

# Using Virtual Reality Headsets in Education: From Theory to Practice in Vietnam

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## ABSTRACT:

*Using virtual reality technology (Virtual Reality - VR) in general and VR headsets in particular in teaching and learning has been implemented around the world. Actual results in many countries show that VR technology provides students with a new and effective learning platform. Students have diverse learning opportunities and practice through interaction to increase the ability to experience, observe and absorb knowledge. With the help of VR technology, students have the opportunity to perform experiments that are difficult to do in real life. Vietnam is not an exception to that general trend; however, there exists a gap between theory and real practice. In order to improve the current situation, suitable assessments and changes are required. This article presents the results of theoretical research and the actual situation of equipping and using VR headsets in secondary schools in Vietnam and proposes relevant recommendations.*

**KEYWORDS:** virtual reality, virtual reality technology, virtual reality headset, general education.

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## 1. Introduction

In the world, the general trend has shifted from knowledge-transmitting education to the “information age”, where students can actively seek and select information and now enter the era of learning through “experience”. In particular, with the application of VR technology in general and VR headsets in education, students can attach learning to its context and associate new knowledge with their life. The technology also creates opportunities for students to form and develop the necessary competencies and qualities to become citizens in the 21st century. As an inevitable trend in the context of technology development, educators are starting to rely on VR simulation to develop learning experiences. VR can increase student engagement; provide a dynamic and tectonic learning environment, increase the frequency of authentic learning experiences; enable students to develop their imagination and creativity (Hu-Au et al., 2018).

## 2. Literature review

### 2.1. Theories about virtual reality and virtual reality headsets

Virtual reality, as its name indicates, is a type of simulated reality that provides users with mediated experience. Despite its recent hype in news media and

popular press, the connotation of VR is often implied without a clear definition. A common definition of VR focuses on technology and refers to a collection of software and hardware for creating computer-mediated simulation (Biocca & Delaney, 1995; Makransky & Petersen, 2019). George Coates (1992) defined virtual reality as “electronic simulations of environments experienced via head-mounted eye goggles and wired clothing enabling the end user to interact in realistic three-dimensional situations”. Another definition by McCloy and Stone (2001) is that “VR is best described as a collection of technologies that allow people to interact efficiently with 3D computerised databases in real time using their natural senses and skills. It is an immersive technology” (912). VR can also be defined as a particular type of experience that affords a medium-induced sense of presence featured by high levels of immersion and interactivity (Radianti et al., 2020; Steuer, 1992).

From the definitions of previous research, it shows that virtual reality is an environment that simulates the real world. It is simulated by humans, and in that environment, all images and operating mechanisms directly affect all human senses, helping the experimenter to perform movement operations (forward, backward, rotate left, right), experimental operations (cutting, picking, pouring, dissecting, ...) to get the most realistic views to bring impressive virtual reality experiences. Thus, the main feature of VR technology is to make the user feel part of the VR environment. At the same time, the user can also perceive various perceptions, such as visual perception, tactile perception, auditory perception, physical sensation, motion perception, olfactory perception and sensory perception...All of these allow users to create an immersive feeling, immersing themselves in a real-life virtual world environment.

*A VR system has three major characteristics:*

**(i) Interactivity:** VR technology interactivity refers to the user interacting with the virtual environment in a natural way with the help of a special three-dimensional interactive device, such as VR headsets. The computer can recognize the user’s action signals in the real world to immediately simulate and perform those actions in the virtual world. The ability of the user to face the virtual environment is key to human-computer interaction. Interaction mainly includes the degree to which an object can act and the degree of sensation actually experienced in the virtual environment. Real-time is the most important factor in the entire interaction, reflecting the state of user input, requiring buffering to respond (Li et al., 2020).

**(ii) Immersion:** This property refers to the immersive experience that virtual environments bring to users. It is considered an important indicator to evaluate the performance of the VR environment. Based on the visual, auditory, and other sensory and psychological characteristics of humans, the computer generates realistic three-dimensional images. Users wear VR headsets, controllers, gloves, and other interactive devices, as if they were in the real world. VR also pushes this feeling “real” even more by affecting other sensory channels (tactile, auditory...). Users can not only see 3D graphics objects, control (rotate, move ...) objects but also touch and feel them as real (Li et al., 2020; Price et al., 2021).

