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Educational Learning Model by Immersive Virtual Reality Technology for Classroom

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Abstract
The learning style is a way to understand how students concentrate and store knowledge. Current conventional classroom experiences are a book-based and difficult to understand, which can lead to a lack of attention from students. The VARK learning style categorizes learning preferences into visual, aural, reading, and kinesthetic styles. The significance of using the VARK learning style is students learn best when the teaching method and classroom activities match their learning preferences. Although the VARK learning style is quite an old model, it is still in use today, particularly when combined with technology. By incorporating VARK modalities into an interactive environment of virtual reality that looks like the real world, especially for the subject of computer science that has programming tasks, students can engage in realistic practice and natural learning. The current VARK learning style only focuses on one modality for every student. For example, if students have a visual preference, they only enjoy studying when there are graphics or images. But when it comes to reading, they become less interested. This research gap is the virtual reality element to combine the modalities of VARK to create multimodal learning. The methodology involves a literature review, virtual reality application development, data collection, evaluation, and statistical analysis. The learning model is used in computer science courses, but because it necessitates abstract thought, many students find it challenging. Because of this, using virtual reality in the classroom instead of traditional methods can foster students' creativity and imagination. The goal is to create a multimodal learning style in order to promote students' motivation and perception in class across subject matters. The teaching of skills and decision-making could be fundamentally altered by the use of virtual reality in the classroom.

Keyword: *Virtual reality, education, learning model*

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I. Introduction

The courses in computing languages, and algorithms are particularly difficult for computer science students[1]. The education and learning style of VARK can be used to enhance the effectiveness of teaching students. Currently, conventional classroom experiences include studying for tests, listening to lectures, and trying to visualize history from a textbook. The formal, theoretical, and book-based nature of these study techniques wears out students' ability to listen and focus [2]. Practical activities during class and lab sessions another difficult aspect of the learning process [3]. Previous research that used the VARK learning style model in the classroom, only focused on one modality of the VARK style, for every student [4], which is one exercise for visual style or one exercise for auditory style, not the combination of the VARK modality. Research is required to determine the best way to create multimodal learning, which would improve the VARK learning style. Nowadays, virtual reality become an emerging tool for education. It helps students be more motivated and engaged in the subject-learning [5]. There is potential to combine various modes of teaching to create a multimodal learning environment. However, this approach has not beenfully investigated, and there is a lack of research on the benefits and effectiveness of such an environment for students' development. [6]. In creating multimodal learning, we proposed a virtual reality environment in improving the VARK learning style. However, because of high-performance tools and the motion-related effect of the virtual reality [7], there is a gap of investigate the virtual reality elements that can combine with the VARK learning style to create multimodal learning to make it suit for higher education students.

II. Literature review

a. Virtual Reality

Real-world objects can be virtually represented with the help of technology [8][9]. Virtual reality is the use of computer modelling and simulation to enable a human to interact with a manufactured three-dimensional visual or other sensory world. By utilising interactive devices that send and receive data and are worn as

goggles, headsets, gloves, or body suits, virtual reality applications immerse the user in a computer-generated environment that closely resembles reality [10], [11].

b. Relationship between Virtual Reality and Education

Virtual Reality is considered one of the most emerging and highly promising technologies for learning and training [12], [13]. It has positively impacted the trend toward faster, more engaging, and higher motivation. Although touch screens and computers are the most popular media platforms among students, virtual reality gear is becoming more readily available [14]. [14]. Virtual education is safer, more affordable, and more effective than traditional education because it takes less time to complete the training [15]. Virtual reality can improve the in-class experience and expand opportunities at all levels of learning. The federal government could promote more innovation by financing research, skill development, creative content creation, and the appropriate use of immersive technology [16][17].

On the one hand, virtual reality environments allow students to explore made-up locations, encouraging them to utilize their imaginations and think outside the box. Virtual reality may represent realistic scenarios and modify the ways that students learn from media because it is both exciting and inspiring and encourages contextual learning and the ability to apply information to real-world contexts [14]. Furthermore, using virtual reality in education makes students learn by doing with creativity [18], improves cognitive skills [19], and can also impress their emotional reactions.

In one article, virtual reality technology is used to enhance the instruction of undergraduate students in computer science courses, particularly Python programming. The project aims to supplement conventional teaching methods, such as classroom lectures and lab exercises. Students can learn Python programming through the game in an engaging and interactive way, and t can enhance the learning environment. The project's effectiveness will be interesting to see as it progresses [1].

Image1: Oculus of PICO4

c. The learning model.

