



# Post-pandemic Architecture: Concepts and Digital Tools as Educational Needs

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**Abstract.** The Covid-19 pandemic has brought major changes in education delivery in general. Architectural education, which aims to produce competent practitioners, needs to adapt to this condition. Architecture is not just about designing a building but also about the interaction between humans and their spatial and environmental settings. It is appropriate to develop architectural concepts following post-pandemic conditions. Understanding the concept of post-pandemic architecture can be done with digital tools so that learning is expected to be more effective. This work studies references that show the importance of post-pandemic architectural concepts and the use of digital tools in today's architectural education. The results of this work are expected to help academics develop post-pandemic architectural curricula.

**Keywords:** Architecture · Digital tools · Education

## 1 Introduction

The COVID-19 pandemic has changed the teaching and learning process, posing challenges for academic and higher education. This condition encourages educators (pedagogy profession) to adapt from traditional education and switch to online learning [1]. It is done to prevent the spread of the COVID-19 virus by combining digital learning tools and communication and information technology. Architectural education, which aims to produce competent practitioners, needs to consider implementing proper architectural education. Therefore, it is crucial to apply architectural concepts following post-pandemic conditions and develop the use of digital tools in architectural education.

Many previous studies have discussed the application of online learning in higher education in general. Still, not much has been discussed related to architectural education, which has a core in studio-based learning. It is estimated that post-pandemic conditions with the new normal will still change the pattern of education in higher education [2]. Architects in this condition play a role in creating healthier building designs, so applying architectural concepts suitable for the post-pandemic also needs to be taught at the higher education level. This concept will be essential in dealing with future crises related to infectious diseases [3].

So that this research is expected to provide input for restructuring post-pandemic architectural education to balance the use of digital tools and technology by prioritizing the quality and effectiveness of post-pandemic learning [4].

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A. Kusumastuti et al. (Eds.): VEIC 2022, ASSEHR 697, pp. 60–65, 2023.

[https://doi.org/10.2991/978-2-494069-47-3\\_9](https://doi.org/10.2991/978-2-494069-47-3_9)

## 2 Literature Review

### 2.1 Architecture Education

Architecture is a design process that involves programming, design, and construction phases in general. It brings together functional components to create a built environment that is functionally efficient, economically feasible, and aesthetically pleasing [5]. According to the UNESCO/UIA Charter for Architecture education, there are points including;

- Understanding of the relationship between people and buildings, and between buildings and their environment, and of the need to relate buildings and the spaces between them to human needs and scale.
- Adequate knowledge of physical problems and technologies and of the function of buildings so as to provide them with internal conditions of comfort and protection against the climate, including one of the fundamental goals in architectural education [6].

The core of architecture curricula is the design studio-based learning. In design studio is where students learn and practice knowledge, the act of designing, evaluating, and developing alternatives [7]. Based on research conducted by Mc Laughlan and Chart-terjee entitled ‘What Works in the Architecture Studio? Five Strategies for Optimizing Student Learning’ provides Five Strategies for Optimizing architecture studio Learning. [8] as follows:

1. *Involve students’ roles in each challenge explicitly*  
In a design studio, student involvement will affect student learning opportunities to reflect critical thinking and develop it in design. Student motivation is also an essential factor in ensuring the level of student involvement in supporting learning.
2. *Provide clear guidelines to support reflective work processes and practices.*  
Students need to be given guidelines at an early stage about describing the design process and how the final submission must be achieved. So that students can understand that a design is produced from various experiments and iterations, which are then developed through the design process. For every assignment given regularly, it is hoped that students will gain new skills and be better prepared to work independently.
3. *Clear communication of expectations*  
There needs to be clear communication about the learning system, goals, and performance expectations that students must achieve. It does not mean providing the entire roadmap at the start of the semester. One way for design studios is to imitate architectural practices by embracing unexpected problems. Students need to be given flexibility in dealing with a problem so that they can explore their ideas according to their interests and motivations.
4. *Encouraging a solid peer culture to support learning*  
This approach prepares students to ‘value cooperation over competition in architectural practice. The joint discussion will create cross-learning that will motivate fellow students to produce their best designs.

### 5. *Expectations are kept high*

Students are encouraged to work harder in the early stages of learning so that it is expected to generate a greater and more profound understanding of long-term learning.

## 2.2 Post Pandemic Architecture Concept

Students who graduate from the architecture program must be prepared to deal with environmental problems. Higher education plays an essential role in forming a practicing architect who is both socially and environmentally responsible. Given the social and environmental impacts of the built environment, architectural education is expected to make a difference (Domenica et al. 2013).

In pandemic conditions, a lot of architectural research has focused on the impact of environmental quality in spaces on the health of occupants. Several recent studies have shown that air pollution can increase susceptibility to SARS-CoV-2 infection. The accumulation of indoor air pollutants contributes significantly to Sick Building Syndrome. It shows a relationship between building design and human health users. For example, building designs that do not pay attention to providing clean air through good ventilation or greening can spread disease [3]. Thus, building occupants in greener and healthier environments are more likely to live in better health conditions [9]. So, the post-pandemic architectural concept needs to pay attention to aesthetics and the health conditions of the occupants and the built environment.

