Развитие цифровой грамотности педагогов при проектировании сюжетов текстовых игр инструментами нейросетей в условиях дополнительного профессионального образования

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АННОТАЦИЯ

Проблема и цель. Цифровая грамотность педагога предполагает наличие у специалиста сформированной системы базовых знаний, навыков и установок в сфере использования цифровых технологий для поиска информации, подготовки дидактических материалов, проектирования электронных ресурсов, персонализации обучения. Для обеспечения соответствующей подготовки педагогических кадров, развития необходимых качеств личности в дополнительном профессиональном образовании активно применяются интерактивные сервисы, средства геймификации, нейросети и т. д. *Цель исследования* – выявить особенности развития цифровой грамотности педагогов при проектировании сюжетов текстовых игр инструментами нейросетей в условиях дополнительного профессионального образования.

Методы исследования. Индикаторы цифровой грамотности педагога: информационная, компьютерная, коммуникативная, медиаграмотность и отношение к технологиям. База эксперимента – Институт развития образования Кировской области (Российская Федерация). К исследованию привлечено 350 слушателей курсов. Программные средства: диалоговые тренажёры, нейросети для генерации текстов (NiceBot, НейроТекстер); веб-приложения (Порфирьевич, GamioAI, Twine). Для оценки уровня цифровой грамотности применяются материалы анкеты Национального агентства финансовых исследований и вопросы авторского теста. Метод статистической обработки – критерий χ^2-Пирсона.

Результаты. Описана система работы слушателей экспериментальной группы по проектированию сюжетов текстовых игр инструментами нейросетей в рамках курса «Цифровая образовательная среда: новые компетенции педагога». Особенность предлагаемого варианта взаимодействия – переход от практической деятельности с диалоговыми тренажёрами, имитирующими автоматическую генерацию текста, к сочинению сюжетов при помощи игровых приложений на базе искусственного интеллекта. Выявлены статистически достоверные различия в качественных изменениях, произошедших в педагогической системе ($\chi^2 = 8{,}204$; $p < 0{,}05$).

Заключение. Сформулированы особенности деятельности, которые обеспечивают дополнительные условия для развития цифровой грамотности педагогов: новый опыт по применению нейросетей и сервисов геймификации, использование цифровых инструментов для моделирования игрового пространства, изменение ролей участников информационного взаимодействия, адаптивный процесс разработки, и т. п.

КЛЮЧЕВЫЕ СЛОВА

игровое приложение дидактического назначения, диалоговый тренажёр, генерация текста, информационное взаимодействие, приложение на базе искусственного интеллекта

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Development of digital literacy of teachers when designing plots of text games using neural network tools in the context of additional professional education

E. V. SOBOLEVA, T. N. SUVOROVA, T. V. MASHAROVA, V. V. UTEMOV

ABSTRACT

The problem and the aim of the study. Digital literacy of the teacher implies that a specialist has a formed system of basic knowledge, skills and attitudes in the field of using digital technologies to search for information, prepare didactic materials, design electronic resources, and personalize learning. Interactive services, gamification tools, neural networks, etc. are actively used to ensure appropriate training and develop the necessary personal qualities of teaching staff in additional professional education. *The aim of the study* is to identify the features of the development of digital literacy of teachers when designing plots for text games using neural network tools in the context of additional professional education.

Research methods. Indicators of digital literacy of the teacher: information, computer, communication, media literacy and attitude to technology. The experiment was conducted in the Institute for Education Development of the Kirov Region (Russian Federation). The study involved 350 participants. Software: dialogue simulators, neural networks for text generation (NiceBot, NeuroTexter); web applications (Porfiryevich, GamioAI, Twine). The digital literacy level was assessed using the questionnaire materials of the National Agency for Financial Research and the questions of the author's test. In statistical data processing, the Pearson's chi-squared test was used.

Results. The article describes the system of work with students of the experimental group on designing plots of text games using neural network tools within the framework of the course "Digital educational environment: new competences of the teacher". The peculiarity of the proposed interaction option is the transition from practical activities with dialogue simulators which simulate automatic text generation to writing plots using game applications based on artificial intelligence. Statistically significant differences in the qualitative changes that occurred in the pedagogical system were revealed ($\chi^2 = 8.204$, $p < 0.05$).

Conclusion. The features of the activity that provide additional conditions for the development of digital literacy of teachers are formulated: new experience in the use of neural networks and gamification services, the use of digital tools for modeling an original game space, changing the roles of participants in information interaction, an adaptive development process, etc.

KEYWORDS

didactic gaming application, dialogue simulator, text generation, information interaction, application based on artificial intelligence

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INTRODUCTION

In the materials of OECD Digital Economy Outlook 2024, international analysts consider a number of issues, including privacy in immersive technologies (e.g. virtual reality); the future of wireless communications and the growth of negative online behavior that affects the mental health of participants in online interactions [1]. This list of components of the digital landscape assumes, according to the conclusions of J. Füller et al., the presence of a certain level of the following competences in members of modern society [2]: knowledge of the capabilities of the Internet, the ability to quickly search for information, the ability to understand the interface of a new gadget, the ability to create a news feed, etc.

The UNESCO Incheon Declaration outlines guidelines concerning the development of functional literacy and numeracy skills [3]. Experts from the National Agency for Financial Research (hereinafter referred to as NAFI) determine that in developed countries the fact of employment becomes impossible without the proper level of digital literacy, including the teacher. Not to mention the fact that, according to the authors' conclusions, digital literacy is the foundation for the development of professional ICT competences [4].

Analysts from the Organization for Economic Cooperation and Development (hereinafter referred to as OECD) note the following fact: in order the benefits of AI become more widespread, the rate of distribution must be maintained at all levels of the education system [1]. According to the conclusions of E. A. Mamaeva et al., the development of digital competences in the coming years will be determined by the degree of popularization of the latest technologies in society; holding events dedicated to cyber literacy, digital security; and the development of digital creative industries [5]. Their ideas are supported by E. V. Soboleva et al., who note that the use of innovative tools in the training of teachers will provide additional conditions for the formation of digital literacy of sought-after specialists of the future. The authors propose using gamification resources for these purposes (development of game mechanics, implementation of the game world in a software environment) [6].

A special role in terms of developing professional digital competences is given to existing teachers. H. H. R. Martins et al. highlight the following factors leading to changes in the role of the teacher [7]: transformation of the content of teachers' activities; mastering new forms and technologies; instilling responsibility for preparing a person for life in the conditions of an uncertain future; the need to promptly respond to the challenges of the time; organization of joint activities and project work. The scientists conclude that it is necessary to pay close attention to: changing the systems and programs for training teachers; increasing the need for continuous self-education of digital school mentors in the new conditions. According to G. N. Tuguskina et al., additional professional education (hereinafter – APE) can be a system, which includes the requirements of the external environment, personal factors of motivation for learning, learning outcomes and options for their application by individuals in order to maintain professional status and expand opportunities for increasing competitiveness in the labor market [8]. So, let's formulate the key factors:

1) the need to solve new problems of ensuring digital security, the emergence of a large number of working tools based on AI, the development of creative industries determine the emergence of high requirements for the level of digital literacy of the professional of the future. Like a person of any other profession, the teacher must have digital literacy;

2) gamification technology, artificial intelligence open up new opportunities and formats of activities for the teacher in terms of the formation of high-demand competences of members of the digital society, including self-education;

3) the expansion of teachers' ideas about the possibilities of new technologies can be realized in the context of APE.

However, the most actively developing and methodically developed aspect at the moment is the implementation of gamification technology, AR and VR, artificial intelligence (in particular, neural networks) when training of future teachers. The following hypothesis is put forward in the work: the use of generative services in the system of APE of teachers will contribute to the development of their digital literacy if neural network tools are actively used in designing plots of text games for didactic purposes.

The aim of the work is to identify and substantiate the features of the development of digital literacy of teachers when designing plots of text games using neural network tools in the context of additional professional education.

Research objectives:

1) to clarify the content and to identify aspects (indicators) of digital literacy of teachers;

2) to determine the capabilities of generative neural networks, the use of which will provide resources for the development of digital literacy of teachers in the context of additional professional education;

2) to identify and justify pedagogical conditions that contribute to the development of digital literacy of teachers when designing plots for text games for didactic purposes;

3) to experimentally test the effectiveness of the proposed system of work in the context of additional professional education.

MATERIALS AND METHODS

In the presented study, digital literacy of the teacher is understood as a system of basic knowledge, skills and attitudes in the field of everyday use of digital technologies. It is the same system as that of specialists in other professions. Aspects (indicators) of digital literacy of the teacher: information, computer, communicative literacy, media literacy and attitude to technology. Each of them is assessed in three manifestations: cognitive (knowledge), technical (skills) and ethical (attitudes). Designing plots of text games using neural network resources to develop digital literacy of teachers was implemented on the basis of the Kirov Regional State Educational Autonomous Institution of Additional Professional Education – "Institute for Education Development of the Kirov Region" (hereinafter – IED KR) with the support of technical specialists of the Department of Digital Technologies in Education. Experimental work was organized within the framework of extra-budgetary advanced training courses: "Digital educational environment: new competences of the teacher"; "Organization of a modern lesson using digital content".

