EDUCATION SYSTEM IN THE REPUBLIC OF SERBIA UNDER COVID-19 CONDITIONS: CHATBOT- ACADIMIC DIGITAL ASSISTANT OF THE BELGRADE BUSINESS AND ARTS ACADEMY OF APPLIED STUDIES

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Abstract: In the Republic of Serbia, the COVID-19 pandemic has created the largest disruption of educational systems in history so far, having a universal impact on the entire country and all levels of education from pre-school education, through secondary schools, technical and vocational education and training, to colleges, universities and institutions for adult education or a skills development institution. As the health crisis developed, causing widespread socio-economic disruptions, the Serbian government reacted quickly to ensure continuity of education and protect students and educational actors. Due to the closure of schools, the domestic education system is turning to greater application of information and communication technologies in all educational subsectors, and teachers are required to switch to the delivery of educational content online and online interaction with their students. The paper especially analyzes the experiences of the Belgrade Business and Arts Academy of Applied Studies in dealing with new challenges in the implementation of teaching and its overall functioning in the conditions of the COVID-19 pandemic. Despite improvement, modernization and digitalization are the basis of the Academy's business strategy, the new working conditions required a quick adjustment of work in order to provide students with the highest quality educational service. In addition to new versions of the student information service application, E-employee application, new versions of the website, the Belgrade Academy began in 2020 to develop chatbot technology using the Weaver platform of the company Saga to provide its students with improved service during studies. Namely, the function of chatbot is based on understanding the requirements regardless of the language or structure of the sentence that is written or spoken. Based on the processing of the sentence with the help of natural language understanding (NLU), and with the application of the appropriate algorithm, the chatbot comes to an adequate answer which is forwarded to the student. The ADA (Academic Digital Assistant) chatbot project is the first project of its kind in the Balkans in the field of education that provides better communication, time savings, faster and more efficient implementation of educational services.
Keywords: education, digitalization, chatbot, natural language understanding, distance learning.

1. INTRODUCTION

The COVID-19 pandemic has created the largest disruption of education systems in history, affecting nearly 1.6 billion learners in more than 190 countries and all continents (UN, 2020). As the health crisis developed, causing massive socio-economic disturbances, governments around the world have tried to ensure continuity of education and to protect students and teachers. Due to school closures, most are turning to information-communication technologies (ICT), requiring teachers to move on to delivering lessons online. Countries have used different modalities that have reopened the issue of growing inequality between those more and less developed with better or worse infrastructure. Namely, analyzes of the experiences of different countries and their educational systems realized in the first half of 2020 indicate a variable coverage by the delivery of digital educational content. Distance learning in high-income countries covers about 80-85 percent of students, while it decreases to less than 50 percent in low-income countries (UNESCO-UNICEF, 2020).

2. EDUCATION SYSTEM IN THE REPUBLIC OF SERBIA IN PANDEMIC ENVIRONMENT

In order to mitigate the potentially devastating consequences of the COVID-19 pandemic on the education system, the Serbian government has reacted quickly in order to ensure the functioning of the education system in the new conditions. The government tried to ensure continuity of education process, accelerate positive changes and

introduce new digital methods of teaching and learning. In the last seven months of 2020, since the beginning of the corona virus epidemic in Serbia, the way students are educated has been organized in different ways in schools. On March 2020, all schools switched to combination of TV teaching, interaction of professor and students through digital classrooms and online platforms and independent learning of students. A survey conducted by Serbian Ministry for education, science and technological development and UNICEF during April 2020, showed that in primary and secondary schools, these forms of learning included 99 percent of students, and in schools for the education of students with disabilities, the coverage was 93 percent (Ranković, T. 2020). However, there are large differences between the types of schools, both in terms of involvement in distance learning and in terms of dominant channels of communication. The TV classes were watched by the majority of primary school students, almost two thirds of high school students and approximately a quarter of students from schools for the education of students with disabilities. On the other hand, almost all high school students, 85 percent of elementary school students and slightly more than half of students from schools for the education of students with disabilities, are involved in teaching and learning through online platforms (Ranković, T. 2020).

