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Investigation of the Factors Affecting Teachers' Attitudes towards E-Portfolio Using Data Mining Methods

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Abstract

This current study aims to determine the factors affecting teachers' attitudes towards e-portfolios by using data mining methods such as the Classification and Regression Tree (CART) algorithm and Random Forest (RF) algorithm. The study group consists of 449 participants willing to participate on a volunteer basis. In the study, the data were collected using the "Scale of Attitude towards E-Portfolio", the "Reflective Thinking Tendency Scale", and the "Scale of Attitude towards Technology". The survey research design, one of the quantitative research approaches, was used in the study. The collected data were analyzed by using the CART and RF analysis methods, two of the data mining methods. It was concluded with the CART method that the variable with the highest predictor importance in predicting the level of (low-high) attitude towards electronic portfolio is the variable of attitude towards technology, while the variable of how teachers see themselves in using technology is with the lowest predictor importance. It was concluded that with the RF model the variable with the highest predictor importance in predicting the level of attitude (low-high) towards electronic portfolio is the variable of attitude towards technology, followed by the variable of reflective thinking tendency, while the variable with the lowest predictor importance is the variable of the type of the graduated university (state-foundation). The results show that the RF method better determines the predictor variables.

Introduction

Individuals who are self-learning and who can take responsibility for learning, who can control and regulate their learning, and who integrate technology into their learning in accessing information will be pioneers in the advancement of society today and in the future. In this regard, the skills that individuals should have constantly change in line with the requirements of the time they live in. Efficiency, productivity and a high-quality workforce are needed for economic growth, and economic growth causes the needs of society to change over time. The need for talented and highly skilled individuals is increasing with each day (Schwab, 2016). For the formation of a contemporary society, the school is the most important institution as it provides individuals with opportunities for cognitive and affective development, and as a result, individuals are expected to be compatible with the innovations of life and all the developments in technology. At the same time, the necessary importance should be

attached to their expectations, decisions, beliefs and values.

The teacher's attitude and approach are critical in individuals' learning. Teachers should have a supportive role in individuals' assuming responsibility for and control of their learning so that it can be possible for individuals to organize, plan, monitor and evaluate their cognitions and behaviours (Pintrich, 2002). Examining the attitudes of teachers towards electronic portfolio, which allows students to self-evaluate and examine their products in the long term, in the current study will provide important data in terms of the evaluation dimension of the education system.

When it comes to learning, taking advantage of educational technologies expands the limits of learning that will take place in the individual. Today, taking advantage of educational technologies is indispensable for learning environments. It is very important for teachers to closely follow educational technologies in order to speak the same language with the learners of the digital age. In order to increase the use of technology and efficiency in education, the International Society for Technology in Education-ISTE website mentions standards for teachers and students. Some of these standards are set because of the belief that using technology to increase efficiency in education, following technological developments continuously for lifelong learning and development, and using technology in students' learning and communication can contribute to students' learning (ISTE, 2021). These standards emphasize that teachers should follow new information technologies and try to integrate them into students' learning as much as possible.

Theoretical Background

Evaluation, which is among the most important elements of the education system, cannot be considered independently of the teaching itself. Today, it is expected that individuals who can fulfil the requirements of the age should have the skills to evaluate their development in the earliest stages of schooling. In this connection, authentic evaluation comes to the fore as one of the evaluation types, and authentic evaluation can enable students to foster their development and knowledge in the process, as well as to find solutions to the problems they may encounter in their daily lives (Wiewiora and Kowalkiewicz, 2019). The five elements that come to the fore in the definition of authentic tasks are as follows (Newman & Wehlage, 1993):

a) It should focus on providing information on students' use of higher-order thinking skills.
b) It should focus on the depth of the knowledge acquired by students in terms of their understanding.
c) It should take into account the contribution of learning and evaluation activities to the daily life of students.
d) It should examine students' learning and understanding levels that will point to their discussion skills.
e) It should examine whether the evaluation process covers all students and whether it meets the expectations of students in this sense.

