Utilization of natural resources in supporting eco-interior design

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Abstract. In creating interior designs, most people do not optimize natural resources and the concept of eco-interior design. This causes a lack of comfort such as hot air, lack of light during the day, and noise entering the interior. The question is how to utilize natural resources optimally in supporting interior eco-design. To answer this, identification on several cases with similar problem solving need to be done. The findings can be used as inspirations for the community in constructing public buildings and residences, so that interior designs can be occupied comfortably. The results and discussion found several alternatives namely technical utilization for optimal but not dazzling sunlight, technical use of optimal cross-air circulation in buildings, and utilization of natural building materials that can absorb sound to overcome noise from outside.

1. Introduction

Many interior designs today, either in residential homes, office buildings, or other public buildings, are less comfortable to live in. To overcome this, occupants usually look for easy solutions, for example, if the room is hot, they install air conditioners or fans. If the room is dark during the day due to poor design planning, electric lights will be turned on to light the room even when the weather is not cloudy. This is contrary to the principle of saving electrical energy which has been highly promoted [1]. Noise disturbances from outside are usually overcome by closing doors and windows completely, even though open doors and windows can be optimized for the benefit of air circulation and natural lighting. The comfort issues of such space conditions can be anticipated if the interior design pays attention to the ecological concepts that exist in the architecture and design.

Eco-interior design is related to the concept of ecology which is the study of the interrelationships between living things and their environment [2]. Ecology in the context of humans or human ecology is a branch of ecological science that pays attention to the physical and cultural background of humans. The elements studied include economic, sociological, political, and cultural aspects which are understood based on the background of the natural environment and the community environment. Human ecology studies include human relations with climate, weather, plants, and so on [3]. Eco-design is a design that focuses the relationship between design, human interests, and environmental sustainability [4]. Eco-interior design facilitates mutual relationship between interior design and the outside environment, i.e., interiors designed to support a sustainable environment and promote the health of the occupants.
Interior Design is a part of a building which elements are planned and designed to function optimally and comfortably for the occupants. Interior design serves for public and residential purposes [5]. Comfort is a condition that is in accordance with the optimal function of human’s five senses, which is supported by facilities that are in accordance with the dimensions of the human body [6]. One of the ways to achieve interior design comfort is by paying attention to its architectural interior systems which include lighting, air conditioning, and acoustics [7], which in this case relates to ecological concepts. Architectural interior system is a way to optimally utilize natural lighting and ventilation for interior design purposes. Beauty in the context of eco-interior design can be guided by the concept of local traditional beauty, such as the Javanese aesthetics which have been proven to last for a long time [8]. Likewise in the case of interior acoustics, natural materials can be used to reduce noise. The problem that must be answered is how natural resources can be utilized to support interior eco-design.

2. Methods
To solve the research problem, data related to natural lighting, natural ventilation, and natural acoustic materials that can be used optimally in interior design were collected. The method applied was examining pre-existing concepts and designs as inspiration or guidelines in solving the existing problems of interior design system. Various examples of the concepts of natural lighting, natural ventilation, and natural acoustic materials were taken as references in making interior designs.

3. Results and discussion
Creating an ecological interior design means utilizing natural resources or natural materials to bring benefit to the interior by considering various technical applications that promote the health of its occupants. Natural resources such as sunlight and air need to be considered in a design to provide comfort of the interior design. This is in accordance with the concept of green building, a building planning approach that seeks to minimize harmful impacts on human health and the environment [9]. Recyclable natural materials that are applied in interior design are solutions to problems in sustainable design. Sustainable Design concept can be seen from energy efficiency, lighting, air conditioning, and materials that make up space and furniture [10]. In terms of lighting, natural lighting can be used for interior lighting. Natural lighting in this case is the light from the sun, moon, or stars, and the strongest natural light is sunlight. Natural light has an erratic intensity that depends on the climate, season, and weather [11]. When the weather is sunny, sunlight can be used for interior purposes from 08.00 to 16.00 [12]. Incorrect application of lighting in interior design such as too much or too little lighting can result in negative effects that affect productivity, mood, occupant comfort, and the beauty of the interior itself [13].

