FORMATION OF SCIENTIFIC RESEARCH COMPETENCE OF MASTER'S DEGREE STUDENTS BY MEANS OF BYOD TECHNOLOGY

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Abstract. *The authors of the article analyzed the features of using the innovative BYOD (Bring Your Own Device) technology in the formation of research competence of master's degree students. The European experience of applying BYOD technology is analyzed. Emphasis is placed on the relevant use of this technology in higher education institutions, which is related to the digitalization of the educational process, the pandemic and martial law in Ukraine.*

The results of the ascertaining phase of the pedagogical experiment are presented, the participants of which were master's degree students of Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University and Mykhailo Drahomanov Ukrainian State University (Kyiv). The students are enrolled in such academic programs as "Pedagogy of Higher Education. Tutoring", "Counseling", "Preschool Education. Primary Education", "Preschool Education. Speech Therapy", "Physical Therapy, Occupational Therapy".

The article reveals the educational potential of BYOD technology for the formation of scientific research competence of master's degree students. It is noted that the use of this technology in terms of offline, online and mixed studying helps higher education students acquire skills necessary to analyze, generalize, systematize and compare information. In addition, information retrieval and critical analysis skills are successfully formed. The differences in the application of this technology in conditions of individual and group work with master's degree students are shown.

Introduction

Integration into the European educational space, modern challenges related to the Covid-19 pandemic, the martial law in Ukraine necessitate the improvement of the content of education by applying innovative approaches to the educational process in higher education institutions. An important ability a higher education student must possess upon completion of studies is scientific research competence. The most important components of such competence are: the ability to understand, describe and analyze the features and principles of the organization of scientific research activities; knowledge of algorithms for setting the topic, problem, aim and hypothesis of scientific research, as well as peculiarities of conducting theoretical and experimental research; the ability to develop a methodology and a research execution plan, and to use theoretical and empirical research methods.

Scientific research is a specific activity that requires significant efforts of a student to be rather good at it. In view of this, the problem of modernization of the educational process of higher education institutions aimed at the development of scientific research competence of each student becomes relevant. Therefore, it is important to create favorable conditions for the maximum motivation of each student in acquiring scientific research competence.

We believe that innovations that improve the organization of the educational process of higher education institutions deserve special attention. One of such innovations is the modern BYOD (Bring Your Own Device) technology. Due to the use of BYOD, master's degree students will be able to develop all components of scientific research competence.

The aim of the article is to highlight the educational potential of BYOD technology in the formation of scientific research competence of master's degree students.

In our research, the following methods were used: theoretical (analysis; generalization of literary sources in order to determine the theoretical aspects of the outlined research problem) and empirical (pedagogical observation of classes in higher education institutions regarding the use of innovative technologies for the formation of scientific research competence of master's degree students; questionnaires).

The theoretical background

The term BYOD was introduced in the IT field in 2009. Intel executives, noticing a trend among employees to bring their own laptops, tablets and smartphones for work in the corporate network, allowed them to use their own

devices for professional tasks. Over time, this approach was applied in the field of education.

Mobile learning is gaining popularity as a new trend that facilitates the process of teaching and learning in the 21st century. However, not all students (Spanish students among others), possessing several personal devices (tablets, laptops, smartphones), use them for studying (Urbano, 2022). Having 20-27 years of work experience at higher education institutions, we can confirm the fact that not all Ukrainian students work in class with their own device for the purpose of studying.

BYOD was first mentioned in 2005 in the university work of Rafael Ballagas. In scientific publications, BYOD is considered to improve cooperation and internal communication within the company (Felix et al., 2017), integration, loyalty and commitment of company employees (Jacobs et al., 2016). BYOD technology has been described in scientific works on higher education issues: as an effective tool for improving students' critical thinking (Urbano et al., 2020), with the aim of creating informal relationships between teachers and students, identifying mentors, facilitating remote work and developing social activities (Garcia, 2011). There are also some works on the use of BYOD technology in primary schools: the educational potential of BYOD technology for the development of creative abilities of younger schoolchildren was revealed (Demchenko et al., 2022), the experience of using BYOD in two Australian primary schools (Maher & Twining, 2017) was described. The author (Zilka, 2021) considers the possibility for students to use their own mobile devices in primary and secondary schools, and in higher education.

Methodology, organization and results of the research

In the course of this study, we used the following methods: theoretical: analysis of scientific sources to determine the state of research on the use of BYOD in the process of preparing masters for scientific activity, synthesis, systematization and generalization of the theoretical provisions of the problem; empirical: pedagogical observation of the activities of masters in classes, conversations with students about the reasons for their use of smartphones in pairs, conversations with teachers of higher education institutions about the use of mobile devices by students in classes for educational purposes, questionnaires of masters of Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University and Mykhailo Drahomanov Ukrainian State University.