The elements mentioned above related to authentic tasks pointing to evaluation processes emerged as a requirement of the constructivist approach. The constructivist approach, which enables students to re-create and develop the knowledge they have acquired and to take an active role by structuring the knowledge in this context,

has caused a change in the perspective towards the evaluation of students. The fact that the constructivist approach has a different philosophy towards knowledge and learning has changed the roles of teachers and students in the process and has supported students to take a more active role in their own learning. Electronic portfolios (e-portfolios), one of the online evaluation methods included in the authentic evaluation, are significant in transforming knowledge into practice and following students' own developments by supporting students to produce solutions to problems they may encounter in their real lives.

E-portfolios, which are among the evaluation types that progress in direct proportion to the development of technology, can easily reflect online evaluation processes. E-portfolios are considered very important in terms of finding indicators of students' achievements in daily life. Thus, e-portfolios have become an important component of the online evaluation process as a mirror of the individual's social life
experiences.

The higher-order thinking skills of students who can control their own learning and evaluate themselves for a long time can develop. It is important to emphasize that e-portfolios are tools that can form the basis of deep learning, especially in terms of reflective thinking, critical thinking, and creative thinking skills and tendencies. They also provide students with important feedback about themselves. Reflective thinking, which is one of the higher-order thinking skills, is an important variable examined in the current study.

The concept of reflective thinking was coined by Dewey (1993), and the features that characterize this concept until today have been addressed in different ways, and their reflections in the field of education have been investigated. While this concept was initially explained on the basis of the interpretation of experience, then the reflective thinking process is explained by Lee (2000) as defining or reconstructing the problem, searching for possible solutions, experiencing, evaluating and finally accepting or rejecting them. In this context, Dewey (1993) argues that the actions involved in developing skills should also be examined. Inquiry and evaluation are effective for the development of reflective thinking (Kızılkaya & Aşkar, 2009). In order to expect students to start acquiring these skills, especially in the early periods, it is very important to examine the level of teachers' mastery of the related skills since they are role models for their students. For this reason, the current study was carried out on teachers to determine their attitudes towards e-portfolio.

Since e-portfolio, as a variable examined in the study, necessitates the use of technology for the learners of the digital age, the current study can also provide important data on the attitudes of teachers towards technology. Thus, this study is considered important in terms of revealing whether teachers' attitudes towards e-portfolio are predicted by the variables of reflective thinking tendency and attitude towards technology.

Literature Review

Here, similar studies on this subject are discussed. In the study conducted by Daşdemir (2022) on pre-service teachers, it was concluded that the use of technology in the accomplishment of mathematics objectives did not vary significantly depending on the personal characteristics of the teachers (gender, length of service, education

level, grade level taught, ability to use information tools). However, in the study conducted by Ardıç (2021), in which the attitudes of secondary school teachers towards the use of technology in education were examined, it was found that the attitudes of the teachers varied significantly depending on their age, branch, the university they graduated from, and the frequency of using technological tools in their lessons. In this study, it was concluded that the positive attitudes of teachers towards the use of technology are effective in improving their technological and pedagogical competences. For teachers to make effective use of educational technologies, they need to use resources and time effectively and efficiently. The creation of technology-supported learning environments is also considered important in this sense.

Bhattacharya and Hartnett (2007) defined e-portfolio as learning interactions through networks. Barrett (2010) mentions two basic features while describing e-portfolio. One of them is its being described as a field of study and the other is its being described as an effective presentation of the learning process, where reflections on learning can be seen immediately. In the results of the study conducted by Garrett (2011), it was seen that the students demonstrated the features of social learning intensively with the use of e-portfolio. Studies in the literature reveal that e-portfolios have a positive effect on students' research skills (Polat et al., 2016). When the studies conducted in general are examined, it has been revealed that e-portfolio provides a systematic analysis of reflective learning, supports individual learning, improves self-regulation skills in self-monitoring and evaluation dimensions, increases academic achievement and attitude levels, and has positive reflections in terms of vocabulary teaching and permanent learning (Gülbahar & Köse, 2006; Demirli, 2007; Polat et al., 2016; Saylan et al., 2019; Ayaz et al., 2020; Uysal & Direkci, 2021).

