Competence-Based Digital Framework for Education as a Service

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Abstract. The article discusses the idea and proposes digital framework models for creating platform for higher and professional education based on Education as a Service (EaaS) model. The prerequisites for creating such a new type of educational approach, which could, through the digital integration of existing educational services, create a single ecosystem for obtaining competencies on an individual request are described in the paper. The basic principles for the development of a digital platform that implements the ecosystem of the EaaS model are discussed in the paper: principle of competency-based learning, principle of service-oriented education, principle of open recourses, principle of student-centered education and principle of academia-business partnerships. The architecture of the system functionally grouped at four levels, which form the frame of the EaaS model: pedagogical level, organizational level, competence level, technological level. The main components of its architecture are described in the paper.

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

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).

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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].

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 macro model of the EaaS information ecosystem (Sect. 4) and conclusions (Sect. 6).

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 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 the 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.

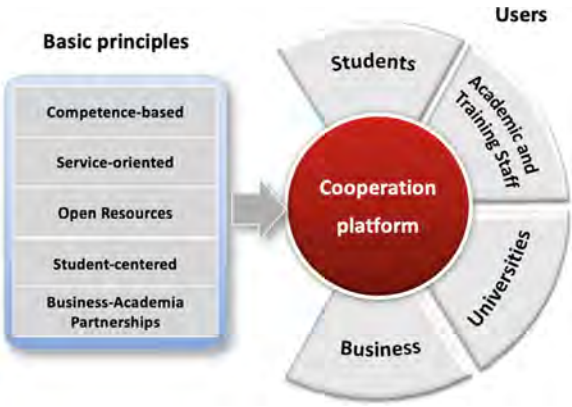

Fig. 1. Framework of EaaS ecosystem.

Case study of edX gives an example of such a 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 model that ensures the interaction of all users on the EaaS platform and the main components of its architecture.

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. 1).

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.
2. Principle of service-oriented education. Today, there are various parties in the education market that directly or indirectly need competency-based education (Fig. 2). 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); and

- 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-centred 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 the business.

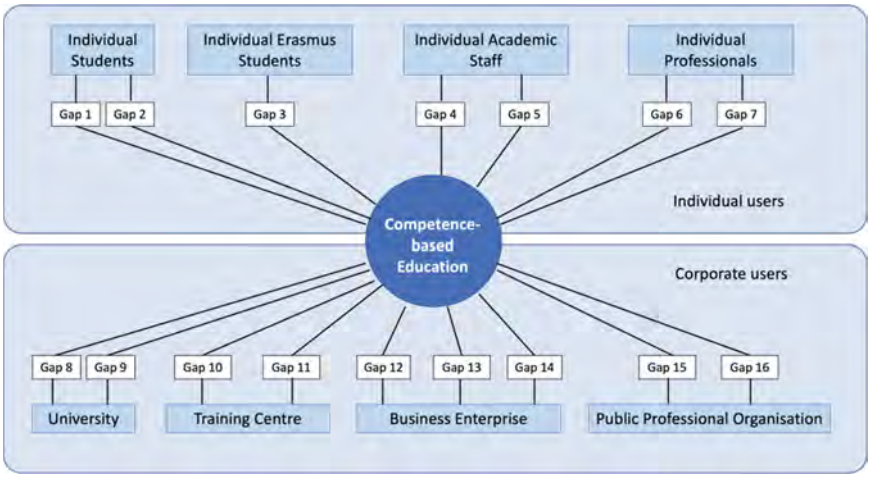

Fig. 2. Main stakeholders of competence-based education

4 Model of the EaaS Information Ecosystem

The life cycle of educational service is accompanied by various actions for its preparation, implementation, and receipt.

These actions should be carried out in a digital environment that ensures the interaction of all parties involved in the provision and consumption of this educational service.

The components of the EaaS model can be functionally grouped at its four levels, which form the frame of the EaaS model (Fig. 3): pedagogical level, organizational level, competence level, and technological level.

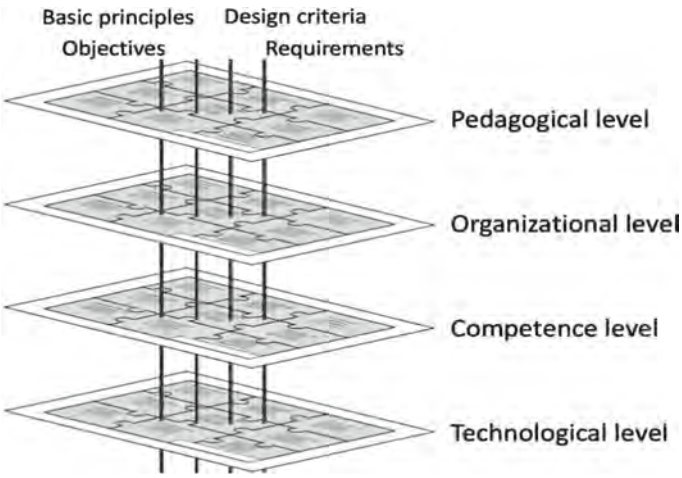

Fig. 3. Architecture of the EaaS model

All levels of the framework are united by common goals, basic principles, requirements, and platform design criteria.

Pedagogical/Academic Level of the Frame Model

The purpose of this level is to create an integrated educational environment using pedagogical digital technologies for a student-centered pedagogical approach that provides the opportunity for students to receive the necessary training at any time. An important task is an integration of existing and the development of new distance pedagogical tools in an open digital environment, providing the possibility of mobility for students and academic staff.

Organizational Level of the Frame Model

The life cycle of educational service, in addition to the actual educational process, includes a number of necessary organizational actions that precede, accompany and complete the learning process for the selected educational component. These processes should be unified and remove all barriers to managing the choice of an individual learning environment. The organizational level contains model components that provide this for all users.

Competence Level of the Frame Model

The competence approach is the main element of the restructuring of the educational process. It is required to combine the efforts of all major stakeholders to implement all aspects of the competency-based approach:

- the formulation of basic competencies in a particular area,
- formulation of narrow competencies required for individual specialties or for individual enterprises,
- academic and professional support of the possibility of obtaining competencies within the framework of the educational process,
- ensuring information accessibility in obtaining and ordering the required competencies and others.

The portal, implementing this level, should serve as a network environment for the interaction of all users, supporting competency-based opportunities for students at various stages of their professional development.

Technological Level of the Frame Model
The EaaS concept involves the widespread use of technical solutions of information technology as a platform for the implementation of pedagogical and organizational tasks in the new ecosystem of digital mobility. The functions of the platform, activating the pedagogical, organizational, and competence-based components, are provided by new models of innovative IT technologies that combine the various functions of existing educational platforms and expand their capabilities using new digital tools (blockchain, cloud technologies, big data technologies and artificial intelligence).

5 Results and Discussion

Considering 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. 4). 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 specific competency request. Thus, another important requirement for the framework appears - it must be open to expanding the set of services.

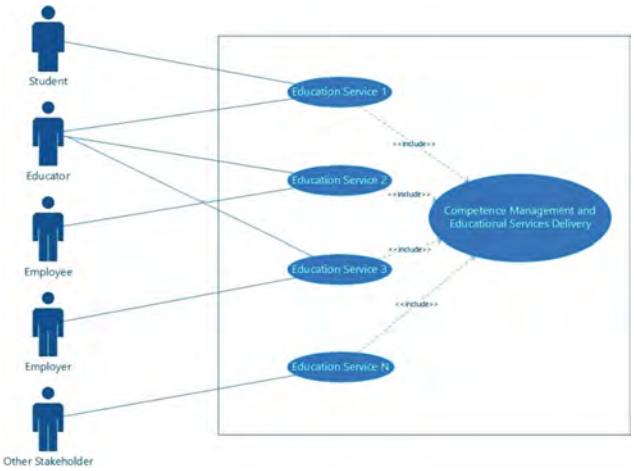

Fig. 4. General view of the competence-based digital framework for education as a service

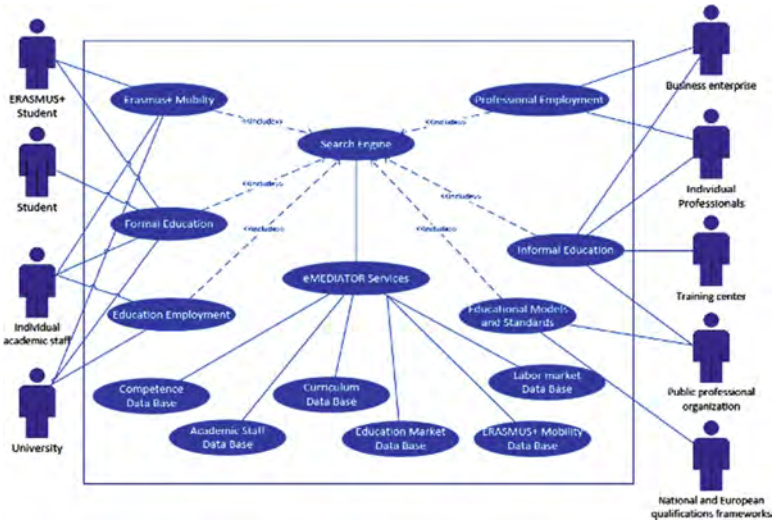

Fig. 5. Use case diagram of EaaS information portal

A use case diagram (Fig. 5) is a graphical depiction of a user's possible interactions with a system and shows various use cases and different types of users the EaaS ecosystem has.

As a result of the analysis, it was shown that the platform being designed has a clear focus on processing large amounts of data. Therefore, the authors proposed another model that generally reflects the expected data processing processes in the ecosystem. This architectural model is presented below (Fig. 6).

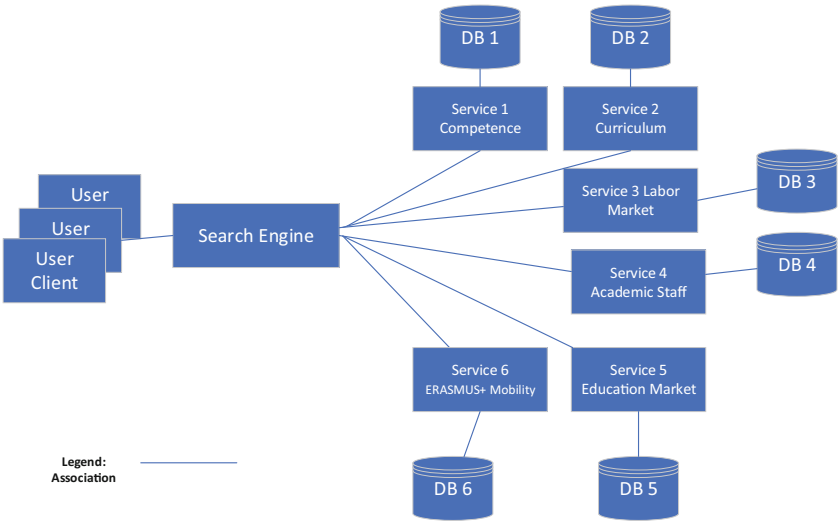

Fig. 6. Data flow processing architecture diagram of EaaS information portal

The main element of the platform is a search engine, which provides information for each of the potential users within the framework of the services provided.

The complexity of communications both with users and between services within the system places special requirements on the development of interfaces (both GUI and API). This issue deserves separate consideration and will be addressed by the authors in a separate publication.

6 Conclusion

The article describes the basic idea and proposes a digital framework for creating a platform for higher and professional education based on Education as a Service model. The complexity of the problem being solved is 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. Some models of such an ecosystem are proposed for different levels of solution.

The basic principles for the development of a digital platform that implements the ecosystem of the EaaS model using a competency-based approach are formulated, and the main components of its architecture are described.