56 students of Mykhailo Drahomanov Ukrainian State University (USU) of full-time and part-time education of the following faculties and specialties took part in the survey: 1. Faculty of Special and Inclusive Education, specialties "Special Education, Oligophrenic Pedagogy", "Special Education. Speech Therapy", "Special Education. Surdopedagogy", "Special Education. Typhlopedagogy". 2. Faculty of Ukrainian Philology, specialty "Secondary

Education. Ukrainian Language and Literature". 3. Faculty of Pedagogy, specialties "Primary Education", "Pedagogical Counseling", "Preschool Education", "Andragogy. Adult Education". In addition, 29 full-time and part-time master's degree students of Valentyna Voloshyna Faculty of Preschool and Primary Education, specialty "012 Preschool Education", and 7 part-time students of the Faculty of Physical Education and Sports, specialty "227 Physical Therapy, Occupational Therapy" of Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University (VSPU) took part in the survey. Let's analyze them.

To the first question of the questionnaire ("How often do you use the Internet?"), 96.4% of the master's degree students of USU said that they use it every day, 3.6% - when necessary. There were no answers "very rarely" and "never". The answers of the master's degree students of VSPU were approximately the same.

Table 1 shows the distribution of the responses of the master's degree students of USU and VSPU to the second question of the questionnaire ("What percentage of time on the Internet do you spend on searching and researching?").

Table 1 **Answers of the master's degree students of Mykhailo Drahomanov Ukrainian State University and Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University to the question concerning the time they spend on research activities** *(made by authors)*

Range	Mykhailo Drahomanov Ukrainian State University, students	Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, students (%)
Less than 10%	1	4
10-30%	15	8
30-50%	24	13
50-70%	12	8
More than 70%	4	3

As we can see from Table 1, most students use 30-50% of their time on the Internet for search and research activities. Such results are quite natural and understandable.

As far as the third question ("How do you search for scientific sources for your own research (indicate the search algorithm)?") is concerned, the master's degree students were asked to give a free answer regarding the algorithm for searching scientific sources for their own research. The spectrum of responses of the students of both universities was extremely wide: from an obscure explanation like "Recommendations of the curator, search for articles on the Internet and physical books where they are, use of resources provided by others" to a quite clear answer: "I go to Google Search, enter keywords of the research topic, start searching for publications in online libraries". However, in this question, it was necessary to specify the search algorithm. Only 5 students of USU and 3 students

of VSPU coped with this task. The answers of the vast majority of the respondents were incomplete: they indicated that they search either through the Google system or through keywords or a topic. Many answers were incorrect. The search algorithm itself was not specified by the great majority of the master's degree students.

The results of the answers of the survey participants to the following question ("Do you know and do you use the institutional repository?") can be seen in Table 2.

*Table 2 **Answers of the master's degree students of Mykhailo Drahomanov Ukrainian State University and Vinnytsia Mykhailo Kotsyubynskyi State Pedagogical University to the question concerning their use of the university repository** (made by authors)*

Range	Mykhailo Drahomanov Ukrainian State University, students	Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, students
Don't know	28	17
Know, but don't use	7	6
Know and use	3	6
Know, but rarely use	15	7
Know and constantly use	3	-

As we can see, a large number of respondents do not even know about the university repository, almost a third know and sometimes use it.

Table 3 shows the distribution of the answers regarding the use of the e-library by the master's degree students.

*Table 3 **Answers of the master's degree students of Mykhailo Drahomanov Ukrainian State University and Vinnytsia Mykhailo Kotsyubynskyi State Pedagogical University to the question concerning their use of the e-library** (made by authors)*

Range	Mykhailo Drahomanov Ukrainian State University, students, students	Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, students
Don't know	5	3
Know, but don't use	17	8
Know and use	13	10
Know, but rarely use	18	14
Know and constantly use	3	1

If we compare the data in Tables 2 and 3, we can see that the respondents are more familiar with the e-library than with the university repository. However, a significant number of the master's degree students are aware of the e-library, but do not use it.

The students' responses regarding their awareness of scientific and metric databases can be seen in Table 4.

*Table 4 **Answers of the master's degree students of Mykhailo Drahomanov Ukrainian State University and Vinnytsia Mykhailo Kotsyubynskyi State Pedagogical University to the question concerning their awareness of scientific and metric databases** (made by authors)*

Range	Mykhailo Drahomanov Ukrainian State University, students (%)	Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, students
Don't know	24	13
Know, but don't use	10	9
Know and use	8	7
Know, but rarely use	12	5
Know and constantly use	2	2

As we can see, more than a half of the master's degree students either do not know about such databases, or know, but do not use them in their own scientific research.

