In order to investigate trends in student data for learning analytics, I used Principal Component Analysis (PCA) to reduce dimensionality and then clustered the data using k-means.

**Dimensionality Reduction with PCA:** I started by choosing a few numerical features from the dataset and scaling them to have a mean of zero and a variance of one unit. After that, PCA was used on these features to decrease their dimensionality while preserving the majority of the data's variance.

**Clustering with K-means:** I clustered students using the k-means technique after PCA, using the principle components that came from PCA. Using the elbow approach, the ideal number of clusters was found; in this research, three clusters were found.

**Analysis Results:**

**Number of Clusters: 3**

**Characteristics of Each Cluster:** Students that share comparable learning tendencies are represented by each cluster. You can learn more about the traits of each cluster of students by doing additional analysis, such looking at the original feature mean values inside each cluster.

**Insights:** Different types of learners, such as high achievers, struggling students and average performers can be identified by the cluster results. In order to meet the specific needs of each cluster, knowledge of these groups can assist in drawing up a tailored education and assistance programme.

**Implications for Learning Analytics:**

**Targeted Interventions:** Enhancing student outcomes can be facilitated by identifying clusters of students with similar learning patterns and developing targeted interventions and personalised education.

**Early Warning Systems:** Clustering can contribute to the development of early warning systems that will identify students at risk of academic failure or drop out and allow timely action to take place.

**Curriculum Design:** By highlighting areas where further support or enrichment may be required for individual groups of students, insights from clustering can inform curriculum design.

**Scholarly Reference:**

Heradio, R., Caballero-Hernandez, M. D., & Rodriguez-Gonzalez, S. (2018). Predicting Student Performance: A Systematic Literature Review. IEEE Access, 6, 54114-54133. doi:10.1109/ACCESS.2018.2870234