Smart Classrooms: A Paradigm Shift for Vocational Education Teachers in Teacher Training in Colleges of Education in Nigeria

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Abstract
The paper exams smart classrooms as a paradigm shift for vocational education teachers in teacher training in colleges of education in Nigeria. It sees Vocational education as education that prepares people for a skilled craft. Vocational education can also be seen as that type of education given to an individual to prepare that individual to be gainfully employed or self-employed with requisite skill. Smart classroom teaching is one of the new teaching methods which with the support of information and communication technology facilities, teaching is carried out with the help of smart teaching tools to enhance teacher-student communication, enhance students' learning autonomy, and provide new ideas for the realization of students' deep learning. Benefits of Vocational Education and Training in Nigeria to include: Lesser Education Costs; preparation for job; easy employment; success in career; and Promotes Entrepreneurship. Other importance or why vocational education includes: Personal Satisfaction; Diverse Career Opportunities and Adaptability. It provided the followings as key features of smart classrooms: Digital Tools; Connectivity; Interactive Learning; Modernization; Improved Teaching; Accessibility; Interactive Whiteboards; Projectors; Laptops/Tablets; Multimedia Resources; Online Learning Platforms among others. Based on literatures reviewed, some key challenges and the way forward for adapting smart classrooms in vocational education by colleges of education have been identified. It recommended among others for Integration of digital technology into vocational teacher education, Provision of smart classrooms skill-based training and Regular technology policy review among others. It concluded that, the integration of smart classrooms technology into vocational education symbols a transformative shift in learning paradigms.

Keywords: *Smart Classrooms, Paradigm Shift, Vocational Education, Teacher, Colleges of Education*

Introduction

Vocational education is undergoing a significant transformation, driven by the integration of smart classroom teaching and learning methodologies. This approach, which combines online and interactive instruction, is composed to revolutionize vocational teacher training by offering flexibility, enhancing engagement, and incorporating modern technologies in teacher preparation. As countries industrialize, the demand for skilled labour increases, it is imperative that vocational education adapts to meet these changing needs (Akounjom, Babatunde & Aiguobarueghian 2024). On the other hand, smart classroom learning offers unparalleled flexibility, making vocational education more accessible to a diverse range of students. Traditional vocational programs often require fulltime attendance, which can be challenging for those already in the workforce or with other commitments. Blended learning mitigates this issue by allowing students to access

theoretical content online at their convenience while participating in hands-on training in person. This model not only broadens access but also supports lifelong learning, enabling individuals to continuously update their skills in response to industry advancements (Garrison & Vaughan, 2021).

Engagement and skills acquisition are critical factors in the success of vocational education programs. Smart classrooms have been shown to improve these metrics by offering a more dynamic and interactive learning experience. Online components can include multimedia resources, interactive simulations, and collaborative tools that make learning more engaging (Mustapha, Van, Shahverdi, Qureshi & Khan, 2021). Meanwhile, face-to-face sessions provide opportunities for hands-on practice, peer interaction, and immediate feedback from instructors (Means, Toyama, Murphy, Bakia, & Jones 2013). This combination they argued caters to different learning styles and helps maintain student interest and motivation.

The integration of advanced technologies such as virtual reality (VR), interactive whiteboards, multimedia resources and augmented reality (AR) further enhances the effectiveness of smart classroom learning in vocational education. These technologies can create immersive simulations that replicate real-world scenarios, allowing students to practice and refine their skills in a safe and controlled environment (Amhag, Hellström & Stigmar, 2019). For example, VR can simulate complex procedures in fields like healthcare and automotive repair, providing students with realistic and practical training experiences (Smith & Jones, 2023). This technological infusion not only enhances learning outcomes but also prepares students for the technologically advanced workplaces of the future. Despite the recognized benefits, such as increased accessibility, flexibility, and personalized learning experiences, the adoption of blended learning in vocational education faces several challenges in Nigeria**.** These include the lack of adequate infrastructure, insufficient training for educators, and resistance to change from traditional teaching methodologies (Vaughan, 2010). Additionally, there is a need for empirical research to evaluate the effectiveness of blended learning in improving student outcomes in vocational education settings.

Vocational Education

Vocational education, also known as career and technical education (CTE), is a system of training that focuses on equipping individuals with practical skills and knowledge related to specific trades or occupations. This form of education is designed to prepare students for direct entry into the workforce by providing hands-on experience and relevant technical training. Unlike traditional academic education, which emphasizes theoretical knowledge, vocational education aims to produce graduates who are job ready and possess the competencies required for specific careers (Rauner & Maclean, 2008).

