Analysis Of Teachers Characteristics With High Internet Self-Efficacy Levels Using The K-Means Algorithm

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ABSTRACT

The purpose of this study was to see the readiness of teachers in conducting online learning. The characteristics of the teachers collected in this study were gender, generation, last education, teacher tenure, learning environment and variations of online learning models. This study used the K-Means algorithm for clustering. The dataset used in this study were 96 junior high school teachers in Central Java with high level of internet self-efficacy. The dataset of teachers with high level of internet self-efficacy was obtained from the results of data analysis on 285 junior high school teachers with various levels of internet self-efficacy, both high, medium and low. The results of the K-Means analysis obtained 8 clusters with various characteristics of each cluster. The data attributes analyzed were gender, generation, last education, teacher tenure, learning environment and variations of online learning models. The results showed that in all data clusters were dominated by female gender with a bachelor educational background. Meanwhile, the relatively more dominant characters in all clusters were generation X data, teacher tenure between 11 and 20 years, supportive learning environment, and data on the use of varied learning models.

Keywords: *K-Means, Teacher characteristics, Online learning.*

INTRODUCTION

During the Covid-19 pandemic, learning is focused on online learning models. There are many advantages and disadvantages of the online learning model in each context. However, online learning is accepted as part of a common learning strategy. So that in post-pandemic conditions the online learning model remains a maintained part. The use of the blended learning model is a realistic choice for teachers to optimize learning (Jr, 2011; Hung & Chou, 2015). However, there are still many teachers who are reluctant or unable to properly organize online learning. It is due to one of the reasons of the low digital skills of teachers.

Internet self-efficacy (ISE) is a belief system in one ability to organize and carry out the activities using the Internet to produce certain achievement targets (Santosa & Sarwanta, 2021). It is a potential factor to explain the success of teachers in conducting online classes. Based on its characteristics, ISE is divided into two types, namely general Internet self-efficacy and website-specific Internet self-efficacy (Hsu & Chiu, 2004). The level of internet self-efficacy of a teacher is determined by the attitude and psychological factors of each teacher (Moos &

Azevedo, 2009). It means that teachers who receive attitude modeling treatment in the form of habituation to computer use will tend to have higher internet self-efficacy than those who do not receive modeling treatment (Cassidy & Eachus, 2002). The level of teacher self-efficacy will determine the success rate of information and communication technology-assisted learning design (Jaber & Moore, 1999).

There are many factors involved in the teacher in determining the use of information and communication technology in learning. These factors are access to existing learning resources, quality of computers both software and hardware, school environment and government policies (Mumtaz, 2000). While the internal factors from the teacher include self-efficacy, teaching experience, teacher commitment to quality learning and teacher educational background. These factors are considered by teachers in creating digital-based learning strategies (Santosa & Sarwanta, 2021).

One experience has an impact on decreasing the level of computer anxiety in an online learning environment (Sam et al., 2005). It is due to the low level of computer use anxiety that has an impact on positive attitudes towards the online learning environment. With a positive attitude, the learning process will be more optimal. Research showed that the higher personil level of anxiety about computer use will decrease the performance. It is caused by the influence of physiological factors and a person weakened thinking power (Heinssen et al., 1987). The experienced teachers will be able to overcome various external obstacles as a form of professionalism of a teacher (Wahlstrom & Louis, 2008).

Some scholars classify humans based on their attitude towards information technology namely digital native and digital immigrant (Prensky, 2001; Wang, Myers, & Sundaram, 2013). There are two commonly used characteristics to define the difference namely age and accessibility. The criteria are based on the date of birth, some experts have varying opinions, namely between the late 1970s and late 1990s (Q. Wang et al., 2013). The characteristic of the digital native generation is that they are very familiar with digital related things, such as computers, video games, digital music players, videos, cellular phones and so on. Meanwhile, digital immigrants are people who need the ability to adapt the information technology (Hills, 2010; Wang et al., 2013). However, this theory is challenged by many experts (Brown & Czerniewicz, 2010; Jones & Czerniewicz, 2010). Based on his study, Wang et al., (2013) said that the division of digital natives and digital immigrants was not appropriate. He prefers to describe it as a continuum between the two groups and this continuum is best conceptualized as the digital fluency continuum. It because it will be too simplistic to state digital nativity or digital fluency solely from age and accessibility factors. Because digital fluency has other factors namely psychological, organizational and social factors.