Holding form – offline. Listeners – teaching staff of educational organizations of Kirov and the Kirov region in the amount of 350 people. Course duration – 596. Average age – 38 years of age. 64% are women and 36% are men. This feature of the sample is due to the specifics of the teaching profession. The largest group of listeners in terms of numbers are teachers of rural schools (43%), urban schools – 27% of all participants. Teachers of secondary vocational education – 20% of the participants. The rest are teachers of higher education. The following software tools were used to design plots for text games at different stages of work:

1) the simulator "Privet" from the "Robotlandia" course and its analogue "Skazka" from "Azbuka Robotlandia";

2) neural networks for writing texts: NiceBot (https://nicebot.ru/), NeuroTexter (https://neuro-texter.ru/);

3) applications for creating text adventures (stories, quests) with artificial intelligence: Porfiryevich (https://porfirevich.ru/), GamioAI (https://gamio.ru/);

4) Twine (https://twine.ru.uptodown.com/windows) is a free program for creating interactive literature.

Selection criteria: target audience; service functionality; a possibility to use the game plot in the educational process; technical difficulties of authorization or installation on a computer; a possibility to join the game of other users. The author's methodology for determining the level of digital literacy of teachers is based on survey materials developed by NAFI analysts. When assessing each of the 5 components (listed earlier), 3 questions were used in the original version from NAFI. During testing, each listener was asked to answer 15 dichotomous questions presented in the form of opposed pairs of statements describing (1) knowledge, (2) skills and (3) attitudes in relation to the five main

dimensions of the digital environment: (1) information (content), (2) computer technologies, (3) media, (4) communications, (5) innovation. All 15 indicators corresponding to the interview questions are assigned the same weighting factors.

For each of the five dimensions of digital literacy, teachers were offered six judgments (three correct and three incorrect). Total 6*5=30 judgments (15 pairs). An example of a dichotomous judgment: "I try to keep up with technological innovations, I follow trends in technology / I have little interest in trends and innovations in technology". For a correct answer in the author's methodology, 1 point was given. That is, for the first 5 blocks, the listener could get the maximum of 15 points. Additionally, the 6th block of questions about the use of generation services when writing texts for the plot of a didactic game was added. Examples of questions are in the "Research Results" section. We get 6*6 = 36 judgments (18 pairs). The assessment rules were the same as in the previous five blocks. The maximum value for the entire questionnaire is 18 points. So, the levels of digital literacy of teachers were determined by the following rule: "high" (from 15 to 18 points), "average" (from 8 to 14 points) and "low" (from 0 to 7 points). In statistical data processing, the Pearson's chi-squared test was used.

LITERATURE REVIEW

The first volume of OECD Digital Economy Outlook 2024 notes that the information and communication technology sector is a key driver of global growth [1]. The UNESCO Incheon Declaration notes the necessity to [3]: develop and/or implement national teacher policies and improve teacher training programmes to increase the supply of qualified and motivated teachers; improve national education policies and plans to promote access to equitable and quality care and education through a whole-system approach and promote lifelong learning.

G. I. Abdrakhmanova, S. A. Vasilkovsky, K. O. Vishnevsky, who are members of a group of scientists from the National Research University Higher School of Economics, when analyzing the essence of digital technologies and the possibilities of their application in the coordinates of the industrial landscape of Russia, formulate and substantiate the following provisions [9]: the ICT profile of a country is important for indicators of national sustainability; there are many different ICT profiles that can lead to high or low indicators of sustainability (social, economic or environmental) at the national level.

J. Füller et al. note that the end of the twentieth century was characterized by the transition of society to a post-industrial or information space. IT technologies are being introduced into almost all areas of society [2]. It is expected that the influence of AI (including neural networks) will be no less large-scale than the influence of the Internet and digital transformation. In addition, in the near future, a new generation of specialists who are accustomed to receiving information from digital channels will manage political, economic, business, and social sphere [10]. In this regard, the role and importance of the teacher as a mentor in the digital educational space is increasing. S. Khahro, Y. Javed note that the technological society of the future set the task for universities to improve their educational processes [11]. Especially in relation to how new technologies can help self-education and self-development. According to the authors' conclusions, teachers should have methods and tools that can make the educational process in the digital environment interactive and exciting. Teachers should be capable of information cooperation and professional motivation of others. According to the conclusions of D. Dancsa et al., students should have a choice in which tools they can use to acquire knowledge and demonstrate it in accordance with their interests and abilities. At the same time, the use of innovative technologies and digital tools should not only be exciting, effective and appropriate, but also form students' responsibility for the choice and use of a digital tool [12].

The UNESCO Regional Office for the Gulf States and Yemen, in collaboration with the Qatar National Committee, the Qatar Ministry of Education and Higher Education and the Media Institute, UNESCO Institute for Information Technologies in Education, organized a National Meeting on Media and Information Literacy in Doha. Participants, sharing experiences and best practices in the field of media and information literacy, put forward ideas such as [13]: improve understanding of the system of formation of this type of literacy, identify areas that need priority support, develop appropriate action plans; specific measures to counter the spread of online disinformation and hate speech; create a safe digital environment by means of innovative technologies (including artificial intelligence, gamification, mobile systems, etc.).

A. Glukhov, O. Kameneva, I. Solomina note that the transition to distance learning during the pandemic revealed a low level of digital literacy among teachers [14]. This factor, according to the authors, hinders the effective use of innovative online services for organizing the didactic process. Scientists focus on such circumstances as: insufficient development of criteria and indicators of digital literacy among teachers; lack of an appropriate monitoring system. A. Glukhov, O. Kameneva, I. Solomina also analyze approaches of foreign and Russian researchers to defining the content of the concept of digital literacy as a guideline for the digital transformation of the education system. Based on the self-assessment of teachers of the Siberian Federal District, the authors identify deficits in their digital training for organizing distance learning.

Digital literacy, according to the conclusions of H. H. R. Martins et al., should be considered: from the position of importance for ensuring productive human life in the digital world; from the position of including digital tools in professional activities and ensuring the effectiveness of educational results. The authors also note that the reasonable use of information and communication technologies is an integral attribute for improving the quality of training of future teachers. This is due to the fact that knowledge of ICT helps the teacher feel comfortable in new socio-economic conditions. The educational institution, in turn, gets the opportunity to switch to the mode of functioning and development as an open educational system [15]. L. León, R. Corbeil, M. Corbeil present a version of a diagnostic tool for digital literacy of the teacher [16]. They are developing a system for assessing digital literacy of preschool teachers. The solution they propose evaluates such parameters as creativity, consistency, structure in the teacher's work, completeness of presentation of material, knowledge of assessment methods and group work, and the use of innovative technologies. M. Dogan, K. Tunçer, H. Arslan determine that digital didactics is a branch of pedagogy that organizes learning in the digital environment [17]. The new learning environment, according to the findings of V. Seevaratnam, D. Gannaway, J. Lodge, involves the use of digital technologies to improve the quality of learning and activate cognition. This study emphasizes the importance of developing digital pedagogical competence in teachers. The latter includes a consistent assessment and development of their attitudes, knowledge and skills in relation to planning and conducting theoretical training using ICT [18]. According to the findings of E. V. Soboleva et al., the role of the teacher in the digital educational space is expanding [6]. The teacher tries on many different roles: a methodologist and developer of digital teaching aids (including interactive novels, text quests, etc.); an organizer of the curriculum; a specialist in project activities; a tutor.

M. Calza-Perez et al. define the specific didactic potential of project activities in the development of game spaces (game mechanics, plot, software implementation): activation of knowledge, taking into account the peculiarities of thinking of modern users, development of thinking (creative, critical, systemic, etc.), the opportunity to study fundamental theoretical material in an interactive form of interaction and partnership [19]. M. Sofwan et al. note the need for special training of teachers to use game mechanics in their professional activities [20].

S. N. Dvoryatkina, S. V. Shcherbatykh, A. M. Lopukhin prove the lack of study of the issues of symbiosis of game and didactic technologies in mastering complex theoretical knowledge, the need to search for effective technologies to find out their influence on the development of the student, the formation of a modern style of thinking [21]. Moreover, the educational process itself using neural networks brings a completely different experience for each person [22]. N. Omrani et al. note that artificial intelligence allows changing the approach to learning and increasing the involvement of students [23]. The possibility of using neural networks in didactics is also justified by the fact that, according to the research of J. Chatterjee, M. Damle, A. Aslekar, people trust digital sources [24].

At the same time, when making a decision, they often rely on the popularity of the resource (for example, social networks or programmer sites), and not on the scientific nature of the information presented [25]. S. Makeleni, B. Mutongoza, A. Linake recognize the following didactic capabilities of ChatGPT [26]: the ability to generate responses that imitate human ones; to remember previous search queries; to independently study by analyzing user messages; to understand and answer a wide range of questions and tasks; to create texts with creative content, imitating the author's style of presentation; to translate text into different languages, etc.

M. Bijou, A. Elmoutaouakkil determine that the synergy between artificial intelligence and computer programming is becoming increasingly transformative. This opens the way to a new level in software development [27]. M. Rocha, P. Doyle note that the inadequacy of the use of gaming

technologies based on software and hardware for improving the qualifications of teachers is mainly due to [28]: lack of professional knowledge of interactive technologies, their purpose, specifics and principles of development and implementation; ignorance of methods of psychological support for players; inability to project a "communicative field", lack of mastery of creative techniques and low skills in creating the game, misunderstanding of the importance of the educational effectiveness of gaming technologies.

