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RESEARCH PAPER

Virtual Space as a Platform for Student Research Practices

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ABSTRACT

Online learning is becoming an increasingly popular request. Many universities are moving fully or partially to this form of study. In the article, the authors considered what is virtual space, what are its criteria, as well as applicability for teaching students and passing research practices. Based on an analysis of existing virtual spaces (platforms), an experiment was conducted. The study showed that in real enterprises social skills develop better, while professional ones are worse; with the complete replacement of actual practice with virtual, social skills (such as teamwork, interpersonal communication, conflict resolution) practically do not develop. When introducing an external curator and uniting students into small groups (2-3 people) for a complex task fulfilment, it allowed strengthening the advantages of virtual practice in terms of developing professional competencies and to level its shortcomings, adding more "reality" The experiment showed that a virtual platform could be an alternative to passing research practice for students. Still, it must be corrected both at the beginning (for certain specialities of student training) and after a particular time. The main reasons that impede the development of the creation of both virtual spaces and the process of "virtualisation" of science as a whole are considered.

KEYWORDS: *Online training; Platform; Student research practices; Virtual space; Virtuality.*

1. Introduction

Virtual space is a part of a diverse information sphere. Virtual space is an invariant of the cognisable by man indirectly real world. Human consciousness can combine the abilities to perceive, transmitting, and synthesising various impulses. That allows virtual space to be the continuation of a real-world, and to have great potential for further development and an extension of its tools and applicability. Virtual space is an area of industrial, technological and social relations that arise, develop, transform, and fade in the process of using a computer or other electronic technical network regarding information, information resources, information services and communications [4]. Several users can simultaneously be in the virtual space. Despite differences in the perception of the world, they use virtual instruments common to all and model the images of the real world following the conditions that the virtual environment provides [5; 35; 36].

The formation of virtual space started with a network of interconnected computers that could transmit data, process it. But gradually, with the development of technology, it became possible to project audio and visual images in a virtual environment, simulate reality in a complex, combining different channels of user perception and achieving an ever more complete correspondence of sensations received by a person in the real and virtual worlds. The difference between perceived objects in reality and simulated images of these objects in a virtual environment allows us to evaluate the correctness of Kant's assumptions, which asserted their fundamental unrecognizability. According to Kant, the study of real things does not give us an utterly fair idea of them. The phenomenon (what we know about a thing) and noumenon (the one, which can exist in reality, but not to be knowable in whole or in part) can vary within the limits of recognizability of one or another object [3; 7].

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In the case of a virtual space, these limits establish not only the degree of sensitivity and ability to transmit sensations, but also the characteristics of the environment from which they are derived. If this is the real world, then the role of the a priori perception of the subject grows. There is the opportunity to repeatedly check and adjust the image, in a virtual environment that transforms under the influence of various factors and most often purposefully, there is no such possibility [9]. Data transfer reveals a dependence on external causes. If a hardware failure occurs or another person changes the image of an object in virtuality, the Internet user will no longer be able to rely on him. In this case, the whole experience acquired by a person before the moment of editing information or failure becomes useless, since it is already impossible to correct or restore the image of the subject. In reality, changes occur with less intensity; the mobility of the medium is much lower. Common to both environments is the absence of a meta component: neither reality nor virtuality has the fundamental property of human consciousness, which allows one to realise, construct, and categorise objects, phenomena, and images that are accessible to understanding. Following the ideas of Kant, such a component may well be present in reality, but not to be conceived as it is [12; 52]. In the future, virtuality will also be able to receive such a component in the form of artificial intelligence.

Currently, there are many attempts to create artificial intelligence; and programs to simulate the human mental operations, by copying and reproducing human speech, both oral and written. There are attempts to create real and virtual robots that have programs simulating specific actions; self-learning programs that adjust their activities depending on the emerging communicative situation are being developed.

Thus, we consider it necessary to study the creation of virtual spaces, explore their applicability to students' research practices and also explain the possible reasons for the underdevelopment of such a technology as a whole.

2. Literature Review

Student education has always been a topic actively discussed in academic circles. Summarising the review of literary sources, we can distinguish the following research groups:

– training of future specialist based on a competency approach [2; 14; 29-30; 39-42; 53];

– case studies training and students project [6; 10; 22; 48];

– using digital technologies, including virtual space for student training [8; 11; 21; 31; 44];

– the study of various methods for determining the effectiveness of training [36; 47-49; 51];

– networking between universities and other stakeholders in students training [1; 24-25; 27-28; 34; 37; 43; 45-46].

However, increasing global digitalisation leads to the fact that the issues of using virtual space in education, and in particular in higher education, are topical.

3. Theoretical Part

3.1. Virtual platforms

In a broad sense, a virtual space for student research practices is any form of distance interaction for the transfer of ideas. These forms include [2; 13; 17; 20; 33]:

1) workshop, which is aimed primarily at teaching or disseminating scientific concepts in the way of training. For example, offline seminars, some of which are carried out on the Internet. There are also entirely online laboratories, which as a rule involve a paid subscription, have a work schedule and use webinar formats;

2) personal sites and blogs are a monologue of the author. Sometimes if the author has high enough ranking or the author is a significant figure in the scientific community, discussions are quite stormy. The comments themselves are not of interest, because they do not relate to the essence of what is happening or they express the opponent's position fragmentarily;

3) Internet conferences offer two options for the development of the situation: the first – the organisers collect articles, publish them on the website in the form of collections, the second - the texts of the reports are put up for discussion on a specially moderated conference website, where it is possible to post feedback on the reports and conduct a debate. The site can upload videos of offline performances; an online broadcast is conducted, the conference itself can be held in the form of a webinar;

4) Internet forums contain topics that are created by people who want a specific solution to a particular problem. Both questions and answers may suffer from amateurism, spam, and obscene expressions. Moderating forums leads to a delay;

5) groups on social networks. There are both self-organising social networks of scientists and corporate networks organised by scientific communities, which exist as separate officially registered organisations. The former includes such social networks as the international community ReseacherGate (https://www.researchgate.net/), Academia (https://www.academia.edu/), LinkedIn

(http: // www.linkedin.com/ – not quite specialised in scientific communication, nevertheless having a significant sector of scientific contacts). Similarly to regular social networks, these networks allow to create groups, share publications, search, correspond and some other options. Corporate networks include Loop (http: //loop.frontiersin.org), Mendeley (https: // www. Mendeley.com/, Elsevier), Scientists Without Borders (http://www.nyas.org/WhatWeDo/ ScientistsWithoutBorders.aspx), and others. Each network has its specialisation, though even in large networks with millions of users, the scientific process does not occur. The goal of user activity is to promote scientific ideas and increase the citation level of their publications;

6) R&D laboratories (laboratories of experimental and behavioral economics). Within such laboratories, software testing or economic and psychological experimentation can be performed.

To date, scientific research is carried out within the framework of scientific organisations (universities, institutes, centres). On the Internet, only the results of offline activities are reflected (published, popularised). However, the speed of change and the globalisation of the scientific space is forcing scientists to seek new forms of cooperation. Ten years ago, the question of virtual activity was perceived as something frivolous, and now and soon, innovations in the field of computer communications will make the scientific community think seriously about virtual spaces.

3.2. Forms of student research practices

The scientific activity of the student is determined mainly by the educational process, i.e. the list of disciplines of the curriculum and their content set out in the curriculum. Classification of scientific research approaches allows defining the type of student research work. In particular, it may be applied, theoretical, experimental, complex, or differentiated research in the field of a specific speciality. Research practice of students is one of the essential means for improving the quality of teaching and equipping future specialists with essential competencies, which they will be able to creatively use at work according to the latest achievements in different areas of science and technology.

The modern concept of the students' research practice includes two interrelated elements [38; 50]:

a) getting students acquaintance with the aspects of research work, sharing with them the skills of this kind of work;

b) the actual research carried out by students under the guidance of the teaching staff in the universities.

Research work of students is a set of methods for developing future specialists in creative thinking, acquisition of theoretical knowledge and the skills of the researcher (Fig. 1).

Research practice allows students to master the methods and techniques of research, develop a sense of the new, and get used to self-education. Scientific and technical creativity will enable students to see the applied value of research and the relationship of disciplines that increase the level of its success, creative and scientific activity. At the same time, the doing research in the universities significantly influences the quality of the educational process; it transforms the structure of the learning process, increases the level of students' knowledge, enriches their practical and creative worldview.