One of the simplest and most practical inventories for identifying students' preferred learning styles is the VARK learning style model. The (V) in the word VARK inventory stands for visual. students who favour graphic methods of information representation. The letter "A" stands for auditory. students who prefer to hear instructions and information spoken to them. R stands for reading or writing. Students who prefer reading information or who take notes while listening to lectures. The capital (K) stands for kinesthetic. Students who prefer to use practical methods and their own experience (Fleming, 2009) [20]. Although this style is an old model, however, in education this model still using until now [21][22][23]. The VARK model is considered dynamic because it can be applied in diverse environments such as classrooms, laboratories, and clinical environments. Furthermore, it is a user-friendly tool that enables students to comprehend and use it effectively. By utilizing this tool, students can develop an awareness of their learning styles and be inspired to improve their academic performance [24].

Image 2: Types of VARK model

d. Existing Education Learning using VARK Learning Style Model

The presentation of learning materials will be more engaging when using a VARK, which is based on the visual, auditory, read/write, and kinesthetic learning styles. This research has carried out an in-depth study of VARK learning approaches to improve students' critical thinking skills using adaptive hypermedia. Students may have various learning objectives, backgrounds, levels of knowledge, and competencies, as well as various methods of learning. This study sought to determine whether using adaptive media applications based on hybrid learning would help students' critical thinking abilities [4].

Another article on the VARK learning style describes a quantitative study that looked for to determine students' preferred learning methods in order to create effective nature-based geography learning strategies for online instruction. The researchers administered an online questionnaire consisting of sixteen questions, based on the parameters developed by Fleming in 2006 to collect data. This study involved 277 high school students. The results of the VARK questionnaire showed that the most preferred single learning style was aural, with 103 students favoring it. Meanwhile, the most preferred combination learning style was AK (Aural- Kinesthetic), which is a combination of aural and kinesthetic learning styles. These findings can assist educators in designing effective online learning materials that maximize geography learning practices, which is the implication of this research.[25].

Students watch videos or animations that use Java applets or Flash components to demonstrate fundamental data structure operations in the classroom as described in the article about using the VARK learning model in the Data Structure and Algorithm course. Students use software visualisation tools in the lab and get the chance to write small amounts of code. This method of combined learning improves student success and the overall study experience, which has a significant positive effect [26].

e. The VARK model's application in virtual reality

The adoption of cutting-edge technology as a teaching tool in higher education is still in its early stages, but virtual reality technology is one of the most revolutionary technologies of this century [27]. VARK is a popular model for understanding and categorizing different learning styles. The use of virtual reality technology in education is growing as a means of developing engaging and immersive learning environments. By combining VARK and virtual reality technology may increase the effectiveness of teaching and learning [28]. To implement this idea, a virtual reality learning platform can be created where students can engage in various learning activities that cater to their specific learning styles. For example, visualstudents can watch interactive 3D models or diagrams, aural students can listen to audio instructions and lectures, read or write students can access digital textbooks, and kinesthetic learners can perform hands-on tasks in a virtual environment [27],[29].

f. Create an improved VARK learning style model.

The VARK model of learning styles, which categorizes learners into four types which are Visual, Auditory, Read or Write, and Kinesthetic is still widely used in education today, despite its age [21], [22], [29]. However, to improve this learning style, it is suggested that multiple preferences or multimodal learning

should be combined [6], [30]. Some individuals have no strong preference for any particular learning mode, while others may have two or three strong preferences such as VAR or ARK. In multimodal learning environment, virtual reality can be used to create an interactive environment that incorporates various elements into VARK, such as 3D images, reading material, audio, and object manipulation. Virtual reality has been a valuable tool for education, especially in allowing students to practice complex tasks repeatedly in a safe environment. However, for a virtual reality experience to be successful, it must be immersive, enabling the participant to feel present and engaged in the virtual space while reducing their awareness of the real world. Additionally, interactivity is important to allow the user to manipulate the virtual environment and test variables, including interacting with objects or avatars and collaborating with others in the virtual space [31-32].

III. Methodology

Phase 1is Literature review and preliminary study. A literature review with searching for virtual reality technology, the relationship between virtual reality and education, andthe VARK learning style. A preliminary study is done on six students, three male, and three female. This phase is done to investigate element of virtual reality in the VARK learning style for multimodal learning for higher education.

Phase 2 is Development Phase. During the development phase, two requirements are needed which are software and hardware. The software that will be used is Unity 3D, Stream, and Steam software. Some of the characters or products for development will buy in Asset Store in Unity. The hardware that will be used is PICO4, Meta Quest 2, laptop with GEFORCE RTX3060, and RAM16GB. There are two sets of headsets, one for the PhD student to do development and another one for testing and demo. Phase 2 will be done to meet Objective 2 which is to formulate the VARK learning style model with virtual reality technology in the classroom.

This is an initial idea of how a VARK learning style can be improvised using virtual reality. In order to facilitate learning for the subject CPC452 Animation and Virtual Reality, it is proposed to have multimodal learning by creating a 3D classroom environment that includes a character model as the lecturer. The lecturer will provide a tutorial to the students, followed by exercises related to the subject matter. In this environment, students read the information provided in the question, use a controller, and draw geometric modeling and virtual object shapes as the task.