**(iii) Imagination:** VR technology makes people from passive to active acceptance

of things, people from the integration of qualitative and quantitative environment, through perceptual knowledge and rational knowledge to actively explore information, deepen the concept, and then produce cognitive new ideas and ideas. There are two aspects of imagination in a virtual world: the travel within the world and the dynamics of the environment. Travel is the user's ability to move around independently, like being inside a real environment. Software developers can set settings for access to certain virtual areas, allows to obtain a variety of degrees of freedom (users can fly, break through walls, travel everywhere or swim, dive, etc.). Another aspect of travel is the positioning of the user's point of view. Point-of-view control is the user's self-monitoring from a distance, observing the scene through the eyes of another person, or moving in a new building as if sitting in a pushchair. Environmental dynamics are rules about how people, things, and things interact with each other in order to exchange energy or information (Christopoulos et al. 2016; Ha et al., 2019).

Basically, any VR system can be classified as immersive, semi-immersive, and non-immersive (Martin-Gutierrez et al., 2017). With each classification has the ability to suit users and meet practical needs in life such as entertainment, science, etc., especially in education, VR provides students with a new and effective learning platform, students experience learning in a rich and diverse way, can practice through interaction to gain the ability to experience, observe, acquire knowledge through hands-on exercises with the support of VR technology, especially for lessons with content related to practical experiments that are difficult to practice outside of reality, experiential lessons explored.

VR headsets are a product using VR technology, capable of recreating and simulating the entire space thanks to the ability to process by computer in a vivid way. VR headsets are being expanded to various industries such as security, defense, medicine, games and education (Hye, 2019). VR headsets can be understood as a device that simulates a physical presence in a geographical location or a computer simulation. Vuong et al. (2022) defined: "VR headsets are devices that express the virtual environment through the accompanying application software, this virtual environment is displayed as a three-dimensional image in real time on the screen, and the user can interact directly with those images".

*The role of VR and VR headsets in education is expressed as follows:*

(1) Virtual reality headsets promote innovation in teaching methods

Using VR headsets in teaching in general and teaching techniques, in particular, provides learners with a new and more effective learning platform than traditional teaching methods. That is, learners can practice through interaction to gain the ability to experience, observe, and innovate through full hands-on exercises with the support of VR technology. Thereby helping learners gain practical skills and improving technology education effectiveness. The application of VR in teaching has overcome the limitations of traditional teaching methods. It allows the creation of objects with which learners can interact with abstract concepts; allows observation, interaction with technical objects, complex technical processes and especially

in the current conditions of high-cost practical equipment (Youngblut, 1998; Grivokostopoulou et al., 2017).

Teachers use VR technology to explain some historical events, give students experience an experiment, travel into space, etc. Turning any event, passive knowledge, boring into vivid, more interesting or see how they work in detail, how to interact with them, makes learners can explore deeply, better understand the world, this helps learners feel interested at the same time. You can easily understand the lesson and remember it more deeply. Schools are being digitized and can use computers and mobile apps for their lessons. On the other hand, the application of this new technology in education will help teachers shorten teaching time, spend time evoking, and raising problem situations to stimulate students' creative thinking. Students can easily visualize and have accurate concepts about images, things and phenomena when exposed to them with visual images like in the real environment (documentary images, maps, movie clips, etc.) (McLellan, 2003; Liou et al., 2017).

(2) Virtual reality allows learners to interact in a way that blurs the line between real and virtual experiences

The VR system achieves the real interaction between the real human environment and the virtual environment, such as hand movements, head rotation and people's movement around. At the same time, with the help of special hardware devices, the virtual reality system allows for a quick response to the user's input information. Allows users to have a sense of the interaction between the real person and the computer. With these characteristics, VR headsets help remove time and space constraints in the user's VR experience.

*VR headsets enhance student engagement:* VR headsets provide opportunity, increase engagement and provide a new way of learning for students. Students get hands-on, interactive, immersive experiences that deliver powerful new experiences they may not have encountered before. For example, with the Google Expeditions app, teachers can "organize" students to participate in virtual trips to Mars, explore the ocean floor or in the jungle, etc. Thereby sparking new interest in the topic, providing the experience for better class discussion and improved engagement. This increased level of interaction can be an opportunity to solve problems that may seem a bit "boring" to students. Topics that previously had a low level of interest in students if they were only taught through books and materials, but when using VR headsets in teaching, students will feel like participating in those events and attractive context will increase students' interest in accessing knowledge. For example, students are "involved" in battles in history. In addition, the appeal and entertainment value of VR headsets can be used strategically to attract the attention of students who are distracted and unmotivated during class hours, and even those who are not subjects that some students may often find boring or irrelevant. Different types of classroom experiences will have varying degrees of effectiveness, for example, reading passages in a book will be different from passively watching a video and completely different from watching a play in a "virtual" theater and interacting with actors and objects in the VR space. By enveloping students in a realistic, multi-sensory experience, VR

headsets bring an object or thing to life (Chalmers, 2017; Retnanto et al., 2019).

*VR headsets provide an opportunity for students to experience “real life”:* When students read about something, they often want to experience it. With VR headsets, they are not just limited to word descriptions or illustrations in books, students get to experience virtual reality trips. Google Expeditions is a prime example of an app designed to provide such an experience. The Expedition is a library of field trips for frequent smartphone users. Each ride includes virtual reality panoramas and different trips from the Great Wall to Mars. People all over the world can visit places that are almost impossible to visit in person. Through the feeling of “immersion” that VR brings, students can learn about a topic by “stepping into” that space. Students can explore the Moon, swim with whales in the sea, walk through the cells of the body, and meeting people Historical figures who participated in battles in the past (Barnett, 2005).

*VR headsets create opportunities for students to learn by doing:* With the support of VR headsets, the teaching process will limit the teaching and transmission of knowledge, students will have the opportunity to learn by doing, performing tasks, interacting with contexts and situations to gain knowledge (Nick Babich (2019). Thereby contributing to the formation and development of students’ abilities and qualities.

### (3) Virtual reality enables distance learning

In education, there are three approaches namely full-time education, part-time education (partly at school, part virtual or distance) and distance education (virtual). Especially, distance education method is a method in which teachers and learners can interact through the network thanks to today’s modern communication technologies. The distance learning model is an online learning model that is being promoted today. The benefit of applying virtual reality technology to this model can be said to be a great utility. Overcome the limitations of geographical distance. Reduce study costs and significant travel costs for learners. Just sitting at home, wearing VR headsets, students feel like they are in the classroom (Tim Fisher, 2021), listen to lectures directly and interact in real time with teachers (Pereira, A. S., & Piovesan, S. D., 2012).

### (4) Virtual reality headsets support effective STEM education

STEM is an important orientation in education that contributes to the formation and development of students’ capacities and qualities, especially through experiences and practices (MOET, 2018). However, those real-life experiences can be hard to come by frequently in the real world. For simple equipment and utensils, it can be met, but with expensive equipment and complicated operation, students have difficulty accessing them. It is also not easy for all students in the school to participate in real-world experiments in limited time frames. The above difficulties can be solved by using VR headsets in teaching STEM subjects. There is no denying the importance of experiences and practices with real devices, but in cases where reality does not meet the conditions of real experience, VR headsets are an effective

solution. In addition, experiencing activities through VR headsets before building solutions or engineering design and manufacturing products in STEM topics is also necessary. For example, before planning to design a flood-resistant house, students can use VR headsets to experience space, test buoyancy, calculate Archimedes' thrust, etc. After experiencing activities in the virtual world There, students embarked on designing and manufacturing real models. If organized like this, it will increase the student's chances of success, reduce the risks and dangers, and reduce the cost of multiple tests.

With VR headsets, students have the opportunity to "access" the world's leading modern laboratories (Onyesolu & Eze, 2009). Technology is becoming more and more modern, so in that laboratory, there can appear a "virtual teacher" who interacts with and guides each student. Besides, students also have the opportunity to participate in STEM lessons easily, for example, students can culture bacteria and observe bacteria grow, experiment to find drugs that kill bacteria, etc. Students can also make electromagnets to sort garbage. STEM lessons will be more effective if students go through the process of designing and creating real products; however, with some dangerous and expensive cases, the "virtual reality" lab is most ideal.

#### (5) Contributing to career-oriented education in high schools

When applying VR headsets to teaching in high schools, students have the opportunity to experience and perform jobs related to careers. With traditional education, without virtual reality technology, it is difficult for students to experience the work of highly specialized professions or to visit factories and companies. Using VR headsets, students not only have the opportunity to visit each production and business facility, but also perform the work of some industries.

Students have the opportunity to "immerse" in the work of an architect when designing and building a house according to the requirements; Students can also become an astronaut to pilot the space shuttle to explore Mars. Thus, students can experience any profession in a virtual environment with VR headsets, but in reality, students hardly have the opportunity to "transform" into those careers. These experiences create opportunities for students to explore careers and contribute to their career orientation right from the early childhood.

## **2.2. Using VR headsets in teaching in secondary schools in Vietnam**

The deployment of equipping and using VR headsets in education and training has been interesting by countries around the world for many decades and has achieved certain results in innovating teaching methods, thereby contributing to improving the capacity of students.

In many countries such as Korea, China, Singapore, USA, the equipment of hardware for VR learning environment includes: computer – the most popular device (from 2000 - 2009), VR headsets such as Google Cardboard, Oculus Rift, HTC Vive, ..., polarized 3D glasses, along with accessories such as joysticks, motion recorders, and haptic gloves used today more in education (Nguyen et al., 2022). Some useful VR software is freely available to teachers and students, such as Google's Street View

app; Google Expeditions; Discovery VR; zSpace System; VR Immersive Education. With this software, just need a device such as a smartphone or a computer, users can create a VR environment in a short time and use it.

In Vietnam, the use of VR technology in general and VR headsets in particular in education has been implemented for the past 5 years; however, the application of VR is mainly concentrated in universities, high-quality human resources and IT training companies (Ha et al., 2019). Since 2019, secondary schools in some localities, including Hanoi, Quang Ninh, Hai Phong, Binh Duong, Tay Ninh, Ho Chi Minh City, Nam Dinh, etc., have equipped and used VR headsets in teaching from the financial support of some projects. The type of VR headset that schools are equipped with is standalone VR headsets, with pre-installed lessons and resources to help teachers organize activities so that students can participate in exploration, discovery and STEM education.

To demonstrate the use of VR headsets in secondary schools in Vietnam, this study conducted a survey to find out the current situation of using VR headsets in teaching in October 2021.

### **3. Research methodology**

On the basis of research on the use of VR headsets in teaching, a set of questionnaires for teachers and students about the practice of using VR headsets in teaching in junior high schools has been designed with the aim of learning about the level and duration using VR headsets in teaching and learning; teaching activities using VR headsets; a few conditions to ensure the use of VR headsets: organizing training courses for teachers; the health of teachers and students; role and features of VR headsets and some difficulties in equipping and using VR headsets in teaching.

The teacher survey questionnaire is structured into the following main parts: Part one, is general information about the teacher, such as year of birth, gender, teaching experience, training level and type of VR headsets being used. Part two, is questions related to the use of VR headsets by teachers in teaching. Specifically, teachers were asked about the extent and duration of using VR headsets in teaching activities, teaching activities organized using VR headsets, and training in the use of VR headsets for teachers. In addition, the second part also collects teachers' information about the role and features of VR headsets as well as some health symptoms that teachers experience after using VR headsets.

The student survey questionnaire is structured into the following main parts: Part one contains general information about students, such as the student's year of birth, gender, and class. Part two, is questions related to the use of VR headsets by students in learning. Students were asked about teaching activities using VR headsets, role and features of VR headsets; some health symptoms experienced by students after using VR headsets.

The study attracted 19 teachers and 153 students in the form of an online survey. In addition, 10 teachers and 03 managers participated in the form of in-depth interviews. Quantitative data results are analyzed and processed by SPSS software

so that there are reasonable judgments and explanations about the practice of using VR headsets in teaching.

The number of participants by gender is presented in the following Table 1.

Table 1. General information of respondents

	Gender	Doan Lap secondary school (Tien Lang – Hai Phong)	Le Quy Don secondary school (District 3 – Ho Chi Minh City)	Trong Diem secondary school (Cam Pha – Quang Ninh)	Total
Pupils	Male	31	18	18	67
	Female	25	30	31	86
Teacher	Male	03	05	02	03
	Female	02	04	03	16
Manager		01	01	01	03

#### 4. Results

Some key conclusions drawn from the survey are as follows:

(i) Level and duration of VR headsets use

Analysis of survey data on the level of VR headsets use among teachers in organizing teaching activities shows that: 47.4% rarely use VR headsets, 42.1% sometimes use it and 10.5% regularly use VR headsets. This result shows that VR headsets may not be really necessary for teachers' teaching.

Regarding the time students use VR headsets in learning activities, about 60% of teachers said that they let students use VR headsets for less than 5 minutes in a learning activity. This may be the right time for a teaching activity because each teacher has many other forms of teaching.

(ii) Teaching activities using VR headsets

Although the frequency of using VR headsets is not high, teachers have also organized teaching activities using VR headsets. In which, the activities that teachers use VR headsets the most are: STEM education, knowledge building, and experimental practice, while assessments, application and test activities are rarely used. The survey results showed that 84.2% of teachers had applied VR headsets in STEM activities, the highest proportion. Next come those who have applied VR headsets in knowledge building, accounting for 68.4%. 63.2% of teachers organized for students to use VR glasses in Experiments/Practice activities. The percentage of teachers who organized students to use VR glasses in warm-up activities, life skills activities and experiential activities was only 52.6%. This is because, for warm-up activities, teachers often give priority to students to play light movement games to change the classroom atmosphere and create fun for students before entering



a new lesson. With a life skills activity, it helps students build confidence in both communication and coordination and cooperation skills, providing them with important tools to develop, find ways to new thinking and problem solving, and provide methods on how to socialize, make new friends, and recognize the impact of your actions and behaviors. Therefore, usually, teachers will prioritize using teaching methods through specific situations for this activity. Experiential activities are basically educational activities that are organized in association with experience and life for students to experience and create, so teachers will organize for students to learn a problem or perform actions, employment or form attitudes through games such as role-playing and group work. The percentage of teachers applying VR headsets in assessment remains low, 21.1%. This may be attributed to the fact that most respondents are those teaching Math, Physics, Chemistry or Technology, or VR headsets suppliers prioritize STEM activities. Furthermore, resources for teachers' testing and assessment haven't got due attention. Through in-depth interviews, some teachers said: *"Currently, the supporting software that comes with VR headsets has little test content, and the assessment questions are not suitable to the requirements of Vietnam's general education curriculum for the year 2018. However, lessons with VR headsets are very suitable for virtual experiments/practices and STEM activities. For instance, in Chemistry subject, more specifically in Lesson 6 of Chemistry grade 9 about the chemical properties of oxides and acids, the use of VR headsets helps students practice the skills of observing, analyzing, recognizing and explaining the chemical properties of oxides and acids; another example in experiential activities, when using VR headsets students have chance to visit and learn about famous historical sites such as the Pyramids and the Great Wall"*.

Table 2. Learning activities using VR headsets

Learning activities	Percentage
Warm-up activities	52.6
Knowledge building activities	68.4
Experiments/Practice activities	63.2
Assessment activities	21.1
Life skills activities	52.6
Experiential activities	52.6
STEM education	84.2

(iii) Conditions to ensure the use of VR headsets in teaching

After equipping VR headsets, schools have actively worked with VR headsets suppliers to organize training for teachers to use glasses in teaching. However, the training is mainly on the technical aspects of using VR headsets, in terms of teaching methods, the VR headsets supplier has no expertise, so teachers must learn, research and exchange experiences with each other through professional activities. Results after the training courses show that the number of teachers who know how to use VR headsets proficiently is not much (15.8%), most of them are at the level of relatively proficient or proficient (see Fig.1). Through in-depth interviews, all manager said:

“After equipping VR headsets, the school actively worked with VR headset suppliers to organize training for teachers to use glasses in teaching. However, the training in use (since 2018 teachers have only been trained twice) is only in terms of techniques and operations. Because the VR headset supplier does not have expertise in teaching methods, teachers in the school have to learn, research and exchange experiences with each other through professional activities”. This shows that in order for teachers to be able to effectively exploit and use VR headsets in teaching, it is necessary for specialized agencies and units to train teachers on methods and forms of teaching organization using use VR headsets.

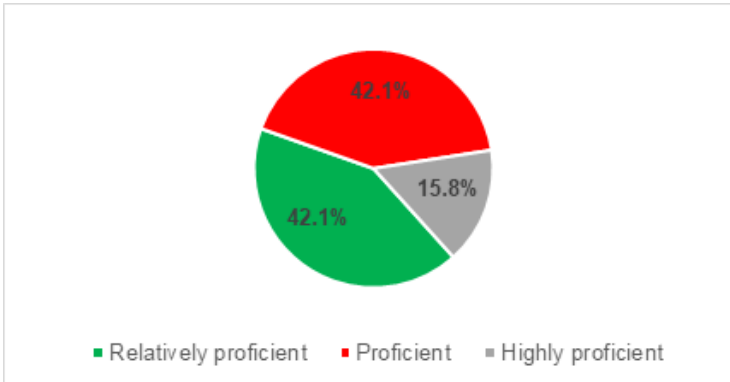


Figure 1. Level of proficiency in using VR headsets of teachers after training

Regarding the health of teachers and students: the use of VR headsets may cause teachers and students to experience some symptoms such as: dizziness, headache, nausea, vomiting and neck pain. Among the interviewed teachers, the majority get dizziness and headache (73.7%), 47.4% have nausea, 31.6% have neck pain, very few teachers have vomiting (see Fig.2). When conducting in-depth interviews, many teachers said: “I am dizzy and have headache after using VR headsets for more than 10 minutes”, among them, 3 teachers said that besides being eye fatigue, dizzy, they also have a headache.

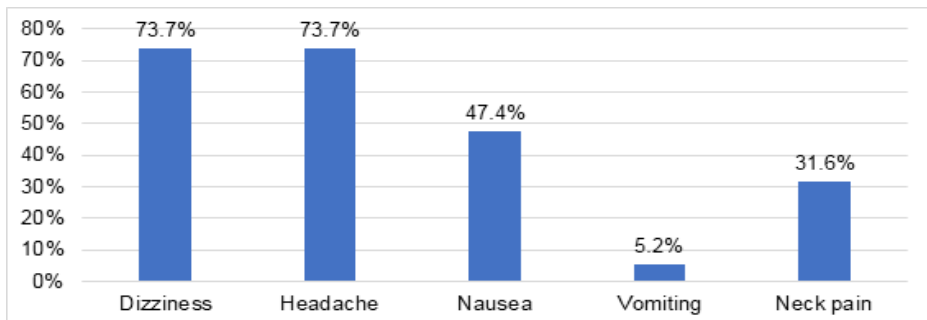


Figure 2. Symptoms that teachers experience after using VR headsets

For students, the majority of students experienced dizziness (56.2%), headache (38.6%) and nausea (33.3%) after using VR headsets. A small number of student experience vomiting and neck pain. In which, there is a difference of opinion

between the 2 groups of male and female students on the symptoms of dizziness (sig. = 0.005 < 0.05), male students have less dizziness than female students (mean difference (male, female) = -0.23 < 0), other symptoms in the 2 groups of students were similar (see Tab.3).

Table 3. Symptoms that students experience after using VR headsets

Symptoms	Percentage	Sig. (T-test)
Dizziness	56.2	0.005
Headache	38.6	0.346
Nausea	33.3	0.647
Vomiting	11.1	0.079
Neck pain	19.0	0.592

From the analysis results, the symptoms that teachers and students experience after using VR headsets are mainly dizziness and headache, the reason is because, when using VR headsets, our brain will receive a large amount of information through the eyes, but this information does not correspond to the rest of the body, thus causing dizziness, headache. In addition, even when using VR headsets for a short time (<10 minutes), users may experience dizziness and nausea. Therefore, VR headsets suppliers need to consider and pay more attention to this factor to improve the quality of VR headsets and minimize unwanted symptoms for VR headsets users in a permissible time.

Regarding the features of the VR headsets: the features of VR headsets are also one of the conditions to ensure that more attention should be paid to the equipment and use of VR headsets. 52.6% of teachers think that VR headsets need to be easier to use. When conducting in-depth interviews, many teachers said that they had difficulty connecting VR headsets with projectors to display lesson content on the projection screen. In addition, because the display language of the software installed on the VR headset has not been localized, teachers have difficulty in manipulation. The percentage of teachers who said that VR headsets are necessary to have an Internet connection control mode is 57.9%, because this will help them control the content that students' access when using VR headsets, avoiding where a student is assigned a learning task but uses VR headsets to watch movies or play games. The percentage of teachers who thought that having a classroom management system was very necessary (63.2%), the classroom management systems will help teachers manage, assign learning tasks and check the content that students have done on VR headsets. 63.2% of teachers when asked said VR headsets have the function of evaluating student performance is very necessary, this helps teachers make adjustments and add timely knowledge to students if their learning results are not satisfactory. An important feature of VR headsets is the ability to adjust the lens to fit each person's eyes, this feature is very necessary by 84.2% of teachers, because some teachers and students have eye problems (nearsightedness, farsightedness) and adjusting the lens accordingly will help to see the image displayed on the glass more clearly.

From the perspective of students and through the process of their use, the need for the features of VR headsets accounts for a high percentage. More than 90% of students think that VR headsets are necessary or very necessary to ensure the following issues: ease of use, functionality to help assess learning outcomes, additional installation of supported software/applications other learning. In addition to the opinions about the suitability and advantages of VR headsets, when equipped and used in teaching, there are certain difficulties, there are also limitations and disadvantages that need to be overcome and adjusted.

Table 4. Teacher's comments on some difficulties in equipping and using VR headsets

Comment	Percentage of agreement			
	Not agree	Partly agree	Agree	Strongly agree
The cost of VR headsets is expensive	0	5.3	63.2	31.6
Using VR headsets can affect the health of teachers and students	10.5	63.2	26.3	0
Using VR headsets in a regular class is difficult because there is not enough time to implement teaching content and activities.	0	31.6	36.8	31.6
There are no classrooms dedicated to teaching activities using VR headsets	21.1	26.3	47.4	5.3
Lack of instructional materials for teachers (about skills, methods and how to organize teaching activities using VR headsets)	5.3	42.1	36.8	15.8
The learning resources that come with the VR headsets are not suitable for the content of the subjects in the general education curriculum	15.8	26.3	42.1	15.8
Lack of open learning resources developed for VR headsets use	15.8	21.1	52.6	10.5
The skills of teachers and students in using VR headsets are not good	15.8	26.3	47.4	10.5
Teachers have difficulty in using teaching methods with VR headsets	15.8	15.8	57.9	10.5

Comment	Percentage of agreement			
	Not agree	Partly agree	Agree	Strongly agree
Teachers do not control the learning process of students	10.5	31.6	47.4	10.5
Students easily confuse the virtual world with the real world	21.1	26.3	42.1	10.5

Analysis of the results on some difficulties in equipping and using VR headsets from the Table 4 shows that over 90% of teachers agree and strongly agree that the expensive cost of VR headsets is a factor that makes it difficult to equip VR headsets in secondary schools today. This is consistent with the current reality on the market that the cost of a standalone VR headset is about 5 million VND or more.

The learning resources accompanying the VR headsets are not suitable for the content of the subjects in the general education curriculum and the lack of open learning resources developed for VR headsets are also the reasons that about 60% of the teachers agree and strongly agree that it makes it difficult to equip VR headsets. However, in reality, there are many free and open learning resources that teachers can exploit and use on VR headsets, such as learning resources built on the website <https://xr.elearn.vn>, this is the website of the project “Adoption of AVR Technology by Vietnamese Schools”, with a library of nearly 1 million VR modules, teachers can completely build lessons for Science, Technology, History, etc.

About 53% of teachers agree and strongly agree that the absence of a separate classroom affects the use of VR headsets in teaching activities. In 3 schools participating in the survey, 01 school has invested in 03 STEM classrooms, the other 02 schools have 01 STEM classroom to organize STEM teaching activities, experiments and practice for students.

Over 68% of teachers agree and strongly agree that the use of VR headsets in a regular class is difficult because there is not enough time to implement teaching content and activities. When conducting in-depth interviews, some teachers said: “VR headsets are more suitable when organizing for students to use in extracurricular activities and review knowledge because students have a lot of time to use them. If used in a regular class, very few students will be able to use VR headsets because just one student working slowly will affect the time of the whole class. In addition, the lack of teacher manuals (on skills, methods and teaching activities using VR headsets) is also one of the difficulties in using VR headsets when nearly 52% of teachers agree and strongly agree.

The percentage of teachers agreeing and strongly agreeing that the skills of teachers and students in using VR headsets are not good, affecting the process of using VR headsets in teaching and learning is nearly 58%. The percentage of teachers agreeing and strongly agreeing that they have difficulties in using teaching methods with VR headsets is over 68%. This is similar to the fact that teachers are only trained in the use of VR headsets. In order to enhance skills and use modern teaching

methods (using VR headsets in teaching and learning), it is necessary for all levels of management to conduct training for teachers and students, which focuses on teaching samples of lessons using VR headsets so that teachers can access teaching methods in a practical and effective way.

Nearly 58% of teachers agree and strongly agree that they cannot control the learning process of students when students use VR headsets in class. When students use VR headsets during class, teachers cannot control the activities that students are doing without a classroom management support system. Students can access the Internet to use it for a different purpose than the teacher's requirement to perform the learning task. The percentage of teachers who agree and strongly agree that students easily confuse the virtual world with the real world when using VR technology is 52.6%.

Although experiencing some symptoms such as dizziness, headache and nausea after using VR headsets, however, only a few teachers agree that VR headsets can affect the health of teachers and students (26.3%). When conducting in-depth interviews, some teachers said: "Although I experience dizziness and lightheadedness after using VR headsets, these symptoms disappear after a few minutes, so I think using VR headsets in a reasonable amount of time, there is no long-term health impact".