Research activities of higher education students are carried out in the following areas [15; 19; 23; 32]:

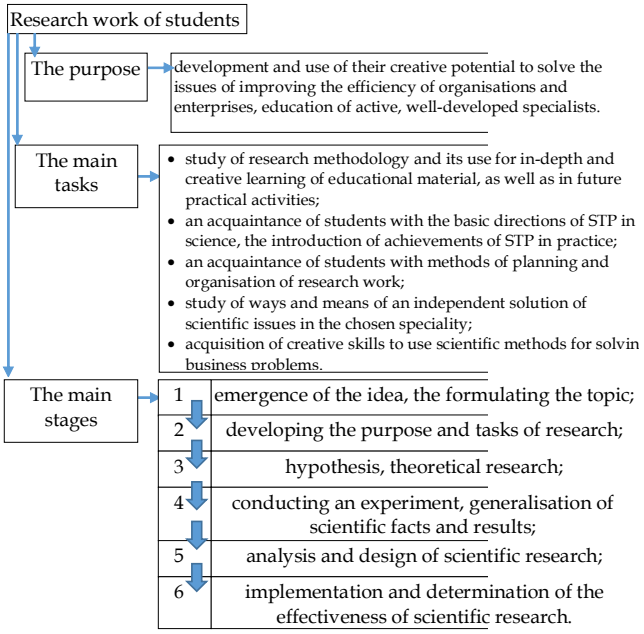

Fig. 1. The structure of a recursive model for shaping taxpayers' intentions to fulfil tax obligations

– research work, which is part of the educational process and is mandatory for all students (writing essays, preparation for seminars, preparation and defence of term papers, dissertations, research tasks during the internship at the request of enterprises, etc.);
– research work of students outside of the educational process. It gives students extra opportunities including participation in scientific circles, presentations of self-supported scientific works within the framework of creative cooperation between departments and faculties;
– working activities of students, such as different kinds of analysis or consultations in agencies, which provide various types of services from travel to translation and education ones;
– lecturing and assisting professors in their teaching and academic activities;
– participating in writing abstracts of scientific reports, publications, etc.

Let us focus on the first group, namely, research and undergraduate practice. The practice is an element of the educational process, which is carried out to consolidate and expand the knowledge acquired by students at the university; obtain the necessary practical skills in the speciality in the production environment; master the advanced methods of technology and labour.

The content of the practice is determined by its type (educational and familiarisation, production and technological, pre-diploma, etc.). The practice contributes to the development of students' independent work. In the process of internships, students learn to independently select and systematise information within the framework of their tasks; put the acquired knowledge into practice; study the technology and equipment used in a particular process; develop teamwork skills; exercise self-control. Nowadays, one of the employers' main requirements is the employee's professional competence. Practical training allows the student to self-assess the level of his or her expertise and determine the need for its improvement in the further learning process at the university.

Teaching through practical training should be considered as a multifaceted and interdependent activity of students and faculties, aimed at:
– development by the faculty of an individual practice that provides a list of key issues to be independently studied by a student in a particular enterprise; deadlines for the implementation of single tasks, including the collection of factual materials for the preparation of course and diploma projects;
– perception, awareness, processing and mastering by a student of information received during the study and the internship; the desire to test the knowledge gained at the university in practice;
– organisation by the teacher of an independent, conscious, rational, productive student activity in mastering the educational information, its application and consolidation in practice.

The organisation of students' activities during the practice is based on normative and teaching materials approved by the leadership of the university/department.

3.3. Examples of existing virtual spaces

Moodle (https://moodle.org/) is a course management system (e-learning), also known as a learning management system or virtual learning environment. It is an abbreviation from Modular Object-Oriented Dynamic Learning Environment. It is a free (licensed under the GNU GPL) web application that provides the ability to create sites for online learning. The first version was written on August 20, 2002. In 2018 Moodle LMS covered approximately 18% of the US [54; 55]. Moodle is a software package for creating distance learning courses and web sites. The system is designed, taking into account the achievements of modern pedagogy with a focus on the interaction between students (discussions). It can be used both for distance learning and for full-time study [17]; the design has a modular structure [26]. Each user can specify his/her local time, while all dates in the system will be translated for him in local time (message time in forums, deadlines for completing tasks, etc.). There are various module components for the creating courses: chat, poll, forum, glossary, workbook, lesson, test, questionnaire, score, survey, wiki, seminar, resource (as a text or web page or as a catalogue). It allows to set up e-mail newsletters, forums, ratings and comments of teachers. Despite some shortcomings, we consider this platform one of the most successful representatives of virtual platforms for students' research practice.