Visual - Students will see their actual 3-Dimensional environment of the classroom through the headset Oculus with involves videotutorials.
Auditory - Students listening to a lecture and interact with virtual character model
Reading - Students read information given by a virtual character model and do a 3D modeling exercise, for example, drawing the shape of a virtual object.
Kinesthetic - It provides a full-body sensation, use a controller for physical movement to learn.

In this proposed idea, all VARK learning style are combine, and there are virtual reality element will used which are the virtual world, fully immersion environment, interactivity activities and sensory feedback.

Phase 3is Experiment Phase. The experiment will be done at the School of Computer Sciences, University Sains Malaysia. The participant is selected using inclusion and exclusion criteria by Dr. Ahmad Sufril from Animation and Virtual Reality class. There are 20 students altogether. During the experimentation process, there are four steps that need to be followed. Step one is setting up the virtual reality room. Step two is a pre-test. The pre-test students need to answer a questionnaire of the VARK learning style Inventory. Step three is an experiment using a virtual reality application with the VARK learning style. Students will use PICO4 and Meta Quest 2 oculus duringthe experiment. The activity for Visual is looking for a 3D environment, auditory activity is hearing the lecture, reading or writing activity is the student need to read the instruction and do the task and kinesthetic activity is they do the task using controller. Then step four is a posttest. For the posttest test students will do a technology acceptance test using the VARK+ perception survey. This experiment took about 20 to 30 minutes.

Phase 4 is Data collection. There are four types of variable measures, which are the VARK perception survey, statistics of VARK learning style based on gender, the average VARK indicator between virtual reality and conventional learning, and Correlation coefficient between virtual reality and conventional learning. Experimentation and data collection will handle by CO3.

Phase 5 is Evaluation of the method. Data collection is evaluated with pie charts, histograms, scatter charts, and correlation coefficients.

Phase 6 is Statistical analysis. Statistical analysis will be done using SPSS software. The contribution of this research is measured when virtual reality is able to improve students education and they get a higher grade. Phase 3 to Phase 6 will be needed to meet Objective 3, which is to validate the interactive virtual reality application for student learning toward a VARK learning style through the VARK perception survey and correlation coefficient method CO2 will handle Phase 5 and Phase 6.

IV. Preliminary Study

This preliminary study aims to evaluate the efficacy of VR technology for education compared to conventional classroom education. There are six participants, three male, and three female, taking part. Data collection is based on the VARK perception survey, statistics of VARK learning style based on gender, average VARK indicator between virtual reality and conventional learning, and Correlation Coefficient between virtual reality and conventional learning. Here is the conclusion.