In Figure 1 Frick and Suskiyatno [2] found that, the optimal use of sunlight in interior design can be done by considering the position of the roof and the creation of a pond that reflects light. The placement of a transparent outer wall can also provide access to sunlight, and the position of a transparent wall in the interior can let light into the innermost part of the room. In utilizing sunlight, in addition to considering its benefits as a source of lighting, interior design also needs to consider protection aspects from excessive sunlight, one of which is by placing plants on the roof or placing a pool on the roof. The pool will also look attractive when exposed as a ceiling with a transparent glass effect like an aquarium on the interior ceiling. Roofs can also be protected by plant placement construction, cross ventilation in the ceiling area, and outdoor plants.

Based on Figure 2, natural ventilation is the use of clean air flow from outside into the interior or room through air vents to provide comfort for the occupants. The position of the air vent will affect the air circulation. This can be anticipated from the start by considering the position of the occupants when carrying out activities in the room to get cool air. Air refresh is also affected by the size of the air vent. When the intake air vent is greater than the exhaust air vent, the air velocity decreases. On the other hand, if the air vent is bigger, the air flow will be faster. Cross ventilation system is the most effective system to utilize natural air [14].
Figure 1. Utilization of natural lighting in office interior design with minimum heat and no glare (a), and several solutions to protect the room from the hot sun (b) (Source: Frick and Suskiyatno [2])

Figure 2. Air movement direction and air flow velocity can be adjusted based on the size of the intake and outtake air vents (Source: Frick and Suskiyatno [2])

For interior design to be comfortable to live in, noise caused by unwanted sounds needs to be minimized. One way that can be done to overcome unwanted noise or sound is installing sound absorbing materials [15]. Most sound-absorbing materials on the market are made of synthetic materials. Sound absorbing materials need to have pores that serves as resonator cavities (sound absorbers) [16]. The use of natural acoustic materials is essential. Wooden plank walls can be sound absorbers. Wall cladding made of wood planks will greatly help reduce noise from unwanted sound sources. In addition to having an acoustic function, wood also displays a natural look. Wood materials can also be recycled naturally when they are damaged.
The third benefit of eco-interior design is that it can reduce dependence on the use of electricity sources when used on a large scale. This is related to the use of natural lighting during the day for various activities. Nowadays, many spaces are massively covered by walls so that sunlight could not enter. This demands the use of electricity for daytime lighting. Natural lighting concepts that are not dazzling and can penetrate the innermost parts of the room can be used to save electricity resources.

When natural ventilation is optimized by adjusting the in and out air vents properly, room comfort can be achieved. Thus, dependence on the use of air conditioners and electricity can be reduced. With the Covid-19 pandemic and its new variants for which a cure has not been found, the use of air conditioners in a closed narrow room with poor air circulation can increase the risk of spreading the virus. The window needs to be opened so that there is a change of air in the room [17]. For this reason, the use of natural ventilation is highly beneficial.

4. Conclusion

Based on the discussion above, it can be concluded that apart from its aesthetic features, architectural interior systems that do not refer to the ecological concept can reduce the comfort of the occupants. Natural lighting that is soothing and not dazzling needs to be optimized properly. The use of natural ventilation that optimizes the function of the ceiling, not only as a roof cover construction or something oriented to the aesthetic function, but also as an element of cooling air circulation. Cross ventilation air circulation is very effective in reducing heat for occupants under the ceiling. The acoustic function of natural materials such as wood or boards can be optimized to absorb sound or reduce unnecessary noise. The application of eco-interior design in residential houses and public buildings can reduce dependence on electrical energy. The application of natural materials for interior design purposes can support the concept of sustainable design.

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