Teachers are the key to the successful implementation of online learning. If teachers fail to prepare online learning then government policies related to online learning during this pandemic will fail. Mumtaz (2000) stated that the results of previous research related to the reasons of teachers who do not want to use computers in their learning, namely because teachers have lack teaching experience with information technology; lack of support for the school environment; lack of assistants to supervise students while using computers; less computer skilled students; not adequate computers for learning tools ; not integrating technology into the curriculum; and lack of financial support.

There are three levels that prevent teachers from using information technology in their teaching tasks, namely barriers at the teacher level, school level and system level (Buabeng-Andoh, 2012). Barriers at the teacher level include a lack of teacher skills in information and communication technology; teachers have lack of confidence in using computers; lack of pedagogical training from teachers; lack of follow-up of training programs and lack of variety of training programs organized. School-level barriers consist of the absence of information and

communication technology infrastructure; unsupported hardware; not suitable software for the learning program; limited access to information and communication technology; limited experience; school strategies related to unsupported information and communication technology. Meanwhile, the barriers at the system level are the normative traditional education system; both for the assessment system, school organizational structure and curriculum that limits the use of information and communication technology. It needs to be minimized if the teacher wants to optimally utilize information and communication technology in learning.

Internet self-efficacy teachers determine the success of an online learning environment (Hung, 2016; Kim & Glassman, 2013; Sam, Othman, & Nordin, 2005; Wang & Lin, 2007). It is because a person self-efficacy will determine his attitude towards technology and the computer-aided learning process (Yeşilyurt, Ulaş, & Akan, 2016; Joo, Bong, & Choi, 2000). Hsu & Chiu, (2004) describe Internet Self-efficacy as general Internet self-efficacy and Web-specific self-efficacy. Internet self-efficacy is a belief in a person ability to organize and carry out various programs that use the internet to produce certain achievements (Eastin & LaRose, 2000); Hsu & Chiu, 2004). It is a determining factor to explain people decision to use Internet-based applications, as well as related to Internet stress and self-disparagement.

In the online learning environment, Hung (2016) states that male teachers have better learning-transfer self-efficacy than female teachers and teachers with more teaching experience and have master degrees will have higher communication self-efficacy. It strengthens the notion that the level of internet self-efficacy of teachers is a predictor of teacher readiness in conducting online learning (Yeşilyurt, Ulaş, & Akan, 2016; Wang & Lin, 2007).Furthermore, the teachers experience in using computer equipment is also an important factor that influences. The results of research by Cassidy & Eachus, (2002) showed a significant positive correlation between computer self-efficacy and computer experience, software use habits and teacher training. It is the experience of using a computer, the habit of using software and computer training will be able to increase computer self-efficacy, where the habit of using computer software is a significant predictor. Another surprising thing from the research of Cassidy & Eachus, (2002) is that the male gender showed significantly higher computer self-efficacy than women.

Based on the explanation above, it states that the role of the teacher in the online learning process is very important. During the study, it was found that there were many cases where teachers complained about the poor quality of online learning, the occurrence of learning loss, and even frustration from students, parents and teachers. This problem requires an analysis of the characteristics of teachers and online learning methods held. This condition encourages the importance of research the characteristics of teachers with high level of internet self-efficacy in their readiness to organize online learning using the K-Means algorithm.

