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Virtual Reality, Interactive Whiteboard Lessons or Traditional Education? Analysis of the Degree of Acceptance of Individual Forms of Activity by Students at the Level of Early School Education

Rzeczywistość wirtualna, lekcje z tablicą interaktywną czy edukacja tradycyjna? Analiza stopnia akceptacji poszczególnych form działania przez uczniów z poziomu edukacji wczesnoszkolnej

KEYWORDS

virtual reality, VR goggles, immersion, interactivity, interactive whiteboard, traditional teaching, acceptance, research results, early childhood education, students

ABSTRACT

The article serves as a summary of one of the parts of the research carried out as part of the research grant: *Initiative of Excellence – Débuts* ("Initiative of Excellence – Research University" program) in the years 2020-2021. The presented analyses concern the comparison of the degree of acceptance of traditional and interactive classes taught with the use of a multimedia board and tablets with interactive classes carried out with the use of VR goggles with motion controllers. The issue of acceptance of classes taught with the use of various techniques and didactic tools is extremely important. A student-friendly environment and working methods influence students' interest and their willingness to be active during lessons. The above-mentioned research was carried out in a group of 570 students in the 2nd and 3rd grade of primary schools from the Kuyavian-Pomeranian Voivodeship. The analyses presented to the readers are mainly based on the quantitative data obtained on the basis of observations and surveys. The research material is supplemented with qualitative data obtained through interviews. During the statistical verification, the following tests were

used: analysis of variance (ANOVA) with *Welch's correction,* post-hoc analysis with Games Howell's pair wise comparison test, and V-Cramer's correlation. The calculations have shown that there is a statistically significant difference in the level of acceptance of the analysed types of classes.

SŁOWA KLUCZE

rzeczywistość wirtualna, gogle VR, immersja, interaktywność, tablica interaktywna, nauczanie tradycyjne, akceptacja, wyniki badań, edukacja wczesnoszkolna, uczniowie

ABSTRAKT

Artykuł jest podsumowaniem jednej z części badań zrealizowanych w ramach grantu badawczego Inicjatywa Doskonałości – Debiuty (program „Inicjatywa Doskonałości – Uczelnia Badawcza") w latach 2020–2021. Zaprezentowane analizy dotyczą porównania stopnia akceptacji zajęć tradycyjnych oraz interaktywnych realizowanych z użyciem tablicy multimedialnej i tabletów z zajęciami interaktywnymi realizowanymi z użyciem gogli VR z kontrolerami ruchu. W ramach badań przyjrzano się również temu, czy poziom akceptacji zajęć ma związek z interaktywno-immersyjnym charakterem zasobów edukacyjnych. Problematyka akceptacji zajęć realizowanych przy udziale różnych technik oraz narzędzi dydaktycznych jest niezmiernie ważna. Przyjazne uczniom środowisko oraz metody pracy w sposób bezpośredni przekładają się bowiem na zainteresowanie uczniów oraz ich chęć do aktywnego działania podczas lekcji. Przywołane badania przeprowadzone zostały w grupie 570 uczniów klas II i III szkół podstawowych z województwa kujawsko-pomorskiego. Przedłożone czytelnikom analizy w głównej mierze opierają się na danych ilościowych pozyskanych na podstawie obserwacji, jak również ankiet. Materiał badawczy uzupełniony został o dane jakościowe otrzymane dzięki przeprowadzonym wywiadom. Podczas weryfikacji statystycznej zastosowano testy: analizę wariancji (ANOVA) z poprawką Welcha oraz analizę post hoc testem porównania parami Gamesa-Howella, korelację V-Cramera. Dokonane obliczenia wykazały, że istnieje statystycznie istotna równica w poziomie akceptacji analizowanych typów zajęć.

Students and Virtual Reality

In most texts, virtual reality is identified with a three-dimensional image that has been created by a computer (Systel, n. d.). However, these texts do not take into account the tool that is used to receive the message. Sometimes literature even points out that "virtual reality (VR) technology is rapidly evolving, as a result of which it is undesirable to define it in terms of specific devices" (LaValle, 2019, p. 2). In one of his articles, Janusz Morbitzer defines virtuality as "reality simulated with the tools of information technology. In this sense, virtual reality is described by the English-language

formula of the 'three I's' or 'I3': Interaction, Immersion, Imagination" (Morbitzer, 2015, p. 414). Depending on the device which is used to receive the stimuli, the participant in the presentation may face non-immersive (or low-immersive) reality, semi-immersive or immersive reality. In the first case, participants interact with the virtual world displayed on the screen on a profiled monitor. In the second case, they have the impression of being slightly immersed in the digital world through cardboard box goggles or floor projectors. Immersive VR, in turn, guarantees full immersion into the digital environment. Such a feeling is possible due to goggles with motion controllers or specially designed VR rooms. Of course, the higher the level of immersion and the greater the amount of interaction, the stronger the attractiveness and credibility of the resources presented. However, the research carried out by Zahira Merchant, Ernest T. Goetzb, Lauren Cifuentesc, Wendy Keeney-Kennicuttd and Trina J. Davis shows that even low-immersive presentations achieve better learning outcomes than traditional forms (Merchant et al., 2014).

The available analyses often do not differentiate between levels of immersion, and their authors keep using the term: "virtual reality". As a result of this, as Kamila Majewska points out, in the area of virtual media it would be worth distinguishing a subcategory: Extra High Virtual Media, which allows for full immersion with the use of VR goggles (equipped with appropriately developed interactive resources) and individual action with the use of motion controllers (2021).

According to Guido Makransky, Thomas S. Terkildsen and Richard E. Mayer, "virtual learning simulations are designed to replace or enhance real-world learning environments by allowing users to manipulate objects and parameters in a virtual environment [...]; they provide a strong sense of physical, environmental and social presence" (Makransky et al., 2019).

A diagnostic survey carried out in 2020 among primary school pupils showed that 98.95% of children know what VR goggles are. The definitions given, although not scientific in nature, fully capture the meaning and possibilities of working with the tool. Children describe VR goggles as: "a computer with a helmet on your head", "special goggles that make it possible for you to explore and see other places", "a super gaming device", goggles that "allow you to transport yourself to another place", "tools that are a hundred times cooler than a computer and a phone" (Majewska, 2021, pp. 288–290).

News about the operation and functionality of VR goggles is usually acquired by children from advertisements (21.4%) and videos posted on social network, such as YouTube (28.4%), TikTok (25%), Facebook (24.2%) or others (1%). Their content is predominantly commercial in nature or depicts the activities of young people in the VR space. This is evident in young people's awareness of the possibilities of using virtual reality. The interviews conducted reveal that students who do not have

educational experience with VR goggles equate them with a better version of the Play Station console, i. e. a tool used mainly for fun.

Currently, 10.18% of early childhood education pupils report owning the equipment on their own; 1.4% of them indicate that they use VR goggles occasionally with a friend or a family member, while 7.72% of the children have tested the tool in a shop or in a playroom. Therefore, the collected data shows that virtual reality is still something of a novelty and it is not as widespread among pupils as, for example, telephones or tablets. All of the surveyed students identify VR goggles as a tool for gaming. The same number of them (100%) accept VR goggles equipped with motion controllers. One in five students surveyed (19.65%) notes that virtual reality allows them to visit and explore previously unknown places and objects (Majewska, 2021).

A lot of researchers, including Polona Caserman, Augusto Garcia-Agundez, Alvar Gámez Zerbani, Stefan Göbel (2021), Eunhee Chang, HyunTaek Kim and Byounghyun Yoo (2020), warn that using VR goggles may result in health problems. On average, one in five children experienced the following as a result of using the goggles: headaches, nausea, vomiting, or problems with balance. Most of the reported cases were girls, which is in line with medical data. Based on his experience, Krzysztof Korzeniewski emphasises that "girls aged 2-12 years are most often affected by motion sickness" (2014, p. 176). Symptoms of sickness, as noted by students, usually occurred after games such as rollercoaster or car racing (Majewska, 2021). This is when our eyes register a constant change of the environment and rapid movement in many directions, which is contrary to the information registered by the organ of equilibrium (the vagus) that does not feel any changes in the body position. The use of calmer, more static presentations in which the image changed according to the user's movement, did not make the students feel worse. It is worth mentioning, however, that many researchers also mention the quality of the equipment, as well as the individual features of a person as factors that determine the user's well-being after the use of VR goggles. Such individual features may include optical flow, graphic realism, rendering, age, gender, health, or motion sickness.

VR goggles and the multimedia whiteboard as tools accepted by students: a brief review of the research

A landmark date in terms of the implementation of virtual reality research was 2016, when the Oculus company started selling integrated goggles. From a technical point of view, these devices proved to be far less demanding and, as a result, more accessible than the models that preceded them. They were better because of their wireless operation, requiring no permanent connection to a computer. The price of

the kit also dropped significantly, opening up the access to a larger audience. Over the years, a number of studies have been carried out around the world covering various aspects of the use of virtual reality for teachers, as well as for students of different age groups. During those studies the following areas were analysed: the existence and nature of the relationship between the use of virtual reality in the learning process and educational outcomes (Innocenti et al., 2019), cognitive curiosity, interest in the materials presented and motivation and readiness to learn new issues and skills (Thisgaardi Makransky 2017), involvement in learning activities (Lindgren et al., 2016), emotions arising in the learning process, and the sense of satisfaction derived from the learning process (PWC, 2020). A part of the analyses was also dedicated to the issue of acceptance of the learning process using VR goggles.

Research reports show that operating VR goggles equipped with motion controllers, as well as those without controllers (e.g. cardboard box), does not cause any problems for students (Dai, 2018; Majewska, 2021). This fact is not indifferent to the acceptance of the tool. In one study, the analysis of qualitative data made it possible to prepare a tag cloud with the most frequently used words reflecting the work with the goggles. Twelve words dominated, and 94% of them were positive. Students described their experience as: funny (10.45%), interesting (9.03%), nice (7.84%), incredible (5.46%), good (4.04%), realistic (3.09%), great (2.38%), exciting (2.38%), educational (2.14%), real (1.9%), strange (1.9%), or other (1.9%). The aforementioned experiment carried out by Adeola Fabola and Alan Miller also made it possible to notice that there was a statistically significant difference between the level of interest shown when using goggles and when watching a presentation displayed on a screen or a multimedia whiteboard (in favour of the former tool). In addition, it was noted that the goggle presentation provided greater immersion than the on-screen visualisation (Fabola and Miller, 2016). The issue of the attractiveness and acceptability of working with VR goggles was also addressed in the analyses carried out by Eleni Demitriadou, Kalliopi-Evangelia Stavroulia and Andreas Lanitis. The data collected by this team showed that working with virtual and augmented reality is more attractive for pupils in early education than activities with traditional worksheets. This, in turn, makes VR activities more acceptable than traditional textbook-based lessons (Demitriadou et al., 2020). Interesting observations were also made by Jaime Guixeres, Javier Saiz, Mariano Alcañiz, Ausias Cebolla, Patricia Escobar, Rosa Baños, Cristina Botella, Juan Francisco Lison, Julio Alvarez, Laura Cantero, and Empar Lurbe dealing with the possibility of using VR goggles in the physical activation of 9- and 10-year-olds. The data collected showed that the tool was fully accepted by the students. Six out of ten of them, when given a choice between virtual and traditional exercises, pointed to the former as more attractive and accepted (Guixeres et al., 2013).

Regardless of the level of interest of the pupils or the immersion of the materials presented with computer tools, it was observed that the children mostly accept working with new technologies. This also applies to the multimedia board. A study conducted by Kamila Majewska (2015) showed that the interactive board is a fully accepted tool by early childhood education students[1]. It is worth noting that, in most of the available publications, the tools referred to are analysed individually or in the context of much simpler technologies. The question arises: will the level of acceptance analysed not individually, but in the context of other technologies (including more complex ones) take analogous values?

Methodology of the research

The research presented in the text was carried out in 2020-2021 within the framework of the Excellence Initiative – Debuts research grant ("Excellence Initiative – Research University" programme). The research was practical in nature, specifically diagnostic and evaluative (Juszczyk, 2002; Juszczyk, 2005; Konarzewski, 2000; Rubacha, 2008). The research involved 570 pupils from classes 2 and 3 of early childhood education and 30 teachers of primary classes from the Kuyavian-Pomeranian Voivodeship. The research sample was random and multistage. The actions taken were based on the diagnostic survey method. The conclusions were mainly based on quantitative data supplemented with qualitative analysis. The research carried out made use of:

* questionnaire, which included both open and closed questions,
* a partially guided interview which resembled a group discussion, carried out in smaller teams (up to 25 people). Interviews were recorded on a voice recorder to facilitate their subsequent transcription. Speakers gained the right to speak after the researcher gave them a code which was assigned to them for the duration of the study (Juszczyk, 2013),
* direct observation that is open, controlled and conducted on the basis of a tool that was prepared earlier. Because of, i. a., personal data protection, there were two spaces in the observation sheet related to the identification of the research participant. The class teacher (the observer) identified the pupils by their first name and surname, which he/she entered himself or herself on the sheet (in the first column) before starting the observation. The second column (after the

1 In the studies referred to, the interactive board was compared with a traditional dry-erase board. The research carried out showed that the level of interactivity of the resources is reflected in the effectiveness of learning, student activity or the pace of work in the lesson. However, there was no correlation between the nature of the resources presented using the interactive board or the form of working with the board, and the acceptance of the tool.

first and last name) contained the individual codes that had been assigned to the pupils before the survey began. Once the observation was completed, the first column was cut off by the teacher and the data submitted for analysis was encrypted, but nevertheless allowing the observation and survey data to be combined (through the code)[2]. In order to reduce measurement errors, data was collected by a single researcher who conducted the lessons individually, thus having control over the actions taken (the content conveyed, the course and the timing of the lessons). The implementation scheme, as well as the topics presented, were analogous for each type of lesson. The classes were observed by class teachers (acting as competent judges), which made it possible to carry out more reliable observations. Nature education topics were discussed during the classes. All tools used in the experiment were verified (subjected to a standardisation and normalisation procedure) and discussed with early childhood education teachers. A detailed analysis of the tools was also carried out in terms of their relevance to the objectives. The planned procedure was not questioned by the Commission in charge of the Scientific Research Ethics[3].

As a part of the first stage of the research (Part A), the students participated in the following activities[4]:

- traditional classes with the use of a multimedia board and tablets (the tools were used to present resources and record notes; the working method used was predominantly a lecture),
- interactive classes with the use of a multimedia board and tablets (constructivist method of work),
- interactive classes with VR goggles equipped with motion controllers (constructivist method of work).

The main objective of the above part of the project was to verify and compare the level of acceptance of activities implemented in a traditional way with the simultaneous use of a multimedia whiteboard and tablets; in an interactive way with the

2 Due to the young age of the people participating in the research, the codes were graphic in nature. It was a triangle, circle or rectangle in white, yellow, pink, red, purple, green, sea, blue, navy or grey colour. Pupils wrote the first letter of the drawn figure and its colour on a piece of paper, e.g. TN (Polish abbreviation for a blue triangle). Due to the choice of names used, the order in which the 'figure colour' or 'colour figure' code was written did not matter. The codes entered by the pupils were completed by the researcher with a prefix consisting of a number from 1 to 12 (denoting the school), and a class identifier e. g. 2b, 3a. The individual code was assigned to the individual for the duration of the entire study.

3 Number of the application: 5/2023/FT; date: 16.02.2023.

4 The indication of specific types of lessons resulted from the desire to compare interactive activities carried out using VR goggles with motion controllers with those currently encountered in schools. Observations in schools show that sometimes the presence of a tool, i.e. a multimedia board or tablets, does not make a lesson interactive. Then, we have to deal with a hybrid: traditional classes with the technology acting as a presenter or a dry-erase board for taking notes.

simultaneous use of a multimedia whiteboard and tablets; and in an interactive way with VR goggles equipped with motion controllers by pupils from the early childhood education level. The second stage of the research (part B) compared the level of acceptance depending on the immersion and interactivity of the educational materials used. As a result, the pupils worked:

- in an interactive manner with a multimedia board and tablets with the support of which they could operate on 3D objects,
- with cardboard box goggles,
- with Oculus goggles equipped with motion controllers.

In the second phase of the research, a constructivist model of teaching was mainly used while working with the students.

In the research presented here, acceptance was identified with the approval of something/agreement with something/willingness to participate in something (Dictionary of the Polish Language, n. d.). During data collection, students were asked whether they agreed to participate in a particular type of activity in the future (whether they accepted it).

As a result, the following detailed questions were formulated:

P1. How much higher is the level of students' declared willingness to participate in interactive activities with VR goggles than the level of students' declared willingness to participate in a traditional learning process with the use of an interactive board and tablets? (part A)

P2. How much higher is the level of students' declared willingness to participate in interactive activities with VR goggles than the level of students' declared willingness to participate in interactive classes with the use of an interactive board and tablets? (part A)

P3. What is the correlation between immersive-interactive nature of educational materials and early childhood education students' declared willingness to participate in the classes? (part B)

Table 1. Variables emphasized in the research (Rubacha, 2008, p. 44)

Detailed question	Random variable	Fixed variable
1.	* Willingness to participate in the classes (identified with acceptance)	* Tools and forms of work used: • group working interactively with VR goggles equipped with motion controllers • group working traditionally with an interactive board and tablets used simultaneously
2.		* Tools and forms of work used: • group working interactively with VR goggles equipped with motion controllers • group working interactively with an interactive board and tablets used simultaneously
3.	* Willingness to participate in the classes (identified with acceptance) * Immersive-interactive nature of educational materials: • low immersion, high interactivity, • medium immersion, low interactivity, • high immersion, high interactivity	

Source: the author's own work.

n order to collect data, the students participated alternately in different types of lessons, which was due to the rotational nature of the procedure. This activity made it possible for them to objectively evaluate each of the lessons that were carried out.

Statistical verification was carried out using: analysis of variance (ANOVA) with Welch's correction, post hoc analysis with Games-Howell pair comparison test and V-Cramer correlation.

Discussion of the results

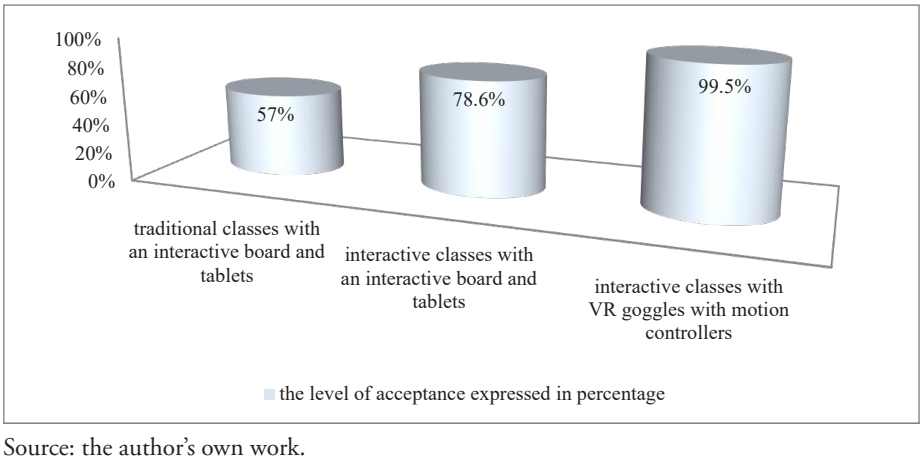
Analyses based on the data collected showed that students are fascinated by the possibility of interactive learning with VR goggles equipped with motion controllers. Slightly lower fascination is shown with regard to cardboard box goggles which are semi-immersive and provide only a low level of interactivity.

The analysis of the relevant data collected in the first stage of the study showed that the condition of the homogeneity of variance (Levene's test) was not met. As a result, due to the lack of homogeneity of variance in the groups compared, Welch's correction was applied. The analysis showed that there were significant differences between the groups in terms of acceptance $F(2;796.903) = 270.223$; $p < 0.001$; $\eta 2 = 0.18$. In order to determine the nature of the differences between the groups, a post hoc analysis was performed using the Games-Howell comparison test. The calculations showed that there were significant differences between:

- the group taught in a traditional manner with an interactive board and tablets used simultaneously and the group working interactively with VR goggles equipped with motion controllers,
- the group taught in an interactive manner with an interactive board and tablets used simultaneously and the group working interactively with VR goggles equipped with motion controllers, and
- the group taught in a traditional manner with an interactive board and tablets used simultaneously and the group working interactively with an interactive board and tablets.

