

Preferences Analysis of Engineering Students on Choosing Learning Media using Support Vector Machine (SVM) Model

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Abstract— This research aims to perform preferences analysis of engineering students on choosing learning media using Support Vector Machine (SVM) model. Data is collected using questionnaire. The questionnaire consists of four items related to students profile and 17 items related to students preferences on learning media. Respondents are students in Faculty of Engineering. The total number of usable responses are 1,911. Data were analyzed using Support Vector Machine Model and resulted in the accuracy of 98.48%. The results show that factors behind learning media choice and the using pattern of e-book as learning media are the most influence variables that affect engineering students preferences on choosing learning media.

Keywords— Preferences Analysis; Engineering Students; Learning Media, Artificial Neural Network

I. INTRODUCTION

The industrial revolution 4.0, also known as the digital revolution, has driven a massive transformation in the world of education [1]. Currently the use of digital technology has occurred in all aspects of life and in various age groups. People have been accustomed to access various knowledge from the internet such as YouTube, various educational applications or other forms of education games, application that enable to bring teachers and students together to discuss from various places in the world as well as an integrated learning process via internet network connections.

In the Google and Wikipedia era, universities are also faced with a dilemma of whether the existence of a library as a learning resource is still relevant to the achievement of learning goals. Previous study convinced that the use of library electronic resources has a close relationship with academic success [2]. This study finds that students with high GPA tend to use online library resources and are more likely to use these resources frequently. This study indirectly proves that there is a shift in the use of learning resources used by students in universities from print learning resources to online learning resources.

The rapid development in digital technology has also created new challenges to conventional education systems at various levels of education, from basic education to higher education. The transformation also changes students' tendency to study, including their preferences on choosing learning media. Furthermore, nowadays students tend to request a freedom to decide what they want to learn,

when they want to learn, and how they want to learn [1]. This phenomena indicates that human behavior and characteristic influence the way people process to think and learn something.

There are four categories of students based on their way on learn something: 1) a sensing learners and intuition learners; 2) visual, auditory, and kinesthetic learners; 3) induction and deduction learners; and 4) sequential and global learners [3]. These categories explain the reason why human characteristic and behaviour correlated to their way to learn. Not only the characteristics and behaviour that influence the way human learn, but the environment and phenomena are also affect their way to learn something, including technology.

II. RESEARCH METHODOLOGY

This study uses a quantitative design approach. Data were collected using a questionnaire which contain four questions of respondents profile and 17 questions on learning style and students preferences on choosing learning media. The indicator variables used in the questionnaire shown in Table 1. The questions on the responden profile describe in which semester is the respondent study when the survey conducted, field of study, gender, and hours spent for an independent study. Data were analyzed using a statistic descriptive to obtain a picture of the respondent profile as well as to find out the most and the least response on each question. In addition, data were also used to build a Support Vector Machine (SVM) model to reveal students preferences on choosing learning media. The SVM model was built using three data partitions ; training (60%), validating (20%), and testing (20%) in order to prevent overfitting model.

Table 1. Item List in the Questionnaire

Variable	Indicators	Number of Items
Independent Variable	Personal Profile	4 open-ended questions
	Learning style	1
	Learning media use pattern	7, 8, 9, 10, 11, 12, 13
	E-learning in SIAKAD (online academic system)use	6
	Factor behind learning media choice	3, 5
Dependent variable	The most preferred learning media	2

III. RESULTS AND DISCUSSIONS

The total number of usable responses are 1,911. The distribution of the respondents field of study is shown in Table 2. The percentage of number of respondents in Table 2 shows almost the real percentage of the total number of students in Faculty of Engineering – Universitas Negeri Malang (UM). The largest number of students is Electrical Engineering, Mechanical Engineering, Civil Engineering and Industrial Technology Department. Thus, the respondent composition is quite good to represent the composition of engineering students in UM.

