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METHODOLOGICAL PRINCIPLES OF EDUCATIONAL AND PSYCHOLOGICAL CHATBOT DEVELOPMENT

Abstract. The study aims to describe the methodology for developing educational and psychological chatbots, covering its key principles, features, and stages. Educational and psychological chatbots are defined as those that provide conditions for psychological (self-)help and teach users more effective thinking and activity strategies, facilitating the acquisition of new knowledge, skills, and abilities. The main objectives of the study include the analysis of modern scientific sources to clarify methodological approaches to the development of educational and psychological chatbots, identifying their psychological and educational functions, and studying aspects of their implementation in various practical fields. Additionally, the study summarizes personal experience in participating in Ukrainian scientific and practical teams involved in developing relevant solutions and the interpretation, systematization, and comprehension of the obtained results. As a result of the conducted research, methodological principles for the development of educational and psychological chatbots using artificial intelligence technologies have been established. These

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principles include empirical justification and effectiveness assessment, personalization of user interactions, adherence to ethical principles (protection of users' life, health, and well-being, ensuring their confidentiality, ensuring the accuracy and objectivity of the provided information), accessibility and scalability, interactivity, interdisciplinary approach, integration of new technologies and approaches, and testing. A general algorithm for the development of educational and psychological chatbots, consisting of 8 stages, has been prepared. Scientifically based development and societal implementation of educational and psychological chatbots using artificial intelligence technologies unlocks significant potential for improving the quality of life and strengthening users' psychological well-being. This opportunity is particularly relevant for Ukraine in the context of full-scale war and post-war recovery. In-depth scientific research and interdisciplinary support in the issues of revealing and implementing ethical principles of chatbot functioning, such as user safety, privacy protection, and ensuring the certainty and objectivity of the provided information, are of priority importance.

Keywords: educational and psychological chatbot; chatbot development methodology; chatbot technology in education; artificial intelligence technologies; distance learning; remote psychological support

1. INTRODUCTION

Problem Statement. The development of the information society is closely linked to the active and comprehensive implementation of info-communicative technologies in various spheres of human activity, particularly those based on the use of artificial intelligence (AI) and Internet communication. The integration of information technologies into the educational and psychological sphere has gained particular importance in the context of these processes, both globally and especially in Ukraine. Three main factors contribute to this. Firstly, the almost total informatization of activities, including education, training, psychological assistance, and support. Computer-mediated activities become more productive, and achieving set goals becomes more economically feasible. Innovative methods and tools for learning based on information technologies are justifiably becoming more widespread. Secondly, the consequences of the COVID-19 pandemic have created conditions for the rapid development of remote formats of work and learning, based on communication and information exchange via the Internet, both individual and group. Thirdly, the full-scale war of the terrorist regime of the Russian Federation against Ukraine has created an urgent need for many citizens to transition activities, which were previously carried out in a “traditional” format, into virtual space. This applies particularly to areas such as education, development, and psychological support, where the shift to virtual platforms has become necessary due to several restrictions and dangers caused by the war. The new conditions of activity during martial law, regular attacks, and shelling by the aggressor have created an urgent need to transfer activities to a safer and often more economically accessible remote format.

Additionally, some specialists, such as educators and psychologists, have been mobilized, injured, have ended up in occupied territories, or have left Ukraine, while the need for these specialists has only significantly increased. Transferring their activities to a remote format using online, offline communication, or telephone communication has become just one way to meet the needs of Ukrainian citizens in educational and psychological work, as the issue of a shortage of specialists remains relevant. Another developing way, either as an auxiliary or alternative to the previous one, has been the development and implementation of AI-based chatbots aimed at providing conditions for educational and psychological and educational-developmental work with their users.

The social significance of researching the methodological foundations for the development of educational and psychological chatbots is determined, on the one hand, by global trends in the digitalization of society, and on the other hand, by specific challenges faced

by Ukraine in the context of war. Modern information and communication technologies facilitate the democratization of access to educational and psychological resources, which is particularly important for vulnerable population groups, such as internally displaced persons, individuals with special needs, and citizens residing in active combat zones. The effective use of AI technologies in the fields of education and psychological services can substantially enhance their quality by ensuring a personalized approach and timely support. The implementation of such innovative solutions contributes to the preservation and development of human capital, which is critically important both during wartime and in the post-war recovery period. Therefore, the research on the methodological foundations for developing educational and psychological chatbots is of not only scientific but also significant social importance, fostering the integration of innovations into the education system and psychological support services, particularly under crisis conditions.

Despite the significant social relevance of implementing educational and psychological chatbots in the context of war and pandemic, the methodology for their development has been extremely under-researched.