T. Serebryakova et al. conclude that a significant trend in the development of additional professional education is its “turn” to a specific person to meet updated educational needs [29]. For example: greater emphasis on user activity; transition from widespread open-access online educational platforms to elective courses; increase in the volume of data and analysis; widespread use of mobile devices and gaming applications, etc. According to the conclusions of A. Onal, one of the strategic directions of any country should be the formation of an effective education system focused on the use of modern technologies and tools in the process of training and retraining (certification) of teachers [30].

Thus, neural networks and gamification services have a powerful didactic potential in terms of developing digital literacy in modern society and training high-demand professionals of the future. The practical application of these services and technologies by teachers requires not only a deep understanding of digital tools and resources, but also an understanding of how to effectively use them to promote learning (and self-learning) based on digital pedagogy. Thus, the introduction of courses on developing digital literacy for teachers using neural networks and gamification elements into the program of additional pedagogical education is of particular importance.

RESEARCH PROGRAM

The main aim of the experiment is to verify that practical activities on designing the plot of text games using neural network resources within the framework of additional professional education will provide effective conditions for the development of digital literacy of teachers. At the first stage, the analysis of the significance of the problem of developing digital literacy (and the teacher, in particular) in modern society was made. It was substantiated that the digital literacy of the teacher (teacher, mentor, tutor, educator, and psychologist) is the foundation for the development of professional competences. It was clarified that all over the world, the presence of developed digital literacy is an important condition for employment.

The areas of professional activities where a digital school mentor will be able to use the acquired skills to develop digital literacy of students were identified. The analysis of software tools (simulators, applications, web services) with the resources to implement the research objectives was also conducted. It was revealed and substantiated that simulators for working with dialog boxes ("Privet", "Skazka"), neural networks for writing texts (NiceBot, NeuroTexer), applications for creating text adventures (stories, quests) with artificial intelligence (Porfiryevich, GamioAI) have significant potential. The Twine application for creating interactive literature using links (transitions) between dialogues (plot situations) was separately considered. Next, the content of various methodological solutions for assessing the digital literacy of the teacher was studied:

– the Digital Citizen system is a professional platform for testing and improving the level of digital literacy. An individual learning path is built based on the diagnostics of digital competences. Disadvantage in the context of the study: the lack of a clear explanation in the public domain – which question tests this or that aspect of digital literacy. In addition, the presence of 64 questions in the test assumes significant time resources;

– the conceptual model for measuring digital literacy as a multicomponent latent construct. Unfortunately, the testing of the measurement tool was carried out only for schoolchildren;

– the methodology for determining the level of digital literacy, presented by NAFI analysts based on the calculation of the integral index for a set of five indicators (information, computer technology, media, communications, innovation) in three dimensions (knowledge, skills, attitudes). Its advantages – the methodology was tested on a large number of participants who are teachers, it has a clear procedure for evaluation and interpretation.

Since the presented study involves an in-depth study of neural networks for writing texts for game plots by teachers, it was decided to modify the NAFI methodology (described in "Materials and Methods"). The author's testing contains 6 blocks of 6 dichotomous questions each. Using the test, all respondents who made up the general sample were divided into the experimental and the control group. Each group included 75 students. The general sample included all teachers who took part in IED KR advanced training courses ("Organization of a modern lesson using digital content", "Digital educational environment: new teacher competences"). All students were aware of the experiment. Their participation was voluntary. The classes were conducted by one teacher – E. V. Soboleva. All services and applications were tested in advance at the Institute. Independent work was also provided: studying additional tools, selecting material for the plot of a text game, testing and debugging, checking the functionality of the game and its purpose during information interaction with students of city schools.

At the second stage, participants studied course materials according to the work programs approved in IED KR.

At the third stage of the study, pedagogical conditions that contribute to the development of digital literacy of teachers when designing the plot of text games using neural network resources within the framework of additional professional education were identified.

RESEARCH RESULTS

This study is based on the UN definition, according to which "digital literacy is the ability to safely and appropriately manage, understand, integrate, exchange, evaluate, create and access information using digital devices and network technologies to participate in economic and social life" [1]. The works devoted to identifying the didactic potential of gamification technology and generative neural networks, in particular, for training students of pedagogical specialties; determining the stages and features of designing text games were studied. It was revealed that an important factor in the success of a didactic game project is the creation of an original plot with simple and understandable mechanics. To simplify this task, game developers actively resort to "collaboration" with neural networks to generate content. A text game for educational purposes is a type of computer game in which information interaction with the player, during which educational information is received, is carried out through text messages. The plot of a text game is a chain of events that are united by motivated connections. It implies interactive action of players, subordinated to a certain structure of the narrative. A neural network for writing texts is a service that can compose texts on various topics, transform a long article into audio and vice versa, support a dialogue (exchange of text messages) and have other functionality. In the study, neural networks for generating text are used to write a plot of a game for educational purposes.

The following sequence of themes was chosen when drawing up the plan for the course "Digital educational environment: new teacher competences": "New digital technologies: problems and prospects", "Fundamentals of ensuring information security in an educational organization", "Selection and use of cloud storage", "Digital tools and services in professional activities of the teacher" (artificial intelligence, gamification tools, interactive simulators, etc.). Practical activities involved creating interactive training sessions; developing cartoon, animation, illustrative content for conducting lessons. Teachers could demonstrate and apply the resulting projects in the classes when studying "Organization of a modern lesson using digital content".

Let us describe the logic of the course in the APE system. The first block of classes is studying the simulator "Privet", which is a part of "Robotlandia", and its analogue "Skazka" – a part of "Azbuka Robotlandia". They are used to create a branching story in the Twine program. Purpose: the teacher can use the constructor "Skazka" as part of courses in information culture, literature or foreign language to stimulate the student's creativity with the help of an unusual, exciting activity. The simulator "Privet" is designed for working with dialog boxes. It helps to form the skill of working with a keyboard, develop the culture of information communication. Work in the simulator is in the "question-answer" mode. Students answer the questions asked by the computer. The result of the survey is an interesting story composed by the computer based on the answers. Such work does not cause difficulties for users, since the form of the question indicates the form of the future answer. The message "I don't know this word" appears if a word that is not included in the range of expected

answers is entered to a question that requires an exact answer. Value of the work done: the teacher understands that only at first glance does the program demonstrate creativity, similar to human fantasy (it makes up fairy tales). In fact, a person makes plans and rewrites them in the form of algorithms for the computer. The computer, without thinking, follows the given instructions.

The logical conclusion was work in the Twine program. Designing in the program requires minimal effort, it is necessary to write texts and connect them with transitions. Its functionality consists of a very simple block diagram, between the blocks hyperlinks can be made. It is convenient to see: if all the nodes are connected by transitions; if the intended choice was implemented or not; if all the ideas have a logical conclusion.

But transitions can't be drawn in a graphic diagram. Nodes can be created and only then it is possible to type special commands in them. These commands will create transitions to the desired nodes. As a result, you get a ready-made game in "*.html" format. It can be immediately launched in the browser. The program can be customized by the user. It is possible to change the background, add music, modify fonts, etc. The speed of developing a text quest in this tool is limited only by the speed of the user in creating the text itself. There are limitations: the program is created only for text games. The program is not suitable for developing "serious" games. This application can be downloaded from the website. No authorization is required to download. The whole group of students implemented one branching plot according to the teacher's instructions – "In the land of unlearned lessons".

The second block of classes. Studying neural networks for writing texts: NiceBot (https://nicebot.ru/), NeuroTexter (https://neuro-texter.ru/). For example, the functionality of the latter offers to make an automatic continuation, expansion, rewrite, reduction of the text and export. NiceBot offers similar capabilities. Then the participants were given the task of writing the text of a fairy tale on any topic based on their professional activities. For example, "From the life of triangles", "In the world of professions of the future", "How a molecule flew into augmented reality", "Somewhere in cyberspace", etc. The advantages and disadvantages of each were noted. For example, for NeuroTexter:

– advantages: clear and convenient sidebar; fast and competent writing of texts; the possibility to rewrite certain paragraphs; high-quality and understanding technical support; smart chatbots that can consult at any time, ergonomic design; free tariff for 3 days;

– disadvantages: Neurotexter can generate text that does not correspond to reality or is false; the quality of the generated text may be uneven and not always meet expectations.

The third block of classes is the study of the application for creating text adventures (stories, quests) with artificial intelligence: Porfiryevich (https://porfirevich.ru/), GamioAI (https://gamio.ru/). The neural network for creating texts "Porfiryevich" generates meaningful (in most cases) texts from several words or sentences. The writing and interface language is Russian. If the result is not satisfactory, it is needed to click on the "Options" button. "Porfiryevich" will give an alternative version. The user can choose possible paths of neurothought development indefinitely: click until the network gives the option that best suits the didactic goal.

In the advanced settings, the user can change the number of auto-completed words (from one word to sixty), turn on auto-completion and change its delay. The neural network is completely free. An example of work with a folk tale is: the participants decided to start testing the capabilities of the neurowriter with two words that open many (if not almost all) Russian folk tales. In the dialog box, the participants wrote "Once upon a time". They clicked the "Add" button and received the result. For example, "Once upon a time there lived a prince and a princess, and everything was fine until a black sorcerer came". Most of the fairy tales turned out to be meaningful, sad and logic.

Then the participants suggested that the neural network continue the "Tale of the fisherman and the fish" by A. S. Pushkin, which is known to everyone. "Porfiryevich", unfortunately, removed the conflict from the plot. According to the neural network, the old man simply asked the old woman to learn how to fish on her own, she went and learned.

