

# Predicting Media Literacy Level of Secondary School Students in Fiji

Pritika Reddy  
Department of Computing Science and  
Information Systems  
Fiji National University  
Suva, Fiji  
pratika.reddy@fnu.ac.fj

Kaylash Chaudhary  
School of Computing, Information and  
Mathematical Sciences  
The University of the South Pacific  
Suva, Fiji  
kaylash.chaudhary@usp.ac.fj

Bibhya Sharma  
School of Computing, Information and  
Mathematical Sciences  
The University of the South Pacific  
Suva, Fiji  
bibhya.sharma@usp.ac.fj

**Abstract**— The digital revolution has set a platform for all the information and means of communication to be digitised, thus creating a digital media society. This explosion of digital media requires individuals to have a set of skills and knowledge to survive in this lifelong digital media society. In such a context, many countries around the world are now leveraging on Media Literacy to enhance the necessary skills of individuals and improve upon responsible media engagement. Therefore, predicting media literacy of students is essential so that suitable interventions can be put in place. This paper presents an analysis of Media Literacy status of Year 12 and Year 13 students at randomly selected secondary schools in Fiji, and it presents a set of predictive models using classification techniques. A quantitative study using a reliable survey was conducted to determine the Media Literacy of students using a Likert scale of 1-5. The analysis for this study was using the R software whereby classification algorithms such as Random Forest Classifiers, Decision Trees and Support Vector Machine Algorithm (SVM) were used to build the predictive models. These models will be used to derive appropriate interventions to improve Media Literacy of students. The baseline data from the study provide information on media literacy of Fijian students. The paper concludes with the important attributes that contribute towards an individual's competency on media literacy.

**Keywords**—media literacy, prediction, Fiji, SVM, Random Forest Classifier, Decision Trees.

## I. INTRODUCTION

The proliferation of new digital technology has created a digital media society where now, the people have access to different states of media, different forms of media and different media contents (a shift from traditional media such as TV, newspaper, magazines to the Internet-mediated media). The use of media is increasing day by day, and this is having both positive and negative impacts on the way people live, think and behave [1] therefore the need to be media literate has become a more important consideration for every individual in this digital media society. A media literate person has the skills and the ability to create content, access content, analyse and evaluate content and communicate content responsibly using various digital platforms[25].The notion of Media Literacy has become a lifelong process as the use of Internet for various purposes such as online communication, listening to music, watching online videos, fostering social relationships and solving assignment questions is part of people's daily life and with the incoming of new digital technologies, this will continue to evolve [27]. Based on this understanding, media education must begin at an early age and be included as part of the national curriculum so that the individuals are aware of the media environment and the roles they play in this media mediated world[30] [27]. According to [29], the

pervasiveness of digital tools in the education environment have regulated and stimulated the use of media in the school context; therefore, the students need to have Media Literacy so that they can cope with the opportunities and risks associated with media.

Several studies have been carried out around the world, which focuses on media education, awareness of media education and measure of Media Literacy. To list a few ; Media awareness amongst Hong Kong primary students [30], Bringing Media Literacy Education into the School Curriculum: A Trilevel Adoption of Innovation Model [31], Media Literacy in Brazil: Experiences and Models in Non-Formal Education [28]. To integrate media education in the school curriculum, the degree of Media Literacy has to be known[2]. According to the researchers, many scales and instruments have been developed to study Media Literacy from various perspectives [2] [29].The purpose of measuring the status of Media Literacy serves as the initial indication of the media skills the individuals have, the skills they are missing and the skills they need to acquire and sets the pathway of the necessary actions that need to be taken to integrate Media Literacy within the school curriculum.