Analysis of Recent Research and Publications. The latest research reveals various aspects of the methodology for developing chatbots that can be applied to educational and psychological work. Researchers are studying issues such as the improvement of numerous cloud services that ensure the implementation and deployment of chatbot functionality, the application of supervised reclassification using an improved barycenter method to achieve higher accuracy and recall rates for data sets [1]; the development of architectural choices affecting the overall accuracy of chatbots, analysis of the "intent set" concept, and the capabilities of commercial chatbot development platforms like Google Dialogflow, IBM Watson Assistant, and Amazon Lex [2]; the conceptualization of chatbot technology as a factor in computer-mediated communication in the digital society, management, and marketing of chatbot development and operation processes, and the formation of a cohesive professional team for their creation and management [3]; the analysis of the functioning of modern messenger systems and chatbots, the results of which can be applied in the development of the CareBot chatbot to improve the emotional state of a person, acting as a mental support assistant for the user [4]; the use of the SolutionChat system, which visualizes the stages of virtual discussion and key thoughts of interlocutors, recommending messages to moderators that match the context of the conversation, improving the quality of summaries with less effort and providing more effective support to users by applying system-recommended messages [5]; the conceptual foundations for developing a quality control tool for mobile applications (including educational and psychological chatbots) for healthcare aimed at behavior change [6]; the capabilities of mobile applications for mental health support that use AI and can converse with users, show empathy, and make decisions based on evidence [7]; the determination of the practicality, acceptability, and effectiveness of a fully automated conversational agent (chatbot) for implementing a psychological self-help program for college students who self-identify symptoms of anxiety and depression [8]; the assessment of ethical and social implications of AI implementation in mental health care, highlighting risks during "non-human therapy" transparency in algorithm involvement, long-term impact consequences, and developing preliminary recommendations to address ethical and social issues of current and future AI applications [9].

Despite the significant social relevance of implementing educational and psychological chatbots in the context of war and pandemic, the methodology for their development remains under-researched and requires further investigation.

The purpose of the study is to formulate the methodology (main principles, features, and stages) for developing an educational and psychological chatbot that provides conditions for

psychological (self-)help and teaches users new knowledge, skills, and abilities that form the basis of productive thinking and activity strategies.

The main objectives include analyzing modern scientific sources to clarify the methodological principles for developing educational and psychological chatbots based on AI technologies, the psychological and educational aspects of its operation, and issues of implementation in various practical fields; summarizing personal experience working in Ukrainian scientific and practical teams on the development of AI-based educational and psychological chatbots; as well as interpreting, identifying patterns, and comprehending the obtained results.

2. THEORETICAL BACKGROUNDS

The Project-Technological Paradigm of Development, developed by M.L. Smulson and Yu.I. Mashbyts, is one of the important foundations of the research. Based on this approach, the concept of "Design" generally considered as a mental representation of the desired state of a certain system, is the activity of creating projects. Specific features characterize these projects: firstly, they describe objects (system states, etc.) that do not yet exist; secondly, they can be fundamentally implemented; thirdly, they are normative, positioning the achievable level of performing the corresponding actions or operations. As a type of activity, design has several key properties, namely the presence of a methodology, the need for problem-solving as a condition for creating a project, an initial orientation towards criteria of effectiveness rather than truth, and the value of the project even without its implementation. In the educational and educational-psychological process, three levels of design are distinguished: conceptual, which describes the creation of a model of desired changes; technological, which involves planning a system of actions; and practical, dedicated to implementing the plan to achieve the goal. An important methodological component is the definition of typical project characteristics, which include the description of non-existent objects, the possibility of practical implementation, and accessibility. The concept of "Technology" according to the project-technological paradigm of development, has various substantive aspects and is considered here as the activity of a psychologist, educator, or organizer of the educational process, including a system of methods and means of influencing the system, as well as the peculiarities of their application. The Project-Technological paradigm is aimed at the development and correction of psychological formations as components of the intellectual sphere of the individual, using a planned and defined system of educational-psychological influences. The design of the latter is based on the selection of the most effective methods of influence and the development of an appropriate environment for development (psychological changes). Identifying and describing the structure of psychological technologies and implementing the project-technological approach in psychology allows optimizing the process of developing methods and approaches for the practical activities of a psychologist, increasing the effectiveness of providing psychological support in practical terms [10], [11], [12], [13].

The psychological approach of cognitive-behavioral therapy (CBT), in which psychological work (counseling, psychotherapy, training, etc.) is understood as a process of teaching more effective skills, competencies, patterns, and models of behavior and thinking, is the next fundamental basis of the research. During psychological counseling in traditional non-virtual conditions or virtual communication, the process of psychological work is viewed as teaching the client new ways of behavior, responding to situations, and thinking, as well as teaching them to manage their own thoughts and emotional states, and developing and implementing more productive behavior in necessary contexts. Maladaptive thinking and behavior patterns are identified and changed through retraining the client. Additionally, clients are offered tasks and exercises for independent execution, which help to reinforce new patterns,

skills, and competencies. In CBT, which underpins many of the studies referenced in this article, therapeutic outcomes are achieved by promoting changes in clients' thought patterns and behaviors through a structured learning process. The intervention involves teaching clients to identify cognitive distortions, adopt more adaptive thinking patterns, and practice healthier behavioral responses. From a methodological perspective, this approach can be viewed as an educational process aimed at enhancing psychological well-being by transforming maladaptive cognitive and behavioral patterns [14].

