process and the positive effect of the grading scale application. According to the research traditional evaluation approach is associated

with an educational course or programme, parts of the programme are evaluated by subjects; parts of the programme included in final examination; pass based on points on a scale; the questions are not known; undertaken at definite times and uses statistical comparisons.

Typical for the competence based approach is that it promotes and aids self-evaluation, associates self-evaluation with competencies and sub-competencies and also includes interaction between the evaluated and evaluating parties regarding the learning process. The evaluated person (worker) first makes a self-evaluation then the evaluator (instructor) checks the self-evaluation with the worker and at the end the results aid in establishing requirements of future training and practice on the job. First step of evaluation prior to certification (UK system) is defining objectives. The next step is gathering evidence, then comparing evidence-objectives and coming to a conclusion. The third is centred on results (defined in the standard). Uncertain time is individualised and it is not associated with a course of study, it does not compare different individuals and does not use grading scales competent or still not competent.

An assessment process is based on grading scale. Firstly, it consisted of three scales which were enhanced to six: 0: Cannot perform the sub-competency; 1: Can perform the sub-competency with permanent supervision; 2: Can perform the sub-competency with periodical supervision; 3: Can perform the sub-competency without assistance or supervision; 4: Can perform the task without assistance or supervision at more than acceptable quality and speed levels; 5: Can perform the task at more than acceptable quality and speed levels and with initiative and adaptability; 6: Can perform the task at more than acceptable quality and speed levels and with initiative and adaptability and can lead others in doing the task.

Advantages of CBE are shown by comparison between traditional certification and certification by competency is shown on Table 3.

TABLE 3. COMPARISON BETWEEN ACADEMIC AND COMPETENCE BASED CERTIFICATION APPROACHES

Traditional certification	Certification by competencies
Issued at the end of a learning cycle	Issued at the end of an evaluation
Based on theoretical and practical tests, usually in classrooms and teaching workshops	Based on proof of performance on the actual job
Centred on curricula that are not always up to date	Centred on standards translated into curricula
Recognition based on prestige	Recognition at the national or sector level
It is earned once and lasts for a lifetime	Must be updated with new knowledge
Does not use external mechanisms that check quality	Uses internal and external quality checking mechanisms
Low or nil participation of social players	High participation of social players
Centred on tasks or jobs	Centred on occupational competencies.

VIII. KARLSRUHE COMPETENCY BASED EDUCATION

Karlsruhe Competency Education Model in Product Development, Germany has had three basic elements: education, environment and key qualification [11].

The key aspects of the competency educational model were the combination of classical mechanical design education with computer sciences and mechatronics requires a high degree of candidness and methodical progression. In the domain of product development model it was essential to work on concrete examples with transferability to other cases. Participated students couldn't learn product design in the first semester, but it was important for the motivation of students in the early stages of their studies. This education might be executed in a step-by-step manner. Conceiving, designing, implementing and operating were aspects that together represent a methodical process and bring together essential *milestones* of product development. Elements of CBE model, education, environment and key qualifications were divided into three. Students' education is divided into three parts. The theoretical knowledge is imparted in the lecture by an excathedra teaching format. In tutorials, students use this knowledge in practical applications by solving various problems, e.g. analysing technical systems, etc. The implementation of this knowledge takes place in the workshop (fig.5).

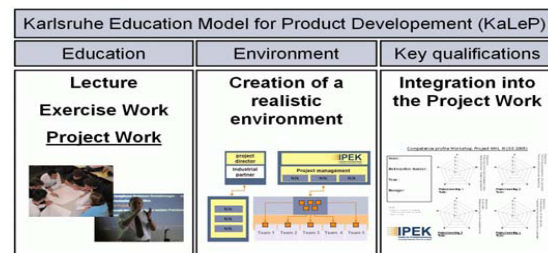


Figure 5 Product development elements

The model is based on a constructivist learning process whereby students must construct their knowledge for themselves in order to understand it correctly. The model integrates such design-build experiences on two levels: by splitting product development education into three stages, a methodical process is achieved. This is oriented towards certain fields of product development-specific knowledge: systems, methods and processes.

