

# An analysis of Big Blue Button remote teaching tool in an Information Systems undergraduate course

*Research-in-Progress*

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## **Abstract**

*Big Blue Button (BBB) as an online learning tool used by higher education institutes to deliver remote teaching, where students can connect with their lecturers via virtual learning environment. During the COVID-19 pandemic, the BBB tool was intensely utilized by HEI in South Pacific for remote teaching. BBB enables online live sessions, which enables the lecturers to hold classes and students to actively participate. The paper analyses student BBB session log data to quantify the effectiveness of using BBB remote teaching tool in online and face-to-face course, where BBB sessions and study mode were predictors of student performance in an Information Systems course. Various statistical analysis such as normality test, correlation analysis and multiple linear regression on a sample of 192 student interaction and performance data. The analysis shows both BBB sessions and study mode have statistical significant effect on students' final marks. The study proposes a multiple linear regression model using two measurements to predict the final mark of students. In future work, similar research is recommended in other disciplines with other human centered variables that could mediate BBB teaching tools effect on student performance. Lastly another future research direction is exploring academics perceptions and attitudes towards using BBB as remote teaching tool in Higher Education.*

**Keywords:** Big Blue Button (BBB), student performance, Higher Education

## Introduction

COVID-19 is a global pandemic that is putting all the sectors of an economy into crisis (MacIntyre, 2020). According to the World Health Organization (WHO), around 600 million university and school children across the globe have been hindered due to sudden closure of schools and universities (Kapasia, et al. 2020). Many countries around the world have taken unprecedented measures such as Country Shutdowns, Lockdowns, Curfews, Travel Restrictions and Social Distancing.

Higher Education Institutes (HEI) particularly have embraced technologies around the world and through continuous research in distance learning has brought about change in delivery mode of courses using Learning Management Systems (LMS) such as Moodle (Sharma, Nand, Naseem, & Reddy, 2019; Owens, Hardcastle, & Richardson, 2009). The HEIs in South Pacific show a similar trend with shoestring budgets, therefore preliminary studies on such technologies is essential in guiding successful adoption and uptake of technology driven solutions.

The study is motivated by the potential usefulness of this new technology in higher education and it sets to provide baseline data and results to researchers, academics and HEIs for further research directions. The study aimed to find out whether the use of BBB online tool has any correlated effect on student performance in an undergraduate Information Systems course. Additionally, the importance of this research study is to enable The University of the South Pacific (USP) to conduct evaluations and effectiveness of its remote learning tool on student performance.

Following research question guides this study:

RQ: What is the effect of number of times a student uses BBB as remote teaching tool and his/her final marks?

## Background

With the advancement of technologies, HEI in South Pacific have contributed to technology enabled learning in areas of online peer assessment (Kumar et al. 2019; Kumar et al. 2020) and mobile based assessments (Kumar et al. 2020).

BBB and Zoom are web conferencing virtual learning tools that are used by universities worldwide to enhance technology enabled distance learning during this global crisis. BBB is an open source online learning tool that allows for better communication between the student and the lecturers (Galindo-Gonzalez, 2020). Studies on eLearning platforms have confirmed that online presence has a significant influence on students' performance (Dixson, 2010; Moore, 2014; Vaughan, 2014; Yang et al. 2016; Mwalumbwe & Mtebe, 2017; Baragash & Hosam, 2018). Researchers have revealed that use of BBB in eLearning shows that students are more engaged in online lectures through the use of BBB features such as desktop sharing, breakout rooms and other interactive tools (Čižmešija & Bubaš, 2020). The paper also highlighted that BBB served as an emergency remote teaching tool which was quick and reliable for temporary change in the learning environment. Furthermore, a regression analysis indicated that there was a strong association between its predictors that was between usability, system quality, information quality, service quality, cognitive involvement and design appeal of BBB as its  $R^2 = 0.759$  (Čižmešija & Bubaš, 2020). Moreover, researchers also highlighted the importance and positive impact of BBB in the University of Zagreb. The major benefit of BBB is its integration with Moodle LMS is already available for use (Čižmešija & Bubaš, 2020). The findings of the study by (Čižmešija & Bubaš, 2020) is relevant to this research study as their analysis was based on the features and graphics of BBB and its effectiveness in learning and teaching. Therefore, with high usage of BBB through LMS Moodle platform during COVID-19 pandemic by universities has created research opportunities on various research dimensions. One of it is BBB usage effect on student performance.