The concept of the Virtual Educational Space, developed by M.L. Smulson and M.M. Nazar, constitutes another research foundation. The virtual educational space is a learning meta-technology that systematically integrates other educational and psychological technologies and is based on the principles of purposefulness, activity, initiative, and subjectness, creating conditions for transforming learning into self-learning and intellectual development into self-development. The relevance of implementing and using virtual educational environments in educational and educational-psychological work is determined by key factors such as providing individuals with access to information resources, the need to integrate modern information and communication technologies into the educational process and psychological work (which offers better opportunities for comprehensive and objective assessment of effectiveness), the effective use of "feedback on feedback" the focus on implementing computer multimedia tools that enable the individualization and differentiation of learning or psychological work, and the formation of specified competencies. The content architecture of learning and psychological work in the virtual educational space considers two main components: the external component, which concerns the management of the educational-psychological process (individualization of approach, development of user models, ensuring convenient dialog interaction, selection and application of internet communication technologies, the modern interface of the technical platform, etc.), and the internal component, which concerns the content of educational-psychological work (providing the necessary content of the educational process or psychological work, establishing criteria for evaluating results, forming the necessary competencies to solve psychological tasks and develop effective thinking, etc.) [15], [16].

One of the important theoretical provisions of the research is the concept of personality developed by G.S. Kostiuk. Continuing the scholar's idea of managing the processes of personal change, psychological support "means designing the gradual formation of personality traits and managing the implementation of outlined projects". In this context, managing changes in intellectual activity during educational and psychological work must take into account the individual characteristics of the subjects of this activity, and their independent overcoming of difficulties becomes a factor in personal development [17].

The proposition that the functional foundation of generative AI is a multifaceted and multi-component phenomenon forms a significant basis of the research work. The characteristic ontological aspects of the development and implementation of generative AI include programmability (AI operates based on a system of predefined programs and algorithms, currently lacking its own independently created or chosen goals, which does not yet justify considering AI as possessing subjectness); logic and analysis; machine learning; automation; limitations in the application and ethical issues (AI has its limits in the ability to understand, such as linking new information with existing knowledge, interpreting meanings and contexts, and adapting to new situations, which must be considered when involving and implementing it in practice) [18].

3. METHODS

The research methodology was based on theoretical scientific methods such as analysis, synthesis, and modeling. The following were conducted:

- Analysis of modern scientific sources from various fields of knowledge dedicated to the methodological principles for developing educational and psychological chatbots using AI technologies, the psychological and educational content of such chatbots, and issues of their implementation in various practical application fields;
- Synthesis of personal experience working in scientific and practical teams developing AI-based educational and psychological chatbots in Ukraine;
- Interpretation, identification of patterns, and comprehension of the obtained results.

V. Panok and A. Shevchenko clarified and defined the conceptual framework of the research and performed the final editing of the scientific article. M. Nazar formulated the research purpose, objectives, and conclusions, and analyzed the latest sources on the research topic. D. Starkov substantiated and refined the application of technologies and approaches to psychological counseling in the chatbot's work. D. Meshcheriakov highlighted the significance of the issue of a chatbot (AI) subjectness, performed editing of the scientific article, compiled the literature list, and translated the text into English. A. Shevtsov analyzed the impact of using educational and psychological chatbots on mental health.

4. RESULTS OF RESEARCH

The use of AI-based chatbots with counseling and guidance functions has the potential to improve the effectiveness of the learning process for users, particularly in educational, psychological, and medical fields. These chatbots help users adhere to proposed strategies for changing thinking and behavior or following prescribed treatments. They are most commonly used to support patients with eating disorders and neurological conditions, aiming to influence patients' emotional states to change their behavior. Personalization and ease of use are considered the most beneficial interaction factors. Thus, even in non-psychological applications, educational and psychological influence is crucial for achieving set goals, making it an important component of the methodology for developing effective chatbots [19].

Modern user interfaces for automated healthcare systems can be improved by incorporating effective communication skills between patients and doctors. Relational behavior in the interface refers to the integration of key relational skills, such as empathy, social dialogue, and verbal/non-verbal immediacy, by embedding communication strategies and social interaction cues into a digital system to foster a stronger user-system relationship and enhance user engagement. Comparing 33 participants using the relational system daily with 27 using a non-relational system showed that relational behavior in the interface significantly enhances the working alliance and the desire to continue using the system. Relational behavior in the interface refers to the implementation of communication strategies and social interaction cues, such as empathy, social dialogue, and immediacy, within a digital system to foster a stronger user-system relationship and enhance user engagement [20].

Internet and mobile interventions (IMIs) have long attracted researchers' attention. One of the most innovative forms is chatbot-based interventions, which can significantly expand access to psychological help and education. Although still partly experimental and mostly in pilot studies, chatbots show promise. It's crucial to address the effectiveness, stability, and safety of educational-psychological chatbots and continue their testing [21], [22].