Regarding higher education in the Republic of Serbia, faculties and colleges consider the transition to distance learning as an opportunity to expand flexible learning modalities, and lay the foundation for a sustainable transition to more online learning in this educational subsector in the future. In higher education institutions, online learning took place mainly through recorded lectures and online platforms. Although higher education institutions in Serbia were quick to replace face-to-face lectures with online lectures, during the state of emergency it became clear that not everyone was fully ready for new ways of working, and that one of the important causes of difficulties in digital integration was the lack of digital competencies. One of the primary tasks of domestic higher education institutions is therefore to establish new digital learning systems, train teachers, create accounts, establish new processes and procedures, digitize learning materials and establish new forms of communication with students.

On September 2020, the Senate of the University of Belgrade made a decision that in the school year 2020/2021 classes will be held in combination, so that lectures will be mostly online, while practical classes would take place live (Univerzitet u Beogradu, 2020). Faculties are left to organize classes according to their specifics, capacities and number of students. Other universities in Serbia have opted for a similar model.

3. EXPERIENCES OF BELGRADE BUSINESS AND ARTS ACADEMY OF APPLIED STUDIES

Despite improvement, modernization and digitalization are the basis of the business strategy of the Belgrade Business and Arts Academy of Applied Studies (BBAAAS), the new working conditions required a quick adjustment of work in order to provide students with the highest quality educational service. As much as the conditions of the pandemic threatened the educational process in BBAAAS, they changed it so much and opened opportunities for different, more advanced and more efficient methods of learning and transferring knowledge. That is why the Belgrade Academy strives to integrate digital technologies into the educational process so that they enable teachers and students to access specialized materials far above textbooks, in multiple formats and in ways that can connect time and space. Quality educational materials offer completely new answers to the question of what students learn, how they learn and where and when they learn. In the digitalization process the question of the value offered by university education, what social networks include and imply, as well as what is the quality of educational content, are highly considered and valued by Belgrade Academy. Professors of the Belgrade Academy believe that technology not only changes teaching and learning methods, but it can also raise the role of teachers from the transfer of acquired knowledge, to work as a co-creator of knowledge, as a coach, as a mentor and as an assessor.

BBAAAS has continuously invested a lot of effort in its presence in the online sphere. Starting in 2006 and the first website that was of a basic informative character for students, the Academy created a new version of the site in 2018 expanding its informative role and introducing new features of the site that directly support and facilitate the teaching process itself. In the conditions of the pandemic, according to Google analytics, the Academy's website records an increase in site traffic. Comparing September 2019 and September 2020, it can be concluded that the Academy's website has 22.12% more new users, and that the number of sessions per user in September 2020 increased by 43.92% compared to September last year.

The Student Internet Service (SIS) application was upgraded in 2020 now offering more functionality to end users. After logging in on the home page of the SIS, students receive an analytics that provides information on possible ways to fund studies, which is their average grade or how many exams they have passed. The SIS application allows students to register for the exam online, to register on a mailing list, to order textbooks online. In fact, SIS offers students a number of other functionalities that enable the safe and easy study.

4. CHATBOT ADA - ACADEMIC DIGITAL ASSISTANT

Practitioners and researchers have been endeavoring to ameliorate their skills in designing utilizer interfaces in human-computer interaction for many decades. This is particularly evident in the development of chatbots, i.e. machine agents using natural-language interface for the purposes of obtaining information or providing services. In fact, the chatbot is a computer program that simulates human conversation or chat and it participates in a dialogue with a human by using natural language and artificial intelligence. Owing to this, chatbot can be used to answer all questions and solve problems. The segment of artificial intelligence enables the analysis of entered messages (phrases) by humans, not by analyzing and searching for key words, but by an absolute understanding of the natural language and the meaning of the whole phrase (Dale, 2016).

The Belgrade Academy wanted to take advantage of the opportunities offered by advanced technology in the form of a digital assistant based on artificial intelligence, with the aim to improve the interaction between students and computers, and thus between users of its educational services and the Academy. The Academy started developing ADA chatbot (https://chatbot.bpa.edu.rs/) in 2020 using the Weaver platform (https://weaverbot.ai/) of the company Saga (https://saga.rs/?lang=en) in order to provide its students with the best possible service during their studies. Thus the Academy became the first educational institution in the Balkans in the field of chat development. Probably the greatest achievement of the ADA is the independence from messaging platforms (channels) and NLU external services. ADA uses multi channels and multi NLU to understand students' questions. ADA also integrates a modern messaging experience natively into the Academy's website through web chat. The ADA actually can let students pick the channel they prefer (FB messenger, Viber, web chat through the website etc.). Since the beginning of its implementation, the ADA has recorded an increase in users and the number of inquiries. Statistics indicate the following tendencies (Table 1).