METHODS

This study used the Phyton programming language with Orange software with several clustering methods, namely K-Means, Louvain and Hierarchy. The reason for using this software is because the open source software. The K-Means algorithm method is widely used to group data based on certain variables (McCool et al., 2012; Auliasari & Kertaningtyas, 2019). The K-Means technique is also widely used in educational research (Islam & Haque, 2012; Aldino & Darwis, 2018; Abadi et al., 2018). The use of K-Means algorithm is to see the readiness of teachers in conducting the online learning needs to be done. In this study, it is necessary to classify the data to further analyze the characteristics of the teachers suspected of influencing the quality of online learning.

Data retrieval was carried out by circulating a Google form questionnaire link to MGMP IPS teachers , but who were willing to fill in 285 data. Then the data were tested for validity and

reliability with valid results. The final step was that all data were analyzed using the K-Means algorithm.

K-Means algorithm is a group analysis method that leads to the partitioning of N (objects of observation) into K (clusters) with each object of observation belongs to a group with the closest mean (McCool et al., 2012). K-Means algorithm is a non-hierarchical data grouping method that partitions existing data into two or more groups. This method partitions data into groups so that data with the same characteristics were included in the same group.

The dataset used in this study were 96 junior high school teachers in Central Java with a high level of internet self-efficacy. The dataset of teachers with a high level of internet self-efficacy is obtained from the results of data analysis on 285 junior high school teachers with varying levels of internet self-efficacy, both high, medium and low.

The data attributes used in this study were gender, generation, education, teacher tenure, learning environment and variations of online-based learning models. The detailed explanation of the six columns is shown in Table 1 below.

Table 1. Data Attributes and Data Description

TABLE ATTRIBUTES			
No	**Attribute Name**	**Type**	**Description**
1	Gender	Nominal	Man or Woman
2	Generation	Nominal	Generasi Baby Boomer, Gen. X, Gen.Y, Gen Z
3	Last education	Nominal	Bachelor or Postgraduate
4	Teacher tenure	Interval	The number of years the teacher has worked from starting to date.
5	Learning environment	Nominal	Support the learning environment in schools.
6	Variations of online learning models	Nominal	Various online learning models are applied.

RESULTS AND DISCUSSION

Results

The results of the analysis using the K-Means Algorithm on 96 junior high school teachers with a high level of internet self-efficacy obtained 8 clusters with certain characteristics. The data variables were gender, generation, education, teacher tenure, learning environment and variations of online-based learning models.

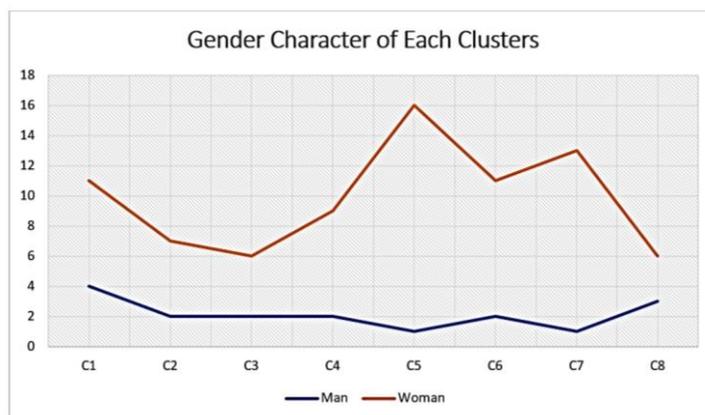The characteristics of each cluster can be recognized in the following figure:
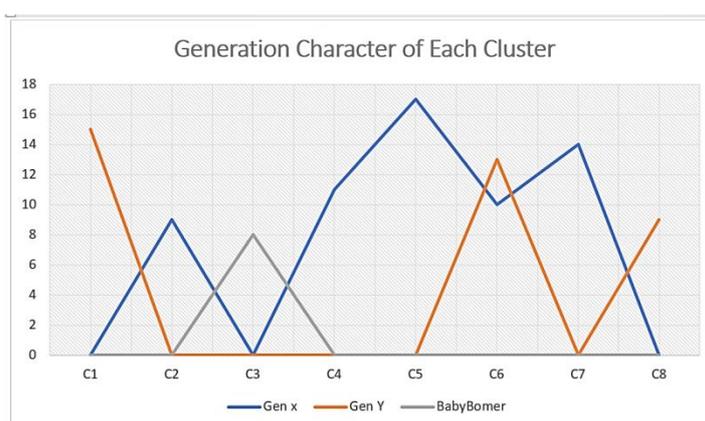
Figure 1. Gender Character

