Organizational Model for The Mobility Education as a Service Ecosystem: Multidimensional Approach

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Abstract. The digital transformation of society affects all its areas, including education. This urgently requires a change in the established paradigms of education based on new forms and methods of teaching and learning. One such innovative paradigm is Education as a Service (EaaS). The purpose of the article is to describe the organizational model for the EaaS ecosystem developed within the framework of the project eMEDIATOR. The paper describes how educational services are managed, delivered, and evaluated, supporting competency-based and service-oriented learning in a student-centric manner. The basic principles for the development of a digital platform that implements the ecosystem of the EaaS framework based on event driven architecture using a competency-based approach are formulated.

Keywords: Education Ecosystem, Digital Platform, Education as a Service, Organizational Model, Competence-based Education.

1 Introduction

The advent of digital technologies has revolutionized various sectors, education being a prominent one among them. As the global educational landscape grapples with the challenges and opportunities of the 21st century, it has become evident that traditional modes of education are unable to fully meet the ever-evolving demands of learners. In response to these changing dynamics, an innovative concept has emerged, namely, Education as a Service (EaaS) [1]. EaaS transforms the traditional, linear model of education into a more flexible, learner-centric, and service-oriented model that harnesses the potential of digital technologies and adaptive learning mechanisms.

While the benefits of Education as a Service (EaaS) are evident, its successful implementation depends heavily on having an adaptable organizational model that works. This model forms the operational backbone, directing how educational services are managed, delivered, and evaluated within the EaaS ecosystem. However, despite its integral role, research on EaaS organizational models remains limited.

This paper aims to address this gap by analyzing the organizational model of EaaS in detail. It clarifies the key components of the model and their impact on the EaaS ecosystem's overall functioning. Additionally, it proposes an evaluation framework for

gauging the effectiveness of EaaS organizational models. By exploring these facets, this study seeks to further understanding of how to optimize EaaS models for high-quality, personalized, and efficient education services.

Through its exploration of the EaaS organizational model, this paper offers valuable insights for educators, policymakers, and technologists seeking to harness the potential of EaaS to create transformative educational experiences that cater to the needs of the digital age.

The Education as a Service (EaaS) organizational model is the operational and structural framework adopted by educational institutions or service providers to implement the Education as a Service philosophy. This model integrates key components such as service-oriented architecture, curriculum design, pedagogical methods, assessment systems, quality assurance processes, data analytics, and evaluation metrics, designed to optimize the delivery of education to learners anytime, anywhere, and on any device. The organizational model aims to foster a learner-centric, competency-based, and flexible education system that can adapt to the diverse needs and preferences of learners in a rapidly changing educational landscape.

2 Related works

The existing model of university education has been formed and remains virtually unchanged for several centuries. The discussion of the question of the transformation of higher education in the academic environment has revealed a massive phenomenon. In the contemporary information society, there is an urgent need to transform this model. Various authors describe the expected transformations of the third- and fourth-generation university, mainly at the level of system-wide criteria [2-8].

The intensive development of technologies in recent years has led to an exponential growth of information and knowledge and requires the acceleration of training of specialists. Under these conditions, universities are increasingly lagging behind in meeting the society's need for competent specialists. Universities maintain their positions and to a certain extent "conserve" themselves at the expense of exclusive rights to certification in the field of education provided by state supervisory authorities.

Such a system leads to the creation of dynamic, highly professional training organizations that have a clearly defined competence-oriented approach, especially in the field of information technology [9]. An example of such professional learning ecosystems is, for example, CISCO [10], Microsoft [11] training academies and others. At the same time, business structures often prefer to hire specialists with certificates of this non-formal education. Course graduates with well-defined competencies necessary for their professional activities have advantages over university graduates with bachelor's and master's degrees, but with blurred competence skills.

The emerging trend of treating learning as a service and involving multiple stakeholders in its co-creation is already being embraced by certain universities [12]. This student-oriented approach can be effectively implemented when students actively participate in the process, using various marketing-oriented methods [12].

