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## **GAMIFICATION IN EDUCATION: CHANGING THE ATTITUDE OF MEDICAL STUDENTS TOWARDS DEMENTIA BY USING VIRTUAL REALITY (PILOT STUDY)**

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### **Abstract**

*The aim of the study was to change the attitudes of medical students towards elderly people with dementia in a positive way and to raise awareness of the importance of studying dementia in the elderly by using virtual reality tools. Hungarian (n = 20) and foreign (n = 20) medical students could experience what it would be like to be an elderly, demented person for 5 minutes by using a virtual reality application. Before and after the experiment, they completed a questionnaire and expressed their opinion on a Likert scale (0-6 points). The evaluation was made by using the Wilcoxon signed-rank test. The attitude of foreign and Hungarian medical students changed significantly in a positive way regarding the importance of studying dementia in the elderly (Z = 18, p < 0.078 and Z = 7.5, p < 0.187 respectively), judging the difficulty of lives of elderly people with dementia (Z = 20, p < 0.0078 and Z = 27.5, p < 0.002 respectively), judging their empathy for elderly people with dementia (Z = 32, p < 0.00112 and Z = 55.5, p < 0.0005 respectively), understanding thinking of elderly people with dementia (Z = 79 p < 0.0001 and Z = 59, p < 0.026 respectively), regarding the likelihood of taking steps to prevent their own dementia (Z = 27.5 p < 0.002 and Z = 27.5, p < 0.002 respectively). The study demonstrated the importance and the effectiveness of applying virtual reality tools in educating medical students.*

## **Keywords**

Gamification, Education, Virtual Reality, Dementia, Medical Students

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## **1. Introduction (Background and Purpose)**

Given the gradual aging of developed societies, it is worth paying increasing attention to the problems of the elderly in the field of education as well (Suzuki, 2020). It is worthwhile for teachers to use new teaching methods that will help them to arouse their students' interest in each topic much better than traditional methods. For many teachers, this is a great challenge as they find it difficult to deviate from traditional forms of education (Dave & Takuya, 2019). However, following the principle of 'if you want to teach me, reach me', teaching methods need to be reformed (Paxinou, Panagiotakopoulos, Karatrantou, Kalles, & Sgourou, 2020). The very first area where teaching methods related to dementia need to be reformed in the area of medical universities, as it is here that the doctors of the future will get their first impressions of dementia in old age.

Medical students' attitudes toward dementia in old age are quite different. Those who have had a personal relationship with such people are usually closer to the subject, but those who only know about the problem from textbooks - and they are in the majority - behave quite distantly about elderly, dementia patients, and even dementia. It has several reasons. According to the research compassion toward people with dementia is often suboptimal in medical students and it has a negative impact on clinical outcome and care (Bickford, Daley, Sleater, Hebditch, & Banerjee, 2019). As it is proven medical students are usually not prepared to care for persons with dementia (Childress & Chen, 2015). They may consider communicating with older adults time-consuming and challenging, lacking intellectual stimulation and overwhelmingly complex (Bagri & Tiberius, 2010). Although medical curriculums are becoming more and more perfect regarding person-centered educational approaches, current curriculums may not adequately prepare students to meet the needs of people with dementia (Gilmartin-Thomas et al., 2020). Another study pointed out that negative attitudes and stigma toward older patients with dementia are pervasive among medical students, but clinical encounters with older patients have a positive effect on students' sensitivity to geriatric issues and attitudes toward elderly people (Bernard, McAuley, Belzer, & Neal, 2003). The clinical encounter can be realized by using virtual reality (VR) equipment as well. VR immersion training is a very effective teaching method to help medical and health professions students develop empathy (Dyer, Swartzlander, & Gugliucci, 2018). This advantage of VR was applied in this research. The aim of the research

was to bring the topic of dementia in old age closer to the thinking of medical students, to develop their empathic skills related to elderly dementia patients and to make them steps toward preventing the development of their dementia.

## **2. Material and Methods**

Hungarian and English-speaking foreign medical students (n = 20 and 20 respectively, age: 19-27, mean: 20.7) participated in the experiment. They filled a questionnaire (Pre-Test Questionnaire - see Supplement 1) before an approximately 5-minute-long virtual reality intervention and then they filled out another questionnaire (Post-Test Questionnaire – see Supplement 2). The questionnaires were created for this study. A Likert-scale (0-6 points) was used since it can be applied to measure someone's attitude by measuring the extent to which they agree or disagree with a particular question or statement. The results of pre- and post-tests were compared to each-other measuring the change of attitude of medical students by the effect of the virtual reality intervention. The statistical evaluation was made by using the Wilcoxon signed-rank test since it can be used to compare two related samples to assess whether their population means ranks differ. Although a separate control group was not included in the study, the attitude of the students before the experiment served as a control. It is not an example without precedent; many studies use a similar experimental design (Cornell, 2004).