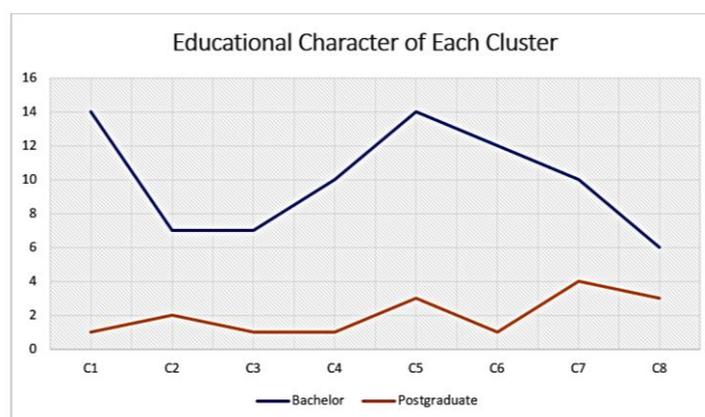*Figure 2. Character Generation*
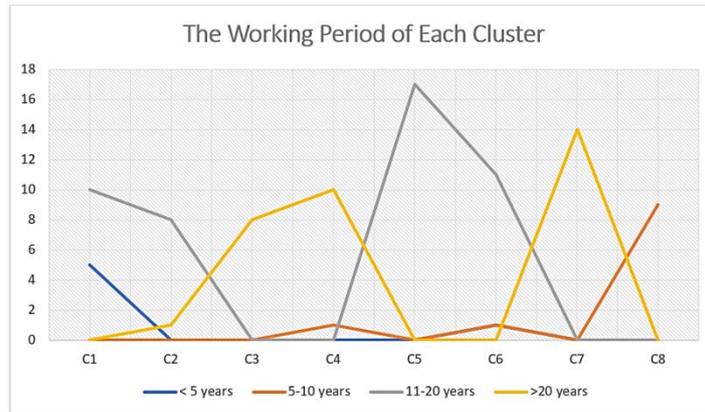

Figure 3. Teacher Education Character

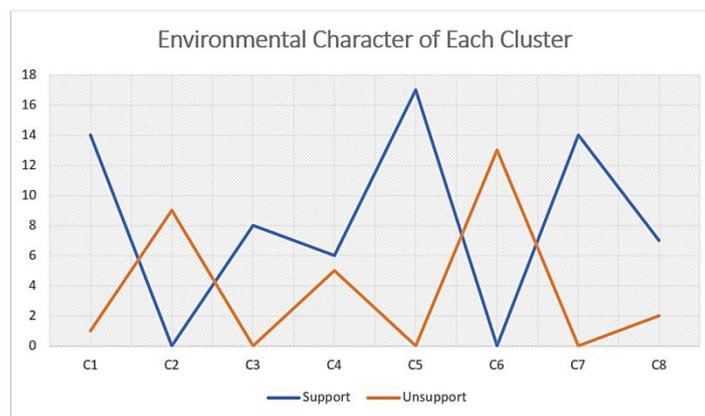Figure 4. Teacher Tenure Characters

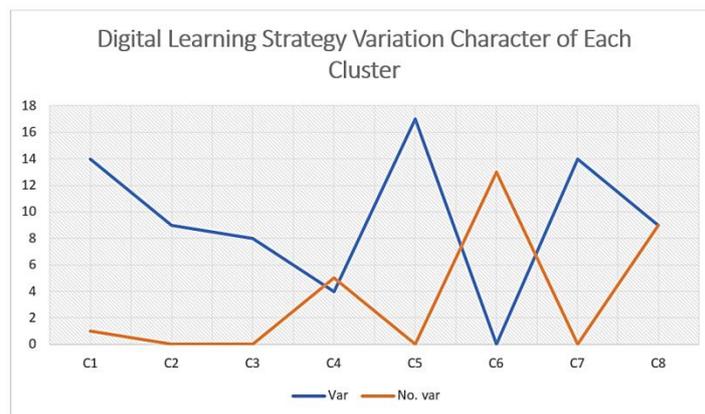Figure 5. Learning Environment Characters

