Smart Campus Development: A Case Study of a Middle School in Wuhan

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This paper presents a case study of smart campus development in a middle school in Wuhan, China. A smart campus leverages digital technology and connectivity to enhance user experience and operational efficiency in educational institutions. The study aligns with the smart education initiatives of the Wuhan municipal, focusing on key evaluation criteria, and aims to understand the perspectives of administrative staff, teachers, and students regarding the evolution of the smart campus. The research involved questionnaires and interviews, providing insights into various aspects of smart campus development. Results indicate positive feedback in areas such as management and support, digital literacy, digital resource access, and classroom innovation. However, challenges in implementing data-driven evaluation are observed, requiring further refinement.

Introduction

The smart campus typically refers to an intelligently designed environment that leverages digital technology and connectivity to enhance both the user experience and operational efficiency (Dong et al., 2020; Roy & Tushar, 2019). Implementing a smart campus strategy can bring numerous benefits to educational institutions, including an improved student experience, enhanced campus safety and security, reduced operational costs, data-driven decision-making, improved efficiency, and a positive impact on the community (Abuarqoub et al., 2017; Dong et al., 2020; MacLeod et al., 2018; Muhamad, Kurniawan, & Yazid, 2017). Based on these benefits, an increasing number of countries and regions are prioritizing the construction and development of smart campuses.

In 2020, the Wuhan municipal government of China issued an implementation plan outlining six pivotal actions aimed at building a national smart education demonstration zone (General Office of the Wuhan Municipal People's Government, 2020). These actions are as follows:

- 1. Promotion of smart education environment to build a high-level smart education infrastructure encompassing the entire city;
- 2. Promotion of digital literacy among administrative staff, teachers and students;
- 3. Innovation in classroom practices to drive changes in teaching and learning methods across all primary and secondary schools;
- Revamping resource supply models to achieve differentiated supply and intelligent service when it comes to digital instructional resources;
- Data-driven evaluation to implement practical actions that leverage data analytics and stimulate the all-round development of students, including their morality, intelligence, physical fitness, aesthetics, and labor;
- 6. Optimizing basic education governance to promote the modernization of the primary and secondary school management system and capabilities.

Subsequently, the Wuhan Municipal Bureau of Education released the 2020 Evaluation Criteria for Smart Campuses in Primary and Secondary Schools (Wuhan Education Bureau, 2020). The evaluation standards consist of five primary indicators:

- 1. Infrastructure construction carries a weight of 25%, comprising various subentries such as the campus network, data center, smart classroom, artificial intelligence laboratory, smart library, campus security system;
- 2. Digital resources supply accounts for 10% of the evaluation, ensuring easy access to fundamental curriculum resources, an array of supplementary materials on various subjects, and an extensive collection of books and periodicals;
- 3. Digital literacy accounts for 10% of the evaluation, focusing on both teachers and students;
- 4. Support mechanism holds a 15%, mandating the appointment of a Chief Information Officer (CIO), the establishment of a dedicated leadership group, and the diligent execution of their duties. It also specifies that 20% of the school's budget should be used for smart campus development, alongside the formulation and implementation of comprehensive development plans;
- 5. Application services constitute the largest component at 40%, including three aspects: school governance, classroom innovation, data-driven evaluation, all aimed at fostering the holistic development of students.

As the evolution of smart campuses gains momentum, it becomes increasingly imperative to grasp how participants engage with and perceive the evolution of these intelligent educational environments. As highlighted in previous studies, understanding participants' perceptions and viewpoints of smart campus development is essential for ensuring the success and effectiveness of smart campus applications, promoting user adoption, and aligning smart campus development with user needs and expectations. This study contributes to the existing literature by scrutinizing the perspectives of administrative staff, teachers, and students in a selected middle school in Wuhan, shedding light on their perceptions and experiences.

Participants and Data Collection

The study involved participants from "M" Middle School in Wuhan, China, which had a population of 1,082 students, 85 teachers, and 15 administrative staff. This school was chosen as a representative model of a public secondary school. The diverse perspectives of its students, teachers, and administrative staff regarding smart campus development were sought to gain insights applicable to secondary schools on a broader scale.

To align with Wuhan authorities' implementation plan and evaluation criteria for smart campus development, the research team of this study designed user experience-oriented questionnaires tailored to school administrative staff, teachers, and students at "M" Middle School. These questionnaires underwent reliability and validity verification, resulting in a Cronbach's alpha coefficient of 0.89 for the entire set. The questionnaires were disseminated to all members of "M" Middle School via the online platform wjx.cn, yielding a remarkable response rate of 91.50% and an effective rate of 96.36%. In addition to the questionnaire surveys, the research team developed semi-structured interview questions. Interviews were conducted with representatives from the school's administrative staff, teaching faculty, and student body, providing insights into the current state of smart campus development from the user's perspective.

Results and Discussion

As shown in Figure 1, the following are the results and discussion after analyzing the questionnaire and interview data.

Figure 1

Radar map of smart campus development status of M middle school



First, the results indicate that the school has received highest positive feedback in three key areas of management and support: the support mechanism, school governance, and infrastructure construction. In terms of the support mechanism, a dedicated leadership group has been established to drive the development of the smart campus, and a significant step has been taken by appointing one of the school headmasters as the Chief Information Officer (CIO). This move has enabled efficient digital management across various aspects of the institution, including teaching affairs, daily office operations, management of state-owned assets, and the oversight of research projects in the field of educational science. Regarding infrastructure construction, the school has made substantial progress. They have successfully completed the establishment of critical components, including the campus network, data center, information terminal, multimedia network classrooms, smart classrooms, digital laboratories, campus security systems, campus radio and television systems, facilities dedicated to innovation and creativity, an online teaching and learning platform, and a campus e-Card system. This comprehensive infrastructure development signifies a significant advancement in modernizing the school's facilities and technological capabilities. Overall, these positive developments reflect the school's commitment to improving its management and infrastructure, ultimately enhancing its ability to provide a modern and effective educational experience.

Second, the results of the analysis show that the school has received highly positive feedback in three critical areas: digital literacy, digital resource access, and classroom innovation. In terms of digital literacy, it's evident that the school's management team has embraced the concept, as all members can apply the school's digital governance platform. Notably, the feedback suggests that younger teachers tend to excel in digital literacy compared to their more senior colleagues. This generational difference is advantageous, as younger teachers are often more adept at handling digital resources, implementing smart instructional methods, and conducting educational research that aligns with the demands of the age of artificial intelligence. The digital resource aspect is also promising, with the school's digital library offering an extensive collection of electronic books, magazines, journals, newspapers, and courseware. This rich repository of digital resources ensures that both teachers and students have easy access to a wealth of educational materials. Furthermore, the school's commitment to classroom innovation is evident in the widespread adoption of smart education concepts, platforms, and facilities. This innovative approach is being integrated into the teaching and learning practices of M Middle School, fostering a dynamic and technology-enhanced educational environment. Overall, these positive developments indicate the school's dedication to fostering digital literacy, providing abundant digital resources, and promoting innovative teaching and learning methods, ultimately contributing to a more advanced and engaging educational experience.

Finally, the results suggest that the implementation of data-driven evaluation in M middle school for assessing the holistic development of all students has not fully met the requirements for widespread application. This is particularly evident in its effectiveness in identifying students with the potential to enter higher-grade schools. While the concept of data-driven evaluation holds promise for evaluating various aspects of a student's development, it appears that there are challenges or limitations in its current application. Further refinement or adjustments may be necessary to address these issues and fully realize the potential of data-driven evaluation in the educational context.

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