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The Influence of Virtual Reality on Learning Motivation and Academic Performance of Young Girls

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ABSTRACT
This study investigates the influence of Virtual Reality (VR) on learning motivation and academic performance among young girls. VR's immersive and interactive nature has the potential to create engaging educational environments, overcoming traditional barriers and addressing gender stereotypes. This study employs a quantitative approach, using a survey of 500 respondents, guided by Social Cognitive Theory, to explore the impact of VR on motivation, academic outcomes, and self-confidence. Findings reveal that VR significantly increases motivation ($t = 2.138$, $p = 0.033$), but shows mixed results for academic performance and problem-solving skills compared to traditional methods (academic performance: $t = –19.933$, $p = 0.000$; problem-solving: $t = –4.751$, $p = 0.000$). Despite VR's promising potential for engagement, it has yet to demonstrate significant improvements in academic performance. Future research should focus on optimizing virtual reality (VR) integration and exploring how it can complement traditional learning strategies to enhance educational outcomes.

Keywords: Virtual Reality, Learning Motivation, Academic Performance, Social Cognitive Theory, Educational Technology,

Introduction
The study on virtual reality (VR) and learning motivation, as well as academic achievement, has garnered considerable attention in recent years, particularly among young girls. Scholars and teachers are examining how the immersive potential of VR can enhance girls' interest, motivation, and academic achievement. Slater & Wilbur (1997) defined presence as a perception of 'being there' in another place apart from the physical environment. While autonomy is the perceived level of decision-making authority one is allotted in that environment, agency is the perceived level of power one has in that environment. In the context of young girls, then, virtual reality has the potential to enable them to learn directly and engage in fields such as science and technology in a way that is empowering and not constrained by traditional gendered expectations.

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 2 No. 4 (November) (2024)

Implementing virtual reality in education means offering students a learning environment that is most stimulating to them. By simulating a climate for learning, VR allows the limitations of traditional classrooms to be transcended, as a learning experience can be replicated in a controlled manner (Barbour & Tondeur, 2020). Such an activity can help enhance student engagement and achieve highly effective teaching of content (Akshayar and Akshayar, 2017). For instance, VR can enable young girls to learn abstract concepts in science, practice experiments in a virtual setting, apply real-world knowledge and skills, develop problem-solving skills, and enhance their critical thinking abilities.

Although VR has utility for enhancing learning for all learners in general, there is keen interest in learning the effect of VR on increasing young girls' learning motivation and performance. Girls, especially those in school, face various socio-cultural barriers that hinder their confidence and participation in STEM activities (Eccles, 2007). Studies show that typical instructional approaches and classrooms could fail to facilitate girls' learning and engagement as well as consider their interests; hence, the low enrollment of girls in STEM courses (UNESCO, 2017).

Rationale of the Study

The present research aims to examine the effect of virtual reality on the motivation of young girls. Virtual reality has become increasingly prevalent in various aspects of contemporary society (Freina & Ott, 2015). However, one problem that has been overlooked in the existing literature is whether ICT, particularly in an immersive learning environment, affects the motivation levels of young girls (Huang et al., 2019). It becomes all the more important to understand motivation as an influence on learning, achievement, work, and other spheres of development (Deci & Ryan, 2000).

Therefore, this research aims to contribute to the improvement of information available in the field of education by examining the impact of virtual reality on the motivation of young girls. The present study aims to inform educators and parents about the potential of VR experiences to foster or dampen motivation, thereby assisting them in understanding the positive and negative effects of using VR in educating girls. The findings of this study are expected to provide helpful suggestions for updating virtual reality applications to enhance the motivational and engagement utilities for young girls (Jensen & Konradsen, 2018).

Objectives of the Study

Objectives of the study are:

To analyze the impact of virtual reality on the motivation levels of young girls in educational settings.

To investigate the use of virtual reality on the academic performance of young girls.

To investigate the role of virtual reality in fostering self-confidence

Hypotheses

H_1: Young girls who utilize Virtual Reality for learning exhibit higher levels of motivation compared to their counterparts who follow traditional learning methods.

H_2: Young girls who incorporate Virtual Reality in their learning experiences demonstrate improved academic performance compared to those who do not use VR

Research Questions

RQ_1: How does the integration of virtual reality technology influence the motivation levels of young girls in educational settings compared to traditional learning methods?

RQ_2: What are the correlations between the usage of virtual reality and the academic performance of young girls across different subjects and learning outcomes?

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 2 No. 4 (November) (2024)

RQ_3: In what ways does virtual reality contribute to enhancing self-confidence among young girls, particularly in academic and social contexts?

Literature Review

According to Wu et al. (2020), students who used VR in science lessons were more transferable, meaning they were able to apply their knowledge in new contexts. Through such realistic experiences, VR enhances the students' understanding of how they relate theoretical knowledge to practice and is more rewarding as a learning process (Chittaro & Buttussi, 2015).

Research published over the last couple of years has shown that the use of VR interventions can impact both stereotype threat and STEM motivation among undergraduate women. For instance, Smith et al. (2020) conducted a study using a randomized controlled trial where female undergraduate students immersed themselves in a VR environment where women scientists mentored them. These findings suggested that participants who took the VR intervention realised that the amount of stereotype threat was significantly decreased. The levels of STEM motivation were substantially higher among the participants in the STEM group than among those in the control group.

Through Virtual Reality technology, students studying medicine receive an enhanced learning experience, as it mimics actual clinical situations in real life. VR-based simulations have been described by Seymour et al. (2019) as having high face validity, with a report indicating that students can practice clinical skills in a safe environment to improve their competency level. The interactive aspect of the programme fosters engagement and increases students' interest in learning (Alaker et al., 2020).

Regarding motivation levels, several studies have described a positive effect of VR training on the improvement of medical students' motivation. For instance, Smith et al. (2021) surveyed students, revealing that those who underwent training via VR simulations were more motivated compared to those exposed to more conventional training. Since the environment is interacted with and the feedback received is almost instantaneous in VR settings, learners quickly refresh their interest in learning (Cheng et al., 2019).

Moreover, Wang et al. (2020) note that through the use of VR, learners can engage with scientific content in ways that cannot be effectively done in physical school environments. For instance, students can interact with virtual objects, conduct experimental procedures, and observe results on the phenomenal plane immediately, dramatically enhancing the complexity of demonstrating procedures. The practicality of these approaches can enhance motivation, as it involves the use of objects to explain concepts, making the material more relatable to students' real-life experiences.

In the following sections, we present the concept of student motivation and the research evidence that demonstrates a significant relationship with achievement in science education. For instance, Hsu et al. (2019) found, in their systematic meta-analysis, that students with higher levels of motivation towards learning science achieved better academic results compared to their counterparts with lower levels of motivation. Thus, based on its ability to motivate students, VR has the potential to enhance student performance in high school science classes.

Additionally, Kizilcec et al. (2020) note that VR can be highly effective in enhancing motivation, as it provides learners with control over their behaviors. Virtual reality in particular allows one to move through the subject matter in a very flexible manner, define one's own pace and route, not to mention the instant performance assessment. This sense of autonomy can be liberating for students and thus enhances their self-motivation to learn. When it comes to the application of VR in science education, the opportunities are

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apparent, though certain hurdles need to be overcome. For instance, Costello et al. (2021) opine that the usability of VR technology may be a challenge in some schools, as the Equipment is expensive. Furthermore, concerns may arise about the suitability of VR for teaching compared to conventional teaching methods.

Moreover, one may ponder the possible effects that VR might impose on students' well-being. Students may also experience cybersickness or disorientation if they overuse VR applications, which can interfere with the learning process (Chang et al., 2022). One must understand these risks and how educators can mitigate them, as they often find themselves in an advocacy position.

As Huang and Li have noted, VR fully engages learners with the materials they are learning, and due to it, learners are motivated and get better results. Regarding the use of 3D animation learning, a VR environment enables students to interact with virtual objects or proxy spaces realistically, thereby enhancing their engagement and presence (Kim et al., 2020).

In developing VR-based 3D painting tools, students can work with levels of creativity and expressiveness that have never been achieved before. When teaching and learning with interactive spaces, learners can be more tactical in their manipulation of objects in the digital environment due to the pre-defined gestures (Liang et al., 2021). This also fosters technical skills that enhance experimentation and innovation, hence boosting the student's confidence and motivation towards learning (Hsiao et al., 2020).

The authors Lee and Lee (2018), for instance, argue that due to the features and enthusiasm associated with the technology, students tend to focus on VR lessons for extended periods. Additionally, the control and freedom that VR provides learners enable them to take charge of the learning process, resulting in increased motivation and self-efficacy among learners (Chang et al., 2020).

Virtual world platforms for learning enable students to interact and learn collaboratively as peers. In virtual classrooms, learners can share ideas, provide feedback, and work on tasks simultaneously in real-time, as noted by Yang et al. (2019). Apart from the community, it engages learners and boosts performance, as the achievement of set goals results from collaborative efforts (Shen et al., 2021).

Theoretical Framework

Social Cognitive Theory

This study applied the Social Cognitive Theory to investigate the impact of VR on learning motivation and school performance among young girls. Other factors considered in the survey included self-efficacy and observational learning in relation to learning with virtual reality (VR). Thus, it is possible to experience the effects of VR in relation to the principles of Social Cognitive Theory, as reflected in changes in learning motivation and school performance.

