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# THE IMPACT OF MENTORSHIP PROGRAMS USING VIRTUAL REALITY ON STUDENT PERFORMANCE

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**ABSTRACT**

The formation of professional knowledge is possible when students interact with a more experienced mentor. The article aims to determine the effectiveness of virtual reality mentorship programmes and their impact on student performance. The study used analysis methods, surveys, the Mann-Whitney *U* Test Calculator, Student's coefficient and the Thurstone scale. Implementing the mentoring project was made possible with the help of unique virtual reality applications: Immerse, which offers a personalised approach to learning (M=9.04) and an automated approach to monitoring progress (M=9.0), and Edpuzzle, which provides a personalised approach to learning (M=9.03) and the transmission of signals between mentor and student (M=8.94). The application also provided automatic control over the completion of tasks (M=9.01), which contributed to the understanding of foreign language rules. It was found that using virtual reality in the mentoring process contributed to achieving high results by students – group 1: theoretical knowledge – 92 points, practical knowledge – 93 points, group 2: theoretical knowledge – 95 points, practical knowledge – 91 points. The practical significance of the work is aimed at the possibility of using virtual technologies to implement mentoring programmes. Future research may determine students' professional competence based on the mentoring and traditional approach.

**Keywords:** *Professional Development, Mentors, Interactive Learning, Virtual Reality, Student Performance, Educational Programs*

## 1. INTRODUCTION

Students' academic performance depends on their understanding of the materials studied and their ability to practice them. Students must perceive learning materials objectively and work individually on possible knowledge gaps. Mentorship programs, which should include a comprehensive approach, can facilitate this process [1]. Virtual reality will allow for a personalized learning process that reflects the current topic of study.

Developing mentorship programs for students using virtual reality is a modern approach to the educational process. It provides more valuable

potential for developing professional skills and the possibility of individual study of complex topics [2]. The positive impact of mentoring programs is related to their focus and academic nature. The effectiveness of mentorship programs in learning is associated with ongoing discussion and problem-solving to provide professional development support [3]. Mentorship programs are aimed at faster adaptation of students to professional development due to specialized orientation for knowledge acquisition. A high level of training further influences professional success [4]. Mentorship programs can be aimed at intellectual stimulation, which ensures the accumulation of necessary knowledge and cognitive confidence [5].

Mentoring can be individual, team, remote and peer-to-peer, involving interaction with students with almost equal knowledge. The mentoring approaches can be implemented through virtual reality [6]. Virtual reality can facilitate the creation of a separate mentorship program, analyzing the effectiveness of teaching tools and controlling the accuracy of students' assignments [7]. Virtual interaction contributes to a deeper understanding of educational materials, support for continuous learning, and professional experience [8]. The development of mentorship programs based on virtual technologies transforms the learning approach depending on the students' knowledge at a particular stage [9]. Virtual technologies contribute to developing students' strengths and motivate them to learn by adjusting project activities.

Based on the analyzed material, it is possible to conclude that mentorship programs are widely used to teach students. However, the possibility of using virtual technologies to implement mentorship programs rather than conducting basic training has been considered superficially. The study aims to determine the peculiarities of the impact of mentorship programs based on the use of virtual technologies on student performance. Research objectives:

- develop mentorship programs to support students based on virtual activities (Immerse and Edpuzzle apps);
- evaluate the functionality of virtual reality applications that facilitate the implementation of mentoring programs;
- to analyze the possibilities of implementing mentoring functions during the research based on the use of virtual reality;
- to determine students' performance before and after the study using mentorship programs.

## 2. LITERATURE REVIEW

Studying in higher education contributes to various problems for students regarding academic adaptation. Mentorship programs promote the social integration of students, especially when these mentors are peers. This approach ensures that certain students belong to a particular specialty, which forms professional knowledge [10]. Peer mentors build the capacity to teach other students, which has been tested over 4 years. Mentorship programs help to broaden the way students perceive learning materials, which leads to better learning outcomes [11]. The mentoring process can be implemented through the use of modern digital opportunities. Studies have shown that students with mentors demonstrated higher academic performance than other students. This group of students was also more motivated and took the initiative to learn new materials [12].