The quest for Media Literacy or media education in the Pacific remains the same. The PIC's (Pacific Island Countries) are in the wave of technological development, and this requires the Pacific populace to have a set of skills and knowledge to use these new technologies around them, not forgetting the new digital media content which is readily available to them now [26].This study revolves in Fiji where the accessibility and availability of digital technology and the Internet have increased when compared to the last decade. Fiji is a developing country in the South Pacific, and recently the uptake of technology at all levels of education is increasing, and according to the research the use of digital media content is on par with the world [3]. This urges the need for media education or Media Literacy in Fiji. However, the Media Literacy status of the people has to be known before media education can be put in place. This paper provides a foundation analysis of the status of Media Literacy amongst secondary school students in Fiji. This study also incorporates some prediction analysis to predict attributes that are important for an individual's media literacy competency. The classification techniques such as Random Forest Classifier, SVM and Decision Trees have been used so for prediction so that the right interventions can be devised to improve media literacy amongst the students. This study becomes the foundation research for Media Literacy in Fiji and the South Pacific as a whole. The predictive models derived can be used to predict Media Literacy of the students and appropriate interventions can be put in place so that Media Literacy amongst the students can be improved.

## LITERATURE REVIEW

The evolution of digital media has transformed the media ecosystem and removed the barriers that prevented access to information. This new media ecosystem requires a new set of skills and qualities for the consumers of information in the new digital media society [32]. This set of skills and abilities is described as Media Literacy. The term Media Literacy is defined as the ability to receive, analyse and evaluate images, sounds and messages that we encounter daily, and which forms an important part of our modern culture, as well as the ability to responsibly communicate the accessible media and create media content [32]. [33] defines Media Literacy as a set of skills that allows audiences to access and create the types of communication signals and recognise the property, wealth, and values underlying the messages, [34] expresses Media Literacy as an umbrella concept which is characterised by a diversity of perspectives and a multitude of definitions. Although there are varied definitions of the concept, it brings new possibilities with the innovation of new technologies [35] believes that Media Literacy is necessary for all citizens, therefore, the awareness for media education should be increased amongst the children and youths today as they are mostly involved in the online sharing of information and using the online information. Therefore education institutes should not think twice and introduce media education in the school curriculum.

According to [35] many Media Literacy programs are in progress such as; in Australia – media teaching is included in the curriculum for Arts and English, in New Zealand- media education is included in the social sciences domain, in Canada- Media Literacy is taught from kindergarten to grade 12. Some more media initiatives from the world include; media awareness amongst primary school students in Hong Kong [4], media education in secondary schools in Russia, Ireland and Spain [36], in European countries media education is also being part of the university curriculum and countrywide media education programs have been developed to improve media education of the people [5]. From the initiatives mentioned above, it can be assumed that the acquisition of media education is necessary, hence the level of Media Literacy of the people has to be known so that appropriate training programs can be developed.

There has been a number of studies conducted around the globe to determine the Media Literacy of the students such as; a study conducted in Iran by [33] to evaluate the level of Media Literacy amongst medical students as new challenges were coming up due to new digital media content and the students needed the skills to differentiate between the 'fake' content and the genuine content. According to the authors, this study was needed so that proper awareness and training could be devised for the students. Another study was conducted by [32] on Media Literacy level in Kyrgyzstan for men and women of 16 years and above focusing on the use of media and frequency of media usage. Similar research was done by [37] in Canada in 2017. According to Literature, the study of the level or status of Media Literacy is at its foundation level and a few scales and tools have been used to measure Media Literacy from different perspectives in few countries [38][36]. According to [38] Media Literacy was also evaluated using competency-based measures which focused on cognitive domain, engaging learners, analysing and creating media text and performance-based measures which involved hand scoring, decisions making and demonstration.

It is also essential to understand the factors that affect the student's media literacy competencies so that appropriate interventions can be put in place to improve the identified competencies. From Literature, classifications and predictive techniques are the most appropriate method to gather the aforementioned information. Some of the classification techniques used for prediction are:

- i. the use of SVM for prediction in medical sciences and education [19] [18] [17].
- ii. the use of Decision Trees mainly for predicting educational factors such performance, grades, GPA, disability in reading and many more [20] [21] [13].
- iii. the use of Random Forest Classifiers for prediction in science, education, networking, software engineering and many more [23] [22] [24].

