International Journal of Social Science And Human Research

ISSN(print): 2644-0679, ISSN(online): 2644-0695

Volume 06 Issue 05 May 2023

DOI: 10.47191/ijsshr/v6-i5-14, Impact factor- 6.686

Page No: 2620-2629

Implementation of Information Communication Technology (ICT) as a Teaching Aid for Children with Special Needs

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ABSTRACT: This study aims to identify the advantages and challenges in the use of ICT in teaching children with special needs in East Java, as well as evaluate the success of ICT implementation and its relationship with the learning achievement of children with special needs. The research methods used are descriptive analysis and regression analysis. The results showed that the use of ICT as a teaching aid for children with special needs in East Java has various advantages, such as increasing children's interest in learning, motivation, and participation, as well as helping teachers in providing more interactive and fun learning. However, the research also identified various challenges in ICT implementation, such as lack of access to adequate tools and infrastructure, as well as the need for training and technical support for teachers and school staff. The evaluation of ICT implementation showed positive results, with the majority of respondents stating that the use of ICT has improved the learning achievement of children with special needs. Regression analysis showed a positive relationship between ICT use and learning achievement of children with special needs.

KEYWORDS: Information Communication Technology (ICT), Enableware, Inclusion Schools, Artificial Intelligence, Disability

1. INTRODUCTION

In addition to having an important role in the industrial or business world, ICT also plays an important role in the development of education [1]. Its role is very important in terms of benefits and advantages contained in it. Along with the times, many fields have undergone changes and updates. As it happens in the world of education. One of the new subjects in the curriculum now is ICT [2][3]. In short, ICT is a concept that discusses technology, communication, and information in real terms [4]. Although not only applied in the world of education, ICT is also quite emphasized in learning in schools [5]. With the use of ICT to get a higher quality visualization. Sometimes learning that still uses old techniques has drawbacks, namely the visualization of images or objects described looks not too interesting, sometimes even in black and white. With technology, you can see real images or visualizations.

Using ICT Innovative learning media the development of learning media using ICT is more diverse and not limited to static text or images [5]. Can use animation or video media to make modules more interesting. When using easy-to-use and flexible information sources, ICT makes it easier for students and teaching staff to access existing information [6]. So you don't have to open books one by one to find answers or knowledge. Simply by typing keywords in the school library database or on a search engine, and you can find the desired answer [7]. The most important thing is a more practical and structured system management Not only facilitating and improving existing learning systems, ICT also makes administrative system management in schools more practical and structured [8]. Now almost all schools in Indonesia have implemented digitalization in school internal management [9].

Through ICT Provision of students and teachers facing the times as provisions to face an increasingly advanced era, ICT is very important for students to understand and learn [10]. The advancement of ICT in an institution is also one of the advantages of the institution from other institutions. Based on the results of the infodatin for people with disabilities issued by the Ministry of Health of the Republic of Indonesia, in 2018 it was reported that the percentage of people with disabilities in Indonesia who did not go to school was higher than children with disabilities who finished elementary school. Schools providing inclusive education need to be supported by GPK (Special Educator Teachers) in the learning process and coaching children with special needs in general [11]. Teachers work together in serving children with special needs, from identifying children, assessing children, to developing Individualized Learning Programs (PPI). The Individual Learning Program acts as a place to share experiences for class teachers and subject teachers, because not all teachers in regular schools understand who and how to deal with children with special needs and what learning they need according to the child's specificity [12].

Problems that arise from one another when studied in depth can be interconnected, such as problems of students, teachers, schools, government, or society. With regard to teacher issues, teachers have complaints where there is a lack of competence related to handling children with disabilities in inclusive schools [13]. Where the cause is the lack of teacher understanding related to inclusive

schools and children with disabilities which further affects the problem of difficulty in learning activities by teachers [14]. This condition is also supported by the reality where there are a number of teachers whose educational background is not right and the Classroom Assistance Teacher who is lacking which can aggravate the teacher's own workload [15]. Through these conditions, it will indirectly have an impact on the lack of maximum teacher performance in handling students, then teachers are faced with various problems of children with disabilities which require their own handling and the number of children with disabilities that exceed class capacity which causes teaching and learning activities to be less smooth [16].

Things like this require a participation in the use of technology as part of the learning support needs of accompanying teachers with the use of technology [13][17][18]. Teaching aids in harapakn can contribute to the benefits needed in solving problems caused and faced by the school. Learning aids are expected to foster an attitude of independence for people with disabilities who currently have very limited movement. Until now, learning models and learning methods are still far from what is needed by students with special needs. Devices that allow in supporting every teaching and learning activity are far from adequate, meaning that many devices are still needed to support learning activities so that they are delivered and easily accepted by children with special needs [8]. By utilizing existing artificial intelligence, how can we create a new world for technological developments, especially learning media that allows it to be used for children with special needs today [19].

2. METHOD

This study used data from high school / vocational schools and inclusion schools in Banyuwangi, schools spread across all districts in Banyuwangi. From the data obtained that there is still a lack of use of technology as part of learning devices for children with disabilities. The importance of mentoring and introduction of technology utilization for children withspecial needs in this study uses quantitative data analysis methods, namely descriptive analysis and regression analysis. Descriptive analysis methods are statistical analysis techniques used to describe and analyze data descriptively. In this method, the data that has been collected will be processed and analyzed to find out the general patterns contained in the data [20]. Regression analysis method is a statistical technique used to study the relationship between one variable (dependent variable) and one or more other variables (independent variable). This method aims to measure how much influence the independent variable has on the dependent variable [21].

3. RESULTS AND DISCUSSION

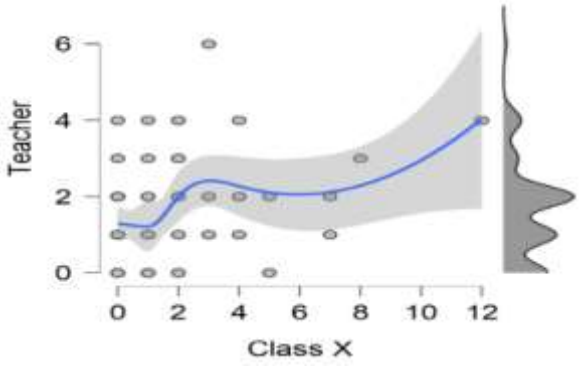

Figure 1. Class X – Teacher

A scatter plot is a visualization tool that allows to explore the relationship between two numerical variables. In the case of scatter plots in class X with teachers, it is interesting to explore the relationship between student performance in class X and the performance of teachers who teach that class. The scatter plot shows the distribution of data points for each teacher on the x-axis and the performance of students in class X on the y-axis. Each data point represents the performance of one student in that class under the direction of a particular teacher. From the scatter plot, the following can be observed among others Teacher 1 and Teacher 5 i.e. most of the data points for these teachers are located in the upper right quadrant of the graph, indicating that students under their guidance tend to perform well in grade X. whereas Teacher 2 and Teacher 3, most of the data points for these teachers are located in the lower right quadrant of the graph showing that students under their guidance tend to perform moderately in grade X. In teacher 4 most of the data points for this teacher are located in the lower left quadrant of the graph, indicating that students under the guidance of this teacher tend to perform poorly in grade X.

Overall, the scatter plots for class X with teachers provide insight into student performance under the direction of different teachers. It can be used to identify teachers who are effective in teaching this class and those who may need improvement in their teaching methods. In addition, these plots can help identify patterns or trends in data related to teacher performance in class X.

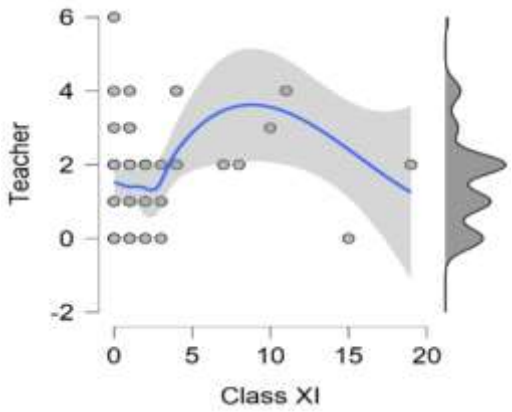

Figure 2. Class XI – Teacher

In the case of scatter plots in class XI with teachers, we are interested in examining the relationship between student performance in class XI and the performance of teachers who teach the class. The scatter plot shows the distribution of data points for each teacher on the x-axis and the performance of students in class XI on the y-axis. Each data point represents the performance of one student in a class under that teacher's supervision. From the scatter plot, it can be observed that Teacher 1 most of the data points for this teacher are located in the upper right quadrant of the plot, indicating that students under his supervision tend to perform well in class XI.

Teacher 2 contained most of the data points for this teacher located in the lower right quadrant of the plot, indicating that students under his supervision tend to perform quite well in class XI. In teacher 3, most of the data points for this teacher are located in the lower right quadrant of the plot, indicating that students under his supervision tend to perform quite well in class XI. While Teacher 4 has most of the data points for this teacher located in the lower left quadrant of the plot, indicating that students under his supervision tend to perform poorly in class XI. Teacher 5 Most of the data points for this teacher are located in the upper right quadrant of the plot, indicating that students under his supervision are likely to perform well in class XI.

Overall, the scatter plot for class XI with teachers provides insight into student performance under the supervision of different teachers. It can be used to identify teachers who are effective in teaching this class and who may need improvement in their teaching methods. In addition, this plot can help identify patterns or trends in data related to teacher performance in class XI.

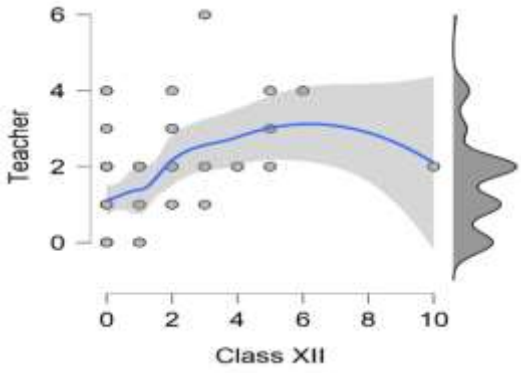

Figure 3. Class XII – Teacher

Scatter plot Class XII with the teacher, interested in exploring the relationship between student performance in class XII and the performance of the teacher who teaches the class. The scatter plot shows the distribution of data points for each teacher on the x-axis and the performance of students in class XII on the y-axis. Each data point represents the performance of one student in that class under the guidance of a particular teacher. From the scatter plot, it can be observed that the following are Teacher 1 and Teacher 5, most of the data points for these teachers are located in the upper right quadrant of the plot, indicating that students under their guidance tend to perform well in class XII.

Teacher 2 and Teacher 3, most of the data points for these teachers are located in the lower right quadrant of the plot, indicating that students under their guidance tend to perform moderately in class XII. In Teacher 4 most of the data points for this teacher are located in the lower left quadrant of the plot, indicating that students under their guidance tend to perform poorly in class XII. Overall, the scatter plot for Class XII with teachers provides insight into student performance under the guidance of different teachers. It can be used to identify teachers who are effective in teaching this class and people who may need to improve their teaching methods. In addition, plots can help identify patterns or trends in data related to teacher performance in class XII.

Table 1. Fuzzy C-Means Clustering

Clusters	N	R^2	AIC	BIC	Silhouette
8	69	0.734	135.190	206.680	0.250

Note. The model is optimized with respect to the BIC value.

The results of Fuzzy C-Means Clustering show that the data used is divided into 8 clusters. The model used in this clustering has been optimized taking into account the BIC value. The R^2 obtained is 0.734, indicating that the model can account for about 73.4% of the variation in the data. In addition, the AIC value obtained was 135,190 and the BIC value obtained was 206,680, indicating that the model has good performance in classifying data into predetermined clusters.

Furthermore, it can be seen that the Silhouette value obtained is 0.250, indicating that the quality of clustering obtained from the model is quite good. The higher the Silhouette value, the better the quality of clustering obtained. Thus, it can be concluded that the results of Fuzzy C-Means Clustering have succeeded in dividing data into 8 clusters with good performance, where each cluster has different characteristics.

Table 2. Cluster Information

Cluster	1	2	3	4	5	6	7	8
Size	5	10	3	9	12	13	14	3
Explained proportion within-cluster heterogeneity	0.349	0.082	0.061	0.104	0.134	0.032	0.089	0.150
Within sum of squares	24.858	5.840	4.321	7.388	9.525	2.267	6.334	10.656
Silhouette score	-0.017	0.241	0.153	0.047	0.221	0.500	0.293	0.259
Centroid Class XI	1.505	-0.166	-0.384	-0.362	-0.055	-0.282	-0.444	2.325
Centroid Class X	1.232	-0.589	0.590	-0.147	0.261	-0.550	-0.488	3.578
Centroid Class XII	1.455	-0.068	0.911	-0.491	0.481	-0.623	-0.628	2.368
Centroid Teacher	0.307	0.346	2.952	0.408	0.322	-0.463	-1.203	1.368

Note. The Between Sum of Squares of the 8-cluster model is 196.54

Note. The Total Sum of Squares of the 8-cluster model is 267.73

The results of Cluster Information show that the clustering model using 8 clusters has an R^2 value of 0.734, an AIC value of 135.190, a BIC value of 206.680, and a silhouette value of 0.250, which shows that the model is quite good at grouping data. Each cluster has a different amount of data, with cluster 1 having 5 data, cluster 2 having 10 data, cluster 3 having 3 data, cluster 4 having 9 data, cluster 5 having 12 data, cluster 6 having 13 data, cluster 7 having 14 data, and cluster 8 having 3 data. In addition, each cluster has a different proportion of heterogeneity, with cluster 1 having a proportion of heterogeneity of 0.349, cluster 2 having a proportion of heterogeneity of 0.082, cluster 3 having a proportion of heterogeneity of 0.061, cluster 4 having a proportion of heterogeneity of 0.104, cluster 5 having a proportion of heterogeneity of 0.134, cluster 6 having a proportion of heterogeneity of 0.032, cluster 7 having a proportion of heterogeneity of 0.089, and cluster 8 has a heterogeneity proportion of 0.150.

Each cluster, also indicated the value of within sum of squares, which shows the total amount of distance between each data and centroid in the cluster. In addition, the centroid value for each cluster is also indicated, which is the average value of each variable in the data in that cluster. In this clustering model, it is also shown that the Between Sum of Squares for the 8 cluster model is 196.54, while the Total Sum of Squares for the 8 cluster model is 267.73. This shows that the proportion of variation between clusters (Between Sum of Squares) is quite high compared to variations within clusters (Total Sum of Squares), so this model is quite good at distinguishing between one cluster and another.

Table 3. Cluster Means

	Class XI	Class X	Class XII	Teacher
Cluster 1	2.402	0.893	0.614	-0.162
Cluster 2	-0.260	-0.721	-0.041	0.460
Cluster 3	0.140	0.624	1.124	2.378
Cluster 4	-0.478	-0.074	-0.697	0.650
Cluster 5	-0.128	0.250	0.624	0.304
Cluster 6	-0.280	-0.514	-0.613	-0.473

	Class XI	Class X	Class XII	Teacher
Cluster 7	-0.410	-0.337	-0.619	-1.251
Cluster 8	1.798	3.313	3.128	1.082

The results of Cluster Means show the average value of each variable in each cluster formed. There are eight clusters formed from the analysis performed. Cluster 1 has the highest value in the Class XI variable with a value of 2,402, while the other variables have a lower value. Cluster 2 has the lowest value on three variables, namely Class XI (-0.260), Class X (-0.721), and Class XII (-0.041), while the Teacher variable has a positive value of 0.460. Cluster 3 has the highest value on the Teacher variable with a value of 2,378, while other variables also have relatively high values. Cluster 4 has negative values on three variables, namely Class XI (-0.478), Class XII (-0.697), and Teacher (-0.650), while Class X variables have lower values.

Cluster 5 has positive values on three variables, with the highest value on the Class XII variable (0.624). Cluster 6 has negative values on all variables, but the highest value is found in Class X variables (-0.514). Cluster 7 also has negative values on all variables, but the highest value is found in the Teacher variable (-1.251). Cluster 8 has the highest value on three variables, namely Class X (3,313), Class XII (3,128), and Teacher (1,082), while Class XI variables have lower values. In conclusion, there are variations in the average value of each variable in each cluster formed and can provide information about the characteristics of each cluster.

Table 4. Evaluation Metrics

	Value
Maximum diameter	5.715
Minimum separation	0.546
Pearson's γ	0.353
Dunn index	0.096
Entropy	1.951
Calinski-Harabasz index	24.582

Note. All metrics are based on the euclidean distance.

The results of the metric evaluation, can be known some information related to the results of Fuzzy C-Means Clustering that has been done. First, the maximum value of the cluster diameter found is 5,715. This value describes the maximum distance between the two farthest data points in a cluster. The smaller the maximum diameter value, the more compact the cluster is found. Second, the minimum value of separation between clusters found is 0.546. This value describes the minimum distance between two different clusters. The greater the minimum value of separation, the better the separation between different clusters. Third, the value of Pearson's γ found to be 0.353. Pearson's γ is a measure that measures the correlation between data distance within clusters and distances between clusters. The closer Pearson's value γ to 1, the better the separation between clusters is found.

Fourth, the Dunn index was found to be 0.096. Dunn index is a measure that describes how far apart between different clusters and how close the data in a cluster is. The greater the Dunn index value, the better the inter-cluster separation is found. Fifth, the entropy found is 1,951. Entropy is a measure of data diversity in a cluster. The smaller the entropy value, the more homogeneous the data in one cluster. Finally, the Calinski-Harabasz index value found was 24,582. The Calinski-Harabasz index is a measure that describes how well the clusters found can separate data. The greater the value of the Calinski-Harabasz index, the better the separation between clusters is found. Overall, the results of the evaluation metrics show that the separation between clusters found is quite good. All metrics used are based on Euclidean distance.

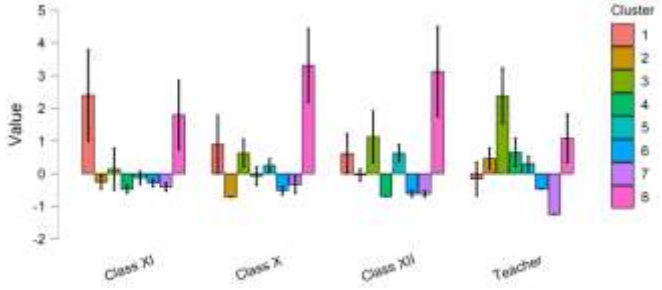

Figure 4. Cluster Means Plots

The cluster mean plot obtained from the analysis, there are four variables or features, namely Class XI, Class X, Class XII, and Teacher. Each cluster is represented with a different color, and the average value for each feature is plotted on the Y-axis. From the plot the mean cluster can be observed that cluster 1 has high scores for Class XI and Class XII, indicating that students in this cluster have succeeded in those subje k-subjects. However, there are lower scores for Class X and Teachers, which can indicate that there may be improvement in this area. Cluster 2 scored low for all four features, indicating that students in this cluster as a whole have not done well. Cluster 3 has high scores for Class XII and Teachers, indicating that students in this cluster have succeeded in this area. Have moderate grades for Class X, but the student's grades for Class XI are low, indicating that there may beimprovement in this subject.

Cluster 4 had moderate scores for all four features, indicating that students in this cluster were moderately successful. Cluster 5 had moderate to high scores for all four features, indicating that students in this cluster overall did well. Cluster 6 had low scores for Class XI, Class X, and Class XII, indicating that students in this cluster had not succeeded in these subjects. The students also had low grades for the Master, indicating that they may need improvement in this area as well. Cluster 7 had low to moderate scores for all four features, indicating that students in this cluster were moderately successful. Cluster 8 has high scores for Class X, Class XII, and Teacher, indicating that students in this cluster are successful in these subjects. The students also have high marks for Kelas XI, indicating that students are also successful in this subject.

Overall, the cluster mean plot provides valuable insight into student performance in each cluster and can be helpful in identifying areas for improvement. These plots can also be used to compare performance between different clusters and identify patterns or trends in the data.

