Prevention through Design: Architecture Student Cognizance

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Abstract. Prevention through Design (PtD) is a process to prevent and control any potential injury occurrences, illnesses, and fatalities by “designing out” or minimizing hazards and risks early in the designing building. It is a process that incorporates related safety-design strategies during the design phase. Due to an overwhelming number of construction industry accidents in recent years, early attention to safety precautions in the design process has been of very deep concern. The lack of PtD knowledge among designers could be a barrier to implementing the PtD concept, from improving the life-cycle of the project to considering safety matters that start from the design stage. Especially in Malaysia, architecture-based programs are generally focused on their design goals at the institutional level, and they aim towards accommodating end-user safety. However, there is no space for a new PtD-centric course to be introduced. Although there have been previous studies on the introduction of PtD, specific studies on the presence of PtD education in architecture programs are still lacking. This paper, therefore, seeks to obtain constructive feedback on prevention through design and its awareness among architecture students. The ideal period of PtD exposure is by scholastic interference to further express the importance of safety concerns in an early design process. Thus, a total of 60 respondents were selected among third-year to fourth-year architecture students in Universiti Teknologi MARA Seri Iskandar Campus in Perak. The findings showed that educational engagement strengthened students’ views on the causality of accidents and promoted safe design thought at the initial design process. However, in the design course, insufficient emphasis on PtD proves to be a challenge for students to consider in the design project application. Further
studies are therefore deemed necessary to identify the method of incorporating PtD
sentience through scholastic intervention as an initiative to promote PtD in
university degree programs to enhance awareness of safety issues.

Keywords: Prevention through Design, Architecture Student Cognizance.

1. Introduction

The rising rate of occupational injuries and fatalities in the construction industry has been a
global annual concern including in Malaysia [1]. Recently, more attention has been focused
on the provision of Occupational Safety and Health problems in building construction, which
is known as a global issue and is still occurring at an alarming rate [2]. According to Chan’s
study, as cited in [3], occupational injuries in the construction industry are frequent and can
lead to permanent injuries and high death rates as a result of fatal and non-fatal accidents
arising from various industries, including manufacturing. The statistics presented in Table 1
indicate the occupational accident statistics by sector from 2015 until July 2020, provided
by the Department of Safety and Health of Malaysia [4]. It is shown that the year 2018
recorded the highest number of deaths in the construction industry sectors, and even though
there has been a recent decrease in numbers, the situation is still identified as serious and
must be addressed immediately.

Construction safety is traditionally the responsibility of the contractor in the construction
industry[5]. There is, however, increasing evidence that designing architects should
contribute to the safety of construction safety. Ideally, all consultants, including architects
and engineers, as well as contractors and developers who are involved in the construction
industry, should already possess the fundamental knowledge of safe design prior to
commencement of any structure [5]. The Malaysian government, under the Ministry of
Human Resources through the Department of Occupational Safety and Health (DOSH), took
a serious step by introducing the guidelines on Occupational Safety and Health in
Construction Industry (Management) (OSHCI(M)) [6] in early 2017 in order to integrate the
Prevention through Design (PtD) principles as part of the initiative to address the capability
of construction stakeholders in improving OHS performance [7].

There are several words used to describe a design for safety, but all of them have the
same definition and significance of prevention through design. Prevention through Design
(PtD) is a comprehensive approach for addressing safety and health issues by “designing
out” hazards and minimizing residual risks [8]. From previous research, Safety and Health
by Design is defined as the whole life cycle of structures, systems, substances, or other
products for the risk management of health and safety [9]. The principle of Prevention
through Design (PTD) is to achieve the solution to reduce the hazard through designing
health and safety measures plan to improve the working environment [10]. PtD includes the
priority in preventing the hazard, surveying all the causes that are the factors of injuries and
illnesses, and ways the designers could improve and apply all the safety methods on design.
In designing buildings that are not only safe to operate but also safe to build, designers need
to be responsive [11]. Such integration of design and building contexts may allow designers
to reach the next level of OSH practices. The reasons for the implementation of the PtD concept in construction include designers’ lack of focus on the safety of the facility end-users, designers’ lack of education and training, and a lack of resources to assist architects and engineers to design for construction safety. Besides these, the implementation of the PtD concept is due to perceptions of increased liability exposure to third-party lawsuits, the codes and standards to which designers prepare their designs, and the customs and culture of the construction industry [12].

Previous studies, however, have indicated that designers need exposure to the PtD knowledge that incorporates safety awareness at all levels [13]. Moreover, the absence of tertiary education related to PtD can easily lead to inadequate knowledge for future professionals to execute it effectively [5], [7], [14]–[16]. Therefore, academia, including professors and their students, as well as designers in the industry and safety professionals, need to be highly responsive to enhance the awareness of PtD. Most of the time, the majority of these practitioners only come across PtD intervention after they have passed thresholds of professional practice [14].