In summary, from the perspective of teachers and students, the equipping and using of VR headsets in schools play an important role in teaching and learning, bringing certain benefits to teachers and students. The most commonly fitted standalone VR headsets. The quality of VR headsets is highly appreciated by teachers and students; Some teaching activities are regularly organized by teachers and bring excitement to students as well as improve their learning results. One of the factors that teachers and students consider necessary and essential to ensure is the characteristics and features of VR headsets. This should also be considered as a selection criterion when equipping VR headsets in schools. In addition, there are some difficulties in the process of using and characteristics and features of VR headsets (cost, expensive price; facilities, proficiency of teachers after training and students when they are trained), use; learning resources accompanying VR headsets; ...) also need to be concerned by suppliers, regulatory agencies and schools when implementing the equipment and use of VR headsets.

## **5. Recommendations on the use of VR headsets in education for Vietnam**

Survey results show that in the process of using VR headsets, teachers have actively exploited the strengths and advantages of VR headsets and detected and overcome limitations at the same time. VR headsets are modern high- cost technology equipment (Standalone VR headsets), so many schools cannot afford to equip them to meet the teaching and learning needs of teachers and students. The VR headsets use training time for teachers is limited and the training content is mainly focused on the product introduction and its technical characteristics; Expert on VR headsets appraisal is not available, the quality of VR headsets depends on the equipment supplier; The preservation of equipment has not been given due importance, which greatly affects the process of organizing teaching activities of teachers when using

VR headsets; Resources and simulations of VR headsets are not suitable with the content of general education, so teachers can hardly integrate or use them directly in the regular teaching hours; The investment cost for a VR headset is quite expensive, so teachers are still hesitant to let students use it regularly for fear that they will drop, break, etc. This is the reality that has been happening at the surveyed schools and will also be the general situation when the use of VR headsets is more common without proper adjustment. On the basis of theoretical and practical research, based on the experience of some countries, in order to promote the advantages, limit the disadvantages, and at the same time increase the effectiveness of using VR headsets in teaching, we propose some recommendations for Vietnam as follows:

It is necessary to study and investigate the suitability of VR technology in order to select equipment, exploit/use VR headsets suitable for Vietnam's economy but still optimize the value and content of use;

Improve the ability to use software and hardware of VR technology for teachers and students by providing training classes for teachers. This can be done through seminars on methods of using VR headsets, examples of integrating VR in lessons and educational activities;

Evaluate the pros and cons of using VR technology, VR headsets in teaching for different audiences as well as its cost-effectiveness and scalability.

On the school management side, it is necessary to provide relevant technical support as well as a reward policy to motivate and encourage teachers to make efforts to effectively use VR headsets in the classroom.

In addition, schools also need to be flexible in equipping and using VR headsets such as:

Instead of using specialized devices, schools should aim to use VR headsets with smart mobile devices;

The adoption of VR headsets should be based on a careful assessment of learning fields and tasks;

Students' participation with VR headsets is only a part of the learning process besides the main learning activities outside the VR environment. Therefore, after students practice using VR headsets, it is necessary to have discussions with each other or with teachers to achieve the highest educational effectiveness;

Need to add different learning activities, such as case discussions or group projects when using VR headsets. In addition, students are often interested in games, so when equipping with VR headsets, it is necessary for schools to choose accompanying applications with educational games with different contents so that students can learn through entertainment in order to bring about effectiveness in learning;

Using traditional methods or VR headsets to assess students' learning outcomes depends on its assessment content (for example, for lessons with experiments and dangerous practices, the use of VR headsets will be more appropriate than the traditional method).

## 6. Conclusions

The use of VR headsets for teaching and learning in public schools in Vietnam currently faces certain difficulties (in terms of economic conditions and school facilities). The proportion of schools using VR headsets in teaching is not much, with funding for VR headsets mainly coming from the support of projects and partly from the public budget. Although it is undeniable that VR headsets have contributed to enhancing students' learning activities, helping students have more modern learning facilities, students have a rich and diverse learning experience. In addition, using VR technology in general and VR headsets, in particular, is a way to create many opportunities for teachers to innovate teaching methods to achieve educational goals. However, for the effective use of VR headsets in teaching, it is necessary to have participation from many sides, from state management agencies (Ministry of Education and Training, Department of Education and Training), management of school to individual teachers and students. At the same time, it is also necessary to involve researchers in research and analysis to come up with appropriate teaching methods and to teach organization forms when using VR headsets.

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