OilCase platform (for universities and students of oil and gas, geological and related specialities). The OilCase platform is a virtual space for working with a digital model of an oil and gas field synthesised based on real production data. The digital model reflects existing wells and research on a virtual licensed area. Platform users (students of specific specialities) have at their disposal virtual monetary and temporary resources. Field management is carried out in stages through the formation of a list of operations and desired research. All user actions are taken into account in a historical report, based on which you can analyse the student's work with a digital model. Working with the OilCase platform is a full-fledged alternative to internships at research centres of oil and gas companies.

GetCourse [15]. The platform for sales and training: seminars, training, courses, full-time and online classes. It is one of the largest networks with convenient functionality, which is developing rapidly (Tab. 1).

Tab. 1. Key indicators of the GetCourse platform over the past five years (formed by the authors based on GetCourse 2019 Results)

Index	2015	2016	2017	2018	2019
Lead attracted	0,6 mln	3,3 mln	5,6 mln	13,7 mln	32,2 mln
Orders created, pcs.	121 k	327 k	1,1 mln	3 mln	8 mln
Orders paid, pcs.	60 k	180 k	615 k	1,7 mln	4,3 mln
Orders paid, mln. $.	5,57	14,18	36,18	114,31	260,46
Letters sent	24 mln	110 mln	330 mln	0,9 bln	1,9 bln
Training created	10 k	24 k	55 k	152 k	328 k
Lessons created	58 k	116 k	270 k	705 k	1,6 mln
Pages Created	5,7 k	19 k	45 k	128 k	298 k
Processes Created	250	2,3 k	8,7 k	30 k	88 k

It is worth mentioning that the number of courses is growing at a tremendous pace every year, but the percentage of purchase rates remains unchanged - within 50-57% (Fig. 2).

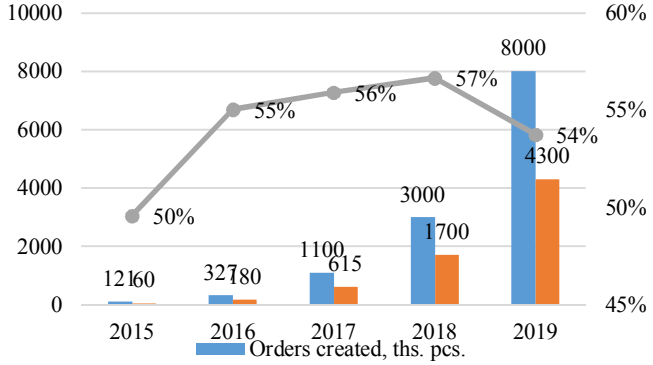

Fig. 2. Trends in demand for platform courses (formed by the authors based on GetCourse 2019 Results)

Absence of a free version does not allow it to become famous as a research platform for teaching students.

Practices and internships from business with subsequent employment (for example, Umka (https://umkaplanet.com/)). Umka platform is intended for practical training for students in IT companies. Its peculiarity is that it is free for a student, but paid for employers. At the same time, the platform supposes that the mentors are being paid for their work of evaluating students and monitoring their performance of tasks in the process of passing practice (Fig. 3).

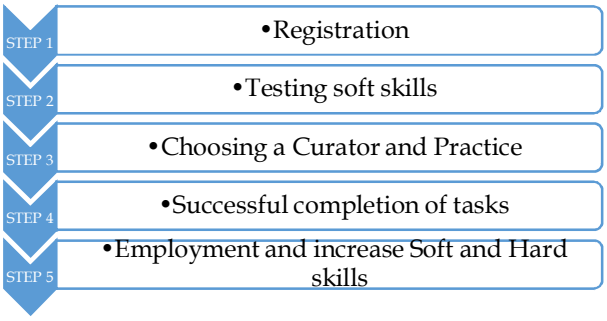

Fig. 3. The practice process on the virtual Umka platform

Practices are created for students by teachers based on real orders from the business. Thus, the student has the opportunity to prove himself/herself as a specialist and to start working in this company immediately after graduation. The platform is more focused on making money and does not focus on developing student competences. It is more of a tool for showing what a student knows and what skills he/she owns for further employment.