## Methodology

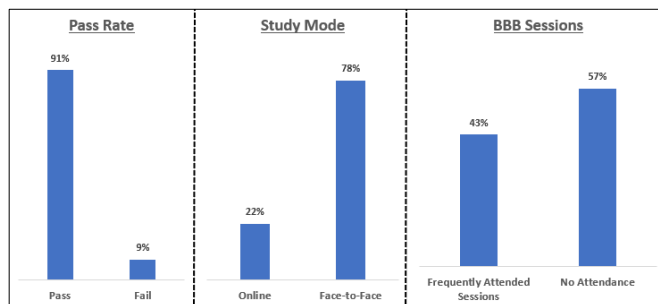
The study followed the positivist paradigm, as the phenomenon under study required statistical knowledge through cause and effect approach (Creswell, 2009) to find out the effect of BBB tool on student performance during time of COVID-19 pandemic at USP. The research study utilizes quasi-experimental method to investigate the correlation between BBB remote teaching tool and student performance.

## Background

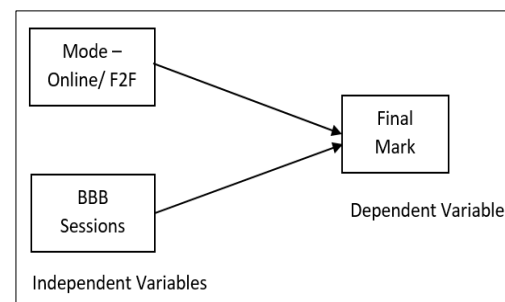
USP is a regional multi-campus higher education institution operating since 1968 and collectively owned by 12 member countries – Fiji Islands, Samoa, Tonga, Vanuatu, Cook Islands, Kiribati, Marshall Islands, Nauru, Niue, Solomon Islands, Tokelau and Tuvalu. Each member country houses at least one campus and main headquarters in Fiji has three campuses. The main Laucala campus is located in Suva with the highest number of students and is the central hub of the university comprising of university's administrative, academic and commercial operations. The teaching staff coordinates most of the courses and programs in face-to-face, online and blended modes through the LMS – Moodle, Turnitin and Mahara e-portfolio system (Kumar et al. 2019; Kumar et al. 2020). Virtual support to students are provided using BBB and Zoom remote teaching tools.

## Settings

The Information Systems course titled Project Management (IS333) chosen for the purpose of this study, is a semester based year 3-degree level course offered in face-to-face at main campus and online mode at all the campuses of the university. The course focuses on building the foundation knowledge necessary to efficiently manage projects in professional organizations. IS333 comprises of an array of formative assessments comprising of tutorials, assignments and tests, final exam as summative assessment towards the end of semester. All assignments and tutorials are submitted online through the LMS-Moodle drop box with Turnitin enabled.



**Figure 1 – Demographic distribution by pass rate, study mode and BBB sessions**



**Figure 2 – Conceptual Research Model**

## Participants

Due to COVID-19 pandemic, the University had to deliver second half of its semester one in 2020 virtually as most countries in South Pacific including Fiji went into a lockdown. The participants comprised of online and face-to-face mode students from first half of semester, where the face-to-face mode students had to finish the course by joining online mode students.

The demographics of 195 students is provided in Figure 1, the distribution is by pass rate, study mode and BBB session attendance. Three students dropped out of the course towards the end of semester. Majority of the students passed the course with 91% (175/192) pass rate. A dominant 78% (152/195) of the students were from face-to-face mode, followed by 22% (43/195) from online mode. It is also

noted that 43% (83/195) of the students were frequent participants in BBB sessions conducted by course lecturers and tutors compared to 57% (112/195) had no attendance in BBB sessions.

### **Variables**

Researchers have selected various sets of variables in measuring online presence on different sets of e-learning technologies. A study by (Mwalumbwe & Mtebe, 2017) used student performance based on LMS student interaction logs, the model showed that online exercises completed and forum posts were two important variables to impact student performance. Furthermore, researchers also noted that number of topics visited and time spent on LMS are also impacting variables to measure student performance (Delialioglu & Yildirim, 2007). Since BBB has recently emerged as remote teaching tool, therefore, adapting number of visits to live and recorded sessions deemed important variable to measure impact of BBB tool on students' performance and applicable for this study (See Figure 2).

### **Data Collection and analysis**

After the ethics approval from the university's ethics committee for the use of student data, the quantitative Moodle log data for BBB sessions were extracted as a comma separated file (CSV) for analysis. The participants were made aware through Moodle course announcement that their learning data through BBB logs would be kept confidential and will be analyzed as a group for publication purpose.