The structuring of learning-teaching environments on the basis of online technologies has made it possible to use e-portfolios and thus to evaluate learning in multiple dimensions. Since evaluation is defined as re-looking at anything one has done and revealing wrongs and truths, the role of reflective thinking skill is quite important at this point. Dewey (1993) expressed reflective thinking as analyzing and interpreting experiences (as cited in Kızılkaya & Aşkar, 2009). It can be thought that through e-portfolio, students' awareness of their learning can be increased, and thus, their reflective thinking skills can also be improved by improving their higher-order thinking skills. In the study conducted in this context (Ayaz, 2021), the effects of reflective thinking skills, learning motivation, technological competence, measurement-evaluation competences of pre-service primary teachers on their attitudes were investigated. This study highlighted the positive effects of all these variables on the attitudes towards e-portfolio. A similar result was obtained in a study conducted by Demiralp and Kazu (2012) reporting that portfolio improves reflective thinking skills.

In a study on the use of reflective thinking skills by teachers in the teaching process, it was revealed that teachers consider this skill very important in the dimensions of knowledge transfer, awareness and evaluation (Çarkıt & İplik, 2020). Pollard et al. (2008) emphasized that reflective teaching, which requires reflective thinking, involves monitoring, evaluating and improving its own practices on a cyclical basis. Reflective thinking is characterized as a skill that strengthens the bond between theory and practice (as cited in Duban & Yelken, 2010).

In the literature, there are also studies examining the reflective thinking tendencies of pre-service teachers together

with different thinking processes (Köksal, 2006; Meral & Semerci, 2009; Yıldırım & Pınar, 2015). In these studies, it is seen that reflective thinking is mostly discussed in comparison with critical thinking and problem solving skill. In other studies on reflective thinking in the literature, it is seen that the relationships between reflective thinking and different variables such as length of service, branch and attitudes towards the profession have been investigated (Hasırcı & Sadık, 2011; Keskinkılıç Yumuşak, 2015; Gözel & Toptaş, 2017).

As mentioned above, no studies have been found in the literature that discuss the connections between teachers' attitudes towards technology, attitudes towards electronic portfolio and reflective thinking tendencies. They are discussed in the literature as separate variables and examined separately. However, it is important to reveal the relationships between these variables because the common point between teachers' attitudes towards e-portfolio and their reflective thinking tendencies is that the element of "evaluation" is at the centre of both. In this regard, it is also important to examine the attitudes of teachers of digital learners towards technology in the digital age. I n this context, the purpose of the current study is to investigate teachers' attitudes towards e-portfolio, demographic characteristics, reflective thinking tendencies and attitudes towards technology by using data mining methods. To this end, the research questions of the study are written as follows:

How is the predictor importance order of the factors affecting attitudes towards e-portfolio (reflective thinking tendency, attitude towards technology, length of service, teacher knowledge on e-portfolio, how teachers see themselves in the use of technology, e-portfolio experience, gender and graduated university) according to;

a) The Random Forest algorithm,

b) The Classification and Regression Tree algorithm?

Method

Research Design

The current study employed the survey method, one of the quantitative research approaches. The main purpose of survey studies is to define the characteristics of a population and to determine how members in a population are distributed according to one or more variables (e.g., age, ethnicity, religious preference, attitudes towards school, etc.). In this study, a cross-sectional survey, one of the survey methods, was used. In a cross-sectional survey, information is collected from a sample taken from a predetermined universe to reveal the situation of the researched subject at a certain moment (Fraenkel et al., 2012).