The VR hardware was Oculus Rift (see Picture 1) with a computer having the following specification: Intel Core i5+ 8400 Coffee Lake 4.0GHz, Intel B360, RAM 16GB DDR4 + 16GB Optane Memory, ASUS TURBO GTX1070 8GB, SSD 250GB + HDD 1000GB, Windows 10 64-bit.



**Figure 1:** *Oculus Rift Set* (Source: <https://www.oculus.com/rift/>)

The name of the software was Dementia. It gave an insight into the life of elderly people living with dementia. The user experienced some short episodes of the patient's life while using virtual reality provided the experience as if the user was the patient herself or himself. The patient's voice could be heard in the head of the user (female voice for female users, the male voice for male users). In the experiment, two scenes were used out of the four. In the first scene, an electric kettle was used by the patient for making tea. During the scene, a complete time and space disorientation could be experienced that made the patient feel completely lost in the previously familiar environment. In the second scene, the patient could not find her/his car-keys meanwhile getting a phone call from her/his daughter who the patient did not realize. The feeling of being confused and lost could be also experienced by the user (see figure 2).



**Figure 2:** *A Part of the Experiment on Changing the Attitude of Medical Students towards Dementia by using Virtual Reality (Own Source).*

### **3. Results**

The results regarding the main factors are shown in Table 1 and 2.

**Table 1:** *The Results of Changes in the Attitude of Foreign Medical Students Regarding Dementia during a Virtual Reality Experiment. The Statistical Evaluation was made by using the Wilcoxon Signed-Rank Test*

<b>Variable (Questions compared)</b>	<b>Statistics</b>	<b>Significance</b>
Pre-Test 1 – Post-Test 1	18	0.078
Pre-Test 2 – Post-Test 2	20	0.0078
Pre-Test 3 – Post-Test 3	32	0.0112
Pre-Test 4 – Post-Test 4	79	<0.0001
Pre-Test 5 – Post-Test 8	27.5	0.002

**Table 2:** *The Results of Changes in the Attitude of Hungarian Medical Students Regarding Dementia during a Virtual Reality Experiment. The Statistical Evaluation was made by using the Wilcoxon Signed-Rank Test*

<b>Variable (Questions compared)</b>	<b>Statistics</b>	<b>Significance</b>
Pre-Test 1 – Post-Test 1	7.5	0.187
Pre-Test 2 – Post-Test 2	27.5	0.002
Pre-Test 3 – Post-Test 3	55.5	0.0005
Pre-Test 4 – Post-Test 4	59	0.026
Pre-Test 5 – Post-Test 8	27.5	0.002

As can be seen from the results of the tables the attitude of foreign medical students changed significantly and the attitude of Hungarian medical students changed almost significantly in a positive way regarding the importance of studying dementia in the elderly ( $Z = 18$ ,  $p < 0.078$  and  $Z = 7.5$ ,  $p < 0.187$  respectively).

The attitude of both foreign and Hungarian students changed significantly positively in judging the difficulty of lives of elderly people with dementia ( $Z = 20$ ,  $p < 0.0078$  and  $Z = 27.5$ ,  $p < 0.002$  respectively), judging their empathy for elderly people with dementia ( $Z = 32$ ,  $p < 0.00112$  and  $Z = 55.5$ ,  $p < 0.0005$  respectively), understanding the way of thinking of elderly people with dementia ( $Z = 79$   $p < 0.0001$  and  $Z = 59$ ,  $p < 0.026$  respectively) and regarding the likelihood of taking steps to prevent their own dementia ( $Z = 27.5$   $p < 0.002$  and  $Z = 27.5$ ,  $p < 0.002$  respectively).

The comments of medical students indicate their change of attitude during the 5-minute-long VR experiment. Some opinions they wrote after the experiment:

“I think this was a very good experience because I have worked with people with dementia, I can understand and know how people with dementia are. But this gave me a new way of seeing it.”

“That was a very alarming experience for me because I see myself very prone to it and I am very excited to know the prevention of this sort of condition & how to treat & balance with these sorts of patients. Thank you very much because of giving this nice opportunity.”

“Very good experience that gives an insight into how a demented patient would live their lives and how it affects them and their loved ones.”

“It was very different from I would say “textbook” knowledge, I could actually at myself (at least a little bit better) in patient’s shoes just for a moment.”

“Before using the VR, I couldn’t deeply understand how difficult to live with dementia. Because it is difficult to understand how they feel when I never experience their life. But after VR, it was way easier to understand how it is tough to do something even a simple thing like finding a car key.”