The lowest level of acceptance was recorded for traditional classes using an interactive board and tablets used simultaneously, where the tools were used to present material and record information. The acceptance level for this type of activity averaged 57%. For interactive activities with an interactive board and tablets used simultaneously, the acceptance level was approximately 78.6%, and for interactive activities with VR goggles equipped with motion controllers, the acceptance level was 99.5%. Students described traditional activities with a multimedia board and tablet as boring, uninteresting and difficult to understand.

Chart 1. Acceptance of classes by students

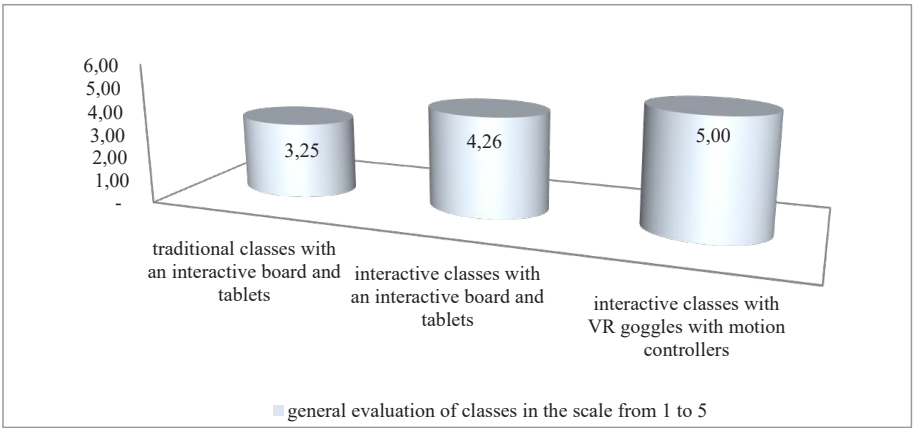


Source: the author's own work.

The calculations performed showed that the acceptance level of interactive classes with VR goggles is higher than the acceptance level of traditional learning with an interactive board and tablets used simultaneously by approximately 40%. The analysis also found that the acceptance level of interactive classes VR goggles is higher than the acceptance level of interactive learning delivered with an interactive board and tablets used simultaneously by approximately 20%.

The recorded level of acceptance of the analysed types of activities was also evident in the overall evaluation of the activities by the students[5].

Chart 2. General evaluation of particular types of classes by students



Source: the author's own work.

The interview conducted with pupils in the first grades shows that they are very positive about interactive activities with VR goggles equipped with motion controllers. It is worth emphasizing that 99.12% of the children rated these activities very good, while 0.88% rated them good. Pupils also declare that they are interested in regularly using VR goggles (with motion controllers) during classes.

The source of such a high acceptance of activities with VR goggles can be found in the opinions of pupils expressed about interactive activities with goggles equipped with motion controllers. Pupils in the early years of the primary school emphasized that:

- "the lesson with goggles was cool" (12btn),
- "the lesson was extra" (22bkcz),
- "it was the greatest lesson" (33atb),

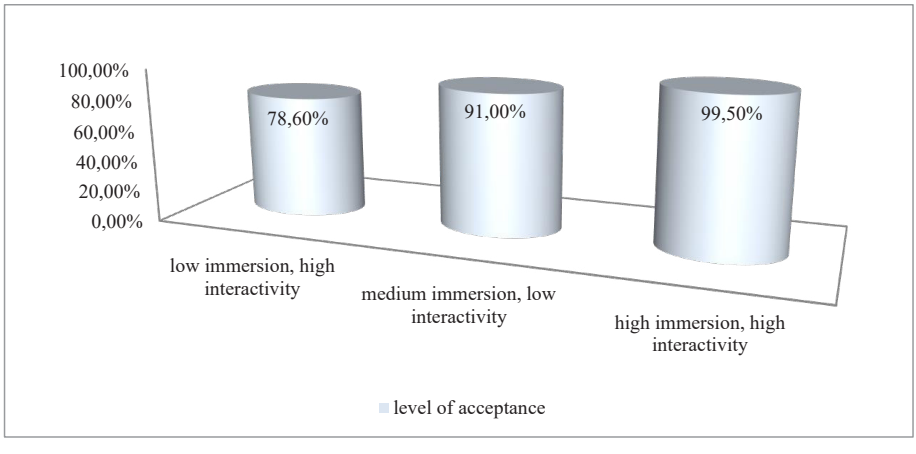
5 The evaluation was of a general nature and it covered content, form of delivery as well as attractiveness of the activities.