AI-based chatbots capable of conversing with users can reduce costs in service and healthcare sectors by improving access to medical services and knowledge. Chatbots are being developed to diagnose patients through voice or text conversations, providing personalized diagnoses with about 65% accuracy based on patient information and medical records. This efficiency suggests that advanced AI medical products can play a significant role in healthcare, support, and patient education [23], [24].

Chatbots are used in diagnosing mental disorders and psychological dysfunctions. One study focused on a chatbot for detecting achluophobia (fear of the dark) and autism in children. The chatbot assesses disorder severity by analyzing user text queries using natural language processing (NLP) and decision trees. Named Aquabot, it has an 88% diagnostic accuracy compared to doctors, making it a valuable tool for psychologists by optimizing diagnosis and saving time [25].

Due to the global shortage of mental health professionals, AI-based chatbots have become essential for supporting people with mental disorders. A systematic review of 12 studies found that chatbots can reduce symptoms of depression, anxiety, stress, and acrophobia. However, there is insufficient data on their impact on subjective well-being, and results on anxiety and emotional state were mixed. Only two studies assessed safety, finding no harmful effects. Chatbots show potential for improving mental health, but further research is needed to confirm their clinical significance, safety, and effectiveness [26], [27].

The impact of computerized and internet-based programs for treating depression was summarized, and factors influencing their effectiveness were identified. Special attention was given to the methodological role of personal support during computerized treatment. After a thorough analysis of the existing literature, 12 studies with a total of 2446 participants were included in the review. It was found that internet programs and other computerized treatment methods have significant potential as effective means of therapy for depression, especially with specialist support [28].

The cost-effectiveness of a computerized version of CBT was evaluated compared to traditional methods. Participants with symptoms of depression or anxiety were randomly assigned to two groups: one received traditional treatment (n=128), and the other received computerized CBT (n=146). Cost and depression metrics were assessed using the net benefit method. Over 8 months, the costs of computerized CBT were £40 higher (90% CI: -£28 to £148), but the loss of earnings in this group was £407 lower (90% CI: £196 to £586). Computerized CBT is identified as a likely cost-effective alternative to traditional psychotherapy methods for depression and anxiety [29].

The rapid development of innovative educational technologies offers vast opportunities for enhancing both learning and teaching. Such digital technologies include mobile applications, social media, virtual and augmented reality, online collaboration tools, and AI. Students must be aware of the capabilities these tools provide for autonomous learning, which were unavailable to previous generations. There is a pressing need for research that demonstrates how technologies, particularly AI, can facilitate the acquisition of lifelong learning skills [30].

The introduction of AI technologies creates conditions for their integration into various aspects of the educational process. The use of chatbot technology is becoming increasingly popular in education, as it has the potential to deliver quick and personalized services to both educational institution staff and students. Researchers provide a systematic review of prior studies on the use of chatbots in education, employing a methodical approach to analyze 53 academic papers from well-known digital databases. It is noted, in particular, that chatbots are a useful innovation capable of enhancing not only the learning process but also other facets of education. Among the key benefits identified in the reviewed articles are content integration, rapid access, increased motivation and engagement, support for multi-user collaboration, and instant assistance. Additionally, chatbots contribute to personalized learning [31].

The advancement of AI in recent years has fostered the proliferation of chatbot technology in the domain of lifelong learning. The effectiveness of their use was summarized, with an assessment conducted on the impact of learning through chatbots on various components of the educational process. A meta-analysis of 32 empirical studies involving a total of 2,201 participants, published between 2010 and 2022, was carried out. The results

indicated that chatbot technology has a medium to high impact on overall learning outcomes, regardless of variables such as intervention duration, chatbot roles, and learning content. Specifically, chatbots significantly enhance explicit reasoning, learning achievements, knowledge retention, and interest in learning, though they have a minor impact on critical thinking development, learner engagement, and motivation. Further research may focus on expanding the use of chatbots, considering other educational components [32].

Among the most prominent AI-driven systems that support learning are conversational agents. Their integration into e-learning systems enables responses to be tailored to the individual needs of each student, allowing them to learn at their own pace. An experimental deployment of an educational chatbot for teaching middle school students the Logo programming language was presented. A total of 109 students participated in the study, divided into three groups: a control group that followed traditional teaching methods and two experimental groups that utilized digital content and chatbot-assisted instruction. Preliminary results suggest that using chatbots can significantly improve students' learning experience, enabling them to study with less stress, save time, and remain motivated. Moreover, integrating these AI systems into smart classrooms creates a supportive environment, fosters better interaction with educational materials, and facilitates higher academic achievement [33].

Another study describes how an AI-powered chatbot personalizes students' learning experience on a higher education platform. The chatbot verifies students' responses and provides recommendations to enhance their study skills. Additionally, it aids in developing critical thinking and adapting to new educational process requirements. Researchers propose an AI-based learning system designed to increase interactivity in a nonlinear environment, with the primary goal of improving students' learning abilities in specific disciplines through conceptual mapping. The effectiveness of mapping was tested based on probability distribution analysis, with the resulting probability curve evaluating students' understanding of the topic. The modeling results were analyzed using parameters such as evaluation coefficient, student feedback, reciprocity, time analysis, expected outcomes, and learning activity, which revealed the advantages of interactive learning over traditional approaches [34].

There are over 400 smoking cessation mobile apps worldwide, downloaded about 780,000 times monthly. However, the impact of specific app features on smoking cessation success and user interaction remains unexplored. A study analyzed the 10 most frequently used features of the SmartQuit app and their links to successful smoking cessation. The study involved 76 participants using SmartQuit for 8 weeks, combining Acceptance and Commitment Therapy (ACT) with traditional CBT. Feature usage was tracked automatically, and effectiveness was assessed 60 days post-study via 30-day smoking abstinence monitoring. The most popular features were quit plan, tracking, progress monitoring, and information sharing. Reviewing the quit plan ($p = 0.03$) and tracking craving management practice ($p = 0.03$) showed a promising link to smoking cessation. ACT skill practice tracking, though less common ($n = 43$), was also linked to cessation success ($p = 0.01$). These findings suggest that integrating AI communication and assistance features into educational-psychological mobile apps is important and applicable in other contexts [35] [36].

The potential of chatbots to reduce alcohol consumption and overcome alcohol dependence is a significant research area. Researchers studied how different components of the Drink Less mobile app affect alcohol consumption reduction. Participants with excessive alcohol use (AUDIT score ≥ 8) tested app modules in a 25-factor study. Modules included: self-monitoring with feedback, action planning, changing self-identity, normative assessment, and relearning cognitive biases. The main indicator was the weekly volume of alcohol consumption. In addition, the total AUDIT score, frequency of use, and usability of the program were evaluated. A total of 672 people participated in the study. Combinations of extended normative assessment and cognitive bias retraining modules, as well as self-monitoring with feedback and

action planning, were found to have a positive effect on weekly alcohol consumption over 4 weeks (F = 4.68, p = 0.03) and total AUDIT score (F = 5.82, p = 0.02). The corresponding functions (specified as combinations of advanced modules) have an undeniable methodological value for the development of chatbots [37].

One clinical study has proven the effectiveness of an educational and psychological chatbot for eating disorders. A chatbot developed based on the StudentBodies© program and applied CBT showed a significant decline in weight and body shape concerns in subjects after 3 months (d = −0.20; p =.03) and 6 months (d = −0.19; p =. 04) compared with the control group. There were no changes in the level of internalization of the thinness ideal. The intervention significantly reduced overall eating disorder psychopathology at 3 months (d = −0.29; p = .003), but not at 6 months. A chatbot is effective in reducing women's anxiety about weight and body shape within 6 months and in reducing the likelihood of the onset of eating disorders [38].

Another study investigated the educational capabilities and efficiency of a chatbot-like mobile app in increasing physical activity. The intervention program followed the protocol for metabolic resistance training. The data collection strategy included sensors to create models that predict real-time user readiness for physical activity. This allowed for better tailoring of the intervention by identifying moments for stimulating messages. The results are important for the development of mHealth interventions, helping to make decisions about program components and adaptations to achieve better outcomes at lower costs [39].

Implementation of an educational chatbot SHIHbot on Facebook for sexual health and HIV/AIDS awareness is a research interest. It answers questions by itself with the support of a database of answers from trusted medical sources. To select questions and choose answers, learned from real questions, NPCEditor platform is used. SHIHbot is the first searchable chatbot on one of the major social networks and has a colossal role in raising health awareness [40].

Peculiarities of teenagers' use of educational and psychological chatbots based on AI technologies constitute another relevant area of research. One study used an intelligent communication agent (chatbot) to answer questions about sex, drugs, and alcohol and compared its effectiveness to traditional helplines and search engines. 929 teenagers (64% girls, average age 15) with different social backgrounds took part in the study. Chatbot usage was carefully monitored. To evaluate its effectiveness, a web banquet was used, which took into account such aspects as anonymity, ease of use, quality and quantity of information, speed of responses, and general interest. The frequency of use was high, the average duration was about 4 minutes, and the overall rating of the chatbot significantly exceeded the ratings of information lines and search engines. The results showed that the chatbot became a useful tool not only for teenagers with experience in the field of sex, drugs, or alcohol but also for a wide range of high school students, helping them to make more informed decisions. Careful monitoring of the chatbot's work, in particular the processing of various topics of requests, the content of communication, and the frequency and duration of interactions, is an important methodological component of its development and support [41].