The data of the study were collected from teachers using self-report instruments in 2021. In the study, the predictor importance order of the factors affecting the dependent variable was revealed by using the Classification and Regression Tree algorithm and the Random Forest method, two of the data-mining methods.

Participants

Demographic data of the participants are presented in Table 1.

Table 1. Participants' Demographic Information

Variables		**n**	***f* (%)**
Gender	Female	283	63%
	Male	166	37%
Type of University	Foundation University	52	12%
	State University	397	88%
Branch	Primary Teacher	171	38.08%
	Branch Teacher	278	61.92%
Length of Service	Less than 1 year	86	19.15%
	1-5 years	85	18.93%
	6-10 years	80	17.81%
	11-15 years	75	16.70%
	16-20 years	65	14.47%
	21-25 years	33	7.34%
	26-30 years	16	3.56%
	31 years or more	9	2%

The study group consists of 449 teachers working in various primary schools in a city located in the Central Anatolian Region of Turkey. The participants were determined by using the convenience sampling method. Convenience sampling is preferred in cases where it is difficult to use random or systematic sampling and easily available individuals are included in the sample. Thus, the participants of the study consist of the teachers selected according to the convenience sampling method.

As can be seen in Table 1, 166 (37%) of the participants are male, and 283 (63%) are female. Of the participating teachers, 52 (12%) graduated from a foundation university while 397 (88%) graduated from a state university. When the branches of the teachers are examined, it is seen that 171 (38.08%) are primary teachers and 278 (61.92%) are branch teachers. Finally, it is seen that the highest number of teachers have less than 1 year of professional experience (n=86, 19.15%), while the lowest number of them have a professional experience of 31 years or more (n=9, 2%).

Data Collection

In the study, the data were collected using the "Scale of Attitude towards E-Portfolio", the "Reflective Thinking Tendency Scale", and the "Scale of Attitude towards Technology". Before collecting the data, necessary permissions were obtained from the relevant institutions. The scales were presented to the participants online and took approximately thirty minutes to complete. While the online questionnaires were presented to the participants online, at the beginning of the questionnaires, the participants were first informed about the purpose and significance of the study, and they were asked to indicate whether they agreed to participate in the study voluntarily. In addition, it was stated in writing that the information collected in the study would be kept confidential and that they could leave the study whenever they wanted. Information about the scales used in the

study is given below:

Demographic Information Form

It was prepared by the researchers to elicit information about the characteristics of the participants such as the type of graduated university (foundation/state), gender, use of technology, experience of using e-portfolio and length of service.

Scale of Attitude towards E-Portfolio

The scale developed by the researchers consists of 45 items. The scale consists of three sub-dimensions. The first sub-dimension is named as "The benefit (contribution) to the student" and has 23 items; the second sub-dimension is named as "Denial (negation or negative perspective)" and has 16 items, and the third sub-dimension is named as "Effectiveness in terms of the instructional process" and has 6 items. The Cronbach Alpha reliability was calculated as 0.968 for the sub-dimension of "The benefit (contribution) to the student", as 0.912 for the sub-dimension of "Denial (negation or negative perspective)" and as 0.882 for the sub-dimension of "Effectiveness in terms of the instructional process" and as 0.957 for the whole scale. In the confirmatory factor analysis of the scale, the following values were obtained: ÷²/sd= 2.69, NNFI =0.95, NFI=0.93, CFI=0.96 and RMSEA=0.07.

