



**UNDERGRADUATE THESIS**

**IMPLEMENTATION OF AHC FOR AUTOMATED  
LEARNING DEVICES USING STUDENT  
BEHAVIOR ANALYSIS THROUGH LMS  
(CASE STUDY AT SMK TELKOM SIDOARJO)**

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SURABAYA  
2026**

## APPROVAL SHEET

### IMPLEMENTATION OF AHC FOR AUTOMATED LEARNING DEVICES USING STUDENT BEHAVIOR ANALYSIS THROUGH LMS (CASE STUDIY AT SMK TELKOM SIDOARJO)

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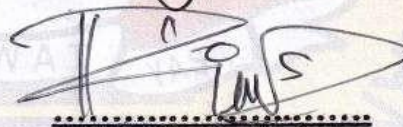
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Hereby declares that this undergraduate thesis contains no part of any other scientific work that has been submitted to obtain an academic degree at any higher education institution. Furthermore, it does not contain any work or opinions previously written or published by others, except for those which are explicitly cited in this thesis and listed completely in references.

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Surabaya, May 26, 2026



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## ABSTRACT

Student Name/NPM : Ahmad Yuan Arby/19081010177  
Thesis Title : Implementation of AHC for Automated Learning  
Devices Using Student Behavior Analysis  
Through LMS (Case Study at SMK Telkom Sidoarjo)  
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The development of educational technology has encouraged the utilization of Learning Management Systems (LMS) as learning media capable of recording various student activities throughout the learning process. These activity data can be utilized to identify student learning behavior patterns more objectively. However, in practice, the learning process is still generally conducted in a uniform manner and does not accommodate the characteristics of individual learning styles. Therefore, this study aims to classify students based on their activity patterns within an LMS using the Agglomerative Hierarchical Clustering (AHC) method with a Single Linkage approach. This research employed an exploratory quantitative approach based on Educational Data Mining. The dataset was obtained from student activities within the LMS and consisted of variables including login frequency, material access duration, number of submitted assignments, forum participation, average quiz scores, and assignment response time. The data underwent preprocessing stages consisting of data cleaning and normalization, followed by clustering using Agglomerative Hierarchical Clustering with the Single Linkage approach. The results indicate that the Single Linkage method produced three clusters, consisting of 29 students in the first cluster, 1 student in the second cluster, and 1 student in the third cluster. The first cluster represents the dominant group, characterized by diverse and relatively active learning behaviors. The second cluster was interpreted as an Auditory learning style due to its high level of forum participation and prompt assignment responses, while the third cluster was interpreted as a Visual learning style because of its high material access duration and assignment completion rate. These findings reveal the presence of a chaining effect, where the majority of data points are merged into a single large cluster. Based on the results, it can be concluded that Agglomerative Hierarchical Clustering with the Single Linkage approach is capable of grouping student data; however, it produces an imbalanced cluster distribution. Therefore, this method can be used for the initial identification of student learning patterns, but consideration of alternative clustering methods is necessary to obtain more optimal clustering results.

**Keywords:** Agglomerative Hierarchical Clustering, Single Linkage, LMS, Learning Styles, Clustering, Educational Data Mining.

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The author realizes that there are still many shortcomings in the preparation of this thesis. Therefore, constructive criticism and suggestions from all parties are highly appreciated for the improvement and perfection of this work.

Finally, despite the limitations of the author, it is sincerely hoped that this thesis will provide benefits to all readers in general and to the author in particular.

Surabaya, May 26, 2026

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