Chatbots in education and psychology, like all AI tools capable of simulating human behavior by text or voice, are handy assistants in many fields, including medicine. Already, the effectiveness of the Vik chatbot has been proven in supporting patients with breast cancer. The chatbot allowed individualized advice to be provided through text messaging. The number of patients in the study was 4,737. The mean volume for the message exchange was 132,970 messages/month. Greater frequency of chatbot use correlated positively with better compliance with treatment regimens. The patients were consistently satisfied, with the general satisfaction rate constituting 93.95%. More than 88% of users reported that Vik helped them in supporting and managing their treatment [42].

The methodology for developing chatbots should consider the psychological aspects of user behavior and thinking. Such chatbots can quickly convey important information, support healthy habits, and reduce psychological stress. However, there are risks, such as the spread of misinformation and limited data on their effectiveness. Collaboration between medical professionals, tech companies, researchers, and governments is needed for better preparation for future pandemics and mental health protection [43].

AI-based chatbots simulate interaction with a new range of opportunities and important social and ethical issues. Minimally, ethical standards for these platforms on privacy, effectiveness, and safety are brought into focus by researchers. One model was proposed to evaluate several platforms like Woebot, Joy, and Wysa. Responsible use of digital technologies for psychological well-being should be urged considering user comfort and safety [44].

The development of mobile applications for the prevention and protection of users' psychological well-being, particularly AI-based educational and psychological chatbots, is progressing. It was found that there are no unified standards or methodologies for their evidence-based development. A systematic review showed a lack of reliable evidence of their effectiveness among hundreds of available applications. 16 methodological recommendations were formulated, each supported by evidence and advice for integration into app development: based on CBT; covers anxiety and low mood; designed for non-clinical groups; automated customization; reporting on thoughts, feelings, and behavior (to help progress tracking); recommending actions for cognitive and behavioral change; psychoeducation; real-time interaction; habit formation for chatbot use; encouragement for offline activities; gamification and intrinsic motivation; the log of previous application use; reminders for engagement; simple and intuitive interface; links to crisis support services; experimental studies for chatbots effectiveness. Special attention is given to developing apps considering behavioral principles and interactive structures that motivate users to engage actively with the app [45].

In practice, the usual problem of chatbots is the low adherence of users to recommendations. One of the possible solutions is the development of psychotherapeutic support simulated by their functionalities. The authors investigated the efficiency of a mobile app that provides users with positive psychology and CBT strategies through Shim-an automated chatbot-in individuals without clinical diagnoses. Results indicated that active users (n = 13) of the chatbot presented significant enhancements in psychological well-being, including reduced perceived stress, compared with controls, with effects small to large in magnitude (Cohen's d range from 0.14 to 1.06) [46].

Another study investigated the educational and psychological effects of chatbots on improving awareness and emotional regulation in conditions of stress. The research studied the effects that a 3-week exposure to the ELME chatbot had on reducing stress levels while simultaneously improving several health-related indicators. It considered perceived stress as the key effectiveness outcome, while the secondary effectiveness outcomes included mindfulness, interoception, subjective well-being, and emotional self-regulation. There were no significant differences between perceived and momentary levels of stress. However, the intervention group had significantly improved mindfulness and improved emotional reappraisal; the level of emotional suppression did not change [47].

In the sphere of psychological support, those "social" chatbots that can establish emotional contact with a user are especially needed and helpful. Within the given research, the intelligent social chatbot was developed aimed at helping students cope with stress and preventing depression. The chatbot analyzes message texts to identify emotions such as joy, shame, anger, disgust, sadness, guilt, and fear and diagnoses the user's psychological state. It uses three deep learning methods: CNN, RNN, and HAN. The key focus of this chatbot is to minimize negative mood states while supporting optimistic thinking [48].

AI chatbots are important in maintaining mental health and acting as a kind of "virtual consultant". The following research has evaluated the usability of the iHelpr chatbot, which provides tools to support self-management of self-esteem, stress, anxiety, depression, and sleep. Usability was measured using a questionnaire and the SUS (System Usability Scale). The comfort of communication with iHelpr was relatively good, but several aspects need improvement-first of, including error handling and AI functions [49].

AI technologies in educational and psychological chatbots simplify the organization of the learning process and acquiring new knowledge. They will turn out to be a convenient tool for modern learning, changing one's way of thinking and activity aspects in psychology, medicine, education, and other fields. In the modern educational environment, a teacher needs means of optimizing their work. Chatbots can help create interactive tasks and assess learning achievements, track the progress of students, and provide individual support [50],[51].

As AI technologies continue to develop, educational and psychological chatbots, like chatbots in general, are becoming increasingly autonomous. This raises questions about their subjectness: both psychological and legal. It is evident that the effectiveness of AI in educational and consultative-psychological fields already depends on its conditional independence in decision-making. There are reasons to believe that the effectiveness of AI, particularly in user communication, will increase with its subjectness (and vice versa), which over time includes, among other things, the emergence of a digital "analogue" of consciousness. This, in the future, will allow for the design and creation of artificial subjects in fields such as psychological development, education, medicine, and more [52], [53].