STEM technologies can be the basis for implementing the mentoring approach, as they contribute to efficiently allocating learning resources. The mentoring approach should be based on logic to achieve the desired results. STEM technologies help to determine the quality of mentoring immediately after the end of the program [13]. Professional development of teachers who can act as mentors is possible through modern technologies. Digital technologies allow for the adaptation of curricula for easier comprehension based on the principles of constructivism. Adapted learning strategies lead to a better perception of information, contributing to professional development [14]. Digital tools facilitate the joint exchange of educational information between mentors and students. They also facilitate the implementation of structural learning approaches and virtual collaboration. This improves students' understanding of certain information, which ensures a sustainable learning process [15]. Blended forms of mentoring help to provide technological assistance and academic tutoring. The online approach helps to increase students' self-esteem and provides ongoing counselling that boosts confidence in understanding the curriculum [16]. Achieving high academic results is possible through mentoring, student commitment and feedback. This can be achieved through training, a preliminary meeting with a mentor, and active learning [17].

The mentoring process should be aimed at providing a specialized classroom and extracurricular scheme. Mentoring over 400 first-year students provided a better perception of professional terminology and increased students' independence. A positive impact was also observed among mentors, who achieved high confidence and

developed interpersonal skills [18]. Modern technologies in distance learning contribute to targeted learning for students and ensure quality mentoring. Digital technologies can help motivate students to learn, which affects their academic performance [19].

The analysis of scientific articles allowed us to determine the role of mentoring and tutoring in student learning. Digital technologies are a common approach, but more in terms of an additional tool for implementing mentoring approaches. The purposeful use of virtual technologies to implement mentoring programs has not been studied, which creates research gaps, so it is necessary to continue researching this issue.

## 3. METHODS

### 3.1. The Research Procedure

Following the sequence of the study was made possible by going through three main stages. The first stage involved the development of a mentorship program with the use of virtual reality aimed at improving professional knowledge among students. The second stage identified the advantages of virtual technologies that facilitated the implementation of mentoring projects. Also, with the participation of teachers, the second stage of the study identified the functions of mentoring that could be achieved through virtual reality. The third stage of the study involved determining student performance by comparing the results before and after the study.

### 3.2. Sample Selection

The study was implemented with the help of 134 students of the Ivan Zyazyun Institute of Pedagogical and Adult Education of the National Academy of Educational Sciences of Ukraine, Ivan Franko National University of Lviv, Lviv Polytechnic National University, Uzhhorod National University, and Ukrainian State University named after Mykhaylo Drahomanov. The students were evenly divided into groups of 67. Group 1 included students studying to become higher education teachers; students in Group 2 focused on learning a foreign language. The sample of the study participants was selected from first-year students who were beginning to master their professional knowledge. Senior students (4th-year students) participated in the study as mentors. They facilitated first-year students' learning for 2.5 months since, after three months, students do not perceive the mentor as a mentor, which affects the improvement of professional knowledge. The choice of virtual learning applications was based on the student's specialisation. The Immerse application was used for students of Group 1 who developed pedagogical skills. The Edpuzzle app was suggested for use by students of group 2 who were learning a foreign language. The choice of applications was based on the study of their functionality, which facilitated the implementation of the mentoring program.

### 3.3. Methods

- This study used various methods that contributed to the implementation of the research program.
- The analysis method allowed us to develop a mentoring program involving virtual applications (Immerse, Edpuzzle). The choice of elements of the mentoring program was related to the possibility of ensuring students' understanding of educational topics and expanding their professional knowledge;
- The Mann-Whitney *U* Test Calculator was used to evaluate the functions of mentoring and to determine the benefits of virtual applications that facilitated the implementation of the mentorship program. It was used based on non-parametric statistical analysis, which can only be ensured between two samples. The selection of indicators that contributed to the evaluation was based on the functionality of the apps and mentoring functions [20].

$$U = n_1 \times n_2 + \frac{n_x \times (n_x+1)}{2} - T_x, \qquad (1)$$

$one n_1$ и $n_2$ – critical values of the criteria;
$n_x$ – number of criteria for calculation;
$T_x$ – reliability of indicators (tabular value)

- The Student's coefficient assessed students' performance before and after the training. The process involved an assessment of academic performance based on the assistance of a mentor. A high level of knowledge could be achieved by students who knew professional terminology and could apply the knowledge gained practically when solving situational problems. The average level was completed by students who had gaps in their knowledge, which was tested using virtual reality applications. Low results reflected a lack of understanding of the principles of professional activity. The teachers provided the scoring. To confirm the final data, the Student's t-distribution was calculated [21].

