Comparison Between Virtual Reality and Integrating Blended Learning Flipped Classroom Model: An Experiment on Secondary School Students

Masood Ahmad
Assistant Professor, Department of Educational Training, The Islamia University of Bahawalpur, Punjab, Pakistan.
Email: masood.ahmad@iub.edu.pk

Sabir Hussain
Ph.D. Scholar, Department of Educational Training, The Islamia University of Bahawalpur, Punjab, Pakistan.
Email: sabirjanmarri@gmail.com

Fakhar-Ul-Zaman
Visiting Lecturer of Education, University of Narowal, Punjab, Pakistan.
Email: malikfakhar717@gmail.com

Abdul Qahar
PhD. Scholar; Secondary Teacher Education, Allama Iqbal Open University Islamabad, Pakistan.
Email: abdulqahar045@gmail.com

Received on: 02-01-2024 Accepted on: 04-02-2024

Abstract

Blended Teaching Flipped Classroom Model and Integrating Virtual Reality are new teaching trends in education; if these integrated with education, they will make teaching much more accessible, and it can also work as a teacher. Through Blended Teaching Flipped Classroom Model and Integrating Virtual Reality, students learn very quickly with pre-videos, lectures and learning material through already feed in Cellular Tablets and discussion in WhatsApp group, and Virtual Reality actual videos, materials and senses in VR Gadgets. The purpose of this research was to conduct a practical experiment to compare the Blended Teaching Flipped Classroom Model and Integrating Virtual Reality to see the students' learning level and the level of students' excitement and engagement. This educational experiment was conducted on Boys Government High School No. 1 Dera Ghazi Khan Class 10th students. For this purpose, two groups of average intelligent students were formed by taking the pre-test. These groups consisted of 15 to 15 students who were given four months of treatment through Blended Teaching Flipped Classroom Model and through Virtual Reality

Gadgets. Then, the data were collected and interpreted through statistical tools. From this experiment, it was found that the excitement and engagement of the students taught through Virtual Reality Gadgets were very high, and the scores on the achievement test were also very high. It is recommended that teachers should be aware of this new teaching method in educational institutions. The government should also allocate a specific budget for Virtual Reality Gadgets.

Keywords: Blended Teaching; Flipped Classroom Model; Virtual Reality Gadgets, Learning outcomes; Pedagogy.

Introduction

1. Virtual Reality

Virtual reality refers to using specialized electronic gear, such as a helmet with an internal screen or gloves equipped with sensors, to interact with computer-generated images and environments in a way that seems natural or tactile (Makinen et al., 2020).

Really immersive experiences include being inspired by stunning vistas from across the globe, gaining a grasp of physics by flying into space, diving very deep below, exploring the human body's interior, and many more thrilling adventures (Plecher et al., 2022).

Virtual reality creates a one-of-a-kind learning environment that engages and excites several senses. Now, students may immerse themselves in the subject matter by physically experiencing what it's like to be a whale—sight, sound, touch, and smell—or by digitally exploring the ocean alongside whales in 3D visuals. Virtual Reality (VR) has turned students from mere observers of the subject matter into active participants in the learning process. Taking an immersive approach to teaching not only boosts students' interest levels but also provides them with a deeper degree of comprehension, which is essential for concept mastering (Young et al., 2020).

Virtual Reality (VR) refers to the use of computer modeling and simulation to immerse a person in an artificial three-dimensional (3-D) visual or another sensory environment (Liu, 2020). Virtual Reality (VR) uses wearable interactive devices such as goggles, headsets, gloves, or body suits to transmit and receive data. In these gadgets, the user is transported to a computer-generated environment that seems just like the actual thing. The standard VR setup involves donning a stereoscopic display helmet and seeing animated images of a simulated environment. A user's movements may be detected by motion sensors, which then adjust the screen display accordingly—sometimes even in real-time—to create the impression of "being there" (telepresence). Consequently, the user may confidently move his hands and head to experience various vistas and perspectives as he moves around a virtual suite of rooms. By donning data gloves outfitted with force-feedback devices, the user may experience the feeling of touch and pick up and control virtual things (Ganadas et al., 2021).

The term "virtual reality" was first used in 1987 by Lanier, whose engineering and research contributed many products to the early VR industry, according to Bhatnagar and Boruah (2024). Early VR research and development in the US was characterized by the involvement of governmental agencies, including the Department of Defense, the National Science Foundation, and the National Aeronautics and Space Administration (NASA). Projects supported by these organizations and conducted in university research labs not only linked academic, military, and commercial activity but also produced a considerable skill pool in areas like computer graphics, simulation, and networked environments. This essay focuses

on the social context in which this technological breakthrough happened and the timeline of its development (Shan, 2023).

Artists, performers, and entertainers have long made use of techniques that enable the construction of imaginative worlds, the placement of tales in made-up locations, and the manipulation of the senses. Many things came before Virtual Reality in the creative and entertainment media world that allowed people to suspend their disbelief in a made-up setting. The architecture of dwellings and public places has long relied on creating illusionary settings via paintings or vistas; the vast panoramas of the 18th and 19th centuries were the pinnacle of this practice. Panoramas aimed to make viewers feel as if they were really a part of the action by erasing the lines that generally would have separated the two-dimensional images showing the main scenes from the three-dimensional spaces they were seen from (Trumpener & Barringer, 2020). This visual heritage inspired several forms of media development during the twentieth century, such as stereopticons, three-dimensional films, future theatre designs, and IMAX theatres, all with the goal of recreating the same effects as the originals. Cinerama, formerly known as Vitarama, was developed from studies on vision and depth perception by Fred Waller and Ralph Walker. It was initially presented at the 1939 New York World's Fair. Based on his research, Waller concluded that peripheral vision is crucial for total immersion in virtual environments. He set out to create a projection method that could capture the whole range of human eyesight. The Vitarama method relied on an arc-shaped screen, a variety of cameras, and projectors to create the illusion of total immersion for the viewer. Known as the Waller Flexible Gunnery Trainer, the device was effectively used by the Army Air Corps for anti-aircraft training during WWII. A connection like this between the entertainment industry and military simulation helped pave the way for V.R. Vitarama, formerly known as Cinerama, did not achieve commercial success until the mid-1950s (Barron et al., 2022).

Prior to the advent of computers, sensory stimulation seemed like a potential strategy for the creation of virtual worlds. Morton Heilig, a cinematographer, showed a keen interest in Cinerama and three-dimensional films after the premiere of a promotional video titled This Is Cinerama (1952) (Champion, 2021). He followed in Waller's footsteps by studying illusions and human sense drives with the intention of making a "movie of infinite." Heilig built an individual console towards the end of the 1960s that could take in stereoscopic pictures, use a motion chair, play music, modify temperatures, emit odours, and blow air, among other

things. He got a patent for this system, which he called the Sensorama Simulator, in 1962. A person's senses might be "stimulated in order to imitate it realistically" using this console. In 1960, while he was working on Sensorama, he also constructed the Telesphere Mask, a head-mounted "stereoscopic 3-D TV display" that he patented. Although Heilig's attempts to sell Sensorama were fruitless, he did add a multiviewer theatre idea to it in the mid-1960s, which he copyrighted as the Experience Theater. At the same time, he created Thrillerama, a comparable system, for the Walt Disney Company (Berkman, 2024).

During the 1950s and 1960s, the foundations for virtual reality were laid in a number of different areas of computing, mainly when it came to three-dimensional interactive computer graphics and the simulation of vehicles and aircraft. Light pens, called initially "light guns," and cathode-ray tube (CRT) displays were first used in Project Whirlwind, a US Navy-funded early-warning radar system, and its successor, the US Air Force-funded SAGE (Semi-Automated Ground Environment) early-warning radar system. Before the SAGE system went live in 1957, these gadgets were already in frequent use by Air Force operators. Aircraft positions might be shown and pertinent data could be altered using these devices (Boslaugh et al., 2022).

2. Blended Learning Flipped Classroom Model

Blended learning is a method of instruction that integrates online and offline components, such as a combination of online resources and classroom-based activities, to provide a more well-rounded educational experience for students (Kumar et al., 2019). "Blended learning is the intentional blending of classroom face-to-face learning experiences with online learning experiences," according to a formal definition of the term proposed by Garrison and Kanuka (2004).

Blended learning, often called hybrid learning, is a method of education that mixes in-person classroom instruction with online electronic learning to provide a more well-rounded education for students. Most public institutions, including junior colleges, colleges, and universities, adopt this "blend" approach to teaching and learning (Aksel, 2021).

This kind of instruction has been gradually included into the foundation of higher education with the advent of digital technology in the twenty-first century and the ubiquitous usage of mobile devices in all facets of daily life (Shurygin et al., 2022). By providing an integrated learning experience that is both valuable and tailored to the requirements of learners, its application aims to facilitate simpler and more successful learning.

The purpose of blended learning is to better assist students in achieving their learning objectives and meeting their individual requirements. Instructors and students alike may get many benefits from blended learning courses when done well (Bouilheres et al., 2020).

The presentation of learning materials and the delivery of synchronous or asynchronous online training are both given more leeway to educators. Also, since it's self-paced, students may study whenever it's convenient for them and adapt their approach based on their individual learning preferences (Moorhouse & Wong, 2022).

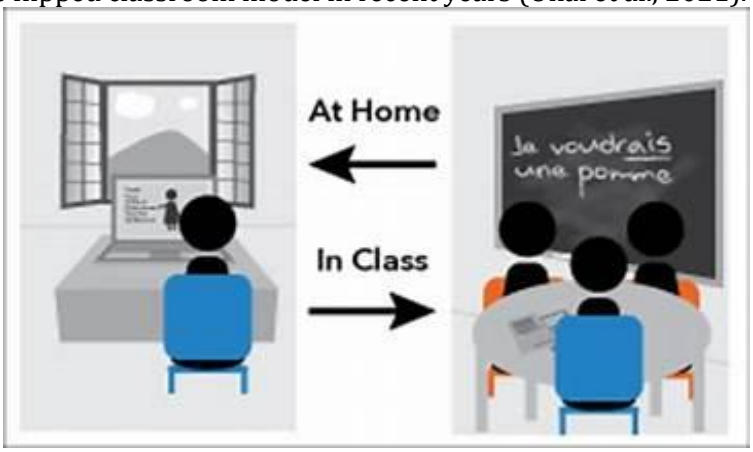
The efficiency and efficacy of meaningful learning experiences may be significantly improved via the use of blended learning methodologies, according to research. Students are more likely to participate and learn from one another when teachers and students are able to communicate via email, message boards, or chat rooms (Ayob et al., 2023).

Teachers in a blended classroom may see their students' progress more clearly and fill up any knowledge gaps with the use of digital resources. Because of this, they are able to tailor their educational experiences and pedagogical approaches to better suit their unique requirements and areas of interest (Ashraf et al., 2021).

A blended learning strategy drastically reduces the amount of time students spend in-person with teachers. Teachers are able to contact more students and take more of them under their wing when 30–70 percent of the learning takes place online (Bornkamm et al., 2021; Umer et al., 2023; Hafeez et al., 2023).

Blended learning has several advantages, one of which is the fact that it helps educational institutions and businesses save money. Educational organizations and institutions may significantly reduce expenses related to travel, venue rentals, and learning material printing by embracing digital learning (Chowdhury, 2020).

One innovative and widely used approach to education is the "flipped" or "inverted" classroom, in which students work on assignments that would typically be assigned at home instead of in class and vice versa (Al-Samarraie et al., 2020). Instead of the instructor only lecturing at the students, in a flipped classroom model, the students take charge of their own education and choose their own pace (Bursa & KOSE, 2020). Teachers may involve students in various learning activities including discussion, problem solving, hands-on activities, and coaching instead of using class time to impart information via lectures. Numerous fields (math, sociology, the humanities, etc.) and educational institutions all over the globe have begun to use the flipped classroom model in recent years (Unal et al., 2021).



Active learning has been equated by some with the flipped classroom model. The flipped classroom model is just one of several strategies for making lessons more interactive and engaging for students. The fundamental tenet of a flipped classroom is the rejection of traditional methods of teaching that rely on teacher-led lectures. Instead, students are provided with the necessary materials before class, allowing teachers more time in class to focus on activities that promote higher-order thinking (Li et al., 2023).