- "the classes were very interesting" (43cpż),
- "goggles with the controller are the best" (52aksz),
- "I really liked it" (63bkz),
- "the images are very realistic" (72cpn),
- "I feel like really being there…" (83atf),
- "the motion controller is super" (92bkr),
- "the controller makes it possible to pick up things on our own" (103ctm),
- "the lessons are interesting and make me want to learn more" (112cpg),
- "all the time I was curious about what I will see in a moment" (123apb).

It is worth noting that the mere presence of the tool does not result in full acceptance of the classes. In the case of cardboard box goggles, which do not have motion controllers and provide a medium level of immersion (semi-immersion), the declared acceptance ranged around 91%. Activities with cardboard box goggles were not only met with a lower level of acceptance, but also with a lower student evaluation. Some students justified this saying that cardboard boxes "do not give the opportunity to manipulate objects" (73bpb). The respondents also emphasised that they lacked motion controllers. In addition, it should be noted that paper goggles are not able to provide complete isolation from the outside world, which significantly reduces comfort of using them.

For question P3, the V-Cramer correlation for the nominal variables showed that there was a clear relationship between the immersive-interactive nature of the materials and acceptance of the activities $rv = 0.31$, $p<0.001$.

Chart 3. Connection between the immersive-interactive nature of the resources and the acceptance of classes by students



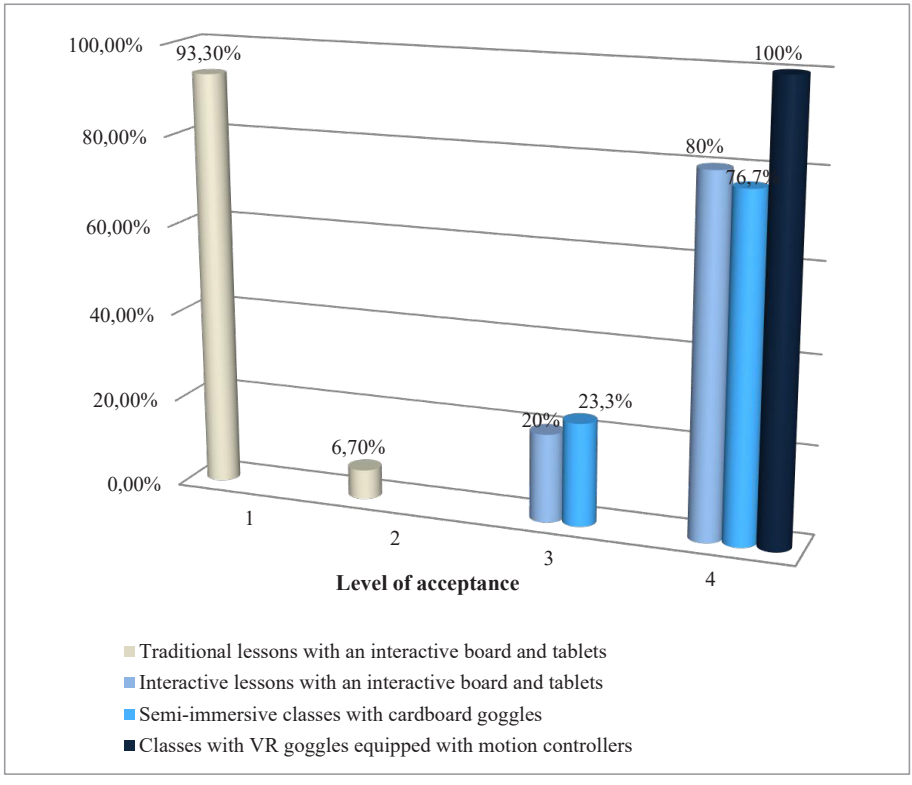
Source: the author's own work.