To apply these classification techniques to predict media literacy competencies, there is a need to measure Media Literacy as it reveals gaps in the skills that individuals have. As mentioned in the Introduction section of this paper, there has been no study conducted on Media Literacy in Fiji and the Pacific as a whole. In Fiji, digital literacy initiatives have been placed which includes the development of Media Literacy [6] however there has been no measure of Media Literacy status in Fiji. In this growing world of digital media, studies need to be conducted to determine the status of Media Literacy in the country so appropriate training programs can be developed. The secondary school students are the focus group as today they are the majority group that has access to the Internet and digital content. Therefore, this measure of Media Literacy in Fiji works on the following questions:

What is the Media Literacy status of secondary school students in Fiji?

What can be done to improve Media Literacy skills amongst the students and the people of Fiji?

## II. BACKGROUND

The Fiji Islands is a country in the South Pacific Ocean about 1300 miles northeast of New Zealand, consisting of about 330 islands and is the home of approximately 900 000 people [7]. Most of the inhabitants live on the two major islands of Viti Levu and Vanua Levu and the sugar cane industry and tourism are paramount. The country is also known for its natural resources and is also involved in the export of timber, minerals, fish and fish products and agricultural produce. In the South Pacific region, Fiji's economy is most developed therefore making the country the economic and technological hub in the Pacific [8].

In the recent years, the country has seen a technological revolution and today thousands of people in the country have access to the Internet [9] that is approximately 441 559 people have access to the Internet and approximately 490 000 people from Fiji are active on social media. The advent of the Internet and the digital technology in Fiji is enormous and the people are using these new technologies in every aspect of their daily lives such as transportation – the use of eTransport card whereby the travellers have to register for

their eTransport card and use it for travelling, use of technology in health services, government- initiatives such as digitalFiji, agriculture – ICT enabled Agriculture and the education sector – ICT enabled learning and teaching at all tertiary education institutions and also at Secondary and Primary schools in Fiji [44] [42] [43] [41] [45] [46]. The country is using digital innovation for its economic growth and working towards a digitally smarter Fiji.

### III. METHODOLOGY

This study aims to explore and predict the Media Literacy status in Fiji; therefore, a quantitative research design was used to collect data from year 12 and year 13 students from randomly selected 33 secondary schools in Fiji. These secondary schools are widespread over the two main islands of Viti Levu and Vanua Levu. A survey methodology was used whereby a unipolar Likert scale 1-5 questionnaire was used to collect the data. The students were given about 20 minutes to complete the questionnaire. A total of 2737 participants were part of the survey. These results were obtained, prediction models were built using the classification algorithms like the Random Forest, Support Vector Machine (SVM) and Decision Trees.

According to [10] Random Forest is an ensemble Classifier technique that is used to classify different objects. This method can be used in classification problems (where the response takes the form of a class, its associates or classifies a set of independent predictor variables with one of the categories present in the dependent variable) or regression problems where the tree response is an estimate of the dependent variable given the predictors [11].

The Decision Tree algorithm is a technique that breaks down a dataset into smaller and smaller subsets and the same time incrementally develops an associated decision tree [12]. According to [12] [13], the algorithm has a tree – like structure where every internal node denotes a test condition on an attribute, each branch represents results of the test condition and each leaf node is assigned with a class label. According to literature Decision Tree algorithm is popular due to the fact that it is easy and simple to use, produces accurate result and take less memory.

The Support Vector Machine (SVM) technique is used for both classification and regression problems and the basic idea of SVM is to find the optimal high dimension classification hyper plane [14]. The SVM technique has been found to produce better predictive performance compared to other classification techniques [15] [16].

All the above techniques were carried out by using the R software, which is a free and an open source software used for statistical computing and graphics.

### IV. DATASET

The data set consists of 2737 rows and 30 variables out of which one is a class variable. The description of the variables is shown in Table 1. There were a total of 13 questions related to Media Literacy, and each question is allotted 5 points and the final weighting is 10 points. A scale which has six levels that are from Level 1 to Level 6 was used to evaluate the Media Literacy status for the students. The total points for each level are described in Table I as shown below.