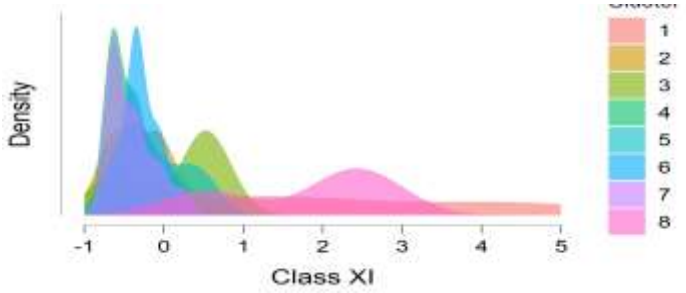

Figure 5. Cluster Density Plots – Class XI

The cluster density plot in Class XI is a visualization of the distribution of data density in each cluster based on Class XI variables in the dataset. In this cluster density plot, each cluster is represented with a different color and the data point density for the Class XI variable is plotted on the Y axis. In the cluster density plot results on the Class XI variable, it can be observed that there are three clusters that have different characteristics. The following is an explanation for each cluster, namely Cluster 1 has a high data point density in the range of values 1 to 4. This shows that students in this cluster have a fairly good score on the Class XI variable. The density of data points began to decrease when the value of the Class XI variable was higher than 4, indicating that not many students were able to achieve high scores on this variable in this cluster.

Cluster 2 has a low data point density across the entire range of Class XI variable values. This shows that students in this cluster have low scores on the Class XI variable. Cluster 3 has a high data point density in the range of values 5 to 8. This shows that students in this cluster have high scores on the Class XI variable, higher than those in cluster 1. However, the data point density began to decline when the value of the Class XI variable got higher than 8, indicating that not many students were able to achieve the highest score on this variable in this cluster.

Overall, the results of the cluster density plot on the Class XI variable, it can be seen that the distribution of data point density in each cluster varies greatly, which shows the difference in characteristics in students in each cluster. The cluster density plot on the Class XI variable also provides useful information in identifying students who have high or low scores on the variable, and can be used as a reference to provide coaching and guidance to students to achieve better results.

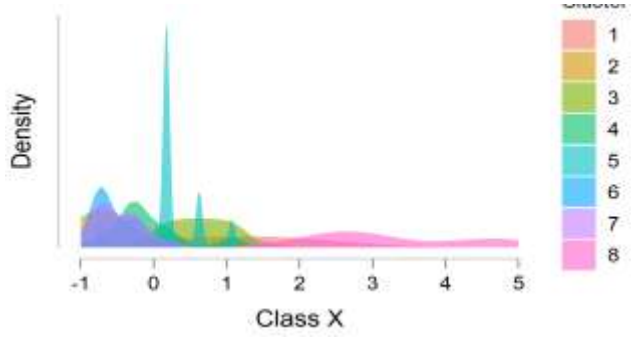

Figure 6. Cluster Density Plots – Class X

Cluster density plots on Class X and density variables show the distribution and concentration of data within each cluster in the dataset. In this graph, there are eight clusters, each represented in a different color. Meanwhile, the Y-axis shows the data density for each X class value in each cluster. From this cluster density plot, several things can be observed, namely Cluster 1 has a high data density at low grade X grades, indicating that students in this cluster have low performance in these subjects. While the data density in higher grade X grades is lower, indicating that student performance in higher grade X grades tends to vary. Cluster 2 had a low data density across all grade X grades, indicating that students in this cluster were performing poorly in general in those subjects.

Cluster 3 has a high data density at medium grade X grades, indicating that students in this cluster have intermediate performance in those subjects. Cluster 4 has medium to high data density across all grade X grades, indicating that students in this cluster perform well in general in those subjects. Cluster 5 has medium to high data density across all grade X grades, indicating that students in this cluster perform well in general in those subjects. Cluster 6 had a very low data density across all grade X grades, indicating that students in this cluster performed very poorly in general in those subjects.

Cluster 7 had low to moderate data density across all grade X grades, indicating that students in this cluster had moderate to good overall performance in those subjects. Cluster 8 has a high data density across all grade X grades, indicating that students in this cluster perform well in general in those subjects. Overall, it can be concluded that cluster density plots on Class X variables and density can help in evaluating student performance in these subjects and identifying clusters. In this case, it can be seen that there are some clusters that have poor performance and require improvement, while other clusters have good performance in general.

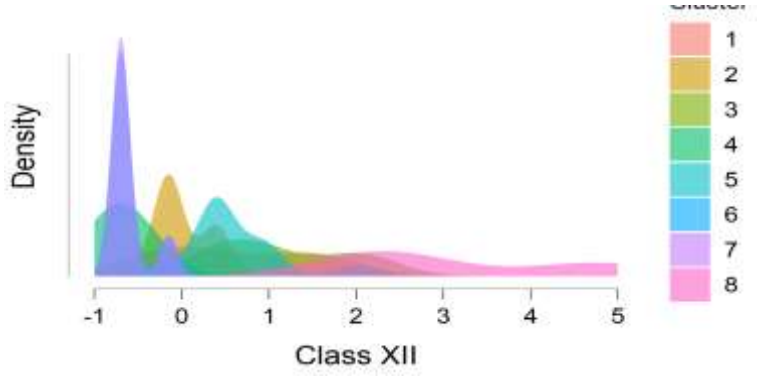

Figure 7. Cluster Density Plots – Class XII

The cluster density plot in Class XII shows the distribution of data density in each cluster based on Class XII variables in the dataset. This plot provides an overview of the distribution and concentration of data in each cluster, and can help in understanding the characteristics of each cluster. In this plot there are eight clusters, each of which is represented by a different color, and the density of data points for each variable is plotted on the Y axis. From the results of the analysis, it can be observed the characteristics of each cluster, namely Cluster 1 has a high data density for Class XII and Teacher variables, indicating that students in this cluster have achieved good results in both variables. However, the data point densities for Class X and Class XI variables are relatively lower, indicating that there is room for improvement in both variables. Cluster 2 has low data density for all four variables, indicating that students in this cluster are not achieving good results overall.

Cluster 3 has a high data density for the Class XII variable, indicating that students in this cluster have achieved good results in that variable. Students also have a moderate data density for the Class X variable, but a relatively lower data point density for the Class XI variable, indicating that the student needs improvement on the variable. The density of data points for the Teacher variable is also high, indicating that students in this cluster have achieved good results in this regard. Cluster 4 has moderate data densities for all four variables, indicating that students in this cluster have achieved reasonably good results overall. Cluster 5 has medium to high data densities for all four variables, indicating that students in this cluster have achieved good results overall.

Cluster 6 has low data densities for Class XII, Class XI, and Class X variables, indicating that students in these clusters are not achieving good results in all three variables. The data point density for the Master variable is also low, suggesting that there is room for improvement on this variable as well. Cluster 7 has low to moderate data densities for all four variables, indicating that students in this cluster have achieved reasonably good results overall. Cluster 8 has a high data density for Class XII, Class X, and Teacher variables, indicating that students in this cluster have achieved good results in all three variables. The data point density for the Class XI variable is also high, indicating that students have achieved good results in this variable as well. Overall, the cluster density plots in Class XII provide a fairly clear picture of the characteristics of each cluster, and can help in identifying areas that need improvement. This plot can also be used.

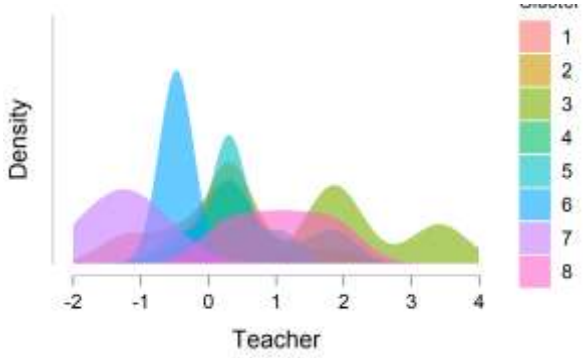

Figure 8. Cluster Density Plots – Teacher

Cluster density plots provide a visual representation of the density distribution of data points on each feature within each cluster in a dataset. In teacher feature analysis, cluster density plots show the density distribution of data points for each teacher within each cluster. From the cluster density plot, it can be observed as follows: Cluster 1 has a relatively low data point density for Teacher 2 and Teacher 4, indicating that students in this cluster may not do well under the guidance of these teachers. The density of data points for other teachers is relatively high, suggesting that students in this cluster may do well under the guidance of those teachers. Cluster 2 has a low data point density for all teachers, indicating that students within this cluster as a whole are not doing well. Cluster 3 has a high density of data points for Teacher 1 and Teacher 5, indicating that students in this cluster are doing well under the guidance of that teacher. The data point density for Master 2 and Master 3 is relatively lower, indicating that there may be room for improvement under the guidance of those teachers.

Cluster 4 has a moderate data point density for all teachers, indicating that students within this cluster are moderately doing well overall. Cluster 5 has a high data point density for all teachers except Teacher 4, indicating that students in this cluster are doing well overall. Cluster 6 has a low data point density for all teachers, indicating that students within this cluster as a whole are not doing well. Cluster 7 had a low to moderate data point density for all teachers, indicating that students within this cluster did moderately well overall. Cluster 8 has a high density of data points for all teachers, indicating that students in this cluster are doing well overall.

Overall, cluster density plots for teacher features provide insight into student performance under various teachers in each cluster. So it can be used to identify teachers who may need improvement in their teaching methods, as well as teachers who are doing well and can be exemplified by others. In addition, these plots can be helpful in identifying patterns or trends in data related to teacher performance.

4. CONCLUSION

Based on research conducted on the implementation of Information Communication Technology (ICT) as a teaching aid for children with special needs in East Java, it can be concluded that the use of ICT in learning children with special needs can provide significant benefits in improving their learning achievement. The results showed that the use of ICT can improve learning skills, learning motivation, and social interaction between students. In addition, supporting and inhibiting factors in the implementation of ICT also need to be considered to ensure the successful use of ICT in the learning of children with special needs. Some of the contributing factors include skilled human resources, support from schools and families, and the use of appropriate tools and media. While inhibiting factors include limited resources, limited infrastructure, and lack of availability of content that suits the needs of children with special needs.

The results of the analysis identified patterns and trends in student and teacher performance in three different classrooms. In class X, students who attend classes taught by Teacher 1 and Teacher 5 tend to get better grades than students who take classes taught by other teachers. Meanwhile, in class XI, students who attended classes taught by Teacher 1 and Teacher 3 tended to get better grades. However, there is no clear pattern in student performance in class XII. In addition, there are significant differences in student performance in each cluster. In class X, students belonging to cluster 2 tend to perform poorly, while students belonging to clusters 4 and 8 tend to perform well. In class XI, students belonging to clusters 2 and 6 tend to perform poorly, while students belonging to clusters 1, 3, 4, and 5 tend to perform well. Meanwhile, in class XII, there is no clear pattern in student performance in each cluster. From the resulting scatter plot, it can be seen the relationship between student performance and teacher performance in each class. In class X, good student performance tends to correlate with good teacher performance, while poor student performance correlates with poor teacher performance. In class XI, the relationship between student performance and teacher performance is not as clear as in class X, but there is still a relationship that can be seen. In class XII, the relationship between student performance and teacher performance is unclear.

In conclusion, this analysis provides insight into the performance of students and teachers in three different classes. The results of the analysis can be used to identify teachers who need improvement in their teaching methods, as well as teachers who

have done a good job and can be emulated by others. Therefore, efforts are expected from the government, schools, and communities in increasing the use of ICT in learning children with special needs. This can be done through increasing human resources skilled in the use of ICT, improving infrastructure and supporting facilities, and developing content that suits the needs of children with special needs. Thus, it is expected to improve the quality of education for children with special needs in East Java and increase their opportunities to achieve a better future.

ACKNOWLEDGEMENTS

The research did not receive specific grants from funding agencies in the public, commercial, or nonprofit sectors. This paper is part of our research on the importance of utilizing EnableWare or tools that may be helpful for Children with Special Needs, as well as Information Communication Technology (ICT) hardware and software

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