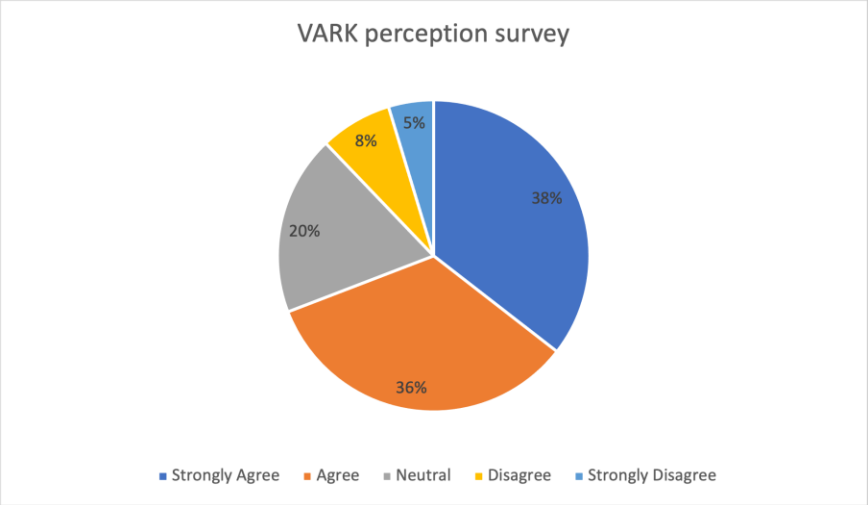

Image 3: VARK perception survey

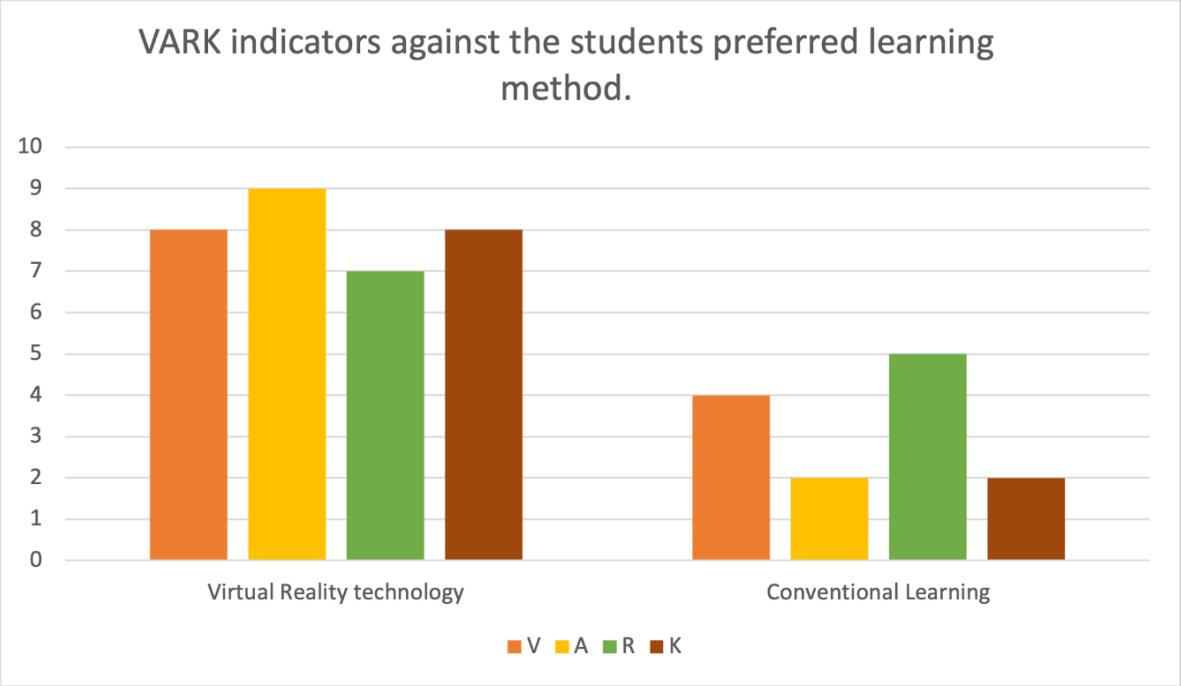

Image 4: VARK indicators against students' preferred learning.

Statistic on VARK learning style of students according to gender

Learning style	Gender	SD	.t	.p
Visual	Male	2.42	-.933	.322
	Female	2.54		
Aural	Male	2.54	-2.893	.001
	Female	2.51		
Reading/writing	Male	2.58	-.667	.010
	Female	2.26		
Kinesthetic	Male	2.47	-.576	.194
	Female	2.36		

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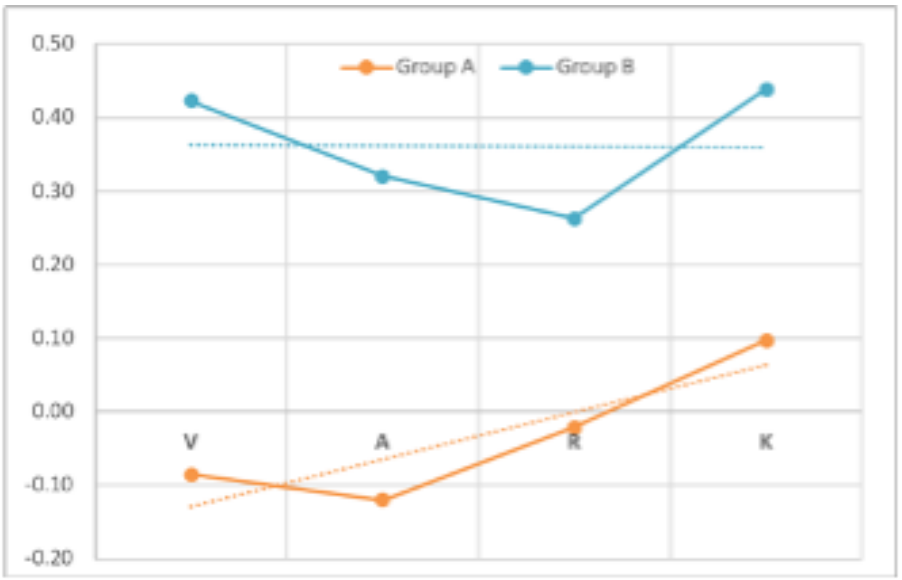

Image 5: VARK statistic between student Group A and Group B

V. Conclusion

The research contribution is to used the VARK learning style model by integrating virtual reality technology to make it multimodal.This approach combines multiple sensory experiences to improve the comprehension of any subject matter. By utilizing an interactive virtual reality environment, this strategy is feasible and can be implemented not only in higher education institutions but also at all educational levels. The core idea behind this approach is that combining various learning modalities improves students' ability to retain information as the VARK model engages the brain through multiple learning styles at once.

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