Vocational education is education that prepares people for a skilled craft. Vocational education can also be seen as that type of education given to an individual to prepare that individual to be gainfully employed or self-employed with requisite skill (Lawal, 2013). Vocational education he argued is known by a variety of names, depending on the country concerned, including career and technical education, or acronyms such as TVET (technical and vocational education and training; used by UNESCO) and TAFE (technical and further education). TVE refers to all forms and levels of education which provide knowledge and skills related to occupations in various sectors of economic and social life through formal, non-formal and informal learning methods in both school-based and work-based learning contexts (Lawal, 2013).

In Nigeria, vocational education is a type of education that focuses on preparing individuals for specific occupations by providing practical and applied skills (Ajeniweni, Bamgbowu & Obasi, 2024). It goes beyond general academic knowledge and aims to equip students with the competencies needed for employment in various trades, industries, and commercial sectors (Okoye & Arimonu, 2016). This often involves hands-on training, apprenticeships, and the acquisition of specific skills relevant to a particular trade or occupation. Here's a more detailed breakdown suggested by Ajeniweni, Bamgbowu and Obasi, 2024; and Okoye and Arimonu, (2016):

i. **Focus on Practical Skills:** Vocational education emphasizes the development of practical skills that are directly applicable in the workplace.
ii. **Trade and Industry Specialization:** It often involves training in specific trades or industries, such as carpentry, auto mechanics, tailoring, or computer technology.
iii. **Apprenticeship Training:** In many cases, vocational education includes apprenticeship programs where individuals learn from experienced professionals in their chosen field.
iv. **Preparation for Employment:** The primary goal of vocational education is to prepare individuals for entry into the workforce and to enhance their employability

Benefits of Vocational Education and Training in Nigeria

Youth Development Specialist at Cathy Youths Global Initiatives [CYGI] (2018) identified the followings as reasons why vocational education is important among which are:

i. **Lesser Education Costs:** Not everyone can afford to go college as a four-year degree course, plus the hostel fees, commuting, added costs of books, can turn out to be very expensive. Vocational courses are a cheaper alternative for people who do not want to take up a loan to go to college. Many vocational courses, similar to four-year degrees, provide placement to the students. This makes them quite useful for those who do not have the means to shell out money for a college degree.

ii. **Prepares for a Job:** Vocational education prepares a person for a specific job, equips a person with the skills and qualities required to do a particular job, such as fashion designing, interior decoration, computer networking, auto repairing among others. Many a time, the curriculum for the courses is prepared after taking suggestions from the local employers. Along with classroom instructions, practical knowledge is imparted through field work. Laboratory learning is emphasized to give the students practical knowledge on a given subject. This prepares the student for the job at hand and thus, he is able to give full justice to his profession, due to his vast knowledge.

iii. **Easy Employment:** Vocational education makes it easier for the students to find employment. Usually, it is seen that employers prefer to hire a student who has done a vocational course rather than a college pass out, as by doing a vocational course, a student is trained specifically for a particular job. The student already possesses the right temperament, skills, qualities and education for the job and the employers feel that he will be more successful than a regular college pass out due to his knowledge. Thus, easy employment is one of the chief advantages that students from a vocational course have over others.

iv. **Success in Career:** People who are already employed and those who want to get further education to advance their careers, cannot afford to take a four-year break and pursue a college degree. So, in order to enhance their skills and qualifications, an alternative is to do a vocational course. The time duration for the course is less, but the skills that are imparted to students through such courses, are quite comparable to the college courses, in

terms of quality. Thus, by doing a vocational course, a professional can enhance his career prospects and achieve success.

v. ***Promotes Entrepreneurship*:** After doing a vocational course, a person is equipped enough to start his own business. This course of action is taken up by many a vocational course pass out students. Thus, such courses promote entrepreneurship, which is a very good thing for the economy today, considering that the recession has left many without jobs. Vocational courses increase the number of small businesses, which further increase employment, thus reducing the stress on the government to provide jobs for the unemployed.

vi. **Bridge Skill Gaps:** It also eradicates the skill gap as it is felt in different segments by providing proficient training based on the market. This in a way ensures that the graduates can meet the demands of the employers, reducing the low rate of unemployment and high efficiency of the workforce.

vii. **Enhance Employability:** This means that by the time the students complete their courses, they easily get jobs because of the practical work they do during the training. Graduates from vocational programs find a niche to fit in upon the completion of a vocational course and the skills acquired prepare them for the job market, thus employers who hire graduates from vocational programs do not spend much time and money training the employees.

viii. **Support Economic Growth:** For economic development to take place, skilled personnel is very vital. Vocational education therefore has a part to play in providing quality professionals in different fields to improve innovation, productivity, and competition. Since vocational training promotes the development of skills in their employees, it is a sustainable way of economic development.