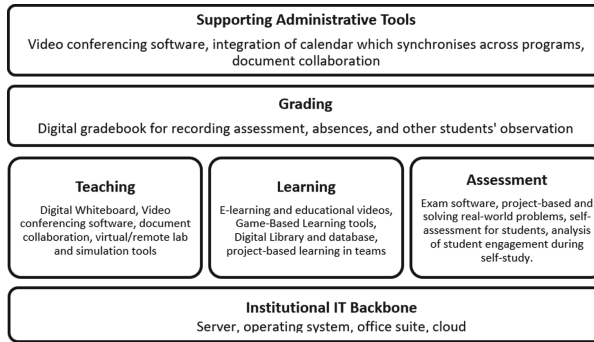
## 2.3 Digital Tools in Architecture

In architectural education, learning can be categorized into 2 groups;

- Traditional expression techniques
- Digital expression techniques

Digital media used in architectural design utilize software and hardware such as computers. This digital tool has advantages in the ease of long-term storage, realistic results, and faster and also precise [10]. Research conducted by Soliman, Taha, and Sayad, 2019 divided eight categories of different computer application courses in the curriculum of various universities, such as 2D & 3D representation, BIM, simulation, GIS, parametric design, digital fabrication, building technology, environmental technology, communication, programming, coding and scripting [11].

Refers to today's architectural profession, which combines digital tools in making the thought process and making designs. Using these digital tools allows for the easier development of new geometries and structures. Design workflows also become more transparent and flexible with integrated software. Therefore, introducing digital tools is an important component of the architecture education curriculum [12]. Especially in the current post-pandemic condition where design studio-based learning is 'forced' to move face-to-face meetings into online learning. These digital expression techniques will facilitate distance learning with computers and the internet [10]. Based on research by Thomas Goldina, Erwin Raucha, Corina Pacherc, and Manuel Woschank proposed



**Fig. 1.** The Reference Architecture [13].

an overview of the reference architecture for using integrated and efficient digital tools in learning shown in Fig. 1.

### 3 Discussion

Architectural education with a core in design studio learning needs to combine traditional skills with digital tools. Student involvement is crucial in every assignment to face future problems following the reality of the architectural profession. Students need to understand how the design process flows and can provide problem-solving in the problems given by the pursuer. The teacher provides clear guidelines and also the expectations that need to be achieved by students without limiting student creativity. On the other hand, teachers provide flexibility so that students can provide solutions according to their respective interests.

In the early stages of learning, students still need to be given traditional expression techniques by drawing hands and physical modeling as the basis for learning. After students are given these skills, then students are introduced to the use of digital tools to develop alternative designs. Problem-based thinking through spatial experience and tectonic construction is the rationale for using digital tools. That way, students will be more efficient in switching from traditional techniques to digital tools [12]. With a broader range of digital tools, it is hoped that it can help students solve architectural challenges in the future and will also facilitate post-pandemic learning. In online learning during the pandemic and post-pandemic, several obstacles may occur. It is as revealed in Musarat Yasmin's research, as shown in Fig. 2.

In post-pandemic conditions like today, solving architectural problems in creating the concept of a healthier built environment should be applied to the curriculum by utilizing digital tools as optimally as possible. Thus, it is not only aesthetic but also provides comfort and does not cause health problems for its users. The post-pandemic architectural concept considers health aspects as a form of prevention against disease transmission problems in buildings.

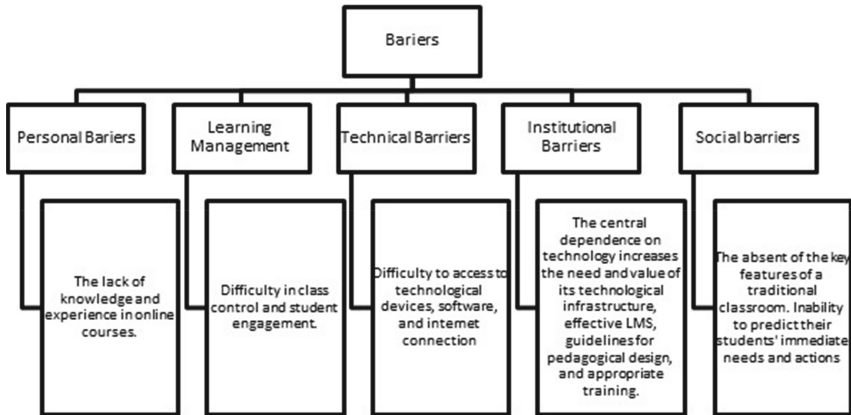


Fig. 2. Online Learning Related Barriers [14].

## 4 Conclusion

Based on the studies conducted, the importance of applying the concept of post-pandemic architecture with the implementation of appropriate digital tools in architecture curricula can be seen. Furthermore, it is important to answer more complex architectural problems in the future. However, this study is limited to references from previous research, so further research needs to be done with validation in real case studies in educational institutions.

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