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References

1. BS EN 16234-1:2019. e-Competence Framework (e-CF). A Common European Framework for ICT Professionals in all Sectors (2019). https://www.en-standard.eu/bs-en-16234-1-2019-e-competence-framework-e-cf-.-a-common-european-framework-for-ict-professionals-in-all-sectors-framework/. Accessed 25 Apr 2021
2. Digital Learning Framework. From Department of Education, published on 18 November 2020, last updated on 30 June 2021 (2021). https://www.gov.ie/en/service/8ae17-digital-learning-framework/. Accessed 27 Aug 2022
3. Misnevs, B., Kabashkin, I., Uzule, K.: Education mobility as a service: model of the ecosystem. In: Kabashkin, I., Yatskiv, I., Prentkovskis, O. (eds.) Reliability and Statistics in Transportation and Communication: Selected Papers from the 21st International Multidisciplinary Conference on Reliability and Statistics in Transportation and Communication, RelStat2021, 14-15 October 2021, Riga, Latvia, pp. 598–607. Springer, Cham (2022). https://doi.org/10.1007/978-3-030-96196-1_54 Accessed 25 May 2021
4. Ng, I.C.L., Forbes, J.: Education as service: the understanding of university experience through the service logic. J. Mark. Higher Educ. (2008). https://ore.exeter.ac.uk/repository/handle/10036/33054. Accessed 22 July 2021
5. Craig, R.: Education-as-a-Service: 5 ways Higher Ed. Must Adapt to a Changing Market (2014). https://venturebeat.com/2014/05/11/education-as-a-service-5-ways-higher-ed-must-adapt-to-a-changing-market/. Accessed 22 July 2021
6. Adachi, C.: Education as a Service. https://www.futurelearn.com/info/courses/digital-learning/0/steps/49002. Accessed 22 July 2021
7. Gokhale, S.D., Vidyavihar, S.: Cloud computing platform for education system: a review. Int. J. Comput. Appl. **177**(9), 41–45 (2019)
8. Meyer, R., et al.: Offering big data services in an educational context using cloud infrastructure. In: Proceedings of the 3rd International IBM Cloud Academy Conference (ICA CON) 2015, Budapest, Hungary (2015). https://www.researchgate.net/publication/281967450_Offering_Big_Data_Services_in_an_Educational_Context_Using_Cloud_Infrastructure. Accessed 22 July 2021
9. Yang, P., Cheng, Y.: Educational mobility and transnationalization. In: Gleason, N.W. (ed.) Higher Education in the Era of the Fourth Industrial Revolution, pp. 39–63. Springer, Singapore (2018). https://doi.org/10.1007/978-981-13-0194-0_3
10. Oliveira, G., Teixeira, J. G., Torres, A., Morais, C.: An exploratory study on the emergency remote education experience of higher education students and teachers during the COVID-19 pandemic. Br. J. Educ. Technol. 1–20 (2021)
11. Barrios, J.M., Hochberg, Y.V., Yi, H.: Launching with a parachute: the gig economy and new business formation, NBER Working Paper No.27183, pp.1–56 (2020)
12. Vallas, S., Schor, J.B.: What do platforms do? Understanding the gig economy. Ann. Rev. Sociol. **46**, 273–294 (2020)
13. Collier, R.B., Dubal, V.B., Carter, C.: Labor platforms and gig work: the failure to regulate, IRLE Working Paper Series, No. 106-17, pp. 1–32 (2017)
14. Nawrot, I., Doucet, A.: Building engagement for mooc students: introducing support for time management on online learning platforms. In: Proceedings of the 23rd International World Wide Web Conference, pp.1077–1082 (2014)
15. Fischer, H., Dreisiebner, S., Franken, O., Ebner, M., Kopp, M., Kohler, T.: Revenue vs. Costs of MOOC platforms. Discussion of business models for XMOOC providers, based on empirical findings and experiences during implementation of the project IMOOX. In: Proceedings of the 7th International Conference of Education, Research and Innovation, pp. 2991–3000 (2014)