“I never thought this in how dementia patients suffer. Now I can understand them better than before.”

“It is especially useful and necessary for all medical students to try this tool.”

“VR applications I used previously were usually interactive and immersive in your perspective but being immersed in someone else’s perspective, especially with a condition like dementia does help really in understanding and empathizing with the patient. I look forward to see further development in these tools for both doctors and families of patients.”

“The VR experience gave me a shock. The only way that I could see how a demented patient lives were only through watching a soap opera. Through VR I could feel how it is for the elderly to fight against dementia.”

“I thought I must be kind to my grandfather and grandmother. It was a really interesting study and I appreciate this chance.”

“I would recommend it to anyone working in healthcare.”

#### **4. Conclusions**

In the field of education, there is an increasing need for modern technical tools that attract students. Virtual reality is one of the achievements that can rightly gain the trust of students (Lopez Chavez, Rodriguez, & Gutierrez-Garcia, 2020). By creating a safe, realistic environment, they model situations that are otherwise difficult or rarely accessible (Rizzetto, Bernareggi, Rantas, Vanzulli, & Vertemati, 2020).

Attitudes of medical students towards elderly patients living with dementia are generally negative. This is primarily because they have a little realistic experience of these patients, rarely meet them in person, and are affected by prejudices heard from others. In a situation created using virtual reality, when they meet an elderly patient with dementia, they can openly express and accept their own emotions without having to fear the patient’s possible negative reactions. In this way, virtual reality provides an excellent training ground for such studies.

The study demonstrated the importance and the effectiveness of applying virtual reality tools in educating medical students. As an effect of a 5-minute-long virtual reality intervention, the attitude of participating students changed positively regarding the importance of studying dementia, judging the difficulty of lives of elderly people with dementia, understanding and feeling empathy toward them, moreover, they also decided to take steps to prevent their dementia.

Both the evaluations are given on the Likert-scale and the thoughts expressed by the students in writing testify that their attitudes towards elderly people living with dementia can be changed in a very short time with the help of a realistic experience. This experience can be easily incorporated into a lesson framework and managing virtual reality software is not an unacceptable challenge for the teacher either.

Since it was just a pilot study involving only 40 medical students bigger research is needed involving more students. It has already been started. The weakness of the study is the lack of a control group and it will be corrected in the next research.

In conclusion, it can be ascertained that VR methods can be applied effectively in medical education and universities should pay more attention to its development.

## **5. Acknowledgment**

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## Supplement 1

### Elderly People with Dementia - VR Attitude Pre-Test Questionnaire

Age:

Sex:

Please mark the points on the scale below reflecting your opinion! Thank you!

1. How important do you consider studying dementia in the elderly?

0            1            2            3            4            5            6

2. How difficult do you think the life of elderly people living with dementia?

0            1            2            3            4            5            6

3. How deep can you feel the feelings of an elderly, demented patient?

0            1            2            3            4            5            6

4. How well can you understand the thinking of an elderly, demented patient?

0            1            2            3            4            5            6

5. How likely are you to take steps to prevent your own dementia in old age?

0            1            2            3            4            5            6

6. How important do you consider the use of VR methods in the education of medical students?

(0 = I don't know or I don't consider it important)

0            1            2            3            4            5            6

7. Would you like to work with elderly, demented patients?

0            1            2            3            4            5            6

## Supplement 2

### **Elderly People with Dementia - VR Attitude Post-Test Questionnaire**

1. How important do you consider studying dementia in the elderly?

0            1            2            3            4            5            6

2. How difficult do you think the life of elderly people living with dementia?

0            1            2            3            4            5            6

3. How deep can you feel the feelings of an elderly, demented patient?

0            1            2            3            4            5            6

4. How well can you understand the thinking of an elderly, demented patient?

0            1            2            3            4            5            6

5. How useful was the VR program?

0            1            2            3            4            5            6

6. How likely would you to recommend the program to other medical students?

0            1            2            3            4            5            6

7. How important do you consider the use of VR methods in the education of medical students?

(0 = I don't know or I don't consider it important)

0            1            2            3            4            5            6

8. How likely are you to take steps to prevent your own dementia in old age?

0            1            2            3            4            5            6

9. How realistic was the experience?

0            1            2            3            4            5            6

10. I felt dizzy while trying out the VR program.

0            1            2            3            4            5            6

11. How many times have I tried the VR experience (except today)?

0            1            2            3            4            5            6

12. How easy was the application of the VR method? (0 = very difficult, 6 = very easy)

0            1            2            3            4            5            6

13. Would you like to work with elderly, demented patients?

0            1            2            3            4            5            6

Comments: