



-RESEARCH ARTICLE-

Impact of Electronic Competence Based Teaching in Higher Education

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Abstract

In the beginning of Bologna's process and creation of European Higher Education Area (EHEA), great importance has been to the transparency, increase of quality and concurrency between institutions of higher education. Nowadays, hot topic in higher education institutions in Europe are real-time learning outcomes, they are analyzed, projected and are evaluated today in all Europe and abroad. Traditional models and methods of success expression in learning and the degree of qualification is substituted with modern online systems. This paper proposes best practices for competence based teaching in higher education by using eCompetence software. The way these competences are organized, activities which are related to these competences and course contents which will help us to continuously evaluate students and prepare them for the labor market. Our results suggest that by implementing competence based teaching system in university evaluation and competence gaining would be more productive and would better prepare students for labor market. Consequently, this paper draws attention on provision of implementation of such a system in higher education by providing competence matrix, a competence software, and evaluation process.

Keywords:

Competence, E-learning, Evaluation, Competence Management System.

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Introduction

European Higher Education (EHE) came into being with the Declaration of the Sorbonne in 1998, which emphasized the role played by universities in the development of the cultural dimension and of the Europe of knowledge. This was extended in the Declarations of Bolonia

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(June 1999), Prague (2001), Berlin (September 2003) and Bergen (May 2005) (Sánchez et al., 2016).

In higher education, it is very important that closeness and communication between students and professors to be at the right level. In this paper, we discuss the engagement of different level competencies that will increase teaching activities and would keep students focused on their studies. All this will be done based on the recommendations of EHEA using ECTS credits and hour engagements per ECTS unit. One of the fundamental aspects of higher education for a state is the research for market needs from which competences for different study programs would be created. With the use of competencies in the University of Pristina we aim to prepare students professionally and based on the market needs and requirements (Juri et al., 2007).

Nowadays, rapid development of technology from which servers, computers, internet, teleconferencing, mobile phones, cannot be an exception of vast amount of data distribution in no time. Such a data is saved in large-scale storage such as big table, Knowledge is one of the great players of global race, possession of knowledge is not enough in itself, and current challenge is how to manage it. Competence shall take place in labor market and should be developed in modern society, for this reason education is related to terms of competences. Main reason behind the competence is interconnection between university studies and society challenges with which young professionals are dealing with when they finish their studies. Following this path has not been an easy task for the universities but a deep cultural change. Comparative models taken into consideration are TUNNING project and REFLEX (Juando Bosch and Peres Cabani, 2014). Competence cultivation is the aim of education programs, competences are created in different teaching units and are evaluated in different phases to create a competence based teaching model. Competence in higher education are useful as part of curricula development of study programs.

Competence management operation provides possibilities for residents to add and remove skills from a resident profile and determine degree of possession by choosing the skill level in web portal supports the following main operations (Smirnov et al., 2016):

- determine a customer task;
- compare the customer task with resident profiles;
- compare profiles of different residents;
- range resident profiles based on similarity to the customer task.

As part of this project which we have taken as a sample for our results, we will provide details on the creation of competencies, their relationship with relevant courses, creation of activities, mapping activities with relevant course and contents using software eCompetences. Furthermore, we explain activity assessment, which leads to the extraction of final grade automatically providing students with transparent and real-time assessment.

As can be seen in Figure 1, main components of the system are Course, Professor, Student, Competences (Transversal, Specific), activities, and Evaluation module.

Figure 1 shows Competence System Architecture with main components.