The calculations showed that as the level of immersion increases, the level of acceptance of the learning resources (and, therefore, of the classes) increases. The analysis of the data made it clear that, despite a decrease in the level of interactivity from high to low, acceptance of the materials increased (from 78.6% to 91%) as the level of immersion changed from low to medium. For the group with a high level of immersion and interactivity, acceptance of the classes ranked at 99.5%.

The statistics determined coincide with the observations of the teachers who emphasised that the students were most willing and open to work with goggles equipped with motion controllers. Based on their observations, the class teachers (who know their students) assessed that for:

- 93.3% of pupils find traditional activities with an interactive board and tablets very unattractive (attractiveness level 1, on a scale from 1 to 4),
- 6.7% of pupils find traditional activities with an interactive board and tablets unattractive (attractiveness level 2, on a scale from 1 to 4),
- 20% of pupils find interactive activities with an interactive board and tablets attractive (attractiveness level 3, on a scale from 1 to 4),
- 80% of pupils find interactive activities with an interactive board and tablets very attractive (attractiveness level 4, on a scale from 1 to 4),
- 23.3% of pupils find activities with cardboard box goggles attractive (attractiveness level 3, on a scale from 1 to 4),
- 76.7% of pupils find activities with cardboard box goggles very attractive (attractiveness level 4, on a scale from 1 to 4),
- 100% of pupils find activities with VR goggles with motion controllers very attractive (attractiveness level 4, on a scale from 1 to 4).

Chart 4. Level of acceptance of particular classes by students according to teachers



Source: the author's own work.

Therefore, it can be assumed that the attractiveness of the materials is the decisive element for acceptance. In the case of high immersion, the students' curiosity is strong enough to make them want to participate in the activities. They analyse, observe, discuss together and exchange their ideas. In the course of the activity, they forget that they are participating in the learning process and treat it as fun. The possibility of individual experimentation with movement controllers makes the work even more attractive and increases acceptance. This situation also comes as no surprise to teachers who are aware of the superiority of working with modern technology over traditional teaching. Unfortunately, as observations at school show, many educators still treat teaching as a one-sided process and new technologies as superfluous devices requiring an enormous amount of work on their part (Majewska, 2015).

Conclusion

As Jeremy Bailenson notes:

> There is a huge difference between the real world and the less vivid and more abstract versions of reality that we encounter even with media that appeal to multiple senses, such as film or video games; and we have no problems with distinguishing between these perceptions and reality. This is all true. In the case of virtual reality, the gap between the "real" experience and the indirectly communicated one may soon become much smaller. It will not be completely eliminated, but VR is psychologically much more powerful than any other medium invented by man until now (2018, s.13).

This tool is, therefore, an interesting suggestion for today's changing education. It provides access to rich resources of a multisensory nature. It strongly stimulates emotions and motivates action. The high level of acceptance of interactive classes with VR goggles equipped with motion controllers is also evident in the increased activity of students, as well as in the higher efficiency of education (Majewska, 2021). This makes interactive activities with VR goggles equipped with motion controllers a much more interesting and beneficial suggestion for students than lessons with cardboard box goggles or with an interactive board and tablets.

The high level of students' declared acceptance as well as evaluation of interactive activities with VR goggles equipped with motion controllers should be verified again. Indeed, the data collected may be the result of students' fascination with the new technology. It should be emphasised that the nature of the materials and the storyline of the activities also played an important role in the context of the collected data. This is because the researcher's previous experience shows that the use of VR goggles only for the presentation of three-dimensional models does not result in such spectacular effects. The positive reception of the classes with VR goggles may also have been derived from the good preparation of the researcher who ensured that there were no technical problems related to the use of the tools during the implemented procedure. It is therefore reasonable to ask whether the students' habituation to virtual reality and the VR goggles would not result in a decrease in the attractiveness of the classes in which they would be used, which, in turn, could be evident in the research participants' declared level of acceptance and in the overall evaluation of the lessons.

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