Services Delivery Model
for Education-as-a-Service Based Framework

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Abstract. The digital revolution is bringing new competition to education compared to classical universities, especially in the form of more accessible online education. At the same time, interest is growing in the mobility of educational services, which is designed to bridge the gap between businesses that require new competencies, the inertia of universities in providing them within the framework of classical programs, and the student's desire to instantly receive services to master new competencies.

All this is accompanied by the development of a competency-based approach to education, which allows structuring the needs of society and clearly formulating the demand of society for the training of professionals. This need has already been formulated in the form of European standards and professional frameworks that create a regulatory framework for the implementation of new approaches to education.

The paper describes the initial results of the study, the aim of which was to create a fundamental feasibility model for a cloud-based service-oriented education platform for the next generation of an educational institution.

This article presents the Service Delivery Model, which provides a description of the main functions of the proposed digital educational platform.

Keywords: Education as a service · Competence-based education · Education ecosystem · Education digital platform · Services delivery model

1 Introduction

In recent years, the learning paradigm has increasingly shifted towards a competency-based approach. In general, this trend is quite understandable. The issues of competence in the field of digitalization have been worked out most actively today [1]. But even in this area, the issues of practical implementation of competency-based learning remain problematic. In addition to this, there is a need to change the classical model of the university, which in modern conditions does not have time to dynamically adapt to the needs of society, especially in the field of information technology and communications.

This brings to life new educational models such as education as a service (EaaS).

Even though the EaaS concept is actively discussed in the academic environment, approaches to its practical implementation remain insufficiently developed. The developers face a difficult task - to create a comprehensive model of a digital platform for a

single space of higher and professional education, which will bring together all the main stakeholders - consumers of educational services (students and employees), providers of educational services (educational institutions and individual trainers-teachers) and sponsors of education (business, state, public organizations).

Confidence in the possibility of solving this problem is inspired by the presence of most of the elements and technologies of such a platform that exist independently, as local educational services that solve partial problems [2].
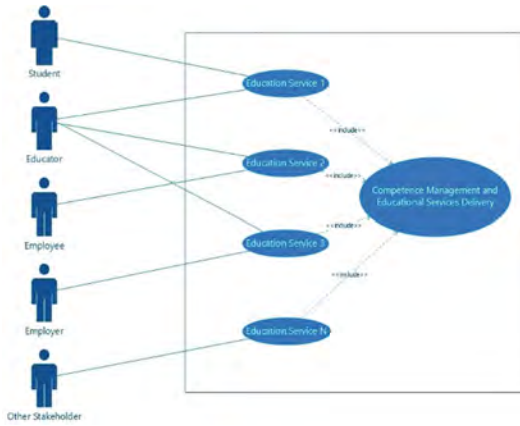
Fig. 1. General view of competence-based digital framework for education as a service (created by authors).

Taking into account the above, we can state that the platform being developed (and, accordingly, the framework itself) as a complex system should have a multi-level structure with distributed functionality and many horizontal links on demand within the framework. At the same time, for the end user, most of the intermediate services should be transparent (invisible). Obviously, when solving this problem, mainly as a problem of integrating a variety of existing educational services, it is necessary to solve the problem of creating a fairly universal interface within a certain architecture. At the same time, this interface should be based on some entity that connects the interests of all stakeholders in education. As such an entity, the competences are used in the article (Fig. 1). All communications with users of the described framework should be related to certain competencies (requested or supplied). The user will be provided (if available) with the required educational service (external to the framework or internal) for the formation of the required competence. In the absence of the required service, the framework will be able to organize the search or creation of the required service for a specificcompetency request. Thus, another important requirement for the framework appears - it must be open to expanding the set of services.

This article proposes a model of the EaaS conceptual framework, which was first identified by the authors in the paper [3].

The structure of the article contains 5 sections: the present introduction, a review of publications on the topic (Sect. 2), a description of the conceptual framework for

the practical implementation of the EaaS (Sect. 3), a description of the service delivery model of the EaaS framework (Sect. 4) and conclusions (Sect. 5).

2 Related Works

The model of a classical university does not correspond today to the high dynamics of the development of the needs of society, especially in the sphere of high technologies. This led to the development of the EaaS concept as a complementary, and in the future, as a replacement for the existing classical models of education. Complementing the ability of universities to adapt their curricula to market requirements using the EaaS model offers new services to all stakeholders in the educational services market.

The trend to treat learning as a service, co-creating it with other stakeholders, is already being exploited by some universities [4]. The student-oriented approach, which is assumed in this case, can be implemented if students themselves are involved in this process, for example, using various marketing-oriented approaches [4].

The implementation of the EaaS concept assumes that students should know the competencies for successful entry into the labor market, and universities should know these competencies and effectively update their programs and courses to ensure their implementation [5]. The competence-based approach is developing most intensively in relation to the field of information technology. It is logical that the development of the first practical steps in the field of application of the EaaS approach is carried out during training in computer science [5].

Pilot projects for the implementation of the EaaS are built based on classical digital technologies [6]. At the same time, developers focus on the technical aspects of implementing the EaaS concept, relying on cloud technical solutions traditional for information technology based on the Infrastructure-as-a-Service model (IaaS) [7]. Individual universities are considering the whole range of service add-ons, introducing other services such as software as a service (SaaS) and platform as a service (PaaS) [8].

Several factors gave additional interest to the development of the EaaS concept:

- the need to provide adequate support for the development of the 4th industrial revolution by specialists with the necessary digital competencies [9];
- educational mobility as an important component of the internalization of education, which allows acquiring the necessary competencies outside the programs of native universities [8];
- remote mobility trends for both students and teachers, especially in the context of the COVID-19 pandemic, which removed many of the psychological problems of distance and blended learning that previously existed in the academic environment [10].

A certain constraint on the development of the EaaS model of education is associated with the susceptibility of traditional forms of higher and professional education to formal restrictions on certification, licensing and accreditation. However, the requirements of a competency-based approach can change the current situation in this area, just as the pandemic changed attitudes towards the possibility of implementing all university programs remotely.

Another factor raising interest in the EaaS concept is the expansion of the services of the Gig economy. The Gig economy and the platforms that implement it are changing the relationship between the employer and the employee, creating new economic and marketing models [11]. At the same time, the models and platforms of the Gig economy themselves can be considered as prototypes of the EaaS concept [12].

Companies within the frame of Gig economy generate revenues via cloud digital intermediation between actors of Gig economy by transferring some business operation costs to platform users [12, 13].

There is the same approach in education cluster of Gig economy.

The main directions of activities in this sector are:

- diversification of offered services and increasing the market share for the offered services [13];
- small tuition fees imposed on certification and registration of courses;
- paid additional organisation services (examination charges) [14];
- paid outside main course academic services [15] and others.

Case study of edX give an example of such kind approach in education [14, 15].

An analysis of research in the field of the EaaS paradigm shows that the main attention of researchers is focused either on the issues of educational services or on the technical implementation of various approaches to service-oriented education. At the same time, there is no holistic description of the EaaS model, considering all the factors necessary for its practical functioning.

The purpose of this article is to describe the holistic ecosystem of the EaaS framework that ensures the interaction of all users on the EaaS platform and it service delivery model.
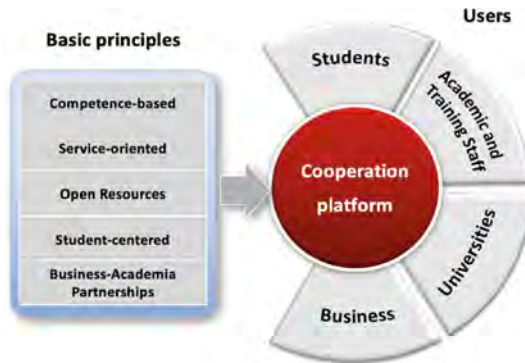

Fig. 2. Framework of EaaS ecosystem (adapted from [3]).

3   Conceptual Competence-Based Framework for EaaS

The framework of the EaaS ecosystem at the macro level includes the basic principles of operation, users and the information environment (cooperation platform) that implements the main functionality of the system (Fig. 2).

There are several key principles, the implementation of which should be incorporated into modern education ecosystems. The main ones are the following.

1. Principle of competency-based learning. This is the defining principle, which requires a change in the traditional model of education. In conditions of high dynamics of changes in the technological environment, education always turns out to be catching up in comparison with the needs of practical business. However, it is the presence of the necessary competencies that makes business and individual professionals in demand in the market.
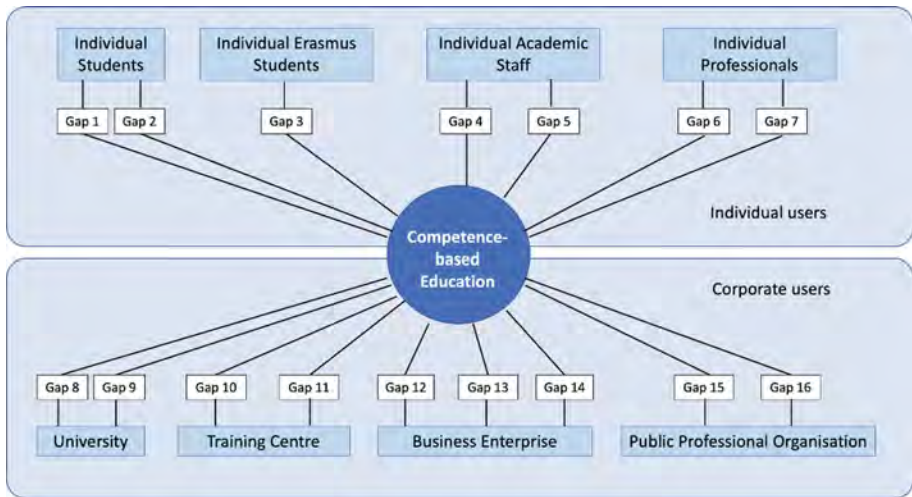
Fig. 3. Main stakeholders of competence-based education (created by authors).

2. Principle of service-oriented education. Today, there are various parties in the education market that directly or indirectly need competency-based education (Fig. 3). At the same time, for each of the categories of users, there is a gap in the possibility of full access to competence-oriented education:

   • individual students who would like to work in certain companies or in specific narrow professional specialties do not know the specific competencies that they need to do this in addition to the general knowledge obtained at universities (Gap 1), and do not have information about where these competencies are located. Can purchase (Gap 2);

- students who have the possibility of mobility within the Erasmus program do not have information about all the opportunities that can be provided to them to acquire the necessary competencies (Gap 3);
- individual academic teachers with a free time resource do not have information about in which educational institutions their skills could be applied (Gap 4), and also do not have reliable information about market-demanded and emerging new competencies that they could teach after retraining (Gap 5);
- individual professionals do not have information about the narrow competencies required by a particular employer (Gap 6), and about educational institutions where these competencies can be acquired (Gap 7);
- Universities experience difficulties in finding teachers for vacant positions (Gap 8) and do not always know the competencies that are in demand on the labor market (Gap 9);
- professional training centers, like universities, have the same difficulties, but in narrower segments of professional competencies (Gap 10 and Gap 11);
- business enterprises do not know who can train specialists with the competencies they need (Gap 12), with great difficulty they are looking for specialists for the competencies they need (Gap 13), while they themselves are not ready to formulate the required competencies for training organizations (Gap 14);
- public professional organizations have the opportunity to participate in the accreditation of educational organizations and the development of professional training standards, but do not use these opportunities to move towards competency-based learning (Gap 15 and Gap 16).

3. Principle of open recourses. The effective functioning of the education ecosystem is possible if all the main sources of information are open.
4. Principle of student-centered education. The existing paradigm of education assumes the priority of curricula, according to which all students who choose it should study. Meanwhile, each student requires an individual approach, taking into account his practical experience and academic background.
5. Principle of academia-business partnerships. This principle is declared by all. However, in practice, its implementation encounters various obstacles, both on the part of the academy and on the part of business.

4   Services Delivery Model

The service delivery model provides the framework within which users receive services. The arrangement or configuration of time, resources, location of services, and collaboration among all actors makes up the service delivery model selected that will best meet individual user needs.

The general structure of the platform services for all users is represented by taxonomy in Fig. 4. This figure shows a basic set of services that can be refined and detailed during platform development and testing of its capabilities.

Fig. 4. The general structure of EaaS framework services (created by authors).

Description of services is given in Table 1.

Table 1. Services delivery model. Description of services (created by authors).

Users	Services	Brief description of services
Individual students	List of potential mobility places based on student requests	Universities have dozens of partners in numerous student mobility programs. At the same time, for each student, if there is an individual request, it is quite difficult to determine the place of potential foreign study under the mobility program, taking into account his personal request for competencies. The portal allows you to solve this problem with any level of detail
	Formation of groups of students with the same requests for mobility	Individual students on mobility programs may have access restrictions for certain courses. This happens, for example, when the course is elective, and there are not enough people who want to study it. If there are requests for the same courses/competencies from several foreign students from different countries, they can be combined into a group, which makes the organization of the corresponding course possible and expedient
	Online processing of documents required for mobility	As the pandemic has shown, there are situations in which the personal participation of students in the preparation of documents necessary for mobility is limited or impossible. In addition, there may be some features of the passage of mobility programs in individual countries or universities, in contrast to typical ones. The portal allows you to process all documents online, taking into account all institutional and national features

Table 1. (*continued*)

Users	Services	Brief description of services
	Formation of a digital trace of a student's mobile activity	When implementing mobility programs, a student has the opportunity to visit several universities in one country or several countries, for example, within the framework of a cross-border partnership. A similar situation arises when a student is studying abroad at the same time at a university and a vocational training center. In any case, there is a problem with the certification and reliability of the acquired learning outcomes. This service allows you to automate and legitimize the individual trajectory of student learning
	List of the required competencies to work in organizations of interest to the student	If a student wants to purposefully get a job in a particular organization, he needs to know the list of competencies that the specified organization requires when applying for a job. The organization itself is also interested in this. The service implements the specified functionality
	List of courses that form the required competencies	For the formation of some competencies, it may be necessary to study not one course, but some set of them. The service facilitates the solution of this task
	Formation of requests to employers to obtain a list of competencies required to work in the relevant organization	If a student wants to better prepare for a potential future job, the service helps him formulate a request for the competencies required for this

Table 1. (*continued*)

Users	Services	Brief description of services
	List of training centers and universities offering courses of interest	Professional competencies can be formed not only by universities but also by specialized training centers. The formation of some competencies can be carried out exclusively outside the framework of academic programs. This service creates an opportunity to expand the set of courses and competencies that go beyond those offered by universities
	Course ratings	If it is possible to obtain the same competencies or take the same courses at different universities, the choice of a particular course in a particular educational institution can be made based on the rating assessment of these courses by previous generations of students. At the same time, this is an indirect assessment of the quality of the respective courses
Individual academic staff	Formation of proposals about their pedagogical opportunities	Currently, due to the increasing specialization of courses, not all university teachers have a full load in their courses. They have the opportunity to implement their professional activities in other universities and training centers. The service allows you to launch a search to meet this possibility
	The offer of courses and competencies that can be provided by the teacher in the guest university	When implementing mobility programs for teachers, the problem arises of finding universities that have appropriate programs and courses

Table 1. (*continued*)

