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Development of a Chat Bot Algorithm to Improve the Efficiency of the Process of Organizing Corporate Training

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Abstract

The development of professional competencies of personnel is an important task for modern organizations. And its effective solution is facilitated by the emerging opportunity to use artificial intelligence, with the help of which the boundaries of access to the latest tools and training technologies are expanding, allowing personnel to adapt to changes and prepare them to solve current problems and achieve strategic goals. Also, the use of digital services and tools opens up broad prospects for ensuring continuous training and development of personnel, which helps to increase the value of human capital in the organization. One of the promising innovations using artificial intelligence is chat bot technology, which provides quick information search, improves adaptation and communication processes, activates human potential, and helps improve learning efficiency through additional interaction with people through text messages. The article presents a summary of the experience of organizations in using chat bot practices in the HRM system. The implementation of the chat bot technology saves labor costs and allows companies' management to personalize training, provide staff with highly intelligent support, free up their time from performing routine tasks, maintain a high level of interactivity in the learning process, while continuously monitoring the acquisition of knowledge by employees with receiving feedback. The following methods were used for the study: analysis, synthesis, comparison, graphic description, structuring, modeling, visualization. The authors have developed algorithms for working with requests for personnel training. It has been shown that the implementation of chat bot technology saves labor costs and increases the efficiency of work with internal clients of the HR department. The authors calculated the effectiveness of the chat bot by reducing the time spent processing applications from internal clients of the HR department. In further research, it is

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advisable to continue the work begun in terms of expanding the functions of the chat bot and supplementing its algorithm with machine learning.

Keywords: algorithm, corporate personnel training, machine learning, chat bot, efficiency.

1. Introduction

The emerging trend of lifelong education in any area of business requires the development and implementation of new technologies and personnel training tools. The range of opportunities for corporate training of personnel has expanded significantly with the introduction of digital technologies, which at the same time complicated the work of specialists in human resources management (Pulyaeva, 2021). The relevance of introducing digital innovations that make eLearning possible and in demand to train employees in the modern world, which is characterized by the rapid pace and speed of introducing changes aimed at improving both technological and management processes (Tome et al., 2021). The new reality is that traditional forms and methods of training do not satisfy modern business (Tome et al., 2022). The emergence of new professions and activities requires the introduction of technologies that allow working with large amounts of information in a rapidly changing environment and an atmosphere of multitasking (Skhvediani et al., 2022). The implementation of new learning strategies involves modern digital methods of transferring knowledge and monitoring their assimilation (Zaborovskaia et al., 2020). E-Learning includes a wide range of applications and processes built on web technologies, involves the use of a personal computer or mobile communication devices, virtual classrooms and other telecommunication technologies (Balashova, Gromova, 2017). The e-learning system is used by almost all of the world's largest companies like Honeywell, Johnson & Johnson, Microsoft, Adidas, Gazprom, Yandex. The entire global online education market is valued at \$165 billion, and by the end of 2023, according to Global Market Insights, it will grow to \$240 billion, and this is a conservative forecast (The High Impact..., 2023). Many large companies that are pioneers in the technology sector, such as Amazon and Google, have introduced new training methods for their entry-level employees and are using social networking technologies (Barykin et al., 2020). The well-known large company Deloitte has switched to a fully digitized and gamified personnel adaptation process. Technological solutions and advances in virtual and augmented reality provide teachers with new ways to provide information and learning materials to users, ensuring high levels of engagement, stimulating their cognitive activity and inclusion in the process. Digitalization of internal corporate training is an integral part of building the digital ecosystem of a modern enterprise (Babkin et al., 2021).

One of the newest and most effective technologies for organizing an internal corporate educational process is a chat bot. This is a program with a specific algorithm and limited content of operating knowledge. The principle of its operation is that the user specifies certain commands using a word or a number (a sign, a combination of symbols, keys, etc.) and an instant response to the given command from the bot (Balatamoghna, Nagajayanthi, 2022).