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$$t = \frac{M_1 - M_2}{\sqrt{m_1^2 + m_2^2}} \qquad (2)$$

- $M_1$, $M_2$ – the difference between the criteria;
- $m_1$, $m_2$ – standard deviation indicators.
- The survey was conducted to determine the benefits of virtual applications and to evaluate mentoring functions based on the Thurstone scale. The first part of the survey was conducted among students, and the second among teachers. The process involved determining what impact a particular virtual application (Immerse, Edpuzzle) had on implementing the proposed indicators. If there was no impact, the score was 0 points, the average impact was 0.5 points, and the significant impact was 1 point.

## 4. RESULTS

Academic mentoring provides individual support for students, focusing on their capabilities. The diversity of mentoring approaches does not allow us to assess their correctness within the framework of our study. Therefore, the authors developed their mentorship program using virtual reality (Figure 1).

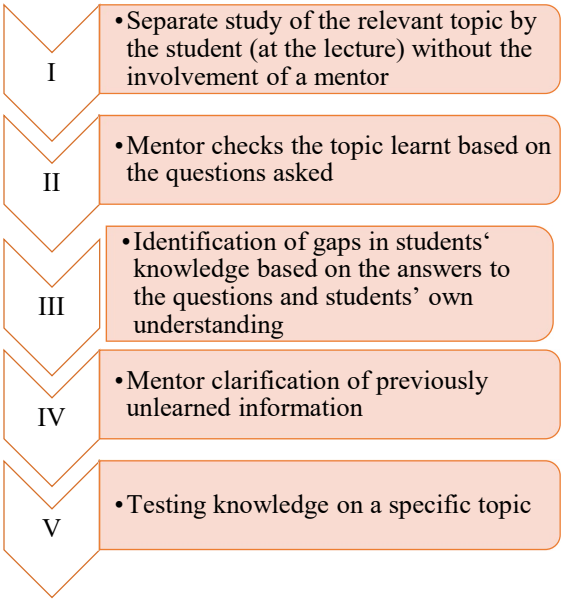


*Figure 1: Mentorship Program For Students Using Virtual Reality*
*Source: Compiled By The Authors*

Mentoring support involved preliminary processing students' requests in a particular topic and independently identifying possible gaps. The process aimed to ensure that students could adapt to their studies and develop their academic performance. The primary task of the students was to perceive information to unlock their potential independently. The mentor's review of the topic based on the questions asked is necessary to determine the student's understanding of the material. The test of students' knowledge was implemented using virtual reality (Immerse, Edpuzzle applications). An automated approach to testing students' knowledge by a mentor allows for greater attention to professional and personal development based on the realization of inherent potential. They are identifying gaps in students‘ knowledge based on the answers to questions and students’ understanding provided for developing students' thinking. The process involves understanding the importance of studying the relevant topic. The mentor's explanation of previously unlearned information allows you to expand your professional knowledge. The knowledge test on a particular subject is necessary to understand the level of students' training in a specific stage. The first part of the knowledge test was automated, which involved using virtual applications. The second part involved communicating with a mentor to explore the topic better.

Since the study involved two groups of students (future teachers and future translators) implementing mentoring programs using various virtual technologies, the Immerse virtual reality application was used to implement the mentoring program for foreign language learning. The functionality of the Immerse application is aimed not only at ensuring communication between the student and the mentor but also at monitoring the mentor's control over the students' practical tasks. The social application aims to provide various social interactions using an interactive approach. While studying the relevant learning material, the app also facilitated the creation of virtual hints, which offered high support. The app's functionality is linked to student interest in learning a foreign language and determining overall progress (Figure 2).