Table 1. Number of ADA users and number of sent messages

	Viber	FB messenger	Web site	Total
Number of users	1.392	968	1.505	3.865
Number of messages sent by users	15.895	10.563	4.846	31.304
Total number of scenarios (stories) without the small talk	124			

Source: ADA database

The analysis of conversation statistics by channels and type of query in the period of three months September / October / November 2020 shows the following (Table 2). In the analyzed period the total number of conversations increased by 85.53%. The dominant channel through which the message was sent to the ADA was Viber, in September 2020, 48.93% of the total messages. In October 2020 Viber used 48.61% of the total number of messages and in November 2020, 47.92% of the total messages that month.

Table 2. Conversation by channels in the period September / October / November 2020

	September 2020.	October 2020	November 2020	Total
Conversation via Viber	4.486	7.276 (+38%)	8.152 (+11%)	19.914
Conversation via Facebook	3.256	4.987 (+35%)	5.896 (+15%)	14.139
Conversation through the site	1.427	2.706 (+47%)	2.965 (+9%)	7.098
In total	9.169	14.969 (+39%)	17.011 (+12%)	41.151

Source: ADA database

Students make various inquiries to ADA, such as: the amount of tuition, which documents are required for enrollment in the new school year, the schedule of lectures or the date of admission of a particular professor. In the analyzed months, the interest of students was in accordance with the school calendar, that is, in September, the month of taking the exams, students were most interested when the teacher teaches, examines or holds exercises in a certain subject. In October, the month of enrollment in the new school year, at the top of the list of inquiries was information related to the amount of tuition and the type of documents required for enrollment. In November students ask about professor's consultations and office, Academy's working hours, etc. ADA also can perform processes such as exam registration or cancellation, change of professor on the exam, reset password or buy a book.

4.1. Technical aspect of ADA project

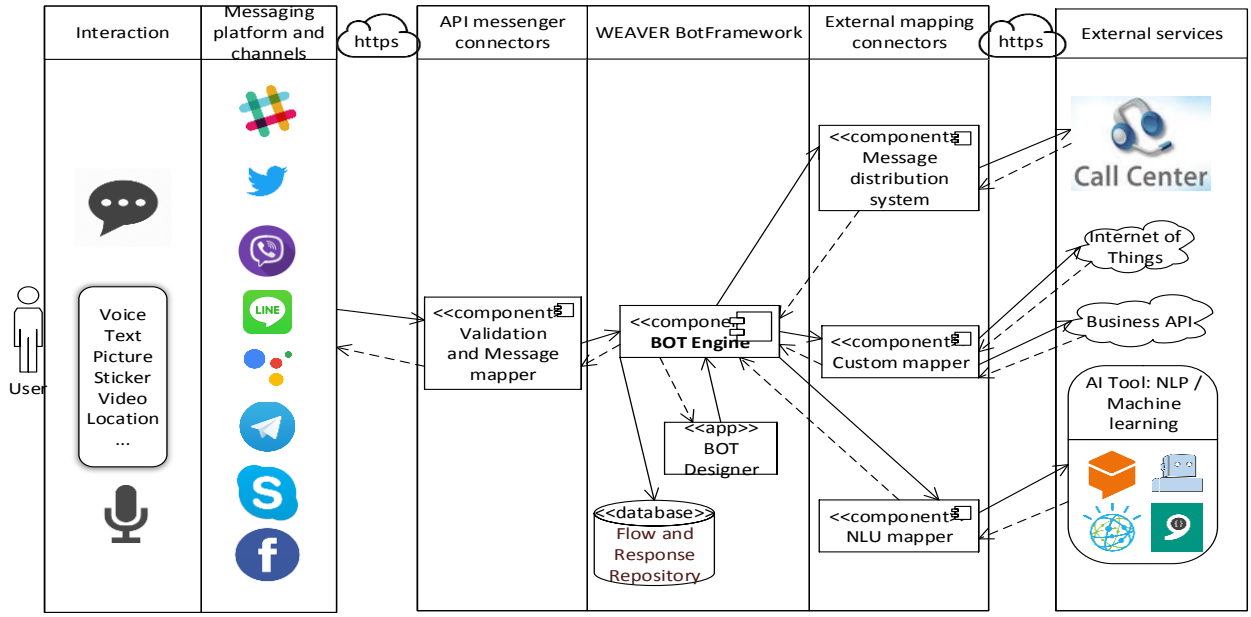
In the incredibly changing environment of modern technology, it has never been more important for the chatbot to be agile and scalable. The proposed architecture for the ADA is established on microservices allowing replacement