Figure 6. Variations of Online-Based Learning Models Characters

Discussion

Figure 1. illustrated the results of the character analysis of each cluster for conditions of high internet self-efficacy and the data were dominated by women. Even in cluster 5, the deviation between men and women was the highest and then followed by cluster 7. Thus it can be seen that the group with high internet self-efficacy levels were dominated by women.

Figure 2. illustrates the results of the character analysis of each cluster for high internet self-efficacy conditions, it showed that generation X was dominant in clusters 2, 4, 5 and 7.

Generation Y was dominant in clusters 1, 6 and cluster 8. While the baby boomer generation was dominant in cluster 3 and cluster 2.

Figure 2. illustrated the results of the character analysis of each cluster for high internet self-efficacy conditions, it showed that generation X was dominant in clusters 2, 4, 5 and 7. Generation Y was dominant in clusters 1, 6 and cluster 8. While the baby boomer generation was dominant in cluster 3 and cluster 2. Thus, it can be seen that in conditions of high internet self-efficacy, the data showed a balance between generation X and generation Y.

The results of the character analysis of each cluster for the high internet self-efficacy condition shown in Figure 3 were the data on the level of teacher education in all clusters dominated by the educational background of Bachelor (S1). While the dominant level of Masters education (S2) was in cluster 7. The most striking data disparity was in cluster 1 where the data with S1 education were 14 teachers and 1 teacher with Masters education. Thus, the variation of educational background data for the condition of the high internet self-efficacy group was dominant with a bachelor education background.

The results of the character analysis of each cluster for high internet self-efficacy conditions shown in Figure 4 describe that the dominant teacher tenure was 11 to 20 years of service. This condition was shown to be in clusters 1, 2, 3, 5, and 6. While the tenure of over 20 years was dominant in clusters 3, 4 and 7. Highly regulated learning is a teacher who has a working period of more than 10 years.

The results of the character analysis of each cluster for high internet self-efficacy conditions depicted in Figure 5 showed the learning environment, both in the form of digital learning infrastructure, school coaching programs, peers have an important role in creating quality online learning (Santosa & Sarwanta, 2021). So this part is important. The results of the analysis showed that the supportive environment was in clusters 1, 3, 4, 5, and 7. While the unsupportive environment dominates clusters 2 and 6. It means that most of the data characters of each cluster for high internet self-efficacy conditions showed support for the learning environment.

The results of the character analysis of each cluster for high internet self-efficacy conditions depicted in Figure 6 showed that the implementation of learning has been carried out by applying variations of online learning models, especially in clusters 1, 2, 3, 5, and 7. the implementation of online learning was shown by clusters 4 and 6. In cluster 7, the data showed that the number of various online learning strategies with those that do not vary. However, there is a unique character of the data, where there is a balance of data on the use of varied learning models especially in cluster 8.

CONCLUSION

The conclusion from the results of the character analysis of each cluster for high internet self-efficacy conditions that the data are dominated by the female with a bachelor educational background. As for the characters on average more dominant in all clusters arethe data of generation X, with tenure as a teacher between 11 to 20 years. Furthermore, it was found that a supportive learning environment would be accompanied by the use of various online learning models.

In addition to the above results, it can also be added that the readiness of teachers to conduct online learning requires supporting characteristics, namely the high level of internet self-efficacy of teachers by providing a supportive learning environment to teachers. This support includes improving the quality of online learning infrastructure, relevant training and regulations that are in line with the improvement of quality of online learning models.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper is free of plagiarism.

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