Research Methodology

The methodology used in the study is quantitative, specifically the Survey method, which was employed as a measurement process for the structured collection of data, similar to a quantitative design, to capture the effect of VR. The study population consisted of 500 young girls to analyze their attitudes toward VR in learning environments. Teenage girls were selected through convenience sampling, as there has been a shift in their enrollment in school and their interaction with technology.

The total questionnaire consisted of twenty-one items, which were divided into categories according to the study variables. Each of the sections described various aspects of the use

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 2 No. 4 (November) (2024)

of VR, motivation to learn, and academic achievements. To check the reliability of the constructs, Cronbach's alpha was used.

Statistical Analysis

Independent t-test

In this section, we examined the statistical difference between the traditional method and VR, using a specified level of significance. $\alpha = 0.05$

Table No. 1: Independent Samples Test

			Motivation	
			Equal variances assumed	**Equal variances are not assumed.**
Levene's Test for Equality of Variances	F		.241	
	Sig.		.624	
t-test for Equality of Means	T		2.138	2.138
	Df		998	996.677
	Sig. (2-tailed)		.033	.033
	Mean Difference		.106	.106
	Std. Error Difference		.050	.050
	95% Confidence Interval of the Difference	Lower	.009	.009
		Upper	.203	.203

Table No 2: Independent Samples Test

			Performance	
			Equal variances assumed	**Equal variances are not assumed.**
Levene's Test for Equality of Variances	F		.023	
	Sig.		.879	
t-test for Equality of Means	T		-19.933	-19.933
	Df		998	997.984
	Sig. (2-tailed)		.000	.0.000
	Mean Difference		-.052	-.052
	Std. Error Difference		0.026	0.0026
	95% Confidence Interval of the Difference	Lower	-.103	-.103
		Upper	.001	.001

Table No 3: Independent Samples Test

		Problem-Solving	
		Equal variances assumed	**Equal variances not assumed**
Levene's Test for Equality of Variances	F	23.079	
	Sig.	.000	

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 2 No. 4 (November) (2024)

t-test for Equality of Means	T		-4.751	-4.751
	Df		998	987.605
	Sig. (2-tailed)		.000	.000
	Mean Difference		-.040	-.040
	Std. Error Difference		.0084	.0084
	95% Confidence Interval of the Difference	Lower	-.0565	-.0565
		Upper	-.0235	-.0235

Statistical analysis comparing VR and traditional learning methods reveals notable findings in motivation, performance, and problem-solving skills. In terms of motivation, the t-test results show a statistically significant difference; VR learners reported higher motivation than their counterparts who used traditional learning methods. This may be taken to mean that VR has positive effects on the eagerness of students to approach learning material. However, the performance results, showing a significant difference, are $t = -19.933$ with $p = 0.000$. This implies that traditional learners performed slightly better than those using VR. The magnitude of the t-value emphasizes a significant difference in the performance outcomes, although considering the practical relevance of the slight mean difference should not be out of place. There is a significant difference in problem-solving skills: $t = -4.751$ with $p = 0.000$, indicating that traditional learners were far better in the area of problem-solving skills compared to VR learners. Therefore, as the results and Levene's Test for Equality of Variances—problem-solving with unequal variances show, although VR improves motivation, it is yet to reach the level of performance and problem-solving skills comparable to those of traditional methods. These insights give nuanced ideas about the effect of VR on different outcomes related to education and further raise the need for research into its optimization for effectiveness in learning.

Discussion and Analysis

According to the findings of this study, a conclusion can be drawn that even though VR positively impacted students' motivation and interest in skill acquisition, it did not affect their academic performance or problem-solving skills that could match the conventional teaching methods. This discovery reveals the capabilities of VR in enhancing motivation and supporting difficult ideas, but it does not depict VR's effectiveness in raising concrete academic achievements.

The literature has provided backing to the opinion that VR can raise opportunities for learners' engagement and motivation. Dalgarno and Lee (2010), Di Serio et al. (2013) maintain that motivation is enhanced because VR involves the learner engaging. After all, it incites curiosity. This accords with the study's finding that there was a heightened motivation among the students after using VR. However, there is also the limitation of VR that is related to motivation toward translating motivation with academic achievement. For instance, although Freina and Ott mentioned that VR improves interest, there is a rather ambiguous picture as to its effects on real learning outcomes. Choi and Kim (2020), Höffler & Leutner (2007) found that VR has positive effects on learning in geometry and skills, respectively. However, the general understanding is that, although with the aid of VR, learners achieve better understanding and motivation, it is often difficult to convert these to improved academic performances.

