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THE EFFECT OF LAYER HEIGHT ON THE LIGHTING CHARACTERISTICS OF THE 3D-PRINTED KALARUPA BEDSIDE LAMP

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Abstract

Additive Manufacturing (AM) has increasingly been adopted in product design due to its flexibility in producing complex geometries and customized products. Among various AM technologies, Fused Deposition Modeling (FDM) is widely used because of its accessibility and ease of operation. While layer height is commonly associated with surface quality and production efficiency, its influence on the visual performance of illuminated products remains relatively unexplored. This study investigates the effect of layer height on the light distribution characteristics of the 3D-printed Kalarupa bedside lamp. A qualitative case study approach was employed using three layer height variations: 0.12 mm, 0.20 mm, and 0.32 mm. The lamp prototypes were fabricated using PLA filament and evaluated through visual observation under identical lighting conditions. The results indicate that lower layer heights produce smoother surfaces and more uniform light distribution, resulting in a brighter and cleaner visual appearance. In contrast, higher layer heights generate more visible layer structures that increase light diffusion and create softer illumination effects. Although the differences in lighting characteristics were relatively subtle, each variation produced a distinct visual atmosphere that contributed to the aesthetic quality of the product. These findings suggest that layer height can function not only as a manufacturing parameter but also as a design parameter capable of influencing the visual characteristics of 3D-printed lighting products.

Keywords: *3D Printing; Layer Height; Light Diffusion*

INTRODUCTION

The rapid advancement of digital fabrication technologies has expanded the possibilities for product development across manufacturing, design, and creative industries. Among these technologies, Additive Manufacturing (AM), commonly referred to as three-dimensional (3D) printing, has gained significant attention due to its ability to produce objects directly from digital models through a layer-by-layer fabrication process. Compared with conventional manufacturing methods that rely on material removal or molding processes, AM offers greater flexibility in producing complex geometries while reducing tooling requirements and material waste (Gibson et al., 2015; Thompson et al., 2016).

Fused Deposition Modeling (FDM) is one of the most accessible and widely adopted AM technologies. The process involves melting thermoplastic filament and depositing it sequentially through a nozzle to create a three-dimensional object. Because the object is formed through successive material layers, the quality and