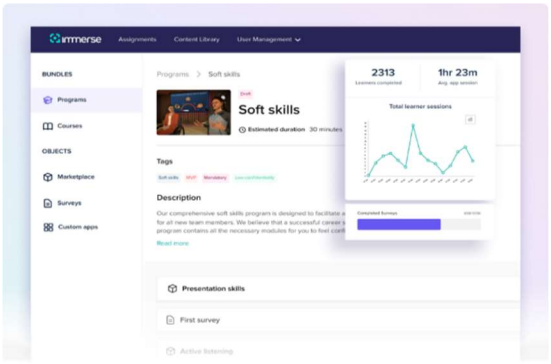


*Figure 2: Peculiarities of Using The Immerse Virtual Reality App*
*Source: created by the authors*

The Edpuzzle virtual reality program interacted with mentors during future teacher training. Working with the program involves creating interactive videos based on lectures. Questions designed for students based on the material they have studied provide for automatic assessment. Another feature of the Edpuzzle virtual reality application is the ability for students to complete tasks based on video lessons, which ensures a more detailed study of educational materials. This interaction between the mentor and the student develops their creativity and communication skills (Figure 3).

After the training, further research was possible, allowing us to assess the benefits of the virtual reality applications - the choice of advantages involved focusing on their functionality. The final results are presented in Table 1.

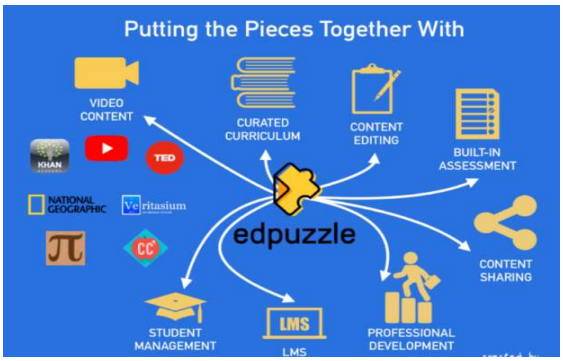


*Figure 3: Peculiarities Of Using The Edpuzzle Virtual Reality App*
*Source: Created By The Authors*

A comparison of the functionality of virtual reality applications was carried out among the Immerse and Edpuzzle applications as students of different groups evaluated them. Compared to Edpuzzle, Immerse has the advantage of providing automated progress monitoring and additional interactive support. These benefits help students develop practical skills while working with a mentor.

*Table 1: Advantages Of Immerse And Edpuzzle Virtual Reality Applications For Implementing A Mentoring Program*

| Advantages | Immerse | | | Edpuzzle | | | The final value of the Mann-Whitney *U* Test Calculator | |
|---|---|---|---|---|---|---|---|---|
| | M | SD | Md | M | SD | Md | U | p |
| Personalised learning approach | 9,04 | 2,36 | 9 | 9,03 | 2,34 | 9 | 171 | 0,07 |
| Automatic control over the execution of tasks | 8,42 | 2,11 | 8 | 9,01 | 2,30 | 9 | 152 | 0,06 |
| Automated monitoring of academic performance | 9,0 | 2,30 | 9 | 8,37 | 1,95 | 8 | 157 | 0,06 |
| Transmitting a signal from mentor to student and vice versa | 8,92 | 2,21 | 8 | 8,94 | 2,27 | 9 | 143 | 0,07 |
| Availability of additional interactive support | 8,04 | 1,98 | 7 | 8,31 | 1,87 | 8 | 129 | 0,08 |

*Source: created by the authors*

Automated progress monitoring helps to reduce the time required for the mentor to process students' results and allows them to find relevant material to fill in knowledge gaps. The availability of additional interactive support is associated with virtual hints that can be turned on during assignments.

The Edpuzzle app has the advantage of automatic task monitoring and easier interaction between mentor and student. The process aims to create relevant, interactive videos and questions based on lectures, facilitating instant information processing. Almost at the same level, the functionality of Edpuzzle and Immerse technologies allows for a personalised learning approach, transmitting signals from mentor to student and vice versa. These interactive capabilities enable the mentor and student to work together, facilitating the detailed processing of training materials.

The research involved determining which virtual reality applications allowed for the

implementation of the main functions of mentoring. These included eliminating knowledge gaps, forming academic knowledge, developing motivation, and creating approaches to solving situational problems. The final results are presented in Table 2.