The well-known nickel and palladium producer Norilsk Nickel has implemented its HR Chat Bot based on the Telegram messenger. A bot named Nika answers all questions regarding internal communications, vacations, receiving certificates from work, annual vacations, etc. (Global Marketing..., 2023). According to previous studies, chat bots, typically built on machine learning, are mainly used in areas such as customer support (Vu et al., 2021), therapy (Konapur et al., 2021) or personal devices (for example, the Siri bot in Apple products) (Mohamed et al., 2021).

Chat bots are widely used in the human resource management system of modern organizations to adapt new workers, helping them solve many issues without addressing more experienced colleagues. This technology saves the time of mentors and managers to solve typical problems when adapting an employee, and the employee himself may not distract the mentor and not wait for an answer for a long time (Suvalova et al., 2021).

Since the organization is interested in accelerating the adaptation of a new employee, delegating the functions of his support to a chat bot allows him to quickly go through all stages of onboarding, including coordinating his actions during this period, developing an individual learning path, informing about the dates of training events and monitoring the results of their completion. Chat bots can show a map of the office, as well as the location of workstations, which will help navigate the new work environment. In the chat bot newcomers can familiarize themselves with the necessary documents: charter, internal labor regulations, work instructions, code of ethics and others. A virtual assistant can, to some extent, replace a mentor by answering

common questions from newcomers, which will save time for mentors. There is an opportunity to get acquainted with information about the organization: its history, mission and values. In addition, you can show informal rules of behavior in the team and in the office, and make newsletters for employees in an interesting and unusual form.

Scientists from Norway studied the practice of using chat bots in HRM and concluded that the chat bot can increase HRM efficiency by processing repeating requests and adapting HRM support in response to the results of the analysis of the chat bot. At the same time, the chat bot affects the HRM function in terms of new tasks and requirements for the competence of HR specialists (Taule et al., 2022).

As Akshay Khetrupal, a specialist from India, notes, there is already a large range of developed chat bots in the field of HR that companies can use to solve the problem in recruiting, adaptation and motivation of the staff. He called 14 modern chat bots from various developers, which allow reducing the temporary costs of the routine tasks of HR specialists (Khetrupal, 2023).

To justify the rationale for addressing the use of a chat bot as one of the examples of the using of artificial intelligence in corporate training, it is necessary to provide a number of arguments. The effectiveness of the spread of artificial intelligence has been recognized in many activities (Kabudi et al., 2021). The obvious use of artificial intelligence resources is expressed in the method of assisting an employee in performing professional functions, taking into account the challenges of the modern world, these include: accelerating the pace of work due to increasing changes, transitions with the processing of large volumes of data, which, in turn, actualizes the need for liberation it from routine and similar tasks, by automating them and delegating them to machines, which allows reducing the labor intensity of performing functions and increasing productivity efficiency. This becomes possible only if innovation is introduced into the employee training process itself, since its organization must correspond to the pace and rhythm of the environment. Therefore, the use of a chat bot, as one of the options for the emerging educational process, should help in achieving the goal of increasing the efficiency and productivity of a person in the workplace. The potential use of a chat bot is to provide time savings and enhance the skills of the worker according to the required requirements to perform the job. Since some of the resources are delegated to the virtual personal assistant, he, in turn, will be able to solve more creative problems that require intuition and empathy. Chat bots allow you to quickly provide access to data, allow you to better manage time, maintain internal communication, etc. Therefore, saving time and material resources is carried out by efficiency measurement factors. For subsequent interaction with suppliers, the chat bot becomes a virtual mentor, interaction with which allows you to maintain a successful learning trajectory in adaptation and course management. This ensures that a new employee quickly joins the team and begins working independently, which indicates the effectiveness of investments in training.

2. Methods

An important scientific source on which the authors of this study relied is the work of scientists from South Africa (Okonkwo, Ade-Ibijola, 2021), who previously analyzed 53 works on chat bots from recognised digital databases. They found that only 5 % of studies focused on the administration and organizational side of using a chatbot. "This implies that the frameworks for the development and implementation of Chatbots, as well as the design features and contents, must be improved" (Okonkwo, Ade-Ibijola, 2021). It is for this reason that the authors chose the following purpose and object for their study.