Table 1. The Occupational Accidents Statistics by Sector from January until July 2020

| Year | Total of Accidents | Total of fatalities in the construction industry | Percentages of fatalities in the construction industry (%) |
|------|--------------------|-----------------------------------------------|--------------------------------------------------------|
| 2015 | 237                | 88                                            | 37.13                                                  |
| 2016 | 222                | 91                                            | 41.00                                                  |
| 2017 | 240                | 111                                           | 46.25                                                  |
| 2018 | 232                | 118                                           | 50.86                                                  |
| 2019 | 275                | 72                                            | 26.18                                                  |
| July 2020 | 137     | 35                                            | 25.55                                                  |

Reference: DOSH. Malaysia [4]

Education, identified as one of the primary activities of the Prevention through Design (PtD) initiative, is a major factor needed to make PtD successful [17]. According to Zia [14], newly graduated students from programs like architecture are not generally made aware of PtD throughout their study at the higher education level. Most curriculum designs typically concentrate primarily on the safety of end-user personnel while overlooking the safety of construction workers. Various methods are therefore needed to educate future designers of the importance of their engagement in the design stage in relation to construction safety at an earlier stage [18]. The goal of nurturing these young designers with PtD is to drill them early with the ability to implement their design as realistically as possible with the lowest possible imminent risk-related circumstances that may arise. Obviously, this would bring advantages not only to the undergraduates, but also to the industry.

In Malaysia, the Architects Council is in charge of architectural accreditation, which was established in accordance with the provisions of the 1967 Architects Acts, and has
empowered the Malaysian Architectural Education Council (CAEM) to regulate architectural studies [19]. The current requirements of these boards, however, do not include health and safety topics in any architectural studies; so, architecture, as well as engineering programs, have made no attempt to include it as a primary course in universities. There have been previous studies in the literature on occupational health and safety courses (OHS) provided by universities [15], but specific studies on the presence of PtD education in Architecture programs are still lacking. Therefore, the purpose of this study is to get constructive feedback on prevention through design (PtD) application and its awareness among architecture students of University Technology Mara Seri Iskandar Campus in Perak. Further research is therefore required to identify the method of implementing PtD sentience through scholastic intervention as an initiative to promote PtD in university degree programmes in order to increase the awareness on safety issues

2. Method

2.1. Research Aim
The purpose of this research is to get constructive feedback on prevention through design (PtD) concept and its awareness among architecture students of University Teknologi MARA Seri Iskandar Campus in Perak.

2.2. Instrument
A questionnaire survey was administered, and the responses were graded to indicate their level of agreement on a 5-point Likert scale (strongly disagree to strongly agree). Data collection was restricted to students’ responses only. The questionnaire was designed to determine the shift in knowledge and understanding of PtD in the design process among third-year and fourth-year architectural students. The questionnaire was constructed on the basis of a previous literature review on the understanding of PtD, enabling all three parts to be answered by respondents. Section A was intended to identify students’ awareness of PtD. In comparison, Section B focuses on the significance of the application of PtD. Finally, Section C attempts to present future values for the eventual implementation of PtD. The findings are presented and discussed in the Result section.

2.3. Sample population
A total of 60 respondents were selected from Semester 5 to Semester 8 architecture students of Universiti Teknologi MARA Seri Iskandar Perak Campus. The survey was distributed online using the Google Form online survey tool. Personal or demographic information of all respondents was discarded prior to data analysis. The data were analyzed using SPSS computer software.

3. Finding and Discussion
3.1. Attentiveness on Prevention Through Design Overview
As part of the initial design review, a majority of architecture students agreed with PtD intervention. Facilitating PtD implementation would ideally help to improve the awareness of students about the importance of the PtD concept and help to incorporate it in a pedagogical approach as part of a scholastic intervention. As shown in Table 2, the mean
score of attentiveness on PtD is 4.28. A positive indication of the results enhances the potential of the PtD concept to be included later as part of the design brief.