*Table 2: Evaluation of Mentoring Functions Transferred Through Virtual Reality*

| Mentoring functions | Immerse | | | Edpuzzle | | | The final value of the Mann-Whitney *U* Test Calculator | |
|---|---|---|---|---|---|---|---|---|
| | M | SD | Md | M | SD | Md | U | p |
| The ability to fill in knowledge gaps | 9,23 | 2,56 | 9 | 8,75 | 2,31 | 8 | 183 | 0,08 |
| The ability to build academic knowledge | 8,64 | 2,29 | 8 | 8,60 | 2,26 | 8 | 163 | 0,06 |
| The ability to develop motivation | 8,59 | 2,25 | 8 | 8,36 | 2,07 | 8 | 161 | 0,06 |
| Creating approaches to solving situational problems | 8,95 | 2,37 | 9 | 9,18 | 2,53 | 9 | 175 | 0,07 |

*Source: created by the authors*

It was found that the virtual technologies used facilitated mentoring interaction between the student and the coach (mentor). First of all, the Immerse application allowed us to eliminate gaps in knowledge and understand the principles of implementing pedagogical activities in the future. This contributed to the development of student motivation. By addressing knowledge gaps, students could ensure the formation of academic knowledge. The Edpuzzle app helped students to immerse themselves in a specific situation to solve situational tasks. This ensured the use of appropriate foreign language words, understanding of vocabulary, and grammar correction. The process involved additional explanations by mentors of specific topics, which were implemented using interactive tools and presented in an easy-to-understand format (videos, diagrams, pictures, etc.).

The study also assessed students' progress in theoretical and practical knowledge, which involved comparing the results before and after the study. The final results are presented in Table 3.

*Table 3: Students' Academic Performance Before And After The Mentorship Program*

| **Type of knowledge** | **Before the study** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Group 1** | | | **Group 2** | | | **Student's t-test** |
| | **Points** | **Mean** | **SD** | **Points** | **Mean** | **SD** | |
| Theoretical knowledge | 78 | 0,217 | 0,041 | 76 | 0,215 | 0,038 | 0,459 |
| Practical knowledge | 72 | 0,205 | 0,034 | 74 | 0,213 | 0,036 | 0,436 |
| **Type of knowledge** | **After the study** | | | | | | |
| | **Group 1** | | | **Group 2** | | | **Student's t-test** |
| | **Points** | **Mean** | **SD** | **Points** | **Mean** | **SD** | |
| Theoretical knowledge | 92 | 0,739 | 0,083 | 95 | 0,772 | 0,085 | 1,960 |
| Practical knowledge | 93 | 0,744 | 0,084 | 91 | 0,726 | 0,081 | 1,875 |

*Source: created by the authors*

It was found that students' performance in both groups before and after the study was at approximately the same level. The accumulation of theoretical and practical knowledge after the survey was higher due to the adjustment of training by the mentor. Achieving a high level of success is associated with ensuring a well-thought-out strategy for implementing mentoring projects that involves unlocking students' potential. The availability of personalized feedback made it possible to fully work through each topic and broaden the perception of educational materials. Based on the knowledge gained, students-teachers were fluent in pedagogical terms, understood the principles of pedagogical activity, and could use the knowledge they had gained in practice. The students who studied a foreign language mastered translation skills, expanded their vocabulary, and followed grammatical rules.

## 5. DISCUSSION

Active learning contributes to the development of meta-cognitive and social skills. The influence of digital technologies ensures mentors' metacognitive awareness, develops communication skills, and the exchange of professional knowledge [22]. Interactive models contribute to the development of mentors' skills. They also provide simulations of curricula to gain pedagogical expertise and feedback. Interactive technologies facilitate the provision of information support between the student and the mentor [23]. The mentoring approach should contribute to developing students' research skills and increasing student progress. The process should include the theory of social learning and information literacy. Mentoring provides a method of information search, transfer of technical knowledge, and improvement of research skills [24]. The presented works indicate that the mentoring approach should be aimed at developing

students' research skills. In our article, we focused on the achievement of students' theoretical and practical knowledge by implementing mentoring approaches using virtual reality.