The purpose of this study is to explore the possibilities of using chat bot technology to improve the effectiveness of corporate training and meet the organization's need for highly qualified personnel.

Achieving the set goal will be based on testing the null hypothesis, which is that the use of the developed chat bot algorithm will increase the efficiency of organizing internal corporate training.

The main object of the study was the activities of an international IT company specializing in the field of information security, using the example of which the process of developing and implementing a chat bot in the corporate training process was analyzed. The subject of the analysis was the procedure for processing applications for training, its optimization and efficiency, which allows for a reduction in the labor intensity of the business process through the use of chat bot technology.

The researchers used the following methods: data collection, survey, compilation of a graphic image of a working day of a specialist, analytical review, comparison, observation, graphic description,

modeling, visualization. The authors relied on the data obtained as a result of the analysis of sources presented in the open access on official websites of the analyzed companies, as well as the internal corporate data of the company being the object of the research. The main object of the study was an international IT company specializing in the field of information security.

The research methodology included the following stages:

- 1) studying scientific and practical literature on the problems of using chat bots in the modernization of management business processes of the organization;
- 2) analyzing the process of intra-corporate training of employees (auxiliary business process) of the organization under study, the identification of its narrow places. At the same time, a graphic image of the working day was used to evaluate the labor cost of HR specialists;
- 3) developing the chat bot algorithm to reduce the preparatory stage of the process of organization of training in the organization using methods of graphic description, modeling and visualization;
- 4) evaluating the efficiency of the developed algorithm based on an assessment of static data on the time spent and the speed of processing employees' applications for training.

The main indicator of the evaluation of the efficiency of the process of organizing corporate training in this study is the speed of processing applications received in the training department from employees of the IT company, which is the main indicator of the efficiency of this business process. The calculation and analysis of the complexity of the business process, as well as an analysis of the degree of automation of the process were the methods of the analysis and economic evaluation of the efficiency of the business process modernized using the chat bot.

As the generally recognized theorist and practitioner of management, Henry Gantt ([Gantt, 1910](#)), emphasizes, time is the most precious thing that employees have, which is precisely the assessment of labor cost reduction and the focus of the authors of this study.

3. Results and discussion

The internal training system in the organization under study is carried out in the following areas:

- 1 – Teaching foreign languages (7 languages to choose from);
- 2 – Training Soft Skills and Hard Skills;
- 3 – Trainings from the Internal Training Academy;
- 4 – Providing access to educational platforms (Coursera, Pluralsight, Safari Online books, etc.).

A division called HR-Scholar is responsible for organizing personnel training in the organization under study. Specialists of this division are responsible for receiving, processing and coordinating requests for training from all employees of the organization, concluding and maintaining contracts with external training providers, as well as drawing up reports on the training provided and assessing its efficiency.

Regardless of the chosen direction of training, the employee is to submit an application for training in the prescribed form, which includes such parameters as: the applicant's name and surname, department, direction of training, justification for the feasibility of this training, approximate budget, training period. After the application is received by HR-Scholar, its employees coordinate the application with the applicant's manager and the head of HR-Scholar. The authors compiled a graphic image of the working day of HR-Scholar specialists (4 people) during a week of observations. Summarized results of labor costs for the entire division are presented in [Table 1](#).

Based on the results of evaluating the labor costs of employees of the HR-Scholar division, we can conclude that 70 % of the working time in this division is spent by employees on processing applications that come from internal clients – the personnel of the organization under study. On average, per week, HR-Scholar specialists process 86 applications in all four areas of study: 13 applications for foreign language training, 33 applications for Hard and Soft skills training, 10 applications for training the leading company specialists, and 60 applications for access to learning platforms. As a result, it was determined that processing an application for foreign languages training or Hard and Soft skills training takes about 0.93 hours, processing an application for training at the Internal Training Academy takes 1 hour, and processing an application for connecting to an educational platform takes 0.5 hours.

Table 1. Labor costs of employees of the HR-Scholar division

Type of work	Time, person/hour
Processing applications for foreign language training	12
Processing applications for Hard and Soft skills training	30
Processing applications for Internal training of leading experts	10
Processing applications for Access to learning platforms	60
Support of study groups	30
Writing reports	18
Total	160

Source: compiled by the authors based on a graphic image of the working day of 4 workers during one working week.