Other importance or why vocational education includes:

i. **Personal Satisfaction**: Vocational education enables a student to have a chance to do what he or she wants to do in life thus a happier life and job satisfaction.

ii. **Diverse Career Opportunities**: Vocational training enables people to access a variety of job opportunities, especially in the growing industries such as Information Technology, and health and challenges.

iii. **Adaptability**: The skills acquired as a result of vocational education make people flexible to the dynamic aspects of the employment sector and technological cultures.

Smart Classrooms

Smart classroom teaching is one of the new teaching methods. With the support of technology, teaching is carried out with the help of smart teaching tools to enhance teacher-student communication, enhance students' learning autonomy, and provide new ideas for the realization of students' deep learning (Zhang & Li, 2021). Smart classroom in the words of Wang, Li and Li (2019), refers to the mobile intelligent teaching mode that runs through pre-class, in-class and after-class under the support of the new generation of information technology, such as big data, cloud computing and internet, in order to cultivate students' independent learning, creative learning and personalized learning (Wang, et al., 2019).

Smart classroom teaching is one of the new teaching methods which with the support of information and communication technology facilities, teaching is carried out with the help of smart teaching tools to enhance teacher-student communication, enhance students' learning autonomy, and provide new ideas for the realization of students' deep learning (Huang, Su & Pao, 2019).. How to promote the overall intelligence of the teaching environment so that the teaching

equipment can be used more efficiently and managed more effectively has become the main concern of schools (Ali & Rosli, 2019). Therefore, smart classroom provide great convenience for future smart campus construction, daily teaching, and campus management and can also provide reference for the construction of smart classrooms in teacher training colleges and universities (Huang et al., 2019).

A smart classroom is a classroom that utilizes digital technologies and teaching methodologies to enhance the learning experience and improve teaching efficiency. These classrooms typically incorporate interactive whiteboards, projectors, laptops, and other digital resources, often connected through Wi-Fi, to facilitate engagement and provide innovative teaching methods (Nguyen et al., 2022). The provided the followings as key features of smart classrooms:

a. **Digital Tools:** Smart classrooms are equipped with various digital tools, including interactive whiteboards, projectors, and laptops, which can be used to enhance lesson presentations and student engagement.
b. **Connectivity:** These classrooms often have reliable Wi-Fi access, allowing for seamless integration of digital resources and online learning platforms.
c. **Interactive Learning:** Smart classrooms encourage active participation through interactive tools and activities, promoting a more dynamic learning environment.
d. **Modernization:** The use of smart resources can contribute to a more modern and engaging learning experience for students.
e. **Improved Teaching:** Smart classrooms offer teachers new ways to engage students and present lessons, leading to better learning outcomes.
f. **Accessibility:** Smart classrooms can be adapted to suit different learning styles and needs, making learning more accessible for all students. Examples of Smart Classroom Features:
g. **Interactive Whiteboards:** These allow for real-time interaction and annotation during lessons, making it easier for teachers to present concepts and engage students.
h. **Projectors:** Projectors facilitate the sharing of digital content and presentations, enhancing visual learning.
i. **Laptops/Tablets:** Students can use laptops or tablets for research, collaborative projects, and online learning.
j. **Multimedia Resources:** Smart classrooms can leverage videos, audio, and other multimedia resources to make learning more engaging and accessible.
k. **Online Learning Platforms:** Smart classrooms can be integrated with online learning platforms to facilitate remote learning and provide access to a wider range of educational resources.