The most challenging aspect of establishing a flipped classroom, according to many instructors, is locating or creating resources for students to utilize outside of class. What really matters in a flipped classroom, as opposed to a traditional lecture hall, is the actual learning that takes place there. Therefore, before you start looking for materials for students

to use at home, you need to determine how you will spend class time. Students are expected to put in significant effort outside of class time in a flipped classroom format. If students do not see how this activity allows them to have more instructional time in class, they will dislike it (Lee et al., 2020).

In the educational strategy known as "flipping the classroom," students are required to do pre-classwork, such as reading the assigned materials or watching a recorded lecture, before attending class. In class, students are encouraged to actively participate, ask questions, and reflect on what they have learned in order to fully grasp, apply, and expand upon course material. During class time, students work together on assignments and make use of active learning tools including problem sets, case studies, and organized discussions. Classes are videotaped (either as video or as narrated screencasts). After seeing these lectures for homework, students work in small groups with the help of teachers and GSIs to complete problems or other highly engaging, organized activities during class time (Da Silva, 2023).

A flipped classroom, as stated by Harvard University, is "based on the premise that lecturing or providing one-on-one guidance is not the most effective use of class time (Goksu & Duran, 2020). The time in class may be better spent on tasks that require higher-order thinking since students are now exposed to the material before class (Hussain et al., 2022). The instructor often takes the lead during class time in a conventional classroom, with students sitting quietly and listening to lectures. After that, students go home and finish up any remaining homework, such as papers or projects. Homework or reading assigned materials constitute student work in a flipped classroom. Deeper learning activities, such as class discussions, laboratories, and teacher-student one-on-one time, take place during class time (Amir et al., 2022; Goksu & Duran, 2020).

The notion of flipped classrooms is fraught with myths. A common misconception is that instructors are being "replaced" with video lessons. This would never happen in an actual flipped classroom. Actually, classes are a great opportunity for instructors to get a lot more done, and they're usually even expected to. Complex laboratories, debates, and projects are supervised by them, and they modify education based on each student's requirements (Rehman & Lakhan, 2021).

The fundamental principle of the pedagogical paradigm known as the "Flipped Classroom" is to "flip" the traditional way of teaching. Prior to class, students are expected to study the assigned materials and attend the lectures so that they are prepared to actively participate in learning activities that are connected to their schoolwork. Make engaging, high-quality recorded lectures that cover all of the material (substantial pre-planning and prep work required before pilot semester). Lessons should be kept to a reasonable length (about 15 minutes) (Gopalan et al., 2022).

Make sure to include Active Learning into your classroom activities. The information that students have learned in class should be put into practice. (for example, educational games, speeches, debates, group projects, problem solving, presentations, individual homework, and case studies). Stay away from "busy job" that's just a time-waster. Keep yourself accessible throughout class time to help out and guide students. Go around, and be ready to lead and inspire student-centered, active learning. Participate in class discussions (Bean & Melzer, 2021).

Statement of Problem

With the development of technology, teachers are searching for new teaching methods for effective teaching-learning. By nature, teachers are researchers; teachers teach according to the student's IQ. Some students are fast learners and some are slow learners. Slow learners can be handled by integrating advanced technology and through Integrating Blended Learning Flipped Classroom Model. Virtual reality is a trending technology and Integrating Blended Learning Flipped Classroom Model also a trending teaching method; both can be used in school education, especially in science subjects like physics and biology. Both can be used at school levels to teach complex theories and concepts. The present research was a new exploration in the field of education, exploring something new for better teaching, especially science subjects, to secondary-level students. It was an experimental study to compare the Virtual Reality and Integrating Blended Learning Flipped Classroom Model impacts on students' academic achievement. The study results will be beneficial in the field of education and pedagogy.

Objectives of the Study

The following were the objectives of the study;

1. To compare the impact of Virtual Reality teaching method and Integrating Blended Learning Flipped Classroom Model on students' excitement and engagement.
2. To compare the learning outcomes by integrating Virtual Reality and Integrating Blended Learning Flipped Classroom Model in biology subject at the secondary school level.

Hypothesis of the Study

The following were the hypotheses of the study;

Ho.1 There is no difference between Virtual Reality teaching method and Integrating Blended Learning Flipped Classroom Model on students' excitement and engagement.

Ho.2 There is no difference between Virtual Reality teaching method and Integrating Blended Learning Flipped Classroom Model in biology subject at the secondary school level.

Methods and Procedures

This study was experimental. The study aimed to compare the impact of Virtual Reality and There is no difference between Virtual Reality teaching method and Integrating Blended Learning Flipped Classroom Model on students' excitement, engagement, and academic achievements in biology subject. For this purpose, class 10th students of Government Boys High School No. 1 Dera Ghazi Khan were selected for the experiment. Through cluster sampling class, the 10th Iqbal-Secon class was chosen for the experiment. First of all, students who pre-tested, high achievers and low achievers, were excluded from the study; only average scorer students were selected for this experiment. According to suggestions by Krejcie & Morgan (1970), only 30 intermediate scorer students were chosen out of 73 students for the experiment. Through the fishbowl simple random sampling method, two groups were made. Fifteen students were selected for the teaching through Virtual Reality VR group and fifteen students were chosen for the Integrating Blended Learning Flipped Classroom Model group.

Experiment Procedure

For the experiment, only one biology subject was chosen. For the Virtual Reality group, Dr Qazi Abdul Ghafor was selected to teach the class integrated through Virtual Reality with the help of an IT teacher and for Integrating Blended Learning Flipped Classroom Model, Dr Sahid Rasool was selected. Japan Electronics Franchise D.G. Khan gifted Virtual Reality Gadgets and Cellular Tablets for Integrating Blended Learning Flipped Classroom Model for experiment. Chapters four to seven of the 10th biology class were already fed in those VR Gadgets and chapter 1 to three were fed in Cellular Tablets. Franchise experts also helped in this experiment. They aimed to advertise these VR Gadgets and Cellular Tablets for use in public and private schools.

Treatment

According to the lesson plan, the teacher handed the Virtual Reality Gadgets and Cellular Tablets to students. Prior to this, the teacher taught the required lesson and gave appropriate directions to students. Then, students visualize the required lesion through Virtual Reality and gain knowledge. After visualization and video session and materials, students were asked to discuss their experiences, and the teacher mentored the discussion, corrected misconceptions, and provided further knowledge on the required lesson.

Experiment Duration

The actual duration of the experiment was six months; in the first month, the pre-test was conducted, and groups were made; treatment started in the second month, the total duration of actual treatment was four months, and the last month's data were collected and analyzed, and final results were concluded.

Development of Tools

Two achievement tests were made for data collection; both tests were teacher-made as usual. The first test was used as a pre-test, and the second was for post-test; both were traditional achievement tests.

Validity and Reliability of the Tools

Experts validated both tests. Then, reliability was checked through SPSS; the reliability of the first test was .91 and the second test was .89, which was excellent.

Data Analysis Procedure

Two achievement tests were made to assess the student's achievement in biology. The first test was used for the pre-test, and the second for the post-test. Only post-test results were correlated with each other; for this purpose, mean score, standard deviation, and independent sample t-test were applied. Students' excitement and engagement levels were checked through the observation method.

Results of the Study

Ho1. There is no difference between Virtual Reality teaching method and Integrating Blended Learning Flipped Classroom Model on students' excitement and engagement.

Findings: All fifteen students in the Virtual Reality group were more excited and engaged than the Flipped Classroom Model group students; the null hypothesis was not accepted.

Table No. 1

Ho2. There is no difference between Virtual Reality teaching method and Integrating Blended Learning Flipped Classroom Model in biology subject at the secondary school level.

Independent Sample t-test					
Groups	*f*	μ	σ	t	α
Flipped Classroom Model	15	2.9048	.28401	-8.803	.000
Virtual Reality	15	3.8952	.33050		

Table No. 1 describes the experiment results. It was found that the Virtual Reality group mean was higher than the Flipped Classroom Model group, and a significant difference between both mean scores was found. The mean value of the Virtual Reality group was (3.8952), and the standard deviation was (.33050). The mean value of the Flipped Classroom Model group was (2.9048) and the standard deviation was (.28401). The t-test value was (-8.803), $p < .05$; the null hypothesis was not accepted.

Research Conclusions

It was concluded that the Virtual Reality group mean score was higher than the Flipped Classroom Model group. The results of the t-test were found to be significant. There was a significant difference between the achievement scores of the Virtual Reality and Flipped Classroom Model groups.