In order to reduce labor costs for routine processing of applications and responding to applicants, the authors created a chat bot algorithm that includes a starting greeting and a standard set of questions to determine the possibility of training for a specific employee. According to the organization’s regulations, training at the expense of the organization cannot be completed by those who work under a fixed-term contract or have not completed the probationary period. The starting algorithm is presented in Figure 1.

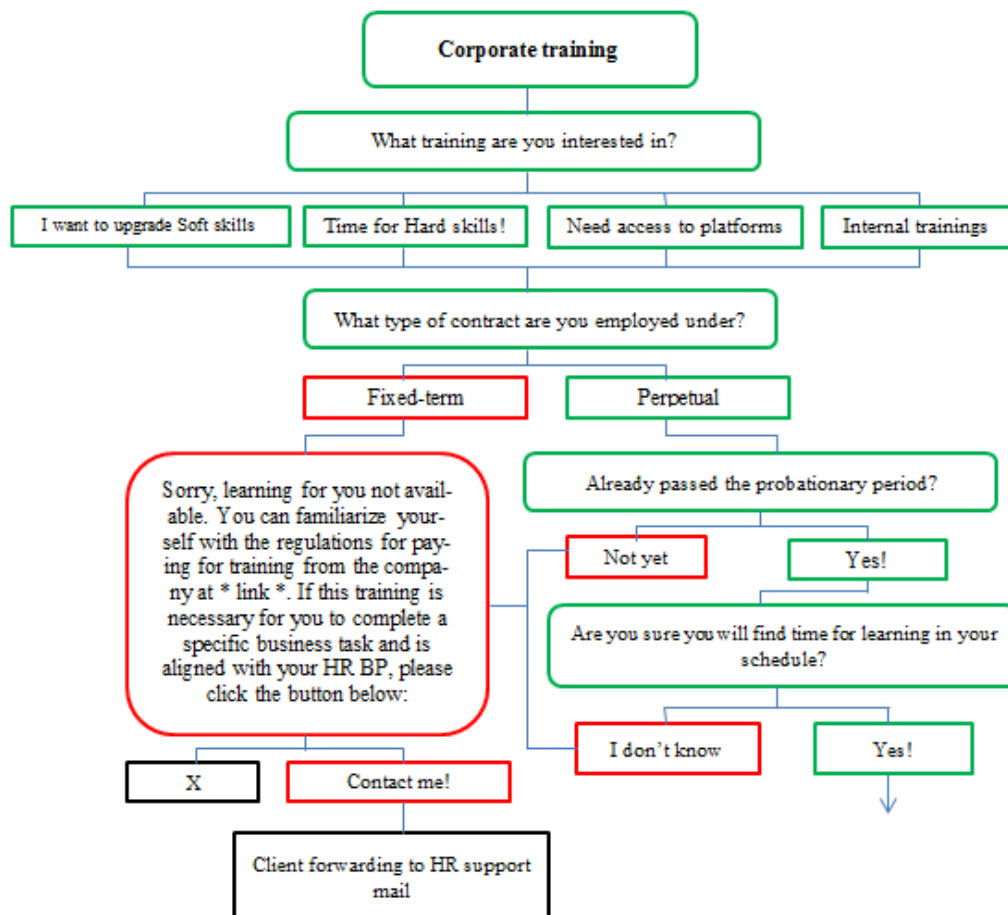


Fig. 1. Beginning of the learning bot algorithm
Source: compiled by the authors.

Response options from the red zone will return the employee to the message that under such conditions the application is impossible, but, if necessary, the applicant will be able to contact the HR department directly for an individual review of the application and assessment of its feasibility. It is important to note that the number of such applications is extremely small and amounts to less than 1 %.

After answering the questions for admission to training, the applicant gets access to one of the options for the bot algorithm, depending on the direction of study he has chosen. For the areas of foreign languages and Hard and Soft skills, the algorithm is presented in Figure 2. These two areas were combined into one algorithm, since when registering for these courses, the questions are identical and ultimately the applicant is redirected to the online application form in the intranet.