Mentorship programs are designed to improve student performance and contribute to strategic efficiency. Supervised mentoring ensures the correction of students' knowledge, which affects the achievement of quality results. Mentoring promotes students' self-realization and influences the development of digital competence and communication culture [25]. Mentoring approaches can be implemented based on STEM technologies, which motivate students to learn. Digital technologies impact the ability to provide asynchronous assessment, continuous encouragement and support. A mentor is an auxiliary tool for the perception of information, which helps to increase student engagement [26]. Artificial intelligence provides personalized, adaptive instruction, meeting students' individual needs and focusing on improving results. Modern technologies contribute to the search for new trends in mentoring to provide a better educational experience [27]. The interaction between teachers and students ensures the implementation of the educational process and contributes to the implementation of a blended learning format. This affects the optimization of academic needs and information retention [28]. Artificial intelligence ensures that the mentoring process is based on increasing student interest. Artificial intelligence eliminates formal learning and aims to improve it [7]. The presented papers study the mechanisms for implementing mentorship programs in distance learning. Our article examined classroom learning through mentorship approaches, which affect the possibility of using virtual technologies. The learning process involved a separate study of the relevant topic by the student, a mentor's check of the topic learned, identification of gaps in students‘ knowledge, an explanation of information by the mentor, and a control test of students’ knowledge.

The growing prevalence of distance learning is driving the need to find online instructors. The process should avoid obstacles to learning, increase students’ self-efficacy, and expand pedagogical knowledge and skills. Mentoring also positively impacts novice instructors, improving technical and pedagogical skills and influencing professional development [29]. Virtual mentoring has a positive impact on students' acquisition of professional skills. Virtual mentoring facilitates the possibility of conducting additional experiments that affect the realization of learning objectives [30].

A comparison of published articles with our work showed differences in the approaches to implementing research information. The articles that have already been published consider mentoring approaches to improve the effectiveness of the educational process. Our work aims to determine virtual reality's effectiveness in implementing mentoring projects. The study used specific virtual technologies that contributed to implementing mentoring support for students of different professional orientations. The research involved studying the impact of virtual applications' functionality on the delivery of mentoring projects. The effect of mentoring projects on students' performance in studying pedagogical disciplines and foreign languages was also assessed. The study fully reflects the tasks that were set to achieve the goal. The practical significance of the work lies in the possibility of adapting virtual reality technologies to the implementation of mentoring programs for different professional orientations of students (pedagogical direction, foreign language learning).

### 5.1. Study Limitations

The study's limitations relate to the formation of the mentorship program. The study envisaged its development using virtual reality, which excluded implementing traditional mentoring programs. In the future, it is planned to compare the effectiveness of conventional and innovative programs to improve students' professional knowledge. In this study, such an approach was not implemented due to the lack of a sufficient number of students.

### 5.2. Recommendations

Virtual technology is a favourable tool for implementing mentorship programs, as it ensures constant communication between the mentor and the student. Their use helps to develop the necessary topics and immerse students in professional activities. The mentoring approach using virtual technologies helps to achieve high results, which has been confirmed in our work. Immerse and Edpuzzle applications can be a practical tool for implementing a mentoring program.

## 6. CONCLUSIONS

The results confirm the relevance of the chosen topic, as they contributed to the formation of an effective mentorship program to achieve high professional results. The presented mentorship program involved the use of various digital technologies by the specialization of students. It has

been established that the functionality of the Immerse virtual application contributed to the provision of personalized learning (M=9.04), automated monitoring of progress (M=9.0), and additional interactive support (M=8.04). The latter criterion provided additional correction of knowledge based on digital tools. The Edpuzzle application allows for a personalized learning approach (M=9.03) and automatic control over the completion of tasks (M=9.01). Edpuzzle facilitates the use of lecture materials so that students can adapt automatically. It was found that using virtual technologies contributed to achieving the main functions of mentoring. The mentorship program positively impacted students, which was possible to combine based on the results of the pre- and post-study. It was found that the theoretical knowledge of students of group №1 was equal before the study (78 points) and after the study (92 points). The practical knowledge of students of group №2 was at the level of 74 points before the survey and 91 points after the survey. The study will compare the effectiveness of traditional and innovative mentoring programs based on the involvement of first- and second-year students.

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