The first stage, mechanical design (fig.6), is placed in the first two years of study accounting for a large number of students. Concrete systems are implemented to gain clarity and reference to practice the fundamentals of design. After finishing education, an examination is held that is split into the theoretical and practical parts. Students are given a very complex constructive task, which demands a structured process, creativity and time management to solve the task within three hours – all aspects that they have learned in the workshop in addition to disciplinary competences.

The second phase is product design and the third phase consists of the course *Integrated Product Development*. A complete product development process through the prototype phase is completed in close cooperation with an industry partner. At the end they have to evaluate their own knowledge and skills in this area. It is possible to compare the tutor's estimation with students' estimation. The grading of the points is: 0: resigned from difficulties, aims

not reached; 1: partially resigned from difficulties, aims reached incompletely; 2: difficulties negotiated, aims reached; 3: difficulties negotiated well, aims reached completely; 4: difficulties negotiated without problems, aims outreached.

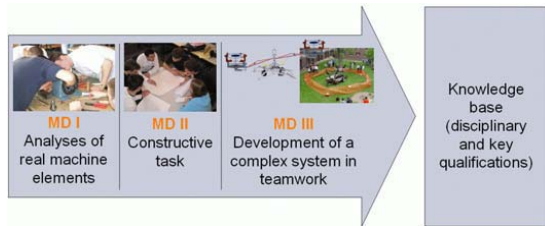


Figure 6 Mechanical design education as methodical process

Students are also integrated in the evaluation process. Team members have the possibility to evaluate each other. After a discussion, the tutor fills in the competence spider. Students thus learn to review other work in relation to their own performance.

IX. CBE CURRICULA DEVELOPMENT

Competency-based curriculum development is experience case study in Agri Chain Management in the Netherlands and in China [12]. This example explains the difference between core and key competency as CBE elements. The core competences give enterprises access to a variety of markets, they provide added value to the products from the customer's perception and the core competences are difficult to imitate. Key competencies are defined as knowledge, skills, insights and attitudes which enable further professional development, belong to the permanent core of a profession, provide possibilities for transfer to related jobs and enhance career transitions. Core competences are the organizational abilities explaining the main differences with competitors and result from competencies of managers and employees. Acknowledgement of the significance of core competences rapidly leads to the translation of personnel's competencies. Competency lists can be considered as a manner to communicate within an educational organization and between education and labour organizations, as well as between educational institutes from different countries operating in different cultural settings. Some organizations (e.g. public services) see competencies as aspects of the whole person, comprising: aptitude (verbal, numerical, spatial); skills and abilities (thinking, leadership); knowledge (general, profession specific, job specific, level specific, organizational specific); physical competencies (stamina, energy); styles (leader, manager, employee); personality (social orientation); principles, values, beliefs, attitudes and spirituality (fairness, equity); interests (dealing with people, dealing with facts).

According to this research professional practice is a main guideline for the development of curricula in accordance with CBE approach. Academic disciplines on the other hand also serve as important input for the curriculum. In order to construct a profession profile a set of distinct competencies is needed.

X. CONCLUSION

All of the cases in this paper prove the critical role of CBE in development of relation between education and industry. Firstly in the paper it is reviewed in a short, TENCompetence concept. Secondly, the DeSeCo initiative is about application of CBE in different educational institution and organization worldwide and third discussed cases about CBE present concrete research results. The advantages of all practices are coming to show that in rapidly changing industrial and information-based society practitioners increasingly need to respond intelligently to this changing situation and to go beyond established knowledge in order to create competitive educational outcome. CBE focuses on outcomes of learning, thus its assessment in extremely important.

In other to be done an accurate assessment it is needed to identify the concrete CBE model. That is why our next research is expected to be focused on different models about CBE.

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