4. Conducting an Experiment and Analysing The Results

In 2016-2019 the authors conducted a series of experiments on the introduction of virtual platforms for students' research practice. Students from three universities participated in the experiment: Bohomolets National Medical University, State Higher Educational Institution “Pereiaslav-Khmelnytskyi state pedagogical Hryhorii Skovoroda university” and State Institution "Luhansk Taras Shevchenko National University". Due to different orientations of universities (the areas and specialities of training), the implementation of the virtual platform was different for various universities. However, the authors set the task of comparing the effectiveness of introducing such platforms to replace offline practice bases with virtual ones. The introduction of quarantine measures following the COVID-19 pandemic and the transition to online training at the time of undergraduate practice confirmed the need to use such tools.

From 2016 to 2019, 487 students from 3 departments took part in the study: Medical and General Chemistry Department, Ukrainian and Foreign Literature and Methodology of Training Department, and Translation Studies Department. Each year, approximately 1/3 of students of different academic performance (experimental groups) used virtual platforms for practical training. Further, their indicators were compared with the students who had practice in offline conditions (control group.

The evaluation was carried out on a 5-point scale, where 1 – is not developed at all, 5 – fully meets the requirements. The faculties of the department, faculties of other related departments, graduates of the departments, practising specialists and potential employers evaluated the impact of practical training on students. Moreover, for the experiment purity, they did not know, which students were practising on the virtual platform, and which ones were using the offline basis for their practice.

The results for years 2016-2017 are shown in Fig. 4.

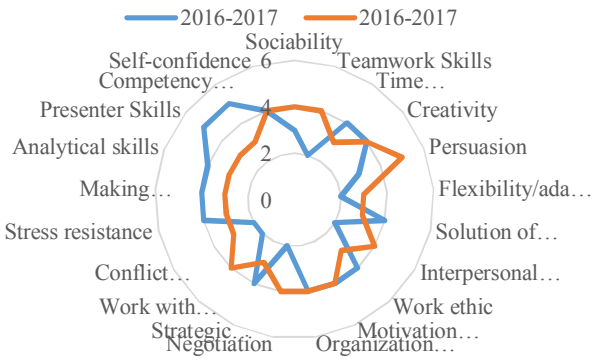

Fig. 4. The results of an experiment on mastering individual student competencies during practical training in offline and virtual conditions (2016-2017)

The comparison analysis demonstrated virtual platforms were more effective in developing the competencies related to students' expertise in their area of specialisation such as competency within the speciality, solution of problems, making particular decisions, and analytical skills, to the detriment of social and soft skills.

It is worth noting that after the first two years, virtual platforms were further developed, taking into account the wishes of students and preliminary analysis, while the offline conditions during the same period stayed without changes. The adjustments of virtual research practice included specific issues of research practice administration, adding group tasks to students, making the "reality" of functions as close to real-life ones as possible, and more clear purposes and forms of communication between students and their mentors. The results for years 2018-2019 are shown in Fig. 5.

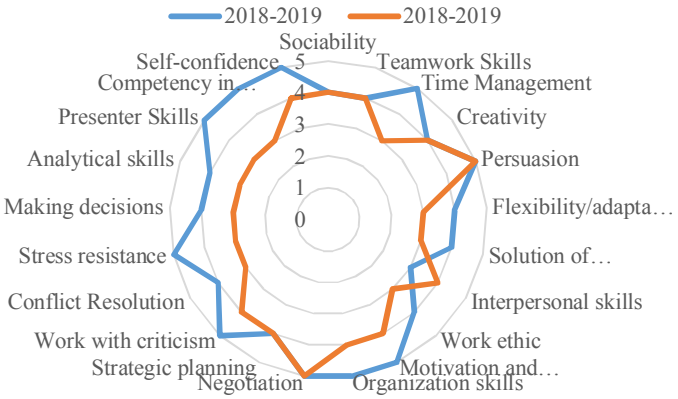

Fig. 5. The results of an experiment on mastering specific student competencies during practical training in offline and virtual conditions (2018-2019)

The analysis of the experiment results after the adjustments have been made, showed increased improved results for most of the student competencies for students using online platforms.

The analysis of the first two years showed that virtual platforms should be adjusted based on the area of studying both at the beginning of an experiment. After a particular time - the virtual platform for medical students without adjustment is not suitable for students studying literature, as well as for students of the business department. However, the ability to configure the virtual platform made it possible to make the initial adjustment, as well as the subsequent ones (after the first two years), which allowed us to achieve reasonably good results (Fig. 6).