The concept of Education-as-a-Service (EaaS) implementation assumes that students should be aware of the competencies needed for successful entry into the job market, and universities should be equipped to identify and update their programs and courses accordingly [13]. The competency-based approach is particularly prominent in the field of information technology, making computer science an ideal area for the initial practical application of the EaaS approach [13].

Pilot projects for EaaS implementation often rely on classical digital technologies [14], with developers primarily focusing on the technical aspects and leveraging cloud-based solutions like the Infrastructure-as-a-Service model (IaaS) [15]. Some universities are even considering additional service add-ons such as Software-as-a-Service (SaaS) and Platform-as-a-Service (PaaS) [16].

Several key factors have contributed to the growing interest in the EaaS concept:

- The need to support the 4th industrial revolution by equipping specialists with essential digital competencies [17].
- Educational mobility as a crucial aspect of international education, allowing individuals to acquire necessary competencies outside their native university programs [16].
- Remote learning trends for students and teachers, especially due to the COVID-19 pandemic, which have alleviated many previous psychological challenges associated with distance and blended learning in academic environments [18].
- The expanding Gig economy services and platforms that are reshaping employer-employee relationships and introducing new economic and marketing models [19]. Interestingly, these Gig economy models and platforms can be seen as early prototypes of the EaaS concept [20].
- Companies operating within the Gig economy generate revenues by providing cloud-based digital intermediation between Gig economy participants, shifting some business operation costs to platform users [20, 21].

In this article, the authors propose an organizational model for EaaS based on Event Driven Architecture (EDA) within the Education-as-a-Service Ecosystem.

3 Organizational model for Ecosystem of EaaS

The EaaS organizational model can be defined as the operational and structural framework adopted by educational institutions or service providers to implement the Education as a Service (EaaS) philosophy. This model integrates key components such as service-oriented architecture, curriculum design, pedagogical methods, assessment systems, quality assurance processes, data analytics, and evaluation metrics, designed to optimize the delivery of education to learners anytime, anywhere, and on any device. The organizational model aims to foster a learner-centric, competency-based, and flexible education system that can adapt to the diverse needs and preferences of learners in a rapidly changing educational landscape.

The EaaS model signifies a major shift in education - from teacher-centric teaching to student-focused learning, from time-bound schooling to lifelong learning, and from

one-standardized approach to customized, learner-driven education. As such, it has immense potential to transform learning and equip students with skills needed today.

The EaaS organizational model delineates how educational services are structured, managed, and delivered. It provides a framework for understanding the interactions between content providers, platform operators, learners, and facilitators. Further, it identifies key resources, activities, and relationships integral to the EaaS ecosystem.

The EaaS model comprises several core components, outlined in Table 1, that work symbiotically to enable effective education delivery. Analyzing each piece and its connections reveals where potential weaknesses and improvements may lie, enhancing the overall EaaS model. This innovative approach thus represents a new paradigm in learning, powered by harmonious, learner-centric components.

Table 1. Main components of EaaS organizational model.

Components of EaaS organizational model	Description
Service-Oriented Architecture (SOA)	The EaaS model is built on modular educational services - content delivery, assessment, feedback - that can be independently managed and updated without disrupting other components.
Student-Centric Design	EaaS focuses on students' needs and preferences through personalized, self-paced learning and interactive platforms with multi-modal content.
Curriculum Framework	The EaaS curriculum is designed to be easily customized and updated based on evolving learner needs and job market dynamics.
Pedagogical Methodology	EaaS utilizes diverse, flexible teaching methods like flipped classrooms, project-based learning, and collaborative learning driven by desired outcomes and learner needs.
Assessment and Feedback Systems	Continuous, formative feedback mechanisms in EaaS promote learner growth while summative assessments enable certification and accreditation.
Quality Assurance	EaaS requires standards for content, teaching, and assessment plus continuous monitoring and evaluation against those standards.
Technological Infrastructure	A reliable, scalable, user-friendly, and secure technological platform - LMS, content delivery, analytics - is crucial for delivering EaaS.
Data and Analytics	Collecting and analyzing student performance, engagement, and outcome data informs decision-making and continuous improvement in EaaS.