Conclusion: "Porfiryevich" is a neural network capable of completing the text of the game plot. However, it is necessary to experiment for a long time with the provided models to obtain a relevant result. The neural network supplements the text in Russian, offering interesting and funny options for the further development of the story.

Gamio AI is a non-linear text adventure. The user decides what the character will say and do. The artificial intelligence will generate responses from other characters, describing the events in the game. The designed game is a text quest, but without a prepared script. The artificial intelligence responds to the user's actions, describing what is happening inside the worlds.

Step 1. Registration. Go to the website gamio.ru and go through the registration procedure.

Step 2. Creating a world. Click on the "New game" button. Enter a story. It can have a cliffhanger, which AI will complement. Click on the second button to automatically complement the story.

Step 3. The game itself. If you do not like the result, you can regenerate it. For example, the story "In the world of right isosceles triangle, a new character appeared – an equilateral triangle. Who were its parents and what are its properties?". An example of a plot from a neural network: "An equilateral triangle is a world where each of the three points has the same characteristics: this can be anything from physical data to social status or intelligence level. The parents of this world are two unique ones, each with their own unique ability – the so-called "prototype". The first parent has the ability to imitate others with diligent study of other people for self-development; the second is immersed in studying the environment and adapting to changes in the environment". The user can freely change the story. Just click on any fragment of text and edit it.

Conclusion: Gamio is not yet a finished project. It receives stable updates and new features.

Thus, in each of the presented gaming services based on neural networks, it is possible to create: descriptions of events happening to the player (context); explanations of certain plot twists; scenario (dialogues and other elements of the game world); detailing of objects, mechanics and locations of the created worlds.

The participants of the control group studied all the topics of the specified classes, according to the course work programs. However, they were not involved in targeted work on designing plots for text games using neural networks. An example of a story fragment that the participants of the control group implemented in Twine: "One day from Lyoka's summer vacation".

The first script with a transition: "Summer. A wonderful time for new adventures and acquaintances. Jack, who came to visit his grandmother in the village for the summer vacation, thinks so too. Next".

The second script: "Early in the morning, Lyoka woke up because the sun's rays crept into the room and everything was illuminated by sunlight. After waking up it was clear that the weather would be wonderful (play on behalf of the boy). Next".

The third script with transitions: "You left the room. Headed to the kitchen for a wonderful smell. Grandma left two types of breakfast on the table. Which one will you eat? But remember that porridge gives more energy…:

– porridge

– sandwich". Etc.

At the fixing stage of the experiment, testing was carried out according to the method described above. Here is an example of the author's question to measure the category "information" and identify the level of knowledge: "If the neural network does not have enough information to write the text of the game plot, it can make it up" / "If the neural network does not have enough information to write the text of the game plot, it will formulate an additional request to the user or issue an error message".

An example of the author's question to measure attitudes in the category "information":

1. The data entered by the user is saved and used to train the neural network. It is worth avoiding specifying confidential information: personal phone numbers and email addresses, corporate information, etc. It is recommended to provide only the data, the leakage of which will be critical to it.

2. The data entered by the user is not saved in the virtual space of the game. Therefore, when training the neural network, you should specify the correct personal phone numbers and email addresses.

An example of the author's question to measure skills in the "information" category:

1. The Gamio AI developer trained own neural network in Russian, without limiting it with moral standards and artificial restrictions.

2. The Gamio AI service does not support writing texts in Russian. Additional tools must be installed.

High level of digital literacy – the teacher actively and reasonably uses information search and processing tools, neural networks to generate plots for didactic text games in the digital space. The specialist knows and correctly applies methods of safe information exchange with other people in the game space supported by artificial intelligence. The user can generate content for the plot of a text adventure and knows how to use it in the educational process. The teacher has skills necessary to register in the application (program, service), install the necessary additional tools, and join other users to information interaction.

Average level of digital literacy – the teacher actively, but not always reasonably, uses information search and processing tools, neural networks to generate plots for text games of didactic purpose in the digital space. The specialist does not know all the ways of safe information exchange with other people in the game space supported by artificial intelligence. Does not think about their correct use. The user knows how to generate content for the plot of a text adventure and knows how to use it in the educational process. The teacher has the skills necessary to register in the application (program, service). But has difficulties installing the necessary additional tools and connecting other users to information interaction.

Low level of digital literacy – the teacher does not strive to actively and reasonably apply the means of searching and processing information, neural networks for generating plots of text games for didactic purposes in the digital space. The specialist knows only the basic methods of safely exchanging information with other people in the game space supported by artificial intelligence, does not think about their correct use. The user makes technical and substantive (according to the game plot) errors when generating the adventure text. Designed games cannot always be used in the didactic process. The teacher seeks help from technical specialists to register in the application (program, service), install the necessary additional tools, and join other users to the information interaction. Table 1 shows the results of measuring the level of digital literacy of teachers before and after the practice of designing plots for text games.