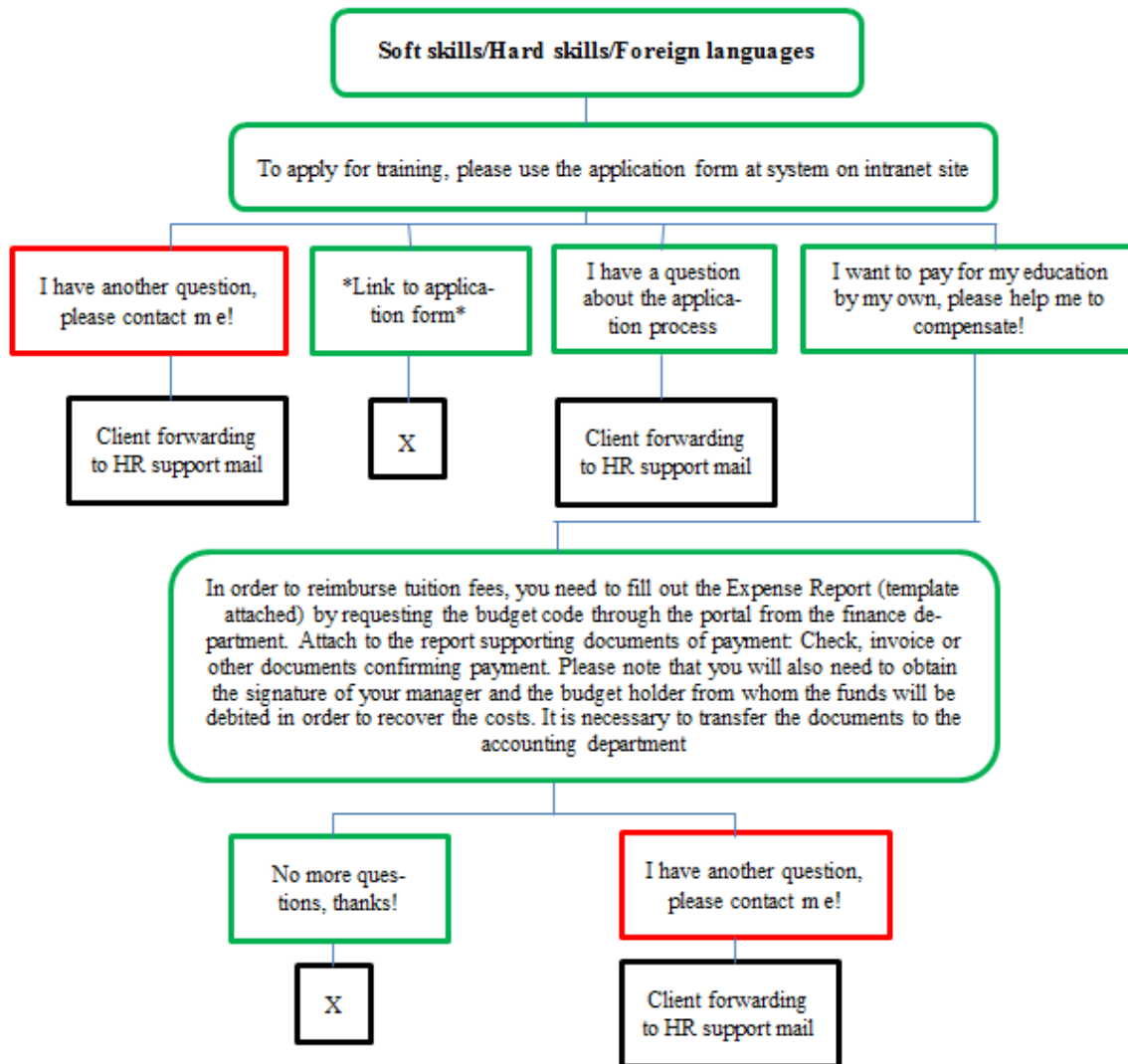


Fig. 2. Bot algorithm for questions on foreign languages, Hard and Soft skills
Source: compiled by the authors.