It should be noted that addressing psychological problems exacerbated by the war in Ukraine requires the active implementation of modern educational and psychological approaches. The increase in anxiety, stress, depression, PTSD, and other psychological disorders among millions of people has created a tremendous burden on existing psychological support resources. Traditional formats of in-person counseling and telephone psychological support can no longer meet the full spectrum of citizens' needs for psychological support, necessitating the implementation of innovative technologies such as chatbots, which can provide psychological support around the clock and free of charge. Based on the analysis of current scientific sources, the latest conceptual approaches to chatbot development methodology, and the experience of developing the "Psychologist" chatbot by a working group created by the order of April 4, 2024, No. 25 o.d. ("On the creation of a working group for the implementation of the 'Psychologist' chatbot project") by the President of the NAES of Ukraine, V.G. Kremen, the main methodological principles for developing educational and psychological chatbots using AI technologies were identified [54].

The development of such chatbots should begin with a clear definition of their goals and objectives. For example, the main goal may be to enhance users' competence in reducing anxiety and stress, developing resilience and self-control, and directing some users (if necessary) to specialized professionals. The next stage of development includes an in-depth study of the psychological problems faced by citizens during the war, analysis of scientific literature, interviews with experts, and data collection, which ultimately allows for the creation of content that is maximally relevant and useful for users. If necessary, psychological training of user models from target audiences can be conducted. The development of the chatbot should consider, on the one hand, the integration of concise diagnostic tools for collecting objective information about users' psychological state (e.g., methods such as HADS, or IES-R), and on the other hand, the most modern scientifically-based methods of psychological help/self-help, such as motivational interviewing, behavioral activation, mindfulness methods, psychophysiological regulation, cognitive restructuring, etc. These methods must be adapted for simple and safe use, even without a psychologist's supervision. The function of simulating psychological (emotional) support for users should be ensured. Equally important are the ethical

principles of development, including the protection of users' life, health, and well-being, ensuring their confidentiality, and the accuracy and objectivity of the information provided. The next stage involves testing, which includes functionality checks, feedback collection, and necessary adjustments [54].

The algorithm for developing an educational and psychological chatbot with AI technologies is included in the basic methodological principles of development, ensuring not only the achievement of set goals but also the relevance and effectiveness of the software product in the long term. The chatbot does not replace a qualified psychologist but supports the identification and achievement of goals, provides initial self-help, and directs users to specialists if necessary. Close collaboration between programmers and psychologists in the design, development, implementation, and optimization of the chatbot ensures a productive context in which the chatbot promotes user self-learning, provides consultative assistance, and adheres to ethical principles [54].

5. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

As a result of the research, it was found that the use of educational and psychological chatbots based on AI technologies opens up new opportunities for improving the availability of psychological support and developing educational opportunities. The effectiveness of such chatbots consists of conducting a dialogue with users, providing information resources for psychological self-help and self-education, creating a resource context for targeting users and organizing the process of achieving goals. The constant availability of chatbots and the personalization function (adjusting the offered content to the specifics of specific users) are of particular value, which makes chatbots an almost universal tool of psychological support and training for wide audiences.

Based on the conducted research, empirical and conceptual principles were identified for the selection of the following methodological bases for the development of educational and psychological chatbots that use AI technologies:

- empirical validity and evaluation of effectiveness. It should be based on empirical, scientifically based data confirming their effectiveness for different contexts, target audiences, and different approaches to psychological (self) help. Effectiveness tracking should be done by evaluating the impact of using a chatbot on the psychological states, characteristics, thinking, and activities of users, including the analysis of the long-term consequences of the interaction;
- personalization of work with users. Chatbots should be prepared for flexible adaptation of their functions, educational and psychological content, and communication to the individual characteristics of users, including their goals, psychological needs, emotional state, features of thinking, etc. Based on the integration of AI technologies and natural language processing, greater opportunities are opened to create individualized recommendations and psychological strategies for users;
- compliance with ethical principles, such as protecting the safety of life, health, and well-being of users, ensuring their confidentiality, as well as the accuracy and objectivity of the information offered. Psychological (self) help methods must have a researched evidence base and all personal information must be securely stored and deleted promptly;
- availability and scalability. Educational and psychological chatbots should be accessible to a wide range of users, including vulnerable groups of the population, in particular, children, adolescents, the elderly, users with special needs, etc. Technologies for the development of chatbots must be prepared for scaling/adaptation of the functioning of

chatbots for their use with representatives of different social audiences, different cultural and linguistic environments;

- interactivity. By personalizing work with users, adjusting its activity according to their responses and requests, and applying various motivational tools (may include goal setting, planning, reminders, exercises to support motivation and attention, etc.), the chatbot should provide dynamic two-way interaction with users, support their activity, initiative, attentiveness, promoting more effective learning to achieve the set goals;
- interdisciplinary approach. The development of educational and psychological chatbots usually requires close cooperation of specialists of various specialties, which may include IT specialists, psychologists, teachers, medical professionals, and others;
- integration of new technologies and approaches. The development of educational and psychological chatbots may contain technologies of deep learning, analysis of emotions, detection of false and dubious statements of users, etc. Thanks to this, chatbots can more accurately assess the emotional state of users, their frankness and congruence in communication, thanks to which they can interact with them more effectively;
- testing. The development of chatbots requires testing their work with users of one or more target audiences, checking functionality in different contexts (for inter-contextual chatbots), and carefully evaluating the possibilities of ensuring the achievement of the given educational and psychological goals. The obtained results are used to refine and optimize chatbots, and the process itself can be repeated if necessary.