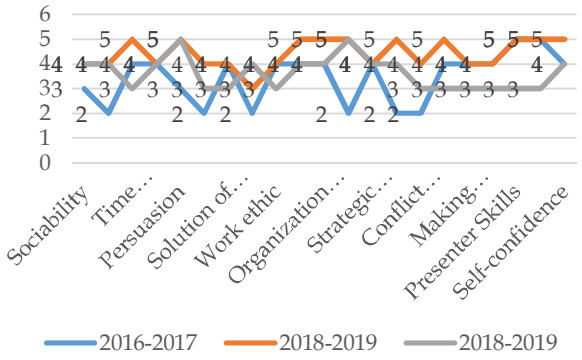

Fig. 6. The impact of changes on student results

Thus, the virtual platform has shown its applicability as an alternative to undergoing research practice for students.

Despite numerous existing advantages of virtual spaces, they are still not accessible for research practice. Moreover, to date, there is no visible progress in the area of scientific ideas exchange. Scientific research is carried out within the framework of scientific organisations (universities, institutes, centres). In most of the cases, the results of offline activities are just reflected on the Internet. The main reasons may be:

1. There is no developed environment for convenient interaction. There are no software products that would allow holding the same high-quality discussion as offline communication. Recently, this has been partially solved by such products as Zoom, Meet, Viber, Skype. However, each product has its limitations, for example, Zoom has a sufficiently large number of participants who can simultaneously participate in a conference/discussion; however, it is limited in time (up to 40 minutes, during the COVID-19 pandemic the restriction was lifted). On the contrary, Meets allows unlimited time (until September 30, 2020), but a limited number of participants. Besides, these platforms require to be present in person, which creates difficulties because of different time zones in different countries and the need for a student or scientist to have time to think before expressing his/her thoughts.
2. In scientific research, not only verbal communication but also non-verbal is essential. In conditions of increased uncertainty of the result, it is useful for the persons involved to communicate and see non-verbal communication from a colleague. Internet communications do not allow you to feel the whole range of signals coming from the opponent. Perhaps this limitation will be overcome as virtual space improves.
3. Scientific relations and scientific schools are subject to the principles of club benefits: a participant cannot freely join an existing community, he or she must meet specific criteria to be allowed in the discussion so that his/her opinion to be taken into account. This obstacle can be eliminated using the principle of building a chat: unregistered participants do not have the right to write messages, but can observe the discussion as they register when they prove their competence, they are allowed to express their ideas. If some experts would like to discuss issues in a small circle, then a "private" mode is possible.

6. Conclusions

The study of the applicability of virtual studying platforms has shown their full suitability for student research practices. However, it is worth noting the following:

1. The analysis showed that during offline-based practices, social skills are more developed compared to professional qualifications. One of the main reasons for this is that in many cases, the mentors prefer not to give students "real" tasks. For the most part, students are involved in work with documents and archives, use special office equipment only to some degree, and observe employees' operations without direct participation.
2. The analysis of the first two years of the experiment showed that in case of replacement of offline practice with the virtual one, the social skills (such as teamwork, interpersonal communication, conflict resolution) develop in a lower degree. Having observed that, in the following two years of the experiment, the authors adjusted some research practice conditions focusing on increasing students' competencies.

3. The adjusted technique has allowed to strengthen the virtues of virtual practice in terms of developing professional competencies, reduce its disadvantages, and add more "reality" to research practices.

The analysis of the results confirmed that for each speciality, the training conditions need to be adjusted. The possibilities of the virtual platforms to improve their configurations made it possible to make the initial adjustments, as well as the subsequent ones (after the first two years), which allowed achieving quite impressive results in increasing students' competencies.

Factors that impede the process of education "virtualisation", include restrictions on the network bandwidth and hardware requirements, absence of convenient tools for performing specific specialised actions. Among the issues not related to the virtual world itself, there were also found the challenges with balancing the time spent between online and offline activities, as well as subjective factors such as the fear of Internet addiction.

Further aspects of the study of virtual spaces as a platform for student research practices may include the development of a platform sample or methodological recommendations for universities with detailed requirements for such platform, its tasks and functionality.

7. Conflicts of Interest

The authors declare no conflict of interest in the design of the study; in the collection, analysis, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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