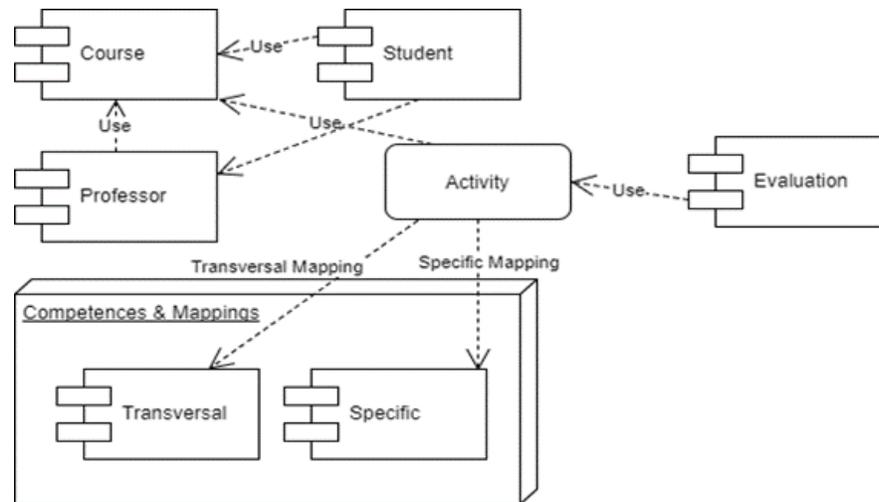


Figure 1. Competence System Architecture.

As can be seen in Figure 1, main components of the system are Course, Professor, Student, Competences (Transversal, Specific), activities, and Evaluation module.

What is Competence?

With *competence*, we understand the ability or skill to realize something successfully or efficiently. Students will gather competences by taking part in different teaching activities, which are related with teaching contents. It is recommended that a particular course be given no more than 5-8 competences.

Based on the recommendations of (Guide to the European Higher Education Area, 2012) University of Pristina has decided that competences be divided into two main categories:

- **Transversal or Generic Competence** – This set of competencies consists of instrumental competencies which are gathered by the end of study program of university courses, providing students a guarantee for the future and preparation for their professional life.
- **Specific Competence** – These are specific competencies for study program. These competences make distinction among different study programs. These are specific for the department of studies in University of Pristina.

Example: Competences in bachelor studies in the program of Telecommunications are different from those in Computer Science. This indicates that students from Department of Telecommunications will gather different competences compared to the students from Computer Science Department or other program.

The concept of competence can be dated back to Persian (in the code of Hamurabbi), Greek (in Lydia of Plato) and Roman times (in general language), has been used in Europe from the sixteenth century and entered professional literature in law (competence of courts and witnesses), public administration (competence of institutions), organizational structure (competence of departments or functions), management (core competence, competence management), and

education and training (competence-based education) from the seventies of the last century (Mulder, 2007). The list below shows the milestones in the use of the concept of competence (Martin Mulder, Judith Gulikers, Harm Biemans, Renate Wesselink, 2009):

- Use in daily speech: Persian – Greek – Roman eras.
- Used in Western languages: Sixteenth century.
- Used in behavioral sciences: 1950s White (1959).
- Used in systems science: 1970s Gilbert (1978).
- Used in management sciences: 1980s Boyatzis (1982).
- Used in corporate strategy: 1990s Prahalad and Hamel (1990).
- Institutionalized in education: 2000s European Commission (2005, 2006).
- Perceived relevance of the learning task is a key issue in this respect.

Competence includes: (i) cognitive competence involving the use of theory and concepts, as well as informal tacit knowledge gained experientially; (ii) functional competence (skills or know-how), those things that a person should be able to do when they are functioning in a given area of work, learning or social activity; (iii) personal competence involving knowing how to conduct oneself in a specific situation; (iv) ethical competence involving the possession of certain personal and professional values. (European Commission, 2005). Whether frameworks adopt an individualist or community of practice approach to competences has important implications for a number of related issues. It has implications, for instance, for attempts to measure competence, what these measurements mean, and whether generally applicable frameworks and performance indicators that are used to assess competence across different institutional settings are meaningful. There are also implications as to whether competence gaps can be plugged simply by buying in specific competences (Sultana, 2009) and (v) digital competence, which involves the confident and critical use of Information Society Technology for work, leisure and communication. It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information and communicate and participate in collaborative networks via the Internet. Preparing students to live in the digital era, using in a relevant way the rapidly changing ICT, while being aware of the new ethical challenges brought about by social networks, but also adapting teaching/learning practices to young people’s digital culture (Halasz and Michel, 2011).