For $\alpha = 0{,}05$, χ^2_{crit} is equal to 5.991. It was determined that $\chi^2_{obs.1} < \chi^2_{crit}$ (0.038 < 5.991), and $\chi^2_{obs.2} > \chi^2_{crit}$ (8.204>5.991). Therefore, the difference in the levels of digital literacy for the experimental and control groups of listeners can be considered non-random.

Table 1

Results of the impact of involving students in the activity of writing plots for text games using neural networks

Level	Groups			
	Experimental (175 course participants)		Control (175 course participants)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
High	34 (9%)	70 (35%)	35 (9%)	45 (15%)
Average	119 (38%)	88 (44%)	119(41%)	111 (38%)
Low	22 (53%)	17 (21%)	21 (50%)	19 (47%)

Let's analyze the changes in the training levels:

1. In the experimental group, the greatest dynamics occurred at the "High" level. The corresponding value increased by 20.6% (36 participants). In the control group, the increase in level was less (5.7% or 10 participants).

2. In the experimental group, the number of participants whose level was "average" decreased by 17.7% (31 participants). In the control group: it decreased by 4.6% (8 participants).

3. In both groups there was a decrease in the number of participants who have "low" level: in the experimental group – by 2.9% (5 participants), in the control group – by 1.1% (2 participants).

DISCUSSION

The distribution and subsequent change in the levels of digital literacy development presented in the previous paragraph, in our opinion, are caused by the following factors: increased interest of teachers in practical work with gamification and neural network services; independence in choosing the content for game plots; active communication in the virtual environment and feedback from artificial intelligence; the initial level of professional training of teachers; openness to new knowledge, communications and changes.

The results obtained correspond to the guidelines and objectives proclaimed in the materials of OECD Digital Economy Outlook 2024, in the UNESCO Incheon Declaration, in the reports of the National Agency for Financial Research, in particular, to the use of digital technologies to support continuous learning (lifelong learning). The conclusions formulated by the authors develop the ideas: E. A. Mamaeva et al. on the organization of project activities for the design of didactic chatbots to improve the quality of training of specialists in the digital society [5]; M. Calza-Perez et al. on the potential of gamification tools in the training of teachers [19].

The identified pedagogical conditions that contribute to the effective use of neural networks for designing game plots in the context of the development of digital literacy can be considered as motivation factors, options for the use of new tools by teachers in order to maintain their professional status and expand the possibilities of increasing competitiveness in the labor market. In other words, they are a concretization of the provisions of the studies of G. N. Tuguskina et al. on the importance of APE for the personal development of the teacher [8]. As an option for developing the research, the following can be noted: identification of the didactic potential of services for generating sound, images, 3D for developing games in the context of additional education.

CONCLUSION

Digital literacy is not a property and is not acquired spontaneously. It is a system of knowledge, skills and attitudes necessary for life in the digital society. Improving the professional skills of the modern teacher, the teacher of the digital future, is impossible without the development and transformation of the system of APE. In particular, one of the results of the study is the clarification of the characteristic features of APE that support the inclusion of gaming services based on neural networks: the prevalence of the adaptive nature of development; the availability of resources for the formation of skills for self-education and self-development; the availability of resources to change the role of the teacher to the role of the student; enrichment of the information space of interaction. The described system of practical activities of teachers on designing plots for text games based on neural networks has the following didactic potential in relation to each aspect of digital literacy:

- information aspect – participants got an idea of new digital tools; gained experience in searching for information using different resources, assessing its benefits and harm;
- computer aspect – participants studied new technical solutions, principles of their interaction, goals of their didactic use;
- communicative aspect – participants realized the existence of special ethics and norms of communication in the digital environment, the difference between digital communications and real communication;
- media literacy – working with services contributed to understanding the diversity of information sources; the need for mandatory verification of reliability of the data received;

- attitude to technology – working with services contributed to understanding technological trends, gaining experience working with new digital tools, understanding the benefits of technological innovations both for the development of society and for the person.

However, there are also objective limitations (pedagogical conditions) that should be taken into account when organizing the described system of work:

- use of outdated information and substitution of facts. When using neural networks for study/work, it is mandatory to double-check the reliability of the messages received;
- caution with information. It is recommended to provide only those data, the leakage of which will be not critical;
- understanding the fact that the neural network is an assistant, but not a complete replacement for a person and intellectual work.

The obtained results of the study are planned to be used to improve the system of additional professional education of the Institute for Education Development of the Kirov Region, taking into account the emergence of new didactic tools.

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