Regarding the answer to the following question ("Which scientific and metric databases do you know?"), 30 students out of 56 who took part in the survey from USU and 24 out of 36 students of VSPU do not know any scientific and metric databases. 16 students from USU and 7 from VSPU know such scientific metric database as Google Scholar, only 7 students from USU and 4 from VSPU know Scholar, Scopus, Orcid, Web of Science and only a few students (2 from USU and 3 from VSPU) know Google Scholar, Scopus, Orcid, Web of Science. As we can see, despite the master's degree students having the disciplines "Methodology and Methods of Scientific and Pedagogical Research", "Research Activity of a Preschool Teacher" and their work with the research supervisor, a significant number of the survey participants are either unfamiliar or partially familiar with such scientific and metric databases as Google Scholar, Scopus, Orcid, Web of Science. The results regarding the time framework of using the applied knowledge in their own scientific research can be seen in Table 5.

As we can see from the table, most students try to apply their knowledge to their own research immediately, at the first opportunity or in a few days. Undoubtedly, such a result testifies to the positive motivation of the master's degree students who participated in the survey to conduct their scientific research independently and qualitatively.

Table 5 **Answers of the master's degree students of Mykhailo Drahomanov Ukrainian State University and Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University to the question concerning the time framework of using the applied knowledge in their own scientific research** (made by authors)

Range	National Pedagogical Dragomanov University, students	Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, students
Immediately, at the first opportunity	24	18
Very often – in a few days	27	14
Before the credit	5	2
Before the defence of the qualification work	-	2

As evidenced by experience and communication with master's degree students, scientific activity is specific and complex. During both online and offline studying, we noticed that while the teacher was explaining the material, the students could communicate with their friends on social networks, text in messengers or play games. The use of BYOD technology makes it possible to involve every student in scientific research work. Let's consider several options for using BYOD technology: during online and offline studying.

As it is known, the effectiveness of scientific activity largely depends on the topic chosen by the researcher. Within the framework of teaching the discipline "Research Activities of a Preschool Teacher" (online studying), we offer the master's degree students to review the list of topics using their own devices. During the review, they ask the teacher questions, propose their own topics and supplement the already formulated ones. As a result, the students start communicating with each other. In case of debatable situations, the teacher can offer the author of the question to review scientific research on this issue, showing the whole group the screen of his/her device. In this way, all students present in class will be involved in the search. Those who search using their own devices comment on the result of their search and discuss it with the groupmates. In the course of a joint discussion, it is possible to find out how relevant this topic is and to study the under-researched aspects of the problem. During offline studying, the teacher's algorithm of actions is similar. If there is a projector in the classroom, the teacher can invite volunteers to search from the central computer if the search results are important for everyone, or students can use their devices to show the search results to the groupmates. In a similar way, the plan and formulation of the scientific apparatus of the future research are drawn up.

At the beginning of the semester students of each academic group usually make a Viber group or community. During the search in class, they can exchange

links to interesting sources both with each other and send them to the Viber group. That is, we have a constructive combination of individual and group forms of work.

Our survey of students, the results of which are given above, shows that the vast majority of the respondents are not familiar with the university's e-library and repository. Using BYOD technology makes it possible to close this gap and motivate students to use their resources for scientific work. Of course, the necessary information concerning the e-library and repository of the university can be provided by the teacher in a lecture or practical classes. However, if the teacher's explanation is supported by the students' independent processing of information in the e-library or repository by means of their own device, then the situation will be changed. Also, our questionnaire showed that the master's degree students of both universities are unaware of the scientific and metric databases. To our mind, the use of BYOD technology can be effective in solving this problem as well.

Modern education has become mobile, that is, it is available regardless of the location of the subject and the time when he/she learns new information. In connection with this, the function of the teacher has changed radically – he/she is no longer a translator and the only source of knowledge – the teacher of a higher school today has to create conditions for his/her students' independent scientific search. As is well known, the search and research activity of master's degree students organized in this way contributes to a more powerful development of scientific thinking, increases positive motivation for scientific activity. All this leads to higher quality scientific work. In our opinion, the use of BYOD technology solves these tasks quite effectively.

Conclusions

The use of BYOD technology makes it possible to provide a differentiated approach to students, to meet the individual needs of each student in receiving advice and guidance from their scientific supervisor. In this way, it is possible to increase the motivation of master's degree students for research activities and to facilitate their access to programs and information on the Internet.

It is feasible to provide formative or control assessment of students (both online and offline in Kahoot, Google Forms, Classtime resources) using their own mobile devices. During classes, it is sometimes necessary to refer to the virtual environment of Google Classroom for certain materials. This is also possible due to BYOD.

The issue of students' use of their own device for educational purposes remains debatable. In order to engage the maximum number of students in the use of their own device for studying, in our opinion, higher school teachers should increase the level of their professional skills. To make the most of the advantages

of mobile devices as educational tools and to use the potential of digital resources and mobile technologies in education, it is necessary for higher school teachers to plan the appropriate use of mobile devices in the educational process, as well as to change activities and choose different digital tools at different stages of the lesson.

The teacher should aim to get students so interested in scientific activity that, at least in class, their desire to work on scientific research exceeds the desire to play games and communicate with friends in social networks or messengers.

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