Users	Services	Brief description of services
	Search for places to improve own skills of teachers in educational organization	As part of the mobility programs for teachers, they have the task of improving their professional level. The service provides an offer to universities and professional centers that implement this opportunity
	Search for places to improve own skills of teachers at enterprises and organizations	As part of the mobility programs for teachers, they have the task of improving their professional level. In some innovative or highly specialized areas, such advanced training is possible not only in universities but also in leading organizations that are market leaders in their respective fields. The service provides an opportunity to implement such a task
Universities	Proposal of programs and courses for mobility for foreign students	Universities offering mobility programs do not always provide detailed information about all the opportunities they provide. The service allows you to exclude personal questions and clarifications for all mobility programs
	Proposals for special courses for the development of specific competences	Universities offering mobility programs do not always provide detailed information about all the opportunities they provide. The service allows you to exclude personal questions and clarifications for all mobility programs

Table 1. (*continued*)

Users	Services	Brief description of services
	Vocational training courses for enterprises and organizations	Not only students but also employees of organizations, as well as the universities themselves, need to acquire new competencies, especially in narrow professional areas. The service is focused on providing these features
	Invitation of teachers to vacant positions	Almost all universities face difficulties in attracting academic staff to individual courses, especially in new and highly specialized fields. The service facilitates the solution of this problem by searching for available specialists in the field of interest of universities
	Partnership with other universities in the field of required competencies	Currently, universities, especially in small countries, need to train specialists with competencies that a single university is not able to provide. The service helps to find partner universities for the joint implementation of programs and courses that cannot be implemented by the university on its own
Business organizations	Formation of a list of competencies required from employees	In order to obtain workers with the competencies required by a particular enterprise, it can form a list of such competencies to orient students to work at their place in the early stages of their studies at the university

Table 1. (*continued*)

Users	Services	Brief description of services
	Providing internship places for students as potential future employees	The presence of competencies according to the formal data of certificates and diplomas is not always sufficient for their inclusion in work teams. A good way to solve the problem is to train students directly in enterprises. The service allows employers and students as potential employees to receive mutually important information during the internship process
	Provision of internship places for academic staff	The universities themselves, need to acquire new competencies for academic staff, especially in narrow professional areas. The service is focused on providing these features
	Formation of a list of competencies and courses where they would like to send their employees to improve their skills	When recruiting new employees and developing areas of activity, organizations are interested in improving the skills and retraining of their employees both in local educational organizations and abroad. The service makes this possible
Professional training centres	Proposal of programs and courses for the development of specific competences	Small, highly specialized training centers face the problem of informing potential clients about the opportunities they have to develop fairly narrow competencies. The service expands opportunities for them in this area

Table 1. (*continued*)

Users	Services	Brief description of services
	Partnership with other training centers and universities in the field of required competencies	Currently, training centers in especially small countries experience a need to train specialists with competencies that a single education establishment is not able to provide. The service helps to find partner organizations for the joint implementation of programs and courses that cannot be implemented by a single training center
Public professional organizations	Development of professional standards	At the national level, professional associations and associations are entrusted with the functions of developers of national professional standards. The involvement of professionals from the academic sphere and industry for this purpose solves this problem more successfully
	Organization of events to identify new competency needs	In the modern world, the intensive development of new technologies in all industries brings to life the need for intensive information exchange between the academic community and business. Creating platforms for such information exchange both face-to-face and virtually is the task of this service

5   Conclusion

The article describes the basic idea and proposes a digital framework for creating platform for higher and professional education based on Education as a Service (EaaS) model. The complexity of the problem being solved are noted. It is shown that due to the digital integration of existing educational services, it is possible to create a single education ecosystem for obtaining competencies on an individual request.

The paper identified the existing design problems of such a framework and outlined possible solutions.

The basic principles for the development of a digital platform that implements the ecosystem of the EaaS framework using a competency-based approach are formulated, and the services delivery model of the framework are described.

The next step in the research will be to detail the approaches to creating the organizational, competency-based and pedagogical components of the proposed model. This will allow us to formulate the requirements and the main functionality for the practical implementation of the portal, which creates an environment for using the EaaS approach in practice.

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