of components with more powerful and faster ones as requirements grow and technology develops. Weaver use local cache to accelerate request retrieval and index tables to solve a quick search. This platform regulates concurrent requests and performs queries asynchronously and queue them. Asynchronous processing removes some of the bottlenecks that affect performance, increasing the scalability choosing modern frameworks for single page application enhancing the overall performance. Scenario definitions are defined in one place regardless of different messaging services.

The logical architecture of the Weaver platform used in ADA project consists of four main building blocks (Figure 1): User; Messaging platforms (channels) through which users communicate; Weaver - Conversational AI platform; External services among which NLU is the most important. Weaver uses the reference chatbot model (Karuppiah, M. et al. 2016) and enables to unify messaging from every channel into a single conversation, creating in this way an interactive messaging experience anywhere. Weaver integrates a modern messaging experience tailored to ADA brand, and seamlessly transfers web conversations to mobile without losing context.

The BotFramework is the central and main part of the architecture which is connected with two main connectors: API messenger connectors and External mapping connectors. Communication between them is performed via HTTPS protocol. Message processing starts with understanding the user's message. Validation and mapping of messages being received from a messenger platform are performed in the API Messenger Connector. Each messenger platform has its own set of mapping rules which are defined in the database and which are used by the connector to fill the object with all necessary data. The Botframework contains the entire logic for processing received messages, works with contexts, chat flow, logical decision-making, integration with predefined scenarios and responses, and various other required rules. Bot engine is a complex component performing all domain-specific calculations for processing user requests. It has separate modules for generating and choosing responses. The response generator must use the context of the conversation and the intents and entities extracted from the last user message. The response selector only evaluates response candidates and selects a response that is the best answer to the user message. In this way, the user can switch from one topic to another, but also return to the started topics at the point where he stopped. These functionalities are great features called context switching and context filling.

Figure 1. The logical architecture of the Weaver platform used by ADA



External mapping connectors serve for connection with external services such as NLU (Natural Language Understanding). The NLU module of intent classification identifies the intent of the user message. It is usually a choice of one of the numerous defined intents, although our sophisticated chatbot may switch to different intent. For the needs of selecting intents, the intent classification may use contextual information, such as intents of previous messages, user profiles, and habits. The entity recognition module extracts structured bits of the message. For instance, ADA can extract teacher and subject, etc. NLU is a big challenge for everyone because it requires expertise and huge amounts of data. These are the reasons why the creators of the ADA at the Belgrade Academy use popular NLU service platforms such as Google Dialogflow (https://dialogflow.com/), Rasa (https://rasa.com/), Facebook

Wit.Ai (https://wit.ai/) and IBM Watson (https://www.ibm.com/watson). Many of them provide own components for machine learning that can be connected to external platforms or product. ADA architecture supports connection to these NLU external platforms (services) enabling multi services and independence from just one NLU services. Each NLU external service has its own metamodels and mapping rules for each specific type and implementation of NLU.

The Botframework can be integrated with the existing contact center application with the help of the component Message Distribution Connector. In the case of not able to respond to complex questions, the role of this component is to connect the user, communicating via the messenger platform with the person working in the contact center.

Using Bot Designer it is possible to directly teach the NLU in order to avoid dependency on a vendor's NLU interface. Also, BOT designer enables visual generation of a flow mapping all potential directions in which the discussion may go. The conversation flow is responsible for predicting all possible input messages and chatbot reactions, and the discussion may go to different branches of this flow.

Flow and Response Repository is used for storing all predefined flows with their actions and conditions, users, responses, conversations, metamodels, mapping rules, logs etc.

Based on the processing of the sentence with the help of NLU and the application of the appropriate algorithm, the chatbot comes to an adequate answer which is forwarded to the student. In order to enable students to receive personalized information, BBAAAS has integrated the Weaver platform with the existing student internet service (SIS). For example, for the sentence "How many failed exams do I have", chatbot returns a personalized answer with additional authorization steps, and in the simplest way, the student receives a complex action answer (Matić, R. at al., 2019).