Reflective Thinking Tendency Scale

The scale developed by Semerci (2007) consists of 35 items, 20 negative and 15 positive. According to the results of the EFA analysis, the KMO value of the Reflective Thinking Tendency Scale (RTTS) is 0.909 and the Bartlett test value is 6811.461 ($p<0.05$). The scale consists of 7 sub-dimensions. These sub-dimensions are continuous and purposeful thinking, open-mindedness, questioning and effective teaching, teaching responsibility and being scientific, being inquisitive, farsighted and sincere, and perception of the profession. The eigenvalues of the factors were calculated to be as follows: 8.816 for the first factor, 2.333 for the second factor, 2.089 for the third factor, 1.637 for the fourth factor, 1.421 for the fifth factor, 1.208 for the sixth factor and 1.140 for the seventh factor. As a result of factor analysis, the percentage of total variance (cumulative %) of the scale was found to be 53.268. The results of the analyses conducted for the RTTS revealed that the item-total correlations ranged between 0.308 and 0.607, that the test-retest correlation was 0.742 ($p<0.01$) and that the split-half correlation coefficient was 0.77 ($p<0.01$). The Cronbach alpha coefficient of the scale was found to be 0.908.

Scale of Attitude towards Technology

The scale developed by Aydın and Kara (2013) consists of 17 items, 15 positive and 2 negative. The scale is one-dimensional. The scale is 5-point Likert type scale of “strongly agree”, “agree”, “undecided”, “disagree” and “strongly disagree”. The Cronbach alpha internal consistency coefficient of the scale was found to be .87. The KMO of the scale was found to be 0.889 and Bartlett Test of Sphericity of the scale was found to be x2=2274.311; sd=190 ($p=0.000$). It was also found that $\chi 2$ / df ratio of the scale is 4.55, RMSEA value is 0.097, GFI value is

0.86, AGFI value is 0.81, CFI value is 0.94, NNFI value is 0.93 and RMR value is 0.066.

Data Analysis

All the participants were found to complete the data collection tool wholly and correctly. Although there are numerous data mining techniques, we will concentrate on those used in EDM practise. The data analysis methods used in the study are explained below.

Classification and Regression Tree Algorithm

The Classification and Regression Tree algorithm can be used when the dependent variable is categorical or continuous data. In this respect, the CART algorithm can be considered as an algorithm that includes multiple regression analysis when the dependent variable is continuous and logistic regression analysis when it is categorical (Güner, 2014).

In this algorithm that produces a binary tree, the sub-options of each feature should be divided into two groups. The group to which each option will be directed is determined through the Gini ratio. In addition, when the dependent variable is categorical data, the method created by using the Gini ratio as the branching criterion is expressed as a classification tree, while for continuous data, the method created by using the sum of squared error as the branching criterion is expressed as a regression tree (Altunkaynak, 2019).

Gini Ratio

Branching based on the Gini ratio is performed according to the Gini separation index calculated for the variables (Loh, 2011). Here, since the variable with the smallest Gini ratio will have the most determinant role on the category, this variable is selected in branching. Since only two branches are made for each of the nodes in the CART, each of the variables must be bi-level (Altunkaynak, 2019).

Random Forest Algorithm

The Random Forest (RF) algorithm, which is a simple classification algorithm, is an algorithm consisting of a combination of a certain number of trees with the highest accuracy and independence. Each of the decision trees branches according to the variables in the data set (Breiman, 2001). It is aimed to make an effective estimation as a result of combining the predictions made with each of the decision trees by combining the decision trees independently of each other and forming decision forests in the RO algorithm (Atasever, 2011).
If classification is made with the RF algorithm, if regression is performed on the mode value of the trained trees, the result is found according to the arithmetic mean of the trained trees and the performance of the RF algorithm in categorical variables is higher than in continuous variables. Since this method is essentially based on CART, it can be used in classification and regression. The main problem in models using the decision tree is that there is an excessive amount of overfitting due to insufficient data (Liao et al., 2016). The RF algorithm is designed to

learn from subsets of the dataset to avoid overfitting, taking into account a certain number of CARTs created. Therefore, it is a method resistant to overfitting (Bhalla, 2014).