The EaaS ecosystem thrives on openness, interconnectivity, and information flow. Transparency enables informed decisions while cooperation and mutual benefit are fostered. All participants act as both consumers and providers, enhancing resilience and adaptability.

The EaaS organizational model contains:

- Stakeholders - Students, academics, universities, businesses, training centers, professional organizations - each with distinct needs and ecosystem roles.

- Services - Offerings meeting stakeholder needs e.g. student mobility info, vocational university courses, professional standards development. Effective service management and delivery is critical.
- Cooperation Platform - Connects stakeholders and facilitates information/service sharing.
- Management and Governance - Oversees ecosystem interactions via guidelines, rules, protocols for communication, service delivery, decision-making.
- Supporting Infrastructure - Technical, logistical, administrative support like IT, staff, locations to enable service delivery.
- Feedback and Evaluation - Ensures service quality and continuous improvement.

The EaaS model must be flexible, transparent, user-focused to enable seamless information flow. It should promote competency-based, open-source, academia-business partnerships and student-centric learning.

4 Event Driven Architecture for Ecosystem of EaaS

The core of the organizational model within the EaaS ecosystem is the cooperation platform, strategically designed to bridge informational gaps among various stakeholders and ensure seamless, transparent, and efficient service delivery. This digital platform serves as the bedrock of the ecosystem, interconnecting all participants and facilitating the exchange of services and information.

Despite active discussions surrounding new education and training concepts in the academic realm, practical approaches to their implementation remain inadequately developed. Developers are faced with a challenging task - to create a comprehensive digital platform model that unifies higher and professional education within a single space, bringing together all key stakeholders (Fig.1). These stakeholders include consumers of educational services (students and employees), providers of educational services (educational institutions and individual trainers-teachers), and sponsors of education (businesses, governments, and public organizations).

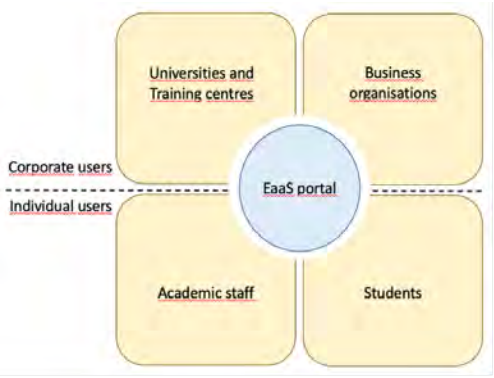

Fig. 1. Main stakeholders of EaaS ecosystem

The ecosystem of the educational environment adapted to the individual needs of all users can be implemented in the form of an information portal based on the concept of event driven architecture.

An event driven architecture is a model or architectural paradigm for software that supports the creation, detection, consumption, and response to an event or a significant change in system state [22]. This structure consists of event creators and event consumers. Creators are those who produce events and know what events have occurred. On the other hand, consumers are those who are affected by the events that are occurring. They are also involved in event processing.

As an example, the Table 2 lists some event generators and the events themselves that can be generated in the EaaS ecosystem.

Table 2. Main events in the EDA of EaaS ecosystem

Event consumers	Events
Individual students	Request on the specific competencies that they need for professional specialties.
	Request on information about where training opportunities for these competencies are located
Students	Request on information about all the opportunities that can be provided to them to acquire the necessary competencies within the Erasmus program.
	Request on information about available Erasmus courses at partner universities
Individual academic teachers	Request on information about in which educational institutions their skills could be applied.
	Request on information about educational institutions where these competencies can be acquired
Universities	Request on finding teachers for vacant positions.
	Request on information about the competencies that are in demand on the labor market
Professional training centers	Request on finding teachers for vacant positions in narrow segments of professional competencies.
	Request on information about the competencies that are in demand on the labor market narrow segments of professional area
Business enterprises	Request on training organization which can train specialists with the competencies they need.
	Request on specialists for the competencies they need
Public professional organizations	Request on development professional standards
	Request on formulation for training organizations of the required competencies for narrow professional area

The EDA concept can be implemented based on a microservices system [23]. In such systems, the main platform is a set of software-executed services, each of which has a separate software application for each business case. This architecture creates many technical advantages. First, microservices are small, lightweight, and easy to implement. Second, they are reusable, which reduces the cost of developing or modifying

applications, makes it efficient use of resources, and makes it easier to scale applications on demand.