Recommendations

According to the study conclusion, some recommendations were made as follows;

1. Teachers should familiarize themselves with emerging technological pedagogical methods, such as virtual reality.
2. Both public and private schools could benefit from embracing VR in the classroom.
3. Virtual reality (VR) should be widely used in the classroom, and all literature and science courses should be created using VR.
4. The government ought to be enthusiastic about advancing VR in education, particularly in school settings, and ought to set aside adequate resources for VR devices in the classroom.

References

1. Aksel, A. (2021). A study on the effectiveness of a blended learning model in English language learning in higher education: Student attitudes and opinions.
2. Al-Samarraie, H., Shamsuddin, A., & Alzahrani, A. I. (2020). A flipped classroom model in higher education: a review of the evidence across disciplines. *Educational Technology Research and Development*, *68*, 1017-1051.
3. Amir, M., Hussain, S., & Muhammad, S. (2022). Identification of the Need for Teacher Training at The Primary School Level. *International Research Journal of Education and Innovation*, *3*(1), 165-176.
4. Ashraf, M. A., Yang, M., Zhang, Y., Denden, M., Tlili, A., Liu, J., ... & Burgos, D. (2021). A systematic review of systematic reviews on blended learning: Trends, gaps and future directions. *Psychology Research and Behavior Management*, 1525-1541.

5. Ayob, H. H., Daleure, G., Solovieva, N., Minhas, W., & White, T. (2023). The effectiveness of using blended learning teaching and learning strategy to develop students' performance at higher education. *Journal of Applied Research in Higher Education*, *15*(3), 650-662.
6. Barron, C., Chang, A., Gluck, T. E., Iwerks, L., Taylor, J., & Maltz, A. (2022). Report from the Academy of Motion Picture Arts and Sciences' Science and Technology Council. *SMPTE Motion Imaging Journal*, *131*(8), 50-60.
7. Bean, J. C., & Melzer, D. (2021). *Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom*. John Wiley & Sons.
8. Berkman, M. I. (2024). History of virtual reality. In *Encyclopedia of computer graphics and games* (pp. 873-881). Cham: Springer International Publishing.
9. Bhatnagar, D., & Boruah, A. (2024). Virtual Reality: A Mechanism for Modern Education. *Transforming Education with Virtual Reality*, 229-247.
10. Bornkamm, K., Koch, C., Dietterle, J., Steiert, M., Fleig, A., Weiller, C., & Brich, J. (2021). Teaching the neurologic examination: a prospective controlled study to compare a blended learning approach with face-to-face instruction. *Neurology*, *97*(20), e2032-e2038.
11. Boslaugh, D., Marland, P., & Vardalas, J. (2022). The Information Age and Naval Command & Control. *Proceedings of the IEEE*, *111*(1), 113-131.
12. Bouilheres, F., Le, L. T. V. H., McDonald, S., Nkhoma, C., & Jandug-Montera, L. (2020). Defining student learning experience through blended learning. *Education and Information Technologies*, *25*, 3049-3069.
13. Bursa, S., & KOSE, T. C. (2020). The Effect of Flipped Classroom Practices on Students 'academic Achievement and Responsibility Levels in Social Studies Course. *Turkish Online Journal of Distance Education*, *21*(4), 143-159.
14. Champion, E. M. (2021). *Rethinking Virtual Places*. Indiana University Press.
15. Chowdhury, F. (2020). Blended learning: how to flip the classroom at HEIs in Bangladesh? *Journal of Research in Innovative Teaching & Learning*, *13*(2), 228-242.
16. Da Silva, L. (2023). *Flipping the classroom to enhance student engagement in first-year statistics education* (Doctoral dissertation, University of the Free State).
17. Ganadas, P., Kiemele, K. L., Sadak, C. M., Santisteban, A. H., & Speirs, S. C. (2021). *US Patent No. 10,976,820*. Washington, DC: US Patent and Trademark Office.
18. Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The internet and higher education*, *7*(2), 95-105.
19. Goksu, D. Y., & Duran, V. (2020). Flipped classroom model in the context of distant training. *Research highlights in Education and Science*.
20. Gopalan, C., Daughrity, S., & Hackmann, E. (2022). The past, the present, and the future of flipped teaching. *Advances in physiology education*, *46*(2), 331-334.
21. Hafeez, A., Hussain, S., Muhammad, S., & Hussain, S. (2023). Effect of PEC Exams on Quality Education in Public and Punjab Education Foundation Funded Secondary Schools. *International Research Journal of Management and Social Sciences*, *4*(3), 358-374.
22. Hussain, S., Ahmad, M. S., & Hussain, S. (2022). Relationship of Teacher-Student Interaction, Learning Commitment and Student Learning Comfort at Secondary Level. *International Research Journal of Education and Innovation*, *3*(2), 156-169.
23. Hussain, S., Ahmad, M., Ul Zaman, F., & Ahmad, A. (2023). Comparative Study of Administrators' Supervisory Skills and Teachers' Pedagogical Skills Towards Quality Education in Public and Punjab Education Foundation Funded Schools at Secondary Level. *Journal of Education & Educational Development*, *10*(2).
24. Hussain, S., Zaman, F. U., Muhammad, S., & Hafeez, A. (2023). Analysis of the Initiatives taken by HEC to Implement Associate Degree Program: Opportunities and Challenges. *International Research Journal of Management and Social Sciences*, *4*(3), 193-210.