**Table 1. Shows data for BBB sessions and student marks**

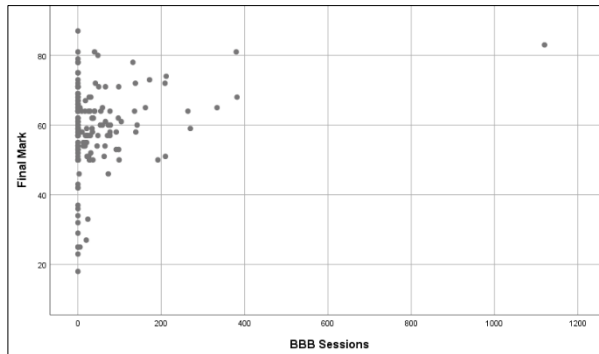
	Study Mode	BBB Sessions	Final Mark
P1	0	0	23
P2	0	36	50
P3	0	21	57
...	...	...	...
P194	1	46	54
P195	1	0	51

The LMS administrator extracted the Moodle interaction logs of all students in SQL format, due to chaotic nature of log data, data cleaning and data reduction was performed using Microsoft Excel built-in functions to limit the data just to BBB interaction. For the purpose of this study the BBB sessions interaction data comprised of live sessions and recorded sessions. Live sessions are when students are virtually live when the lecturer is presenting whereas recorded sessions are when students view the recorded sessions later for their reference. Table 1 shows the data format, variable study mode represents online mode as 0 and 1 represents face-to-face mode. BBB sessions represents combined live and recorded session student interactions and final mark is the student's final mark after completing all required assessments of the course. Due to COVID-19 restrictions, there was no final exam in this course, instead students were required to complete supplementary assignments and submit online via Moodle drop box with Turnitin enabled.

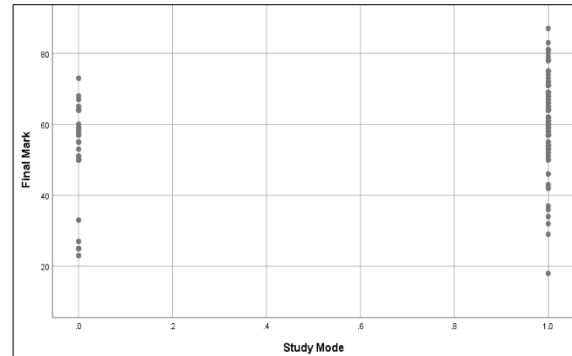
### **Results**

The following data analytics steps were followed to analyze the dataset: Step 1: Data cleaning, Step 2: Normality test, Step 3: Data Visualization using Scatter Plot, Step 4: Correlation analysis, Step 5: Hypothesis testing, Step 6: Designing a Prediction model.

In Step 1, the data were cleaned using Microsoft Excel functions and unwanted data were simply deleted, Table 1 shows the final format of the data used for analysis using IBM SPSS-25. Step 2 involved normality test conducting using Kolmogorov-Smirnov and Shapiro-Wilk tests, the results shown in Table 2 indicates that data were not normally distributed ( $p = 0.000 < 0.05$ ). Furthermore, in step 3, data were represented using scatter plots as shown in Figure 3 between BBB sessions and final marks, where the large cluster of students got above average marks without participating in live sessions and viewing any of the BBB recordings. However, it can also be noted students who did not pass the course without participating in live sessions and not viewing any of the BBB recordings also got final marks below average. Figure 4, shows the scatterplot for study mode and final marks, it can be seen that less online students failed the course compared to students from face-to-face mode who had to join online mode due COVID-19 pandemic.



**Figure 3. Scatterplot for BBB sessions and Final Mark**



**Figure 4. Scatterplot for Study mode and Final marks**

**Table 2. Descriptive analysis and Test for Normality**

	Mean (SD)	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Study Mode	0.79 (0.407)	0.487	192	0.000	0.499	192	0.000
BBB Sessions	38.53 (102.447)	0.353	192	0.000	0.389	192	0.000
Final Mark	59.75 (11.661)	0.115	192	0.000	0.939	192	0.000

**Table 3. Correlation analysis between variables**

			Final Mark	BBB Sessions	Study Mode
Spearman's rho	Final Mark	Correlation Coefficient	1.000	<b>.022</b>	<b>.285**</b>
		Sig. (2-tailed)	.	.047	.000
		N	192	192	192
	BBB Sessions	Correlation Coefficient	<b>.022</b>	1.000	<b>-.342**</b>
		Sig. (2-tailed)	.047	.	.000
		N	192	192	192
	Study Mode	Correlation Coefficient	<b>.285**</b>	<b>-.342**</b>	1.000