In the process of creating the forest, each tree is created according to the following algorithm (Breiman, 2001):

- Let there be N individuals in the data set used to grow the tree. N individuals are sampled from this data set by repeated sampling, both randomly and with displacement. It is the training dataset used to grow the sample tree.
- The number of predictor variables is p. In each node of the tree, there is a fixed m value less than p. Here, m is the number of predictor variables that provides the best split for each node in the tree. These m predictor variables are randomly selected from among the predictor variables that have not been used before, and the best split is achieved in the studied node. The number of selected predictor variables m is the same for all trees. Every tree in the forest is grown in the best way without trimming.

Performance Measures of the Methods Used

The absolute and relative performance criteria to be used in the applications are shown in the formulas numbered (1) to (6). Absolute performance criteria such as Correct Classification Rate (CCR), Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) are calculated using the formulas.

Findings

In this section, the findings obtained in line with the sub-problems of the study are presented. In this connection, first, the predictor importance levels of the variables affecting the attitude towards e-portfolio with the RF method are given in Figure 1.

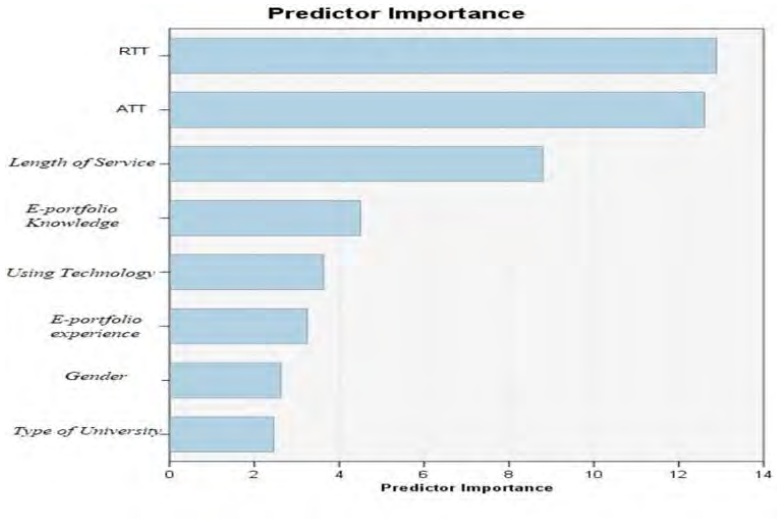

Figure 1. Predictor Importance Levels of the Variables Affecting Attitude towards E-Portfolio with the RF Method

When Figure 1 is examined, it is seen that the variable with the highest predictor importance in predicting the

level (low-high) of attitude towards electronic portfolio is the variable of reflective thinking tendency, followed by the variables of attitude towards technology, length of service, knowledge about the electronic portfolio, how teachers see themselves in using technology, electronic portfolio experience, gender, type of university graduated. Similarly, the predictor importance levels of the variables affecting the attitude towards e-portfolio with the CART method are given in Figure 2.

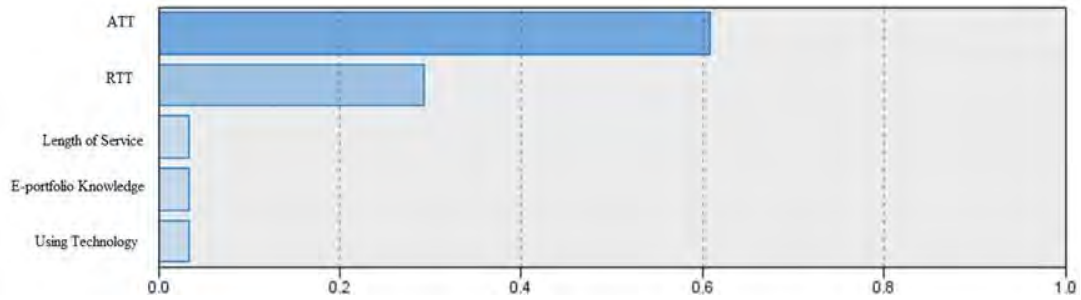

Figure 2: Predictor Importance Levels of the Variables Affecting Attitude towards E-Portfolio with the CART Method

When Figure 2 is examined, it is seen that the variable with the highest predictor importance level in predicting the level of attitude (low-high) towards electronic portfolio is the variable of attitude towards technology, followed by the variables of reflective thinking tendency, length of service and how teachers see themselves in using technology.