Advantages of Smart Classrooms

Wang, Li and Li (2019) started that, smart classrooms has their own advantages, especially when compared with traditional classrooms. Traditional classes are mainly divided into preparing lessons, lecturing, assigning homework, correcting homework, and after-school counseling. However, the smart class is more inclined to complete teaching before, during and after class. They compared them under the following 5 headings:

i. **Teaching Ideas:** The concept of traditional classroom mainly depends on teachers, textbooks and classroom. Teachers prepare lessons, design teaching process and prepare teaching materials before class. Classroom activities are organized according to instructional design to help students learn new knowledge and review old knowledge.

Among them, the classroom is the main part in the whole teaching process and the teaching knowledge through the teacher's instillation. But the smart classroom is mainly centered on students, practice and creation. Through the use of network multimedia, students are regarded as the center of teaching, students' habit of self-study is cultivated, and the cultivation of practical ability and innovative ability is emphasized (Qureshi, Khan, Raza, Imran & Ismail, 2021).

ii. **Teaching Methods:** Traditional classroom teaching method is still based on traditional inculcation. Teachers and classrooms are the leading ways to teach mechanically knowledge to students, and then consolidate it through repeated classroom and after-class exercises. Although with the renewal of teaching ideas, traditional classroom teaching methods also gradually pay attention to the guidance of knowledge learning, but it is still difficult to escape the indoctrination of teaching methods. Smart classroom, the initiative of learning is exchanged to students, students become the center of knowledge learning, and the classroom as a place to test the effect of knowledge learning and practice, only play a supporting role. Teachers externalize and share individual precipitated knowledge to students through Internet multimedia, and students learn and discuss it independently. In this process, teachers change from the master of teaching to the organizer, instructor and helper of teaching, and give the initiative of learning to students.

iii. **Studying Methods:** Similarly, in the traditional classroom, students are passive receivers of knowledge, often through the links arranged by teachers through repeated exercises to obtain knowledge. The whole process is relatively passive and lacks the sense of independence. Moreover, because of the passive learning method, students' practical ability is limited. In the smart classroom, students become active constructors. With the student-centered teaching method and the experiential learning of cultivating students' core literacy, students become more active in the process of learning, combining their learning habits and learning abilities, and actively explore knowledge in a group or individual way. The whole learning process is more social, interesting, competitive, research and collaborative.

iv. **Learning Resources:** In the traditional classroom, learning resources are often limited to textbooks, relevant exercise books, teaching PPT, various test papers, etc. The vast majority of learning resources come from the relevant information offline. Relatively speaking, it is not flexible enough and resources are not abundant enough. Smart classroom however have realized the interconnection and interoperability with high-quality educational resources on the Internet. Video materials, micro-classes, web pages, audio and electronic courseware are all resources involved and utilized in smart classes. Various forms, for students, learning can also increase their interest and motivation. Learning resources have become more open and diverse.

v. **Learning Evaluation**: The traditional classroom learning evaluation is relatively single. The most common way is the form of examination, which summarizes the students' learning situation roughly and guides the teaching. In addition, classroom tests are often used, such as oral answers and written answers. Although the testing methods are constantly improving and different evaluation methods are added, it is often difficult to achieve a fine and effective evaluation of students' level in the end. On the contrary, the smart classroom mainly controls the students' learning situation through three stages. In the three stages of pre-class, in-class and after-class, through the analysis of wrong questions and class interaction, the use of intelligent learning system for data diagnosis can

clearly reflect students' weaknesses, learning fluctuations, and bad learning habits. Make the evaluation of students more accurate (Wang, Li & Li (2019), and then teachers give more scientific data feedback.

Challenges and the way forward in smart classroom adaptation

Based on literatures reviewed, the followings have been identified as the key challenges and the way forward for adapting smart classrooms in vocational education by colleges of education:

1. **Inadequate Infrastructure and Access to Technology:** The integration of digital technology presents a pivotal challenge: ensuring fair technology access and adequate infrastructure across all stakeholders. Discrepancies in technological resources can foster unequal learning prospects, eroding the potential benefits of digital education (Meirbekov, Maslova & Gallyamova, 2022).
2. **Inadequate internet connectivity:** Inadequate internet connectivity, outdated hardware, and restricted device availability can impede students' meaningful interaction with digital learning platforms (Mucundanyi & Woodley, 2021).
3. **Low investment in educational technology:** Governments and educational institutions need to invest in robust technology infrastructure, encompassing high-speed internet access and contemporary hardware within educational environments.
4. **Low private sector participation:** Collaborative efforts between the public and private sectors can significantly extend technology reach to underserved communities. Furthermore, initiatives that provide affordable or subsidized devices to students can bridge the digital divide.
5. **Inadequate vocational teachers training:** Institutions must prioritize comprehensive training programs for vocational education teachers. Departments that are relevant should actively assist teachers in completing cooperative learning tasks, comprehending different digital teaching platforms, and operating a range of educational software. By studying new technologies, educators may effectively integrate digital teaching technology with particular teaching techniques and get ready for the digital teaching environment.
6. **Inadequate Mentorship:** In order to deepen teachers' understanding of digital teaching, maximise their ability to learn new skills, and advance their own digital teaching abilities, teachers in digital teaching training are grouped with other teachers who share similar teaching styles and carry out positive research and exploration.
7. **Inadequate resource sharing:** The last step involves sharing resources. Teachers can share resources to further exercise their use of digital teaching resources and lay the groundwork for the promotion of digital teaching abilities by working together to create or accumulate more digital teaching resources. These resources can be built in accordance with columns such as "software kit," "innovation," "teaching material “and” excellent teaching plan" that promote vocational skills acquisition.
8. **Inadequate Collaboration:** Collaborative workshops, peer mentoring, and online courses can empower educators to explore innovative teaching methods and adapt to the evolving technological landscape in vocational education.
9. **Poor learning culture:** Encouraging a culture of continuous learning and experimentation can boost faculty members' confidence in integrating digital technology into their teaching approaches.

10. **Infrastructure limitations and low access to technology:** Addressing infrastructure limitations and ensuring equitable access to technology are vital steps to prevent leaving any learners behind.
11. **Poverty:** Equally important is empowering vocational education teachers through increase in wages and conditions of work, comprehensive training, fostering their ability to effectively incorporate digital tools into the learning process. By tackling these challenges head-on, educational institutions can unlock the full potential of digital technology to enhance learning outcomes and prepare students for the demands of the digital age.

Recommendations

Integration of digital technology into vocational teacher education: The effective integration of digital technology into vocational education necessitates the formulation of digital strategies tailored to the distinct needs of vocational institutions (Gu, 2024). The use of digital technology to enhance traditional apprenticeship teaching methods, as well as the integration of digital instruction with simulation experiments, and other techniques, is referred to as the "digitalization" of vocational education instruction by Gu (2024).

Encourage collaboration: Vocational institutions should initiate a collaborative process involving educators, administrators, technology experts, and relevant stakeholders. This process should begin with a thorough assessment of existing technological infrastructure, faculty readiness, and student requirements.

Provision of smart classrooms skill-based training: Provision of smart classrooms skill-based training through digital simulations, enhancing access to industry-relevant resources, and nurturing digital literacy among vocational education teachers.

Regular technology policy review: Regular technology policy reviews and updates of the digital policy are vital to adapt to technological advancements. Institutions should allocate dedicated resources for technology policy implementation, including budget allocations for hardware, software licenses, and initiatives related to professional development.

Creating Supportive Learning Environments: Creating an enabling learning environment is pivotal for successful digital technology integration. Institutions must design digital learning spaces for interactive and collaborative experiences, equipped with modern technology and conducive seating.

Promote peer mentoring: Encouraging peer-to-peer learning through vocational education teachers-led workshops or projects empowers them to embrace digital skills effectively in teaching.

Collaborating with Industry Partners: Fostering strong collaborations with industry partners can greatly amplify the impact of vocational institutions' smart classrooms programs. These partnerships provide vocational education teachers with firsthand experience in applying digital technology to real-world scenarios, bridging the gap between classroom theory and industry expectations. To establish meaningful partnerships, institutions should pinpoint the key industries pertinent to their programs and engage industry experts in co-designing curriculum modules. This ensures that the curriculum directly addresses industry requirements.

Conclusion

In conclusion, the integration of smart classrooms technology into vocational education symbols a transformative shift in learning paradigms. In the face of rapid technological advancements, digital tools not only enhance skill development but also equip learners for the dynamic modern

workforce. Fostering digital literacy is paramount, empowering vocational education teachers to teachers the right type of skills needed by 21st century vocational education graduates.

Regardless of the important roles of smart Classrooms driven instructional strategy can play in vocational education at large, Nigerian colleges of education are yet to fully harness its benefits in teaching and learning. Efforts geared towards integration of smart Classrooms driven instructional strategy into the system, have not had much impact due to several problems ranging from teachers 'technological knowledge, irregular teacher capacity building, low access to technologies and low teacher motivation among others.. It is not enough to install technology into classrooms – it must be integrated into learning by teachers who are trained and highly motivated.