25. Kumar, A., Krishnamurthi, R., Bhatia, S., Kaushik, K., Ahuja, N. J., Nayyar, A., & Masud, M. (2021). Blended learning tools and practices: A comprehensive analysis. *Ieee Access*, *9*, 85151-85197.
26. Lee, Y., & Martin, K. I. (2020). The flipped classroom in ESL teacher education: An example from CALL. *Education and Information Technologies*, *25*, 2605-2633.
27. Li, R., Lund, A., & Nordsteien, A. (2023). The link between flipped and active learning: A scoping review. *Teaching in Higher Education*, *28*(8), 1993-2027.
28. Liu, X. (2020). Three-dimensional visualized urban landscape planning and design based on virtual reality technology. *IEEE access*, *8*, 149510-149521.
29. Makinen, O., Hatala, A., Saransaari, H., Muurimaki, J., Bushnaief, J., Muszynski, J., ... & Truong, V. (2020). *US Patent No. 10,713,845*. Washington, DC: US Patent and Trademark Office.
30. Moorhouse, B. L., & Wong, K. M. (2022). Blending asynchronous and synchronous digital technologies and instructional approaches to facilitate remote learning. *Journal of Computers in Education*, *9*(1), 51-70.
31. Plecher, D. A., Keil, L., Kost, G., Fiederling, M., Eichhorn, C., & Klinker, G. (2022). Exploring underwater archaeology findings with a diving simulator in virtual reality. *Frontiers in Virtual Reality*, *3*, 901335.
32. Rehman, U., & Lakhan, M. A. S. A. (2021). A review on state of the art in flipped classroom technology a blended e-learning. *Int. J*, *9*.
33. Shan, Y. (2023). *Social imaginary and virtual reality in China's cultural industries* (Doctoral dissertation, Queensland University of Technology).
34. Shurygin, V., Ryskaliyeva, R., Dolzhich, E., Dmitrichenkova, S., & Ilyin, A. (2022). Transformation of teacher training in a rapidly evolving digital environment. *Education and Information Technologies*, 1-20.
35. Trumpener, K., & Barringer, T. (Eds.). (2020). *On the Viewing Platform: The Panorama Between Canvas and Screen*. Yale University Press.
36. Umar, Z., Hussain, S., Khan, I., & Perveen, F. (2023). Parents' Involvement Effect on Students' Academic Achievement and Quality Education in Public and Private Schools at Elementary Level. *International Research Journal of Management and Social Sciences*, *4*(3), 400-411.
37. Umar, Z., Sadiqi, T., Hussain, S., & Qahar, A. (2023). Compare the Quality of Infrastructure on Student Outcomes in Public and Punjab Education Foundation Funded Schools at Secondary Level. *International Research Journal of Management and Social Sciences*, *4*(4), 26-39.
38. Unal, A., Unal, Z., & Bodur, Y. (2021). Using Flipped Classroom in Middle Schools: Teachers' Perceptions. *Journal of Research in Education*, *30*(2), 90-112.
39. Young, G. W., Stehle, S., Walsh, B. Y., & Tiri, E. (2020). Exploring virtual reality in the higher education classroom: Using VR to build knowledge and understanding. *Journal of Universal Computer Science*, (8), 904-928.