TABLE I. LITERACY LEVELS

Levels	Total Points
Level 1	0-10
Level 2	11-20
Level 3	21-30
Level 4	31-40
Level 5	41-50
Level 6	51-60

The variables from M1 to M13 (Description given in Table II) have been used to calculate the points for each participant hence giving the status of Media Literacy for each participant.

TABLE II. DESCRIPTION OF VARIABLES FOR DATA SET

#	Attribute Name	Description
1	School	Name of the Participating Schools
2	Year	Year of
3	Gender	Female/Male
4	Age	Age of the Participants
5	Tertiary Institute	Preferred institution for Tertiary education
6	Location	Rural/Urban
7	Country	Country of Survey
8	Field of Study	Arts/Science
9	Confidence	How confident the students are in using computers
10	Smartphones	Using smartphones for activities like communication, research and assignments
11	Basic Phone	Using Basic Phone for activities like communication, research and assignments
12	Desktop	Using Desktop Computers for activities like communication, research and assignments
13	Laptop	Using Laptops for activities like communication, research and assignments
14	Tablets	Using Tablets for activities like communication, research and assignments
15	Technologies Used	Which of the technologies used by the students – YouTube, dropbox, Facebook, Twitter
16	DL Importance	Is Digital Literacy important?
17	M1	Creating new content word/excel/powerpoint
18	M2	Creating pdf documents
19	M3	Revising existing content
20	M4	Choosing appropriate media
21	M5	Understanding copyright
22	M6	Understanding Intellectual property rights
23	M7	Knowing how to use computers, smartphones, tablets and smart media
24	M8	Navigating through hyperlinks
25	M9	Interpreting media messages
26	M10	Selecting possibilities through online newspapers, cookies, websites and news channels
27	M11	Communicating and presenting using media such as using Blogs and YouTube
28	M12	Using different sources of information and media devices, e.g. Internet and social networks
29	M13	Participating in public through debates, e.g. using social media, emails and online forums
30	LEVEL	Decision variable with six levels.

## V. RESULTS

From simple excel analysis, we know that 1319 records out of 2737 fall below Level 4 of Media Literacy. This means that 61.4 % of the students in Fiji are below level 4 whilst 38.6 % of the students fall in Level 4, level 5 and Level 6. The attributes in the dataset speak about whether a student is media literate or not. From the results gathered, we also want to investigate which attributes in combination of other attributes has a high chance of influencing the prediction. Therefore, we will build three models using this dataset and predict using the model whether a student is media literate or not. More specifically, the model will predict the medial literacy level a student falls into. Random Forest, SVM and Decision Tree classifiers were used to construct three different models.

All models were trained and tested for Media Literacy levels. The dataset was divided into 70% train and 30% test set. Function `traincontrol` was used to specify sampling parameters such as 10-fold cross-validation and Function `train` was used to run all three models.

### A. Random Forest Model

Random Forest generates several trees, and the best tree will be used for prediction. Figure 1 shows the number of randomly selected predictors with accuracy. Accuracy was used to select the optimal model. The model selected for prediction had 36 randomly selected predictors, and the accuracy was 95.6%.

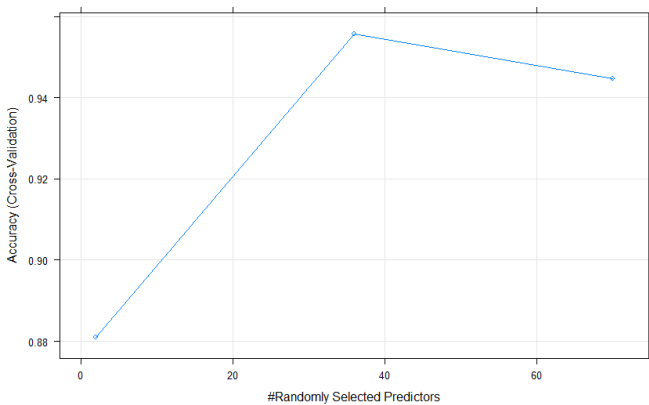


Fig. 1. Number of Randomly Selected Predictors with Accuracy

Table III shows the confusion matrix generated by the model on the test dataset. There were 50 instances of Level 1, and they were correctly classified by the model. Likewise, 106 instances of Level 2 were correctly classified. For Level 3, 240 instances out of 245 were correctly classified by the model, five instances were classified as Level 4. For Level 4, 266 instances out of 271 were correctly classified. There were six instances and one instance that was misclassified for Levels 5 and 6 respectively.

TABLE III. RANDOM FOREST CONFUSION MATRIX

Prediction	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Level 1	50	0	0	0	0	0
Level 2	0	106	0	0	0	0
Level 3	0	7	240	2	0	0
Level 4	0	0	5	266	5	0
Level 5	0	0	0	3	133	1
Level 6	0	0	0	0	1	3

TABLE IV. RANDOM FOREST STATISTICS BY CLASS

	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Sensitivity	0.98	0.93	0.98	0.98	0.95	0.75
Specificity	1	0.998	0.983	0.978	0.994	0.999
Positive Pred Value	1	0.991	0.96	0.957	0.971	0.75
Negative Pred Value	0.999	0.989	0.99	0.99	0.99	0.999

Table IV shows statistics of specificity, sensitivity, positive prediction value and negative prediction value by class. Accuracy is not the only measure used to compare different classifiers. Accuracy takes into account the correct predictions whether it was true positive or false positive. Sensitivity also known as Recall is the fraction of positives predicted correctly while specificity is the fraction of negatives predicted correctly.

The accuracy of the random forest model came to 97.08% and kappa was 0.9545. Kappa measures the observed accuracy with expected accuracy and it ranges from -1 to 1. A value greater than 0 and closer to 1 indicates that the classifier is doing better than expected. In this case, kappa value is closer to 1. We will use kappa to compare other classifiers in this paper.

Positive predictive value is the probability that a student positive at a particular level is truly at that level. Table 4 shows that for Level 1 the positive prediction value is 1 which means that the students predicted as Level 1 are truly at Level 1.

Negative predictive value is the probability that a student negative at a particular level is truly not at that level. From Table 4, probability for students predicted not at Level 1 is 0.999, which means that the students are not truly at Level 1.

### B. Support Vector Machine

Table V shows the confusion matrix generated by the SVM model on the test dataset. There were 50 instances of Level 1, and 48 instances were correctly classified by the model. Likewise, 108 instances out of 113 of Level 2 were correctly classified. For Level 3, 241 instances out of 245 were correctly classified by the model. There was one instance for both levels 5 and 6 that were misclassified.

TABLE V. SVM CONFUSION MATRIX

Prediction	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Level 1	48	2	0	0	0	0
Level 2	2	108	0	0	0	0
Level 3	0	3	241	1	0	0
Level 4	0	0	4	265	0	0
Level 5	0	0	0	5	138	1
Level 6	0	0	0	0	1	3

TABLE VI. SVM STATISTICS BY CLASS

	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Sensitivity	0.96	0.956	0.983	0.978	0.992	0.75
Specificity	0.997	0.997	0.993	0.992	0.991	0.999
Positive Pred Value	0.96	0.982	0.984	0.985	0.958	0.75
Negative Pred Value	0.997	0.993	0.993	0.989	0.999	0.999

Table VI shows the sensitivity, specificity, positive predictive value and negative predictive value for each class. For Level 1, students predicted for Level 1 correctly is 0.96 while students predicted correctly for other levels (not Level 1) is 0.997. The probability that the students predicted for Level 1 are actually at Level 1 is 0.96 while the probability that student predicted and actually at other levels (not Level 1) is 0.997.

The accuracy and kappa for SVM model was 97.69% and 0.9692, respectively.