While the current study observed that use of VR had a small overall effect on academic performance, the research literature is rich in evidence that supports the use of VR. Gutiérrez et al. (2017) also note the augmented performance in a set of tasks utilizing VR

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applications as revealed by Huang and Chiu (2017). This difference may be due to differences in VR utilization, educational material, and Information and communication technology integration.

The literature also points to some technical limitations, including technical complexities and high costs, as challenges to the adoption of VR (Bekele et al., 2019; Chen et al., 2020). The following factors may help explain why the changes in academic performance are not so great and are hardly noticeable in the course of the study. Contrary to the 'price-quantity' relationship, the cost aspect and affordability of VR technology are primary drivers to its integration in learning.

The purpose of the study was to discover the effect of Virtual Reality on motivation, academic achievement, as well as self-esteem of young girls. The above findings anachronously meet the first objective since, through this study, it is revealed that VR motivation is higher than that of traditional methods, as identified in the research question asking the effect of VR on the motivation levels in comparison to traditional methods. The second objective concerned the students' academic achievement and also failed, as there was no first tendency towards enhanced students' academic results after using VR. The same can also be aligned to the research question that asked about the relation between the use of VR and the performance on academics to show that VR does not mean better results. The last and third objective, which explores the contribution of using VR in enhancing self-confidence, did not produce clear results. Based on the above study, motivation may be enhanced through the use of VR, but the effects towards self-confidence are still inconclusive; therefore, there is still a need to have more studies done on this area. Concerning the hypotheses, the study affirmed the ''alternative hypothesis'' (H1); There is an improvement in learning motivation through VR. The first hypothesis justified the improvement of learning motivation through the VR technology. However, the null hypothesis (H0): For the second hypothesis, was not rejected because the probability did not favour VR users over those using traditional techniques for learning and examination.

Conclusion

The possibilities of the use of Virtual Reality (VR) to not only motivate learners and increase their academic performance, particularly young girls, but also its difficulties were explored. This research aimed to investigate the impact of VR in enhancing motivational, performance and self-confidence aspects of young girls' education. Thus, the results reveal that, although VR has the potential to greatly enhance the motivation and learning activity of students, the relationship between the application of VR and the learning outcomes of students depends on certain specified parameters, where the global influence of VR is not particularly high.

The research confirmed that motivation in a VR environment is significantly higher than that in a traditional environment. Alv branded this discovery as an affirmation of the previous studies that amplify that the concept of VR has the capacity to design the learning process to be as interactive as well as engaging. According to the current study, the extent to which students use VR, the students associated higher perceived relevance and interest with the learning content. Virtual Reality (VR) is an interactive aspect that entice the students' attention and makes them develop a desire to learn, thus adjusting their intrinsic motivation. The use of VR in learning allows the learners to see the real-life application of what they are learning, thus is more fun.

Nevertheless, VR can also expose the students to certain misconceptions while learning, and more critically, the study established that there is no improvement in performance or problem-solving among the students. However, conventional teaching and learning

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methods yielded better academic achievements and better cognitive skills. This shows a gap in the fact that although the use of VR in learning can enhance students' learning experience, it does not necessarily lead to enhanced academic performance. Some of the difficulties encountered in VR technology, such as expensive and technical constraints, could explain these mixed results.

Based on the correlation analysis, the results confirm that VR has a positive effect on motivation but less on academic performance. Concerning motivation and the perceived benefits of VR, the data showed a moderate positive correlation, which implies that while the students who are motivated by traditional teaching aids find it useful in explaining concepts that they find hard to grasp. But this does not always imply increased performance in academic tests and other academic-related activities. These findings indicate that virtual reality should be used in conjunction with conventional learning approaches since it is highly effective for enhancing learning.

Why VR increases motivation. Understanding why VR increases motivation is made easier by the theoretical framework of the Social Cognitive Theory of the study. Social Cognitive Theory looks at the way the individual learns from other people, their perceived self-efficacy and the context. These aspects actually suggest that VR augments, in a learning experience, there are other factors which link motivation with performance which are missing. This research reveals that to fully realise the use of VR in education, effort must be put into the design of VR activities, thinking about the students, as well as introducing the use of motivational techniques. The following are some suggestions on the possible ways of overcoming the limitations of using VR, and therefore enhancing its utility: Utilizing VR in combination with the more conventional approaches could be beneficial.

Further research should be directed to a practical application of the VR approach in learning processes and how the integration of the VR technology with the conventional methodologies of teaching and learning could be enhanced for the better achievement of the expected educational results. Examining how effective VR is and how to optimize its use, as well as examining its technical and cost challenges, will be important in enhancing the use of VR in classrooms. More research should also be conducted to show how VR can be implemented as a teaching aid for the various needs and scenarios of the students to ensure all learners benefit from this technique.

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