



Smart Classroom-Based Innovative Solution Toward Uninterrupted Education: Perspective

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ABSTRACT

Pandemics create a lot of disruptions in the society, and we are directly affected. The COVID-19 pandemic has changed a lot of aspects of human lives since the beginning of 2020. Several countries have gone for complete lockdown for several months to protect their citizens. Other countries too have restricted many common activities to some extent. In the majority of the countries, traditional classes in the schools, colleges, and universities were not possible. Smart classrooms have emerged as a main alternative for the traditional classes. These smart classrooms are very different from the video broadcasting. Several immersive and interactive technologies have been proposed for smart classrooms. In this article, the authors provide the basic principles of smart classrooms, their enabling technologies, and their impact on the education sector. They also provide specific pandemic-centric initiatives for effective education in a virtual environment and their effects on the students, teachers, and other stakeholders.

KEYWORDS

Augmented Reality, Immersive Technologies, Internet of Things, IoT for Smart Classrooms, Mixed Reality, Pandemic-Centric Smart Classrooms, Smart Classroom, Virtual Reality

INTRODUCTION

In this article, we present the main enabling technologies of smart classrooms such as the virtual reality technologies, IoT, and artificial intelligence assisted techniques. We show that a robust and resilient smart classroom can prevent pandemic obstructions in education. We also present the main utilities of smart classrooms which are very much different from the traditional classrooms. Finally we have gone through the long term sustainability aspects of the smart classrooms.

DOI: 10.4018/IJVAR.306689

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Large scale pandemics affect every facet of human activities. Education sector is no exception. But there are several technological alternatives to fulfill the voids created by the pandemics. Due to the technological advances, education methods and policies have been changed significantly over the last hundred years. Numerous effective methods have been introduced at different levels. Several virtual technologies such as virtual reality (VR), mixed reality (MR), and augmented reality (AR) are found to be very effective in the education sector (Liu et al., 2017). In addition to them, there are several other immersive and interactive technologies which are essential for smart teaching and learning. Especially, the Internet of things (IoT) has provided a lot of options for interactive education. Extensive uses of artificial intelligence (AI) and machine learning (ML) have added new dimensions to the smart teaching and learning environments. Amidst the raising demands for smart and remote learning, the world faced the tough situation of the Covid-19 viral pandemic in 2020. The needs for smart classrooms have been felt more than ever before due to this pandemic. Keeping the current difficulties in view there are needs of pandemic centric education systems. These systems should not be affected by the pandemic situations like the one we saw in 2020 and now. These systems have to be resilient and technology enabled so that the teaching and learning methods are not affected by the pandemics. In fact, these methods must promote both physical as well as the remote learning techniques. In either way the teaching and learning outcomes must not be differed to a large extent. This is a great lesson for the future that any pandemic or pandemic-like situations must not affect the school, college, and university education the way it has been affected by Covid-19. The enabling technologies of smart classrooms are also readily available in the recent years. Therefore, pandemic centric smart classrooms are essential for the future education systems.

There are several technologies which are essential for the smart classrooms. Immersive technologies are found to be the most effective tools for the smart classrooms. In Liu et al. (2017), applications of VR, AR, and MR have been analyzed for the smart classrooms. Using several case based analyses it shows that the immersive technologies are very effective in the smart classroom initiatives. The powers of the modern immersive technologies are really exemplary. It has been proved in several instances such as the three dimensional movies and several other business related applications. Several of those instances have been presented with their overall efficacies in Dieck and Jung (2019). Smart classroom solutions are multi-pronged and need a lot of advanced technologies to setup them. In (Smart Classroom Solution, 2021), several basic needs, essential requirements and prerequisites for modern smart classrooms have been described. In the recent years, several immersive solutions have been tested for educational setups using simulations and other secondary techniques. In their simulation, Lui and Slotta (2014) tested some of the commonly used immersive solutions. They have applied the test outcomes at the secondary level science education to check their overall effectiveness. These advanced immersive technologies are expected to revolutionize the education system. One of the main motivations behind the large scale applications of the immersive technologies is to improve the quality and ability of the students. It has been observed that immersive technologies are very effective in the improvement of the quality of remote and classroom education and they directly enhance the abilities of the students (Zhang, Wang & Zhou, 2021). In order to evaluate the quality, feedbacks from students are essential in the smart classroom initiatives. In smart classrooms, student feedbacks should be collected smartly while addressing the main needs of the students. A smart student feedback system has been proposed in (Martinez-Maldonado et al., 2015) which addresses key issues about the students and their needs. This feedback system is aimed at the enhancement of the quality of education in classrooms and also in the remote environments. A creative and adaptable smart classroom has been proposed in (Pham et al., 2021). In this smart classroom, the immersive environment is less dependent on the communication infrastructure. This smart classroom presented in (Pham et al., 2021) efficiently adapts to the limitations and short-comings of the communication system in place. We have observed that IoT has the potential to provide new dimensions to the smart classroom environments. Both directly and indirectly it provides multiple benefits of sensing and actuation in the smart classroom environments. Cellular IoT are ubiquitous solutions available for

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