When submitting an application for training from the Internal Training Academy, the bot will offer the applicant training options and descriptions. Figure 3 shows an example of the bot algorithm when applying for the development of communication skills with the help of leading specialists of the organization itself. Searches for internal trainings are carried out using keywords and based on a database of trainings developed in the company.

To get access to the learning platform, the chat bot will connect the applicant’s manager to obtain his approval and, after receiving this approval, will immediately send access keys to the platform (Figure 4).

The developed chat bot algorithm was implemented in the organization under study on the basis of Power Virtual Agents from Microsoft, which is a platform for developing chat bots that integrates with other Microsoft products.

Previously, researchers from Poland demonstrated an increase in the efficiency of contact centers' response to customer requests when introducing various technologies, including chat bots (Plaza, Pawlik, 2021). The results obtained in the study conducted by the authors also indicate a significant increase in the efficiency of the HR department in terms of communications with internal clients by reducing the time spent on processing training applications (Table 2). The first column presents the types of requests, the second and third columns show their processing time in minutes before the implementation of the chat bot (calculated on the basis of Table 1) and after it (determined by the observation method during approbation of the chat bot), respectively. As already mentioned, time expenditure is the main indicator of the efficiency of HR-Scholar specialists when working with internal clients.

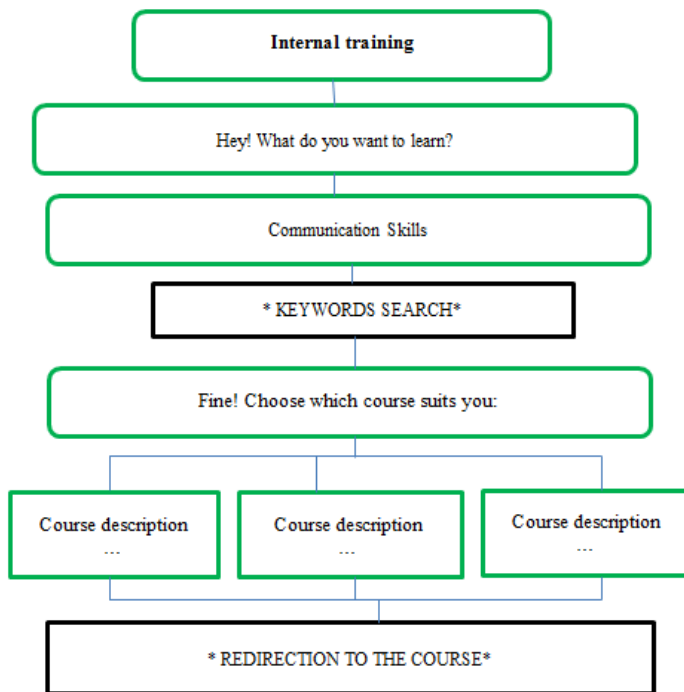


Fig. 3. An example of a situation with a bot algorithm for questions about internal courses
Source: compiled by the authors.

Table 2. Comparison of time spent before and after launching a chat bot

Parameter	Time spent before implementing a chat bot, min.	Time spent after implementing a chat bot, min.	Saving, %
Foreign languages or Hard and Soft trainings	1	2	$3=(1-2)*100/1$
Internal training from leading experts	56	35	37.50
Access to learning platforms	60	15	75.00
Total minutes:	30	0	100.00
Total in hours:	146	50	65.75
	2.43	0.83	65.75

