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Chatbots as a Component of the Digital Learning Environment to Support STEM Education

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1 Introduction

The development of the industry's intellectual human capital during wartime and in the post-war reconstruction period requires consideration of global trends. In the context of Industry 4.0, digital skills and educational and professional qualifications in STEM fields are in particularly high demand [1–2]. STEM specialists play a key role for Ukraine during wartime, contributing to the development of innovations in military technology, medicine and healthcare, stimulating scientific research and ensuring the strengthening of national resilience [3–4]. The Second World War marked the starting point for the emergence of STEM. At that time, scientists and the military joined forces to develop innovative technologies that helped defeat the enemy [5], However, STEM was not introduced into education until much later, at the end of the 20th century [6].

An analysis of recent research indicates that chatbots and artificial intelligence technologies are playing an increasingly significant role in the educational process [7]. It has been confirmed that the integration of artificial intelligence tools, in particular ChatGPT, into STEM education contributes to the development of cognitive skills, critical thinking, the ability to analyse information and make informed decisions, which are important components of modern professional training [8-9]. At the same time, chatbots can perform not only an educational but also a socio-psychological function, providing immediate support to students in conditions of heightened stress and uncertainty, particularly during a state of emergency [10].

The aim of this study is to demonstrate the benefits of using a chatbot as part of a digital learning environment to support STEM education and career guidance for students, as well as to develop and test the STEM_lntu_bot chatbot.

2 Methods and results

The first stage involved a study of how students at Lutsk National Technical University understand the concept of STEM. The target group comprised first- to third-year students (76 respondents) specialising in Vocational Education (Digital Technologies) and Secondary Education (Computer Science) at the Faculty of Digital, Educational and Social Technologies, as these fields are directly linked to the development of technology and education. Students on these courses need to understand the basics of mathematics, algorithms and programming, as well as the engineering principles

underpinning the creation of technology. In the future, they will either teach others or create innovative solutions. Without a knowledge of STEM, they will find it difficult to prepare competitive graduates or create technological products. The survey results confirmed the value of developing a chatbot to support STEM education and career guidance for students. Although 36.8% of respondents are well acquainted with the concept of STEM, almost two-thirds of those surveyed either have only a partial understanding of this field (28.9%) or do not understand its essence at all, even though they have heard of it (28.9%). The results indicate an information gap between the popularity of the STEM concept and the level of awareness among students.

The survey also revealed that students predominantly associate STEM solely with specific disciplines, primarily mathematics, physics and computer science, whilst the interdisciplinary nature of this approach is not sufficiently recognised. This points to a need for an accessible tool that would provide structured information about STEM fields, their components, opportunities for professional development and employment prospects.

Today's young people are used to gadgets and technology, so learning via a bot feels natural and comfortable to them. That is why the next step in our project was to develop the 'STEM_lntu_bot' information chatbot. The SendPulse platform and the Telegram BotFather service were used to create the chatbot. In the first stage, a new Telegram bot was created and a unique API token was obtained to connect it to the SendPulse platform. The bot was then integrated with the chatbot management system and its main operating parameters were configured. Next, the chatbot's structure was developed, including a start menu, thematic sections and user interaction scenarios. For each section, information messages were prepared, navigation buttons were configured, along with transitions between blocks and links to additional resources. Functions were also implemented to automatically provide information on STEM education, STEM careers and the university's educational opportunities.

Once development was complete, the chatbot was tested to ensure that all scenarios, navigation elements and transitions between sections were functioning correctly. Following the test results, identified shortcomings were rectified and the structure of user interaction was optimised. The developed chatbot was implemented as part of a digital educational environment to provide information, support STEM education and offer career guidance to students.

3 Conclusion

Thus, the creation of the STEM_lntu_bot chatbot was a response to the identified need for a prompt and convenient source of information on STEM education. The chatbot is designed to raise awareness among students, provide access to up-to-date information on STEM disciplines and professions, and promote career self-determination and the popularisation of STEM fields among young people.

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