When all of the data are used as training data in the study, the Correct Classification Rate (CCR), Root Mean Square Error (RMSE) and Mean Absolute Error (MAE), Kappa (κ) coefficient, Root Relative Squared Error (RRSE) and Relative Absolute Error (RAE) values calculated for the Random Forest (RF) method and Classification and Regression Tree (CART) method used to predict the attitude towards two-category electronic portfolio (low-high) are given in Table 2.

Table 2. Performance Criteria for the RF and CART Methods

	Absolute Performances			**Relative Performances**		
Methods	**CCR**	**MAE**	**RMSE**	**Kappa**	**RAE**	**RRSE**
RF	99.777	0.156	0.184	0.995	31.464	37.002
CART	75.723	0.312	0.395	0.497	62.952	79.301

As can be seen in Table 2, the correct classification percentages of the models created by the Random Forest (RF) method and the Classification and Regression Tree (CART) method for the level of attitude (low-high) towards electronic portfolio were found to be 99.777 and 75.723%, respectively. Accordingly, the correct classification performances and Kappa coefficient of the model created by the RF method were found to be at a very good level. Thus, it can be said that the RF model serves the purpose very well and the order of predictor importance levels of the predictor variables obtained through this model was confirmed very well. Moreover, it was determined that the correct classification performance of the CART method was at a good level, and the Kappa coefficient was at

a moderate level. According to this result, it can be said that the CART model serves the purpose at a good level and the order of predictor importance levels of the predictor variables obtained through this model was well confirmed. When the RF and CHART methods were compared in terms of classification performance and model fit based on Kappa coefficient, it was found that the RF method gave better results in terms of both correct classification performance and model fit. When the RMSE values of both models were compared, it was found that more errors were involved in the classification process in the CHART method. The results show that the RF method is better in determining predictor variables.

Discussion and Conclusion

In the current study, the predictor importance order of the variables affecting the level of attitude towards electronic portfolio, which is the dependent variable of the study, was examined by using the CART and RF data mining methods. According to these prediction results, it was concluded that the variable with the highest predictor importance in predicting the level (low-high) of attitude towards electronic portfolio through the RF method was the variable of reflective thinking tendency, followed by the variable of attitude towards technology.

When the findings obtained with the RF method are considered, it is seen that the reflective thinking tendency levels of the teachers predict the electronic portfolio attitude level at the highest level. This research result, which indicates that teachers' reflective thinking tendencies and attitudes towards e-portfolio predict each other at the highest level, shows parallelism with the research results in the literature (Demiralp & Kazu, 2012; Ayaz, 2021) reporting that e-portfolio is a variable that improves reflective thinking skills. In the study carried out by Çarkıt and İplik (2020), it was found that reflective thinking is in the centre of teachers' information transfer, awareness and evaluation processes, which concurs with the result of the current study indicating that the variable of reflective thinking tendency has the highest predictor importance in predicting the level of attitude towards electronic portfolio.

The variable with the second highest predictor importance in predicting the level of attitude towards electronic portfolio was found to be the attitude towards technology and in a study in the literature (Cheng, Chen and Yen, 2015), the variable of attitude towards technology was found to be the variable with the highest predictor importance in ensuring continuity in the use of electronic portfolios. Similar to the result of the current study, it was seen that the technological competences of teachers had a positive effect on their attitudes towards e-portfolio (Chou, 2012; Demirli, 2007; Shana, 2008). This result is similar to the result obtained in the study conducted by Ülker, Ünlü and Usta (2021).