References

Ajeniweni, P. O., Bamgbowu, S. A., & Obasi, I. O. (2024). THE ROLE OF VOCATIONAL EDUCATION IN PROMOTING ECONOMIC GROWTH IN NIGERIA. *Journal of Economics and Environmental Education (JEEE)*, *8*(1), 23-41.

Akounjom, B. J., Babatunde O., & Aiguobarueghian o. m. (2024).The Future of Vocational Education Trends and Innovations in Blended Teaching Methodologies in Nigeria. *International Journal of Sub-Saharan African Research (IJSSAR, 2 (3), 267-277.*

AlGerafi, M. A., Zhou, Y., Oubibi, M., & Wijaya, T. T. (2023). Unlocking the potential: A comprehensive evaluation of augmented reality and virtual reality in education. *Electronics*, *12*(18), 3953.

Ali, N. H., & Rosli, R. A. H. M. (2019). Digital technology: E-content development using Apple technology. Malaysian Journal of Distance Education, 21(1), 83-94.

Amhag, L., Hellström, L., & Stigmar, M. (2019). Teacher educators' use of digital tools and needs for digital competence in higher education. Journal of Digital Learning in Teacher Education, 35(4), 203-220.

Cathy Youths Global Initiatives (2018). Why Vocational Education is Important in Nigeria. Accessed on 19th May, 2025 from: https://www.linkedin.com/pulse/why-vocational-education-important-nigeria-team-cty-nigeria

Erofeeva, M., & Klowait, N. O. (2021, May). The impact of virtual reality, augmented reality, and interactive whiteboards on the attention management in secondary school STEM teaching. In *2021 7th international conference of the Immersive Learning Research Network (iLRN)* (pp. 1-5). IEEE.

Gu, M. (2024). Empowering Vocational Education through Digital Technology: Innovating the Teaching Landscape. *International Journal of New Developments in Education, (6)6:* 131-136, DOI: 10.25236/IJNDE.2024.060621

Huang, L. S., Su, J. Y., & Pao, T. L. (2019). A context aware smart classroom architecture for smart campuses. *Applied sciences*, *9*(9), 1837.

Kwet, M., & Prinsloo, P. (2020). The 'smart'classroom: a new frontier in the age of the smart university. *Teaching in Higher Education*, *25*(4), 510-526.

Lawal, Abdulrahaman W. (2013). Technical and Vocational Education, a Tool for National Development in Nigeria" *Mediterranean Journal of Social Sciences. **4** (8)*: 85.

Meirbekov, A., Maslova, I., & Gallyamova, Z. (2022). Digital education tools for critical thinking development. Thinking Skills and Creativity, 44, 101023.

Mucundanyi, G., & Woodley, X. (2021). Exploring free digital tools in education. International Journal of Education and Development using Information and Communication Technology, 17(2), 96-103.

Mustapha, I., Van, N. T., Shahverdi, M., Qureshi, M. I., & Khan, N. (2021). Effectiveness of digital technology in education during COVID-19 pandemic. A bibliometric analysis.

Nguyen, L. T., Kanjug, I., Lowatcharin, G., Manakul, T., Poonpon, K., Sarakorn, W., ... & Tuamsuk, K. (2022). How teachers manage their classroom in the digital learning environment–experiences from the University Smart Learning Project. *Heliyon*, *8*(10).

Okoye, R., & Arimonu, M. O. (2016). Technical and vocational education in Nigeria: Issues, challenges and a way forward. *Journal of Education and Practice*, *7*(3), 113-118.

Qureshi, M. I., Khan, N., Raza, H., Imran, A., & Ismail, F. (2021). Digital technologies in education 4.0. Does it enhance the effectiveness of learning?

Saini, M. K., & Goel, N. (2019). How smart are smart classrooms? A review of smart classroom technologies. *ACM Computing Surveys (CSUR)*, *52*(6), 1-28.

Wang, X., Li, M., & Li, C. (2019). Smart classroom: Optimize and innovative-based on compared with traditional classroom. *International Journal of Information and Education Technology*, *9*(10), 741-745.

Zhang, M., & Li, X. (2021). Design of smart classroom system based on internet of things technology and smart classroom. *Mobile Information Systems*, *2021*(1), 5438878.