Competences in University of Prishtina

University of Prishtina has created competence catalogs for the pilot program in a few academic units and is working to extend the catalogue for other study programs too. Using competence matrix we create the link between course and the competence (see Table 1).

Table1. Competence Matrix and Course Linking.

Competence	Course 1	Course 2	Course 3	Course n
Competence 1	1	1	1	1
Competence 2		1		1
...

Competence	1	1	1	1
N				

Numbers (1) which are placed in the above table mark the relationship between the competence and the course. To keep the process simpler, it is recommended that for a single course there be no more than 5-8 competences specified. In the case provided in the table (see Table 1) we can observe that Course 1 is related to competences {1, n}, Course 2 with competences {1,2, n} and so on.

Many institutions in Europe claim to have a competence-based curriculum. However, in many cases, only superficial changes in the curriculum have taken place, and learning processes have not changed in practice. We consider that it is necessary to redraw the curriculum with interdependent feedback loops, constructing a map of competences downwards from the top and upwards from the bottom after determining the core competences by deliberation and through a partaking process (Edwards et al., 2009). Communicative qualities of personality which characterize the development of the need for communication, relation to the method of communication and communicative competences, that is the ability to own the initiative in communication, the ability to be active, emotionally respond to the state of dialogue partners, formulate and realize their own individual program of communication, the ability to self-stimulation and mutual stimulation in communication (Lukyanova et al., 2015).

Students Role

Students will have access to the course syllabus, teaching activities, they will be able to see different notifications and results and their overall assessments. The CUP (Competence System in University of Pristina) interface will be an important factor because the students will have a better overview of their achievements on their studies. This will allow the students to focus their studies and their commitment on these parts that they have less succeeded successfully. This will increase the study quality, their professional preparation and increase the competitiveness. The syllabus and the teaching activities will be a contract between students and their teacher.

Teaching Activity

To increase students’ engagement, teaching activities are created. Table 2 shows details with all attributes for a teaching activity.

Table 2. Teaching activity details and attributes.

Activity
Title
Activity Title
Description
Activity Description
General data
Type of activity
Choice list (lectures, Exercises, Seminar, etc.)
Hour summarization of student’s engagement for activity
Provided values are samples!

	B efore	V ith	A fter	T otal	
With h professor	0	2	0	2	1 2.00h
With hout professor	0	0	1 0	1 0	
Evaluation criteria Tells if activity will affect the final assessment and the final mark					
Evaluates					
Is assessed? If yes, a criteria should be written as a description together with percentage for the final mark.					
Description					
Description of criteria for the final activity assessment					
Mark %					
The percentage that this activity will have in final mark/assessment. (i.e.: 10, 20, 30, 80, etc.)					
Relation with competence - will the student gather by taking this learning activity.					
Competences					
Complete list of competences which are related to the course will be given during the process of creation of activity. Teacher (user) will be able to select those that this new activity will develop.					
Relation with content –with which unit in the table of contents is this activity created.					
Table of contents					
Teaching units are chosen from the list.					
Attachments (Documents)					
Different attachments for the activity i.e. articles, brochures, similar work, photos, videos, etc., which might be related to the teaching activity so that students will have access to.					

Activities are divided into two main categories:

- Activities that are evaluated and
- Activities which are not evaluated.

Activities that are evaluated

Evaluating activities play an important role in overall assessment of the students. During the creation of activity the weight in percentage for the final mark is given. Final mark will be extracted as a result of the sum of all evaluating activities specified for a single course. The total percentage of all activities should be 100%, thus it is important that percentage be divided uniformly. CUP makes this process easy by disabling professor’s mistakes in percentage, by limiting them not to overcome the total of 100% or by giving warnings when this values is less than that for the evaluating activities.