Source: compiled by the authors based on Table 1 and internal corporate data

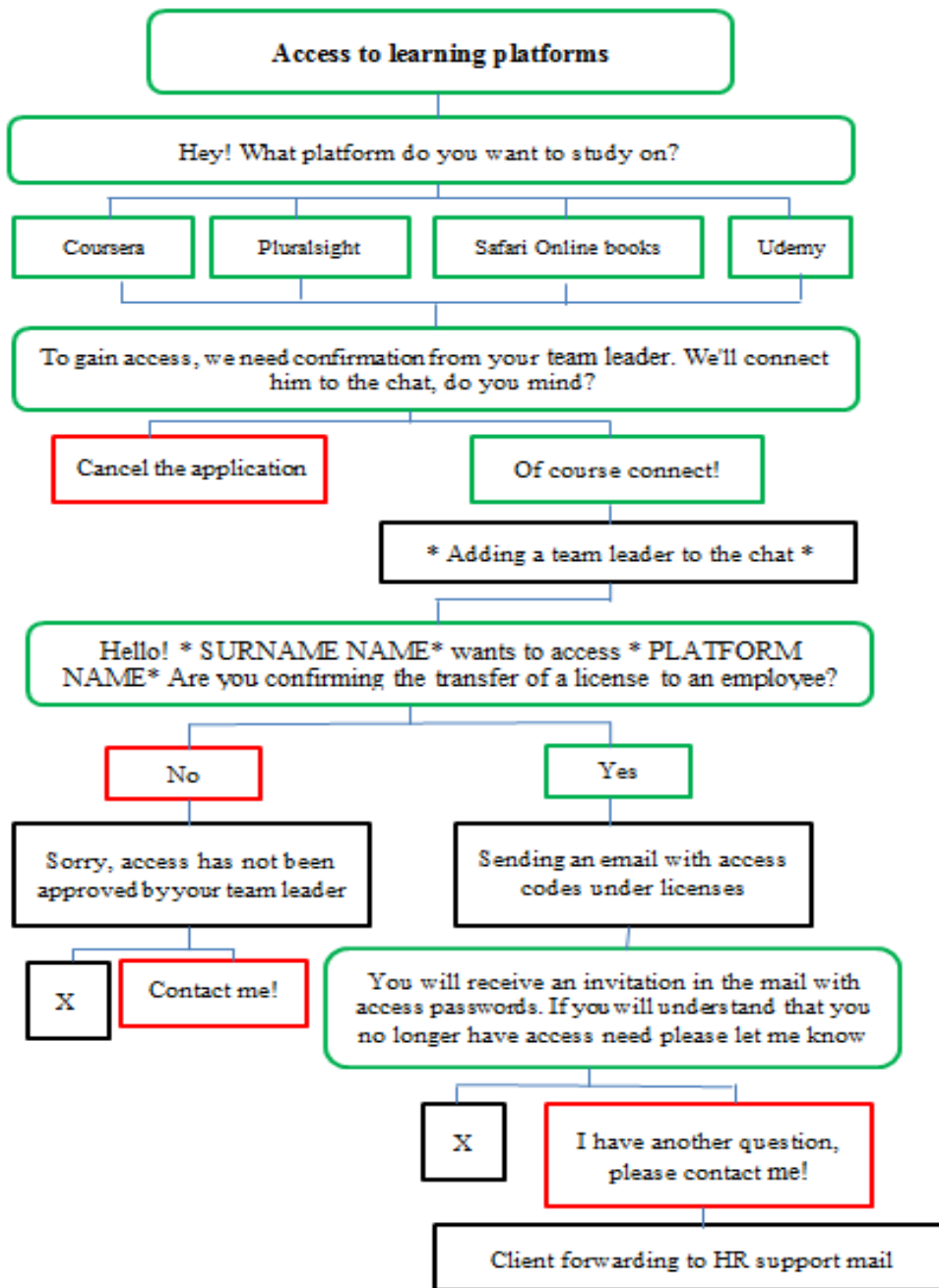


Fig. 4. Bot algorithm for gaining access to learning platforms
Source: compiled by the authors.

As it can be seen from [Table 2](#), the processing time for applications using a chat bot will be reduced by 37.5-100 %: the savings will be 37.5 % in Foreign languages or Hard and Soft trainings, 75 % in Internal training of leading experts and access to learning platforms will not require spending any working hours of an HR specialist at all.