The specified methodological principles contribute to the creation of effective and safe educational and psychological chatbots capable of providing users with high-quality psychological support and productively contributing to their educational process.

The general algorithm for developing an educational and psychological chatbot based on AI technologies includes the following components:

1. determination of the specified goal (purpose) of the chatbot operation;
2. description of the tasks, the performance of which is necessary to achieve the goal;
3. identification of psychological characteristics of potential chatbot users / preparation of their models (if necessary), which may include empirical data collection, analysis of scientific literature, expert assessments, etc.;
4. implementation of effective diagnostic tools;
5. implementation of appropriate methods of psychological (self) help and training;
6. providing the function of simulating psychological support for users;
7. compliance with the ethical principles of protecting the life, health, and well-being of users, their confidentiality, accuracy, and objectivity of the information provided;
8. testing/improving the chatbot, which includes checking its functionality, collecting user feedback, and making the necessary changes.

The further development and societal implementation of educational and psychological chatbots with AI technologies, developed based on clear and well-founded methodological principles, open up significant prospects for improving the quality of life and enhancing the psychological well-being of users (especially in Ukraine during the large-scale war with the aggressor and in the post-war period). However, they already require in-depth scientific research and interdisciplinary support, primarily in the areas of adhering to ethical principles of safe chatbot use, protecting confidential information, and ensuring the objectivity of the information provided.

Further research on the methodology for developing educational and psychological chatbots should focus on several key aspects, such as the assessment of the effectiveness and safety; in-depth study of interaction personalization; exploration of AI's psychological support capabilities; investigation of chatbot subjectness (psychological, legal, etc.); further research and definition of ethical principles ensuring responsible and safe use of AI technologies; study

of the standardization features of their development; identification of effective communication formats; research on the long-term effects of psychological impact; clarification of the implementation features of psychological self-help and self-learning methods in mobile applications, and the development of a clear methodology for this process.

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МЕТОДОЛОГІЧНІ ЗАСАДИ РОЗРОБЛЕННЯ НАВЧАЛЬНО-ПСИХОЛОГІЧНОГО ЧАТ-БОТА

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Анотація. Метою дослідження є опис методології розробки навчально-психологічних чат-ботів, що охоплює її ключові принципи, особливості та етапи. Навчально-психологічні чат-боти визначаються як такі, що забезпечують умови для надання психологічної (само)допомоги та навчання користувачів ефективніших стратегій мислення й діяльності, сприяючи опануванню нових знань, умінь і навичок. Серед основних завдань дослідження – аналіз сучасних наукових джерел щодо з'ясування методологічних підходів до розробки навчально-психологічних чат-ботів, виявлення їх психологічних і навчальних функцій, вивчення аспектів впровадження у різні практичні сфери. Крім того, узагальнений власний досвід участі в українських науково-практичних командах, що займаються розробкою відповідних рішень, а також проведена інтерпретація, систематизація та осмислення отриманих результатів. Внаслідок проведеного дослідження встановлені методологічні засади розробки навчально-психологічних чат-ботів, що застосовують технології штучного

інтелекту. До таких засад належать емпірична обґрунтованість та оцінка ефективності, персоналізація роботи з користувачами, дотримання етичних принципів (захист безпеки життя, здоров'я та добробуту користувачів, забезпечення їх конфіденційності, забезпечення точності й об'єктивності пропонованої інформації), доступність і масштабованість, інтерактивність, міждисциплінарний підхід, інтеграція нових технологій і підходів, тестування. Підготовлений загальний алгоритм розробки навчально-психологічних чат-ботів, що складається з 8 етапів. Науково обґрунтована розробка та суспільне впровадження навчально-психологічних чат-ботів, що застосовують технології штучного інтелекту, відкриває значний потенціал для покращення якості життя й зміцнення психологічного добробуту користувачів. Така можливість є особливо актуальною для України в умовах повномасштабної війни та під час повоєнного відновлення. Пріоритетного значення набувають поглиблені наукові дослідження та міждисциплінарна підтримка в питаннях розкриття й впровадження етичних принципів функціонування чат-ботів: безпеки користування, захисту приватності, забезпечення певності та об'єктивності інформації, що надається, тощо.

Ключові слова: навчально-психологічний чат-бот; методологія розробки чат-ботів; технологія чат-ботів у навчанні; технології штучного інтелекту; дистанційне навчання; дистанційна психологічна допомога.

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