Activities which are not evaluated

These activities include all activities that do not directly affect the assessment of the student. Some of these activities might include:

- Lectures
- Numeric exercises
- Labor work
- Dictation and
- Other activities which do not directly affect assessment.

Evaluation of learning process

Evaluation of learning process will be continuous by assessing learning activities, those activities that are assessable with the effect on the final mark. The result of each activity is transparent until the final assessment. Evaluating techniques in UP are not always continuous, most of the professors follow classic methodologies of assessment by evaluating student only at the end of semester by providing them final exams. In the following we explain how the continuous evaluation is realized for a course based on activities and competence evaluation for overall studies from which a diploma supplement is extracted. Courses have different activities where some of these activities will be evaluating and will have direct effect in final mark. Competence Software developed for the University of Pristina is based on the above logic and will do all these calculations automatically and keeping all this process as simple as possible.

Evaluating activities

Evaluation is done for activities that are linked with competences which students attend and get assessed. Also, activities are linked to course contents.

Table 3 shows list of activities per course with evaluating activities, their weight in the final evaluation and grades for each activity.

Table 3. Activities and course final assessment.

Activity	Course	Mark percentage	Grade for activity
Activity 1	Course Name	10%	10
Activity2		20%	10
Activity3		30%	10
Activity4		40%	10
Percentage and final grade		100%	10

As can be seen from the above table requirements are that overall activity percentage be 100%. In this case (see Table 3) we have taken an example where student has taken maximal grade 10 for each activity thus its final grade is 10.

Mathematically this can be expressed in the following relation (1):

$$FinalEvaluation(CourseX) = \frac{\sum Grade(Activity_N) * Percentage(Activity_N)}{10} \quad (1)$$

From relation (1) we can see that final assessment depends on activity evaluations. Calculation of a single activity will result as follows in the relation (2):

$$Activity\ Evaluation = \frac{Activity\ Grade * Percentage}{10} \tag{2}$$

Example: Based on the equation (2), if we take a learning activity named “Group Project” and if it’s evaluated with 30% weight on the final grade, and if after assessment student gets grade of 9 we calculate:

$$ActivityEvaluation(Group\ Project) = \frac{9 * 30}{10} = 27\ points$$

After doing the same calculating for each activity using relation (2) we can extract final results (final assessment) for overall activities in a course using relation (1).

Final assessment based on standards and agreements in the University. In University of Pristina grading is done through points i.e.: 0-49=5, 50-59=6, 60-69=7, 70-79=8, 80-89=9 and 90-100=10.

Evaluating activities

As specified above each learning activity is linked to specific or transversal competence. Therefore we should do calculations so that we can extract results from overall assessment and list competences which the student has acquired. CUP enables extraction of diploma supplement at completion for graduate students, which as addition to diploma provide better overview of student’s qualifications and competences. In the following methodology for evaluation of competence in the general level of study program is explained. Competence mapping for study program in tabular form is given in the following (see Table 4).

Table 4. Mapping of competence and course.

	Course 1	Course 2	...	Course N
Competence1	√ (30)	√ (20)		
Competence2		√ (15)		
Competence3	√ (10)			√ (30)
...				
CompetenceN	√ (40)	√ (30)		

From Table 4 we can see that Competence 1 is referenced in Course 1 with 30 points, in Course 2 with 20 points. Competence 2 is referenced only in Course 2 with 15 points.

Competence 3 in Course 1 with 40 points and in Course N with 30 points. Competences are distributed into groups of courses or the study year at the beginning of academic year (Skowron et al., 2017).

Calculations of percentage for course (highlighted in blue in Table 4) is calculated with following formula (3):

$$ReferencePercentage (K,L) = \frac{\sum_1^n An}{n} \quad (3)$$

Where:

K - Competence,

L - Course,

An -Total points in each activity (calculated using formula given in relation (2),

n - Number of activities where the competence has been referenced.