At the same time, the period of launching the bot is associated with an increase in the load on HR service employees, which is due to the time required for them to master this function. At the stage of implementation of this digital technology, it is difficult to avoid information doubling, since requests for training can come from many channels, including the organization's email services. However, the benefits that this innovation brings to the organization of corporate training certainly outweigh the difficulties that may arise when launching a chat bot. In addition, as HR specialists and all employees of the organization work with the chat bot, various errors in algorithms may be identified. In this regard, the algorithms will be adjusted and improved.

4. Discussion

The presented algorithm for interaction between a chat bot and a person has significant prospects, as it allows to expand the audience of participants in joint activities, without reducing the quality of processing applications and servicing internal clients of the HR-Scholar division. The continuous development of digital technologies will allow to continue to introduce new functions and possibilities for using the chat bot. And the diversity of its organization will lead to an expansion of the range of tasks in corporate training that can be solved.

In modern conditions, the advantages of using such a digital tool include: providing support to the HR service in terms of optimizing its work and increasing the efficiency of processing applications for training, which, of course, frees up time that is spent on solving such routine tasks (Ivanova, Sadova, 2020). However, with the expansion of machine learning capabilities, it will be possible to implement systematic monitoring of results and build an individual learning trajectory (Kabudi et al., 2021). The use of artificial intelligence will make it possible to recognize the student's potential, eliminate possible errors and provide him with advice on the way to obtaining the necessary knowledge and competencies (Okagbue et al., 2023).

Ten years ago, researchers from Iran proved that the use of IT tools increases the productivity of human resources above average (Shoushtary, 2013), which is fully consistent with the results obtained by the authors on reducing labor costs for organizing the learning process with the implementation of the developed chat bot. Also, scientists from India substantiated the efficiency of implementing chat bots in HRM by monitoring their functionality in real time (Majumder, Mondal, 2021).

As a result of the study, the opinion was identified and substantiated that the speed and quality of processing an application for training, which are the leading time parameters, are the main indicators that determine the effectiveness of the training process. However, and this is important to emphasize, other equally important indicators that influence this should also be analyzed. These include: the degree of staff involvement, the number of requests to the teacher, the regularity of completing tasks, the number of users, their activity in training, the results of monitoring the success of training, etc. Since the use of artificial intelligence and neural networks increasingly makes it possible to recognize the student's potential and provide him with advice on ways to obtain the necessary knowledge and competencies, then assessing the correlation between the acquired amount of knowledge and its application in work is also a parameter that measures the effectiveness of training (Webb et al., 2021).

The work carried out by the authors continues previous researching of the international scientific community, and the conclusions obtained by the authors do not contradict previous studies.

5. Conclusion

The authors' analysis of earlier studies on chat bots showed that the use of a chat bot resource has a positive effect on increasing the awareness of employees regarding their opportunities to undergo training, and also opens access to training content and accumulated knowledge bases in the organization.

The practical study showed that a large share of an HR training specialist's working time is occupied by routine tasks of processing applications from internal clients. Reducing labor costs for these operations is possible by using a chat bot developed in Power Virtual Agents from Microsoft. The efficiency of this innovation is justified by the reduction in time spent processing training applications from the organization's personnel.

It is important to continue this research in the following directions. Firstly, it is necessary to improve the proposed algorithm, taking into account the introduction of additional options in connection with the use of machine learning. The introduction of a chat bot during the procedure for processing applications for training at the initial stage is considered as an initial innovative impulse, which will make it possible in the future to reconsider all work on organizing corporate training. Secondly, the development of chat bot technology is also seen in the high potential of its use in onboarding and mentoring processes, in providing consulting services when choosing directions and courses of study, conducting evaluation procedures after completing training, making adjustments during training, carrying out control activities, and also as an electronic assistant in the management and distribution of working time.

In addition, in the future, the authors plan to evaluate the effectiveness of the use of chat bots not only by time indicators of labor costs, which can be quantified, but also by qualitative characteristics, such as involvement, satisfaction and quality of training.

Thus, expanding the functions of the chat bot can improve the administration process of the entire organization and ensure increased staff involvement in its affairs. Through the active involvement of personnel in the exchange of knowledge, the organization will acquire the status of a self-learning one, which will ensure an increase in the value of its human capital. All this confirms the relevance of subsequent study of the problem outlined in this article.

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