Table 2. Section A: Attentiveness on Prevention Through Design Overview.

| Have you ever heard about Prevention Through Design? | Is knowledge of PTD important for designers and students? | Do you agree that the implementation of PTD can minimize hazards? | Do you think that PTD is effective in preventing hazards? | Do you think safety and health design is important during the designing stage? |
|----------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------|
| Valid                                              | 60                                                       | 60                                                              | 60                                                        | 60                                                                       | 60                                                                       |
| Mean                                               | 3.72                                                     | 4.12                                                            | 4.17                                                      | 4.10                                                                     | 4.28                                                                     |

3.2. Significance on Prevention Through Design Application

Based on the findings of Section B, most respondents agreed that safety and health design is best practiced as part of the design nature. The design should consider the safety structure, the working environment for comfort, and the contribution to risk at the pre-design thought stage. The data in Table 3, on the other hand, reveals the mean score of 3.77 (48%), showing an average perceivable response on PtD application that would improve workers’ safety and how the surrounding area would contribute to mitigating hazard. This survey demonstrates very clearly that a significant amount of exposure and awareness is needed to establish knowledge of young designers to improve safety and health in workplace design. This is because the data show that student respondents considered this to be an intriguing thought for enhancing workplace health and safety during the design process. In order to identify hazards and develop optimal designs during learning time, the provision of appropriate resources for this assistance is beneficial for the students.

Table 3. Section B: Significance on Prevention Through Design Application.

| As a designer, will you ensure to put the safety and health design as priority on your design? | Do you think that Prevention Through Design can minimize injuries and illnesses? | Do you feel safe with a structure that implements PTD? | Do you prefer to work in a good, safe, and healthy environment? | Can a designer improve worker hazard while performing PTD in their design? | Do you usually think that your surrounding and your work are contributing to hazard? |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Valid                                                                                      | 60                                                                              | 60                                                   | 60                                                                  | 60                                                                     | 60                                                                             |
| Mean                                                                                      | 4.12                                                                            | 4.15                                                 | 4.42                                                                | 4.00                                                                   | 3.77                                                                          | 3.77                                                                          |
3.3. Application Potential of Prevention Through Design Application

The survey results in Section C have a mean score of 3.83 (50 percent) for the question related to the delivery of PtD knowledge in their syllabus or educational content. This feedback indicates that there is a lack of a PtD approach implemented in the undergraduate program. Therefore, being part of the education awareness in achieving PtD knowledge, strategies to enhance the safe architectural design as an integral part of the underlying design approach should be established. Although students were aware of the PtD concept, many of them pointed out these concepts are not included in the specific course content, and as a result, they are not considered a priority. The same result can be found in previous studies where future practitioners are required to be trained in OHS and PtD, but current education and training are inadequate to achieve this [15].

Table 4. Section C: Potential of Prevention Through Design Application.

| Would you apply PtD in your design if you know what it is all about? | Do you think that the surrounding of your working place is designed in a good design? | Are there sufficient opportunities to gain further training in Prevention Through Design (PTD)? | Do you think that your working environment needs to be improved to incorporate safety and health design? |
|---|---|---|---|
| N Valid | 60 | 60 | 60 | 60 | 60 | 60 |
| Mean | 4.48 | 4.28 | 3.40 | 3.83 | 4.17 | 4.38 |

Despite the absence of PtD knowledge and awareness at the education level, this paper examines the degree to which knowledge of safety and health is encouraged to be promoted throughout the undergraduate program. Determining the level of awareness is essential in determining the acceptance of the PtD concept in order to gauge the adequacy of its implementation during the design process. By considering health and safety in the design process, the education intervention on the PtD concept is all about achieving the way to mitigate the hazard. In order to promote scholastic intervention in PtD through design pedagogy, universities and lecturers should ensure that they are completely integrated into a well-organized system for the professional development of our industry-ready graduates. Furthermore, students should be exposed to a comprehensive concept of PtD that lays out a clear perspective as to how safety design is to be implemented. Additionally, contractors and consultants should provide practical students the right platform to learn more about PtD and expose them to realistic exposure of PtD practices during practical training. Furthermore, scholastic interventions in the current courses should be included with case studies and outlining problems that actual designers encounter in order to integrate awareness and apply it in practice. Other than that, the educator also needs a wide range of understanding and
knacks solely on the technical understanding of construction safety and the ability to recognize and minimize all sorts of on-site hazards. In accordance with this, knowledge of any pertinent acts, standards, legislation, codes, laws, and obligations is also important for students to focus on PtD.

4. Conclusion

In conclusion, making it compulsory for the Architecture students to apply knowledge of PtD as part of pre-design thought would help to cultivate these young designers to integrate low potential risk-related circumstances into their design as efficiently as possible. Thus, it would be a good practice to encourage PtD education to be part of studio learning and incorporated in the syllabus. Other than that, the delivery of PtD can be made using various teaching techniques, including the use of pedagogical approaches, serious gaming and simulations, massive open online courses (MOOCs), and lessons learned from case studies. Besides that, ideally, with the focus on introducing PtD education at the higher level of a university degree, designers, particularly future architects, will gain early exposure as their work experience needs to offer knowledge by considering PtD in their professional disciplines. Therefore, more research is required to establish the method of integrating the PtD concept through scholastic involvement as an effort to encourage the inclusion of PtD education in university degree programs in order to enhance awareness of safety issues.

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