Calculation of total points gathered for competence in general level (study program level i.e., Computer Science, Telecommunication, etc.) is calculated using relation (4):

$$Total Points (K) = \frac{\sum_1^n K(Ln)}{n} \quad (4)$$

Where:

K - Competence,

L - Course,

K (Ln) – Number of points acquired for a competence in one course

n - General number of appearance (references) of competence overall study program.

Based on the equation (4), if we calculate total points from Table 4 we will get the following results: Competence 1 = 25 points, Competence 2 = 15 points, Competence 3 = 20 points and Competence N = 35 points. From where we can understand that the student has been best in acquiring Competence N, which has 35 points. These values (points) based on the agreement can be converted into grades (from 5-10) or with literals.

Competence in University of Prishtina CUP

CUP is developed based on the procedures of Quality Assurance Framework of Qualifications, and recommendations of cooperating teams inside University. The aim of this system is to develop and promote procedures, assessment instrumentations for improvement of competence harmonization according to competences developed in higher education institutions for labor market requirements. The CUP is a research-supported system based on the Primary goal of defining the critical competencies (behaviors) needed for effective and superior individual and institutional performance (Tripathi and Ranjan, 2010). Main motivation of research: identify the competencies of the faculty members for the competitive enhancement of the educational institution, develop a competency model for the faculty members. Integrate the competencies and the job functions of the faculty member in the institution and Extract the significant patterns from the competency database to help in succession planning and performance assessment (Tripathi and Suri, 2010). In the following, we provide screenshot excerpted from CUP. To keep all this simple we provide only the most important views.

Mappings between competence and course

In the following (see Figure 2) is a depicted view of mapping department and transversal competence.

Figure 2. Competence matrix for mapping competences.

As depicted in the figure, the user which has Management (user-role) access can choose competences which are relevant to the selected course (see Figure 2).

Activities

In the following figure (as shown in Figure. 4), depicts details for creating an activity.

	Before	During	After	Total
Total hours with professors:	13	0	0	13
Total hours without professors:	0	0	13	13

Figure 4. Details provided when creating a teaching activity.

During the creation of activity the Course's professor will choose type of activity, specifies engagement hours for activity, specifies weather the activity is assessable or not. When assessable activity is created, we specify the criteria and the weight of the activity in the final grade. In the final part, competence-activity and content-activity mappings are provided by choosing relevant competences and contents that this activity will develop.

Activity Evaluation

As shown in the following (see Figure 5) the list of choice for activities is provided such as that when professor selects one of the evaluating activities it can evaluate each student by providing a grade to each one.

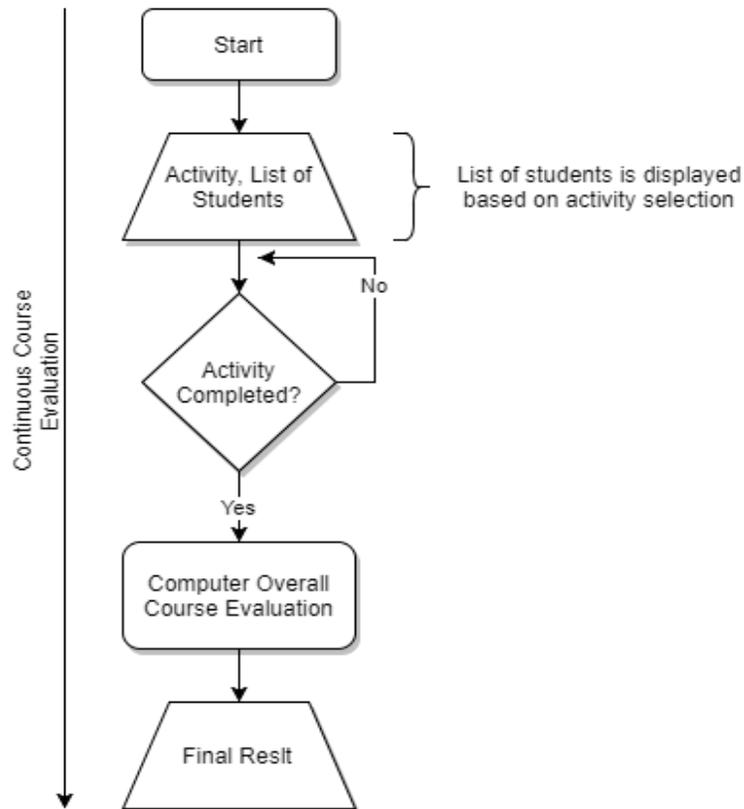


Figure 5. Activity Evaluation.

Teacher as per merit provides a grade for each student. The CUP then based on the Final Evaluation provided by Equation (1) makes automatic calculations by providing final grade as a recommendation every and each time a new activity is evaluated with a grade. CUP recommends final grade based on the results provided for each activity. At the end, professors will decide for the final grading and they are able to confirm the final grade. After professor has confirmed the final grade, students can decide if that is the grade they want, or refuse it for re-assessment. Considering the fact that student also confirmed the same, final grade is stored in transcript of records.

Results

We have asked a considered number of professors to publish materials and to get involved in competence based teaching process and we have received the following feedback from about 77 teaching professors within two first months, see Figure 6.

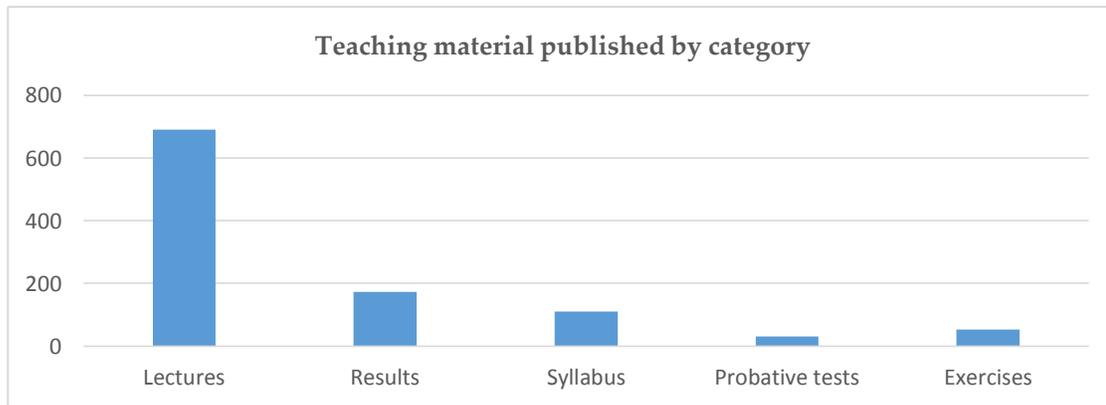


Figure 6. Number of teaching materials published by academic staff

Results have shown that the more teaching material is published the more engaging the students' get. Figure 7, provides statistics on student activity by providing number of downloads by category.

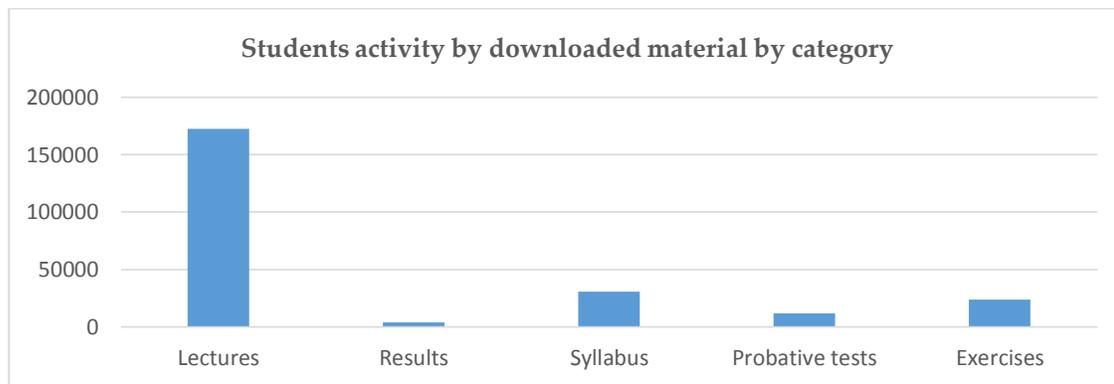


Figure 7. Student involvement by download per material

Case Study: Measuring Competence Based Teaching effect on pass success ratio

We have analyzed results from three departments in University of Prishtina:

- Computer Engineering – Faculty of Electrical and Computer Engineering (FECE),
- Banks, Finance and Accountability – Faculty of Economy,
- Agriculture - Faculty of Agriculture

First department from computer engineering in first semester in 2017 had a success ratio of 0.68, which included success of 167 students in total, the second department from Faculty of Economy included 493 students from first semester in 2017 and had a pass success ratio of 0.60. The last one from agriculture had a passable success ratio of 0.78 with participation of 139 students. Having only agriculture department implement competence based learning results are clear that students success ratio is better when using competence based teaching thus with increased success ratio. Figure 8 shows these results in graphical form.

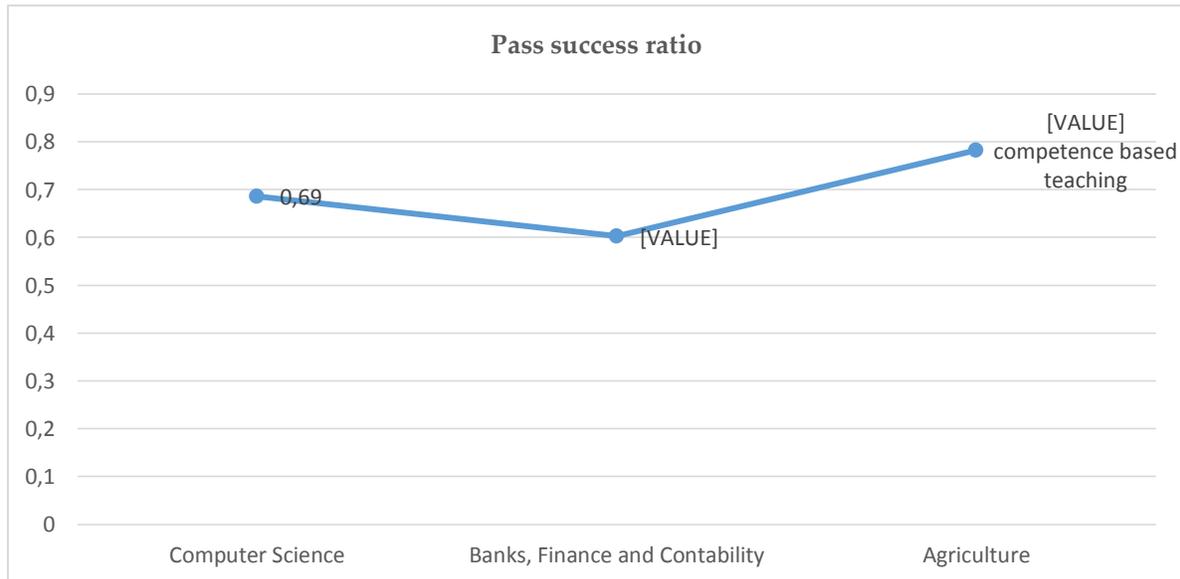


Figure 8. Pass success ratio of agriculture department in comparison with two other departments that have not implemented competence based teaching

Conclusion

This paper provides implementation of eCompetence system in teaching, learning and evaluation of students based on competences in University of Prishtina. The system is implemented for competence based teaching management and is supported by provision of data inputs and the information retrieval is then published in university portal to provide transparency and quality increase in university. Paradigm shift from knowledge based to competence based is a supporting pillar of initiative of EHEA which includes main processes, but not limited to Bologna's and European Qualification Framework. Formulation of adequate strategy for digital competence teaching is a must for a contemporary higher education institute. Even though it has not yet been achieved in all higher education institutes in Europe, bypassing such a shift in the near future will be almost impossible.

Monitor your access through the eCompetence system in your teaching activities. Do not consider competence based teaching something 'strict'. Make sure that all of this remains of what you've achieved until now. Do not hesitate to take student's opinion on your competence based teaching approach, because they are really sincere in this point. At the end, do not get discouraged, as all other projects in this life, this will too have its good and bad moments. Insist in what is fruitful and throw away what is not functioning. Give a clear mission that there be no misunderstanding, at first meeting talk about time and schedule, also arrange when the groups will be created and how they'll be organized. Ensure students submit materials through eCompetence system in electronic form so that you can easily open them and evaluate with ease. Do not give students access to create their groups by their desire. In their real life they'll not be able to choose their colleagues, teaching them to work with anyone is a great competence in life. This is possible with competence based teaching system and is achieved in University of

Prishtina, and has made it possible that students be more successful, better prepared for labor market and promote transparency and comparativeness in study programs.

We have provided a model of implementation of competence based teaching system which is straightforward and simple. Results provided have shown that the success ratio for a department that has implemented this model has an increase pass success ratio. We encourage implementation of this model in order to harmonize the labor market requirements with the competence retrieval in higher education.

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References

- Edwards, M., Sánchez-Ruiz, L. M., & Sánchez-Díaz, C. (2009). Achieving competence-based curriculum in engineering education in Spain. *Proceedings of the IEEE*, 97(10), 1727-1736.
- Halász, G., & Michel, A. (2011). Key Competences in Europe: interpretation, policy formulation and implementation. *European Journal of Education*, 46(3), 289-306.
- Juando Bosch, J. & Peres Cabani, M. L. (2014). *Competence-based teaching: building a model and some tools*. Spain: Education Research Institute, University of Girona.
- Juri, L., Herder, E., Koesling, A., Lofi, C., Olmedilla, D., Papapetrou, O., & Siberski, W. (2007). A model for competence gap analysis. In *Proceedings of 3rd International Conference in WEB Information Systems and technology Barcelona, Spain*.
- Lukyanova, N., Daneykin, Y., & Daneikina, N. (2015). Communicative competence management approaches in higher education. *Procedia-Social and Behavioral Sciences*, 214, 565-570.
- Mulder, M., Gulikers, J., Biemans, H., & Wesselink, R. (2009). The new competence concept in higher education: error or enrichment?. *Journal of European Industrial Training*, 33(8/9), 755-770.
- Sánchez, L. E., Santos-Olmo, A., Álvarez, E., Huerta, M., Camacho, S., & Fernández-Medina, E. (2016). Development of an Expert System for the Evaluation of Students' Curricula on the Basis of Competencies. *Future Internet*, 8(2), 22.
- Skowron, A., Dymek, J., Gołda, A., & Polak, W. (2017). Are We Ready to Implement Competence-Based Teaching in Pharmacy Education in Poland?. *Pharmacy*, 5(2), 25.
- Smirnov, A., Kashevnik, A., Balandin, S., Baraniuc, O., & Parfenov, V. (2016). Competency Management System for Technopark Residents: Smart Space-Based Approach. In *Internet of Things, Smart Spaces, and Next Generation Networks and Systems* (pp. 15-24). Springer, Cham.
- Sultana, R. G. (2009). Competence and competence frameworks in career guidance: complex and contested concepts. *International Journal for Educational and Vocational Guidance*, 9(1), 15-30.
- Tripathi, P., & Ranjan, J. (2010). A Competency Mapping for Educational Institution: Expert System Approach. *Int. J. of Computer and Communication Technology*, 2(1), 75-93.

Tripathi, P., & Suri, R. K. (2010). Development of competence based management and performance assessment system for academic management: Empirical investigation. *International Journal of Innovation, Management and Technology*, 1(4), 357.