4.2. Business aspect of ADA project

In order to remain competitive, the Belgrade Academy strives to create such a learning environment for its students so that digitalization becomes a tool that expands and complements the student-professor relationship. Thanks for the quick responses received from the ADA, students become well-informed and more willing to engage in interactive communication with professors and in the process of working together, learning, researching, and collaborating. On the other hand, following their questions, exam results, selected contents, the Academy gets to know its end users better and comes to the position to offer them learning systems that will suit them better and that are better adapted to personal learning styles with great precision (personalization of educational content). So far, the Academy has developed a first version of the ADA chatbot, and the advantages of the ADA that should be singled out are (Vidas-Bubanja, M. et al., 2020):

- **Availability 24/7/365** - High availability is provided to the student for 7/24/365 days, and everyone wants services outside normal working hours from 9 am to 5 pm. Chat is available 24 hours a day all year round;
- **Time saving** - Ability to simultaneously serve thousands of students and users. The step of going to the counter is skipped to get certain information. It values and saves the student time and frees up more time they can use to learn;
- **Fast service** - Students tackle traditional communication by phone and email. Instead of leaving students on hold, the ADA solves simple student requests;
- **Keeping up with the world** - The task of the ADA is not just to provide information, to facilitate everyday tasks, but to introduce a new digital strategy using elements of artificial intelligence;
- **Easy communication** - Anyone who is a user of the Viber platform or Messenger for communication, will be able to communicate with chat very easily and simply;
- **Multitasking** - Rapid provision of information can bridge the gap between the large number of students seeking information and the limited, primary human resources of the Academy, which need to provide assistance;
- **Lower costs and higher efficiency of the Academy's work** - thus enabled communication with students for the Academy means the possibility of faster and more efficient implementation of its services at lower costs.

5. CONCLUSIONS

Digital technologies have been present in the education system of the Republic of Serbia for some time, but the conditions of the COVID 19 pandemic in 2020 accelerated the further process of digitalization of teaching and pointed out potentials, opportunities but also some risks of distance learning and delivery of digital educational content. The main challenge for educational institutions in the Republic of Serbia is to apply modern digital technologies so that they enable the improvement of the teaching process, facilitate learning and provide a higher level of interaction between students and professor. However, the conditions of the pandemic confirmed that not all participants in the educational process in the Republic of Serbia are equally ready for the application of digital technologies. In Serbian education system much remains to be done in terms of equipment in educational institutions, improving digital competencies of teachers, changing legislation, ensuring quality infrastructure. This is

a serious task in which all actors of the educational process must participate, both schools and universities in the private and public sector, as well as the state and its institutions.

The Belgrade Business and Arts Academy of Applied Studies strives to improve and digitize its educational process and provide the student, who is always at the center of its interests, with the highest quality educational service. In addition to new versions of the Student Information Service, E-employee and responsive website, the BBAAAS began in 2020 with the development of chatbot. The Chatbot is software that serves as a user interface that uses natural language to obtain information or perform services. It is a computer program that simulates a conversation using artificial intelligence and participates in dialogue with humans using natural language, and can understand the text, voice messages and can largely interpret their meaning. Based on the natural understanding of the sentence with the help of artificial intelligence and the application of an appropriate algorithm, the chatbot comes to an adequate answer which is forwarded to the student.

One of the main goals in Belgrade Academy was to make agile chatbot architecture, in order to handle a highly variable environment of modern platforms and emerging technologies. ADA has an advanced architecture for the chatbot framework built on microservices, i.e. API service architecture. The proposed architecture is flexible, inherently scalable, platform-independent, and supports various channels for user interactions and natural language understanding. Furthermore, the extensibility of this framework simplifies the integration of other useful external services. Switching from one messaging platform to another or from one NLU to another is very easy to accomplish in a couple of clicks due to the flexibility and low coupling of the basic parts of the architecture. What speaks the best about the success of this implementation is that Academy dedicated the whole brand image campaign to ADA.

The ADA chatbot project is the first project of its kind in the Balkans in the field of education that significantly influence the way students experience educational institutions and the way they interact with them. In this way chatbot in education can provide better communication, time savings, faster and more efficient implementation of educational services. Chatbot may not be the solution to all student problems, but it is a powerful tool that can increase the efficiency of the Belgrade Academy and support the realization of the educational process. Future research and implementation include automatic extraction of user sentiment from conversations and distributed cache. The support service should then be enabled for voice messages and additional performance measurements to identify bottlenecks.

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