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# Readiness and Challenges of E-Learning during the COVID-19 Pandemic Era: A Space Analysis in Peninsular Malaysia

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**Abstract:** During the COVID-19 era, most countries, including Malaysia, have shifted from face-to-face teaching systems to online teaching programs. The aim of this study is to identify the main challenges that higher education students face during e-learning based on their residential location throughout Peninsular Malaysia. This study further examines the readiness of higher education students to apply e-learning. Therefore, a cross-sectional survey approach is used to fulfil the outlined objectives. Accordingly, 761 public (95.3%) and private (4.7%) higher education students residing in Peninsular Malaysia are sampled in this study. The survey was administered online for 37 days, from 21 October 21 to 6 December 2021, using either WhatsApp or Facebook. The raw data is inferentially (Principal Component Analysis, K-Means Clustering, Kruskal Wallis, and spatial analysis) and descriptively (mean, standard deviation & percentage) analyzed. It has been revealed that six clusters of students in Peninsular Malaysia face various challenges while following the e-learning program. Most states in Peninsular Malaysia are dominated by students in Cluster D (Terengganu, Perlis, Penang, Selangor, WP Kuala Lumpur, and WP Putrajaya) and Cluster B categories (Melaka, Johor, Kelantan, and Kedah). Students in the Cluster D category tend to suffer from physical health disorders and social isolation, while students in the Cluster B category face problems with decreased focus in learning, mental health disorders, and social isolation. The outcomes further indicate that the more challenges students face during e-learning programs, the lower their willingness to continue with the program. The results of this study are significant in addressing the challenges of e-learning, which will help stakeholders address and strengthen student abilities.

**Keywords:** online learning; online education system; university students; Geography Information Systems (GIS); cluster analysis



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## 1. Introduction

In mid-December of 2019, the world's population was shocked by the outbreak of the COVID-19 pandemic which occurred in Wuhan, Hubei, China [1–4]. The chain reaction of the pandemic contagion has led to changes in the education system [5], primarily in the teaching methods [6,7]. As a result, almost all countries, such as India, Chile, Ecuador, Italy, Mexico, Portugal, Poland, Romania, Turkey [8], China [9], and Malaysia [10–12], have shifted from using face-to-face teaching methods to online learning (e-learning), including at the tertiary level [8,13]. The ultimate purpose was to prevent the COVID-19 virus from spreading further [10,14]. It is undeniable that although implementing e-learning limits