In general, the EDA based on a microservices system can be described as shown at the Fig. 2.

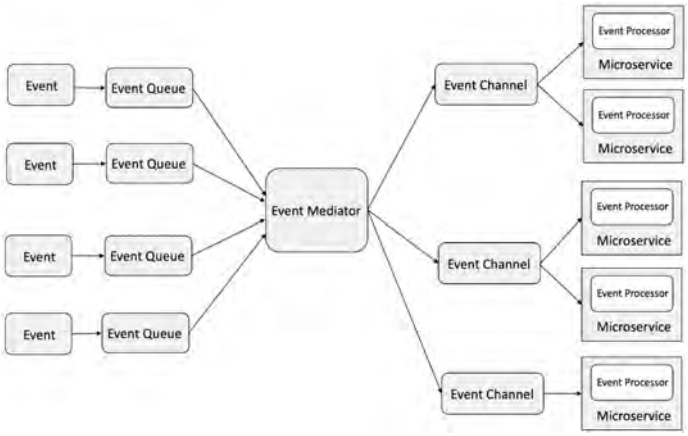

Fig. 2. The EDA based on a microservices system.

The initiator of changes in system states are events. Events can be combined into topics, forming sets of events united by a single logic. In general, two types of events can be distinguished:

Discrete events based on separate independent actions. These actions are logically unrelated to previous events. Such events contain information about the change that occurred, but do not contain information about the reasons that caused this change. An example of a discrete event is a notification that a request has been created in the system by a business organization to train its employees for a new competency.

Series events. Such events are part of the flow of events. All events are ordered by the time of their occurrence and the relationship between them. Examples of such events are student requests for competencies needed to work in a particular position or in a particular organization.

The EaaS architecture assumes an Event Mediator topology that requires some level of coordination/organization to handle an event. This architecture uses one common queue of events, which are managed by a single element (event broker) for their delivery to the elements of their processing. This architecture is typically used for multi-step event processing. In a staging topology, each event source has its own event queue. This queue is already responsible for communicating with the event broker, which interacts with the event channel, which are responsible for passing events to the event processor for processing. Event channels can take the form of message queues or message subject lines. Each application has its own event handling logic. The specified logic is put into the event handler. Event handlers are independent architectural elements that are associated with specific tasks implemented by the system. Coming from

the overall EDA architecture with its central Event Mediator element, the EaaS platform being developed was called eMEDIATOR [1].

5 Conclusions

In this era of digital transformation, Education as a Service (EaaS) stands out as an innovative approach capable of reshaping the educational landscape. The EaaS model aims to offer flexible, personalized, and efficient educational services by leveraging the power of technology and adaptive learning mechanisms. However, the successful realization of this model heavily relies on its underlying organizational structure. This paper endeavored to elucidate the intricate nature of this organizational model and its crucial role in orchestrating the functioning of the EaaS ecosystem.

Through a comprehensive exploration of the main components of the EaaS organizational model, we highlighted the pivotal roles that governance, educational service delivery, competency-based learning, IT infrastructure, student-centricity, and feedback loops play in the successful implementation of EaaS. The paper also addressed the importance of understanding and managing both static and dynamic parameters within this model to ensure its adaptability to evolving educational needs and technological advancements.

We proposed a practical and effective evaluation framework that can be employed to assess the effectiveness of the EaaS organizational model. By continuously monitoring and assessing static and dynamic parameters through this framework, institutions can keep track of their performance, identify areas of improvement, and make data-driven decisions to ensure the model's alignment with its educational objectives.

However, it is crucial to acknowledge that the EaaS organizational model is not a one-size-fits-all solution. Its implementation needs to be carefully tailored to the specific context of each educational institution, considering its unique educational objectives, available resources, and the specific needs and preferences of its learners.

As the field of EaaS continues to evolve, further research should be directed towards understanding its implementation challenges and possible solutions, especially in diverse and resource-constrained settings.

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