After these variables, the other variables with the highest predictor importance can be listed in descending order as follows: length of service, e-portfolio knowledge, using technology, e-portfolio experience, gender, and type of university (State-Foundation) graduated. In light of the literature review, it is thought that pre-service teachers' e-portfolio experiences support their e-portfolio use (Çukurbaşı & Kıyıcı, 2018). According to Goldsmith (2007), teachers' lack of experience in implementing e-portfolios can result in some problems. With the development of technology, it is seen that the perceptions towards the use of technology positively affect the use of e-portfolio

(Shroff et al., 2011). This result also concurs with the results reported by Chou (2012).

It was seen in a study that there was no significant difference between teachers' attitudes towards e-portfolio depending on their gender (Barış, 2013). Similar research results indicate that there is no statistically significant difference between students' attitudes towards the e-portfolio teaching process depending on the gender variable (Barış & Tosun, 2013; Kutlu et al., 2014; Polat & Köse, 2013; Cheng et al., 2015). It was also reported that teachers' attitudes towards e-portfolio do not vary significantly depending on the variables of gender, branch and length of service (Polat & Köse, 2013). This result also concurs with the results of the study conducted by Arabacı and Turhan (2010). The results of the current study are also supported by the results of the study conducted by Daşdemir (2022) concluding that teachers' attitudes towards the use of technology do not vary significantly depending on gender, length of service and teachers' competence of using technological tools.

With the CART method, it was found that the variable with the highest predictor importance in predicting the level of attitude (low-high) is the variable of attitude towards technology, followed by the variables of reflective thinking tendency, length of service, e-portfolio knowledge and how teachers see themselves in using e-portfolio. According to the model obtained with the CART method, while the variable with the highest predictor importance in predicting teachers' attitudes towards e-portfolio was found to be the variable of attitude towards technology, the predictor importance of the variable of reflective thinking tendency was found to be less than its predictor importance found with the RF model. The other variables (length of service, knowledge about e-portfolio, how teachers see themselves in using technology) were found to have the least predictor importance.

The correct classification percentages of the models created by the Random Forest (RF) method and the Classification and Regression Tree (CART) method for the level of attitude (low-high) towards the electronic portfolio were found to be 99.777 and 75.723%, respectively. Accordingly, the correct classification performances and Kappa coefficient of the model created by the RF method were found to be at a very good level. Thus, it can be said that the RF model serves the purpose very well and the order of predictor importance levels of the predictor variables obtained through this model was confirmed very well. Moreover, it was determined that the correct classification performance of the CART method was at a good level, and the Kappa coefficient was at a moderate level. According to this result, it can be said that the CART model serves the purpose at a good level and the order of predictor importance levels of the predictor variables obtained through this model was well confirmed. When the RF and CHART methods were compared in terms of classification performance and model fit based on Kappa coefficient, it was found that the RF method gave better results in terms of both correct classification performance and model fit. When the RMSE values of both models were compared, it was found that more errors were involved in the classification process in the CHART method. The results show that the RF method is better at determining the predictor variables.

In the current study, in which the relationships of teachers' attitudes towards e-portfolio with different variables (attitude towards technology, reflective thinking tendency, length of service, knowledge about using e-portfolio) were investigated through two different methods, the variables of reflective thinking tendency and attitude towards technology were found to have higher predictor importance than the other variables, indicating that they are better

predictors of attitudes towards e-portfolio. Determining the factors affecting the attitudes towards e-portfolio is important for teachers to consider these factors. In particular, it is suggested that studies with different samples be conducted for the generalizability of the findings of the current study. In addition, the current study is thought to be an example on the use of data mining methods for educational research. Furthermore, the current study is believed to be useful in terms of the effective use of e-portfolio in instructional and educational processes by raising the awareness of the factors affecting the attitudes towards e-portfolio. Moreover, different methods and models can be used on the basis of different variables that affect the attitudes towards electronic portfolios.

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