#### C. Decision Tree

Table VII shows the confusion matrix generated by the Decision Tree model on the test dataset. There were 50 instances of Level 1, and all were misclassified by the model. All instances of Level 2 were also misclassified. For Level 3, 182 instances out of 245 were correctly classified by the model. 170 instances of Level 4 were correctly classified. There were 70 instances for level 5 and 4 t instances for Level 6 that were misclassified.

TABLE VII. DECISION TREE CONFUSION MATRIX

Prediction	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Level 1	0	0	0	0	0	0
Level 2	0	0	0	0	0	0
Level 3	50	109	182	68	11	0
Level 4	0	4	62	170	59	0
Level 5	0	0	1	33	69	4
Level 6	0	0	0	0	1	0

Table VIII shows the Decision Tree statistics for each level. No students were predicted correctly for Levels 1 and 2 while other levels had some correct positive predictions (sensitivity). The negatives predicted correctly, for Level 1 is 1. Positive predictive value is Not a Number (NaN) since no students were predicted for Level 1. The negative predictive value for level 1 is 0.939.

TABLE VIII. DECISION TREE STATISTICS BY CLASS

	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Sensitivity	0	0	0.742	0.627	0.496	0
Specificity	1	1	0.588	0.773	0.944	1
Positive Pred Value	NaN	NaN	0.433	0.576	0.645	NaN
Negative Pred Value	0.939	0.863	0.843	0.808	0.902	0.995

The accuracy and kappa for Decision Tree model was 51.22% and 0.3104, respectively.

#### D. Comparison

TABLE IX. COMPARISON OF CLASSIFIERS

Classifier	Accuracy	Kappa	AUC
SVM	97.69	0.9692	0.987
Random Forest	97.08	0.9545	0.9859
Decision Tree	51.22	0.3104	0.8307

Table IX shows accuracy, kappa and Area Under the Curve (AUC) for three classifiers used in this paper. SVM is the best classifier in this case. Decision Tree has the lowest accuracy, kappa and AUC.

#### E. Feature Ranking

Table X shows the top predictor variables that are considered by the model important in prediction. From Table 2, attributes 1-16 has been ranked as either 0 or between 0 to 4. It can be seen that "interpreting media messages" leads the ranking and is considered as the utmost attribute for prediction followed by M12 which is "Using different sources of information and media devices, e.g. Internet and social networks".

TABLE X. FEATURE RANKING

Attributes	%
M9	100
M12	69.6
M10	58.8
M6	58.3
M3	57.7
M4	55.2
M8	53.7
M11	53.6
M13	51.8
M5	49.8
M1	36.3
M7	29.2
M2	16.4
Age	10.3

## VI. CONCLUSION

The need for Media Literacy education is becoming an utmost important concept for the students in Fiji. It is because the students need to have a better understanding of the different sources of information, the ethics surrounding digital media content, and interpreting the various forms of media messages. This study shows that Media Literacy skills amongst secondary school students in Fiji are limited and missing.

While almost all of the 2737 participants of this survey have some knowledge about Media Literacy, the results show that 61.4% of the participants can be classified as individuals having low to very low levels of Media Literacy (Level 1 to Level 3). It means that the students lack the necessary Media Literacy skills and are vulnerable to face issues while participating in digital media environment today. The results also show that the two most important attributes that decide on the Media Literacy status of a participant are M9 and M12, which represent interpreting media messages and the latter using different sources of information and media devices. These two attributes were also seen to be the most important when predicting Media Literacy for a sample of the general population.

Today, the students are avid consumers of digital information, and their Media Literacy needs to be improved so that they become informed and responsible media literate citizens. Hence, there is a need for Media Literacy curriculum to be developed at individual, school and university levels to narrow the digital gap that is existing in Fiji. To support this inclusion of Media Literacy content into education, proper training should be developed and provided to the facilitators of Media Literacy, and more awareness programs about Media Literacy education should be carried out by relevant stakeholders. For Fiji, to have a society where the people can articulate problems, understand and explain situations and share information ethically, Media Literacy and media education is the way forward.

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