Table 2. Distribution of Respondents Field of Study

Field of Study	Count	Percentage (%)
Mechanical Engineering	479	25.07%
Civil Engineering	362	18.94%
Electrical Engineering	731	38.25%
Industrial Technology	339	17.74%

This study uses the support vector machine (SVM) model, one of data mining technique, to analyze the student preferences. The Support Vector Machine Model (SVM) built in this study uses RBF kernel type, regularization parameter =10, regression precision = 0.1, gamma = 1.0, and RBF gamma = 0.1. The accuracy of the SVM model on each data set are shown in Table 3. Since the accuracy on each data set > 95%, it can be conclude that SVM results in a good and fit model to represent student preferences on choosing learning media.

Table 3. Misclassification rates on each data sets

Partition	Training Data Set (60%)		Validation Data Set (20%)		Testing Data Set (20%)	
	Count	%	Count	%	Count	%
Correct classification Rates	1,105	98.66%	389	97.98%	388	98.48%
Misclassification Rates	15	1.34%	6	1.52%	8	2.02%
Total	1,120		394		397	

Based on the results analysis used SVM technique, this study summarize the students preferences as shown in Table 4. The table shows ten most important variable that affect students preferences on choosing learning media. This results shows that the respondent answer the questions relatively consistent since two questions that related to the factor that respondent considered during the choosing process are found as the top three important variables. This result also reveals that student learning styles does not significantly affect student preferences on choosing learning media.

Table 4. Importance level of each predictor variable

Variables	Importance Level
Frequency of using e-material in SIAKAD as a learning source (6)	0.0527
Frequency of using module as a learning source (9)	0.0534
Field of study (profile)	0.0597
Frequency of using library resources (13)	0.0627
Frequency of using presentation slide as a learning source (12)	0.0742
Frequency of using youtube as a learning source (11)	0.0771
Frequency of using online information as a learning source (10)	0.1061
The most influence factor on choosing learning media (5)	0.1139
Frequency of using e-book as a learning source (8)	0.1185
Factors to be consider when choosing learning media (3)	0.1293

Table 4 also show that library is still considered as a useful learning resources according to the students perception. During the increasing use of YouTube and Wikipedia as learning resources by the students, the development of digital technology has also encouraged UM library to improve its ability to provide electronic resources such as e-books, online catalogs, reference management systems, online bibliographic databases and online journals. These resources facilitate an access to knowledge and information, broaden the ease of access to connect with the latest and high-quality material, improve the quality of the writing of students and lecturers and provide opportunities for students and lecturers to have personal learning resources [4].

In addition, the results also show that the use of e-book, online information, and youtube are three learning sources that are frequently used by students in Faculty of Engineering – Univesitas Negeri Malang. This result implies that students tend to choose electronic media than printing media as their learning sources. Detail results of the most frequently used learning source is shown in Table 5.

Table 5. Frequency of The Most Frequently Used Learning Sources

Learning source	Count	Percentage (%)
Printed Text Book	227	11.88%
Printed Module	148	7.75%
Presentation Slides	222	11.62%
Interactive video	169	8.85%
E-book	194	10.16%
E-module	49	2.57%
E-journal	87	4.55%
Online information	814	42.62%

The development of information system and technology has introduced several new learning resources in education field. The type of media used as learning resources varies greatly according to the preferences of lecturers and students in carrying out the learning process. Some students tend to choose electronic-based learning resources, while others still tend to use print learning resources. Electronic learning resources that are not paid and can be obtained freely tend to be widely used by students in the learning process in higher education [5].

The results as shown in Table 5, are also in line with the results found by Montenegro, et.al [6] that concludes the student preferences in accessing each type of learning sources are significantly different. This study also reveals that the preference for using various types of learning sources depends on personal or cultural factors. The study also found that access to Electronic Resources (e.g. electronic journals and online databases) have a greater effect on students' achievement than reading print materials (e.g. books, journals or printed theses).

IV. CONCLUSION

This study find that online information is the most frequently used by engineering students as learning sources. The two least frequently used learning sources are e-module and e-journal. The students preferences on choosing learning sources is affected by the students personal characteristics and behavior. Thus, it is important to explore and understand students characteristics and behavior in order to optimize the utilization of learning resources provided by the university. In addition, the availability of preferred learning resources is expected to increase the students motivation to enhance their knowledge and as a result it also increases the students achievement.

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