		Sig. (2-tailed)	.000	.000	.
		N	192	192	195

**Table 4. Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the estimates
1	0.378 <sup>a</sup>	0.143	0.133	10.855

**Table 5. ANOVA**

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	3702.937	2	1851.469	15.712	0.000 <sup>b</sup>
	Residual	22271.063	189	117.836		
	Total	25974.000	191			

Furthermore, in Step 4, the associations between the BBB sessions and Final marks, and the Study mode and Final marks were investigated using Spearman's ranked correlation test. There is a moderate correlation between BBB sessions and final mark, study mode and final mark with a correlation coefficient of 0.022 and 0.285 respectively shown in Table 3. However, there is a negative correlation coefficient of 0.342 between BBB sessions Study Mode, the inference can be made is when there is increase in BBB sessions then Study Mode decreases and vice versa. A hypothesis was designed in Step 5 to determine if the associations identified in Step 4 were significant. The null hypothesis ( $H_0$ ) was that there is no significant association between BBB sessions and final marks and between study mode and final marks respectively. The null hypothesis was rejected (i.e.  $p = .000 < .05$ ), thus, concluding that there is significant association between the proposed two variables and final marks

**Table 6. Multiple Linear Regression**

Model		Unstandardized Coefficients		Standardized coefficients Beta	<i>t</i>	Sig.
		<i>B</i>	Std. Error			
1	(Constant)	51.585	1.765		29.231	0.000
	BBB Sessions	0.027	0.008	0.233	3.448	0.001
	Study Mode	9.024	1.934	0.315	4.665	0.000

Lastly, in Step 6, a Multiple Linear Regression (MLR) was utilized to find a model that could be used to predict the final mark of students during unprecedented cases like COVID-19 pandemic and also predict a causal relationship between the two factors (BBB sessions and study mode) and final mark. The MLR modeling showed an adjusted  $R^2 = 0.143$ , which meant that 14.3% of the variation in the final mark of Information System course students could be explained by the two predictors of the study as shown in Table 4. Table 5, provides ANOVA which indicates a significant effect of the two predictors on the final mark at  $p$ -value =  $0.000 < 0.05$ . The regression provided in Table 6 outlines a summary of predictive factors in terms of coefficients, *B*, and for each variable in the regression analysis. The results generated from the analysis of both variables, BBB sessions and study mode have shown to have a

significant positive effect on student performance at  $p = .000 < 0.05$  with study mode being the stronger predictor amongst the two predictors. A formula was generated to predict the results based on the correlation between the independent variables (*BBB sessions*, *Study Mode*) and the dependent variable (*Final Mark*):

$$Y = 51.585 + 0.027 (\text{BBB sessions}) + 9.024 (\text{StudyMode})$$

The model indicates that for every additional unit in study mode, we can expect final marks to increase by an average of 9.024, if the BBB sessions is kept constant. Similarly, for every additional number of BBB sessions attended, we can expect final marks to increase by an average of 0.027 if study mode is kept constant. It can be noticed from the model that if a student has both the BBB sessions and study mode equal to zero then his/her final marks can be at most 51.585%. The constant in the regression model is from the fact that if a student just completed all required assessment during COVID-19 pandemic for Information systems course, there is likely chance of passing the course with minimum grade.

## Discussion

The purpose of this study was to investigate the effect of using BBB remote teaching tool in an Information Systems undergraduate course during COVID-19 pandemic restrictions on student performance. BBB tool played a pivotal role and served as best remote teaching tool for most universities around the world to conduct distance learning classes more effectively. We proposed two variables: BBB sessions and study mode as predictors of student performance using correlation analysis. One of the variables selected in this study (BBB sessions) were amongst the most frequent examined factors of student performance in other e-learning platforms (Mwalumbwe & Mtebe, 2017).

*Research Question:* What is the effect of number of times a student uses BBB as remote teaching tool and his/her final marks?

The overall study used the COVID-19 pandemic student logs and performance dataset of IS333 course to analyze the use of BBB as remote teaching tool in the second half of the semester due to COVID-19 pandemic restrictions placed by various South Pacific countries. This posed a direct effect to USP, since USP is made up of twelve member countries and all fourteen campuses were also affected.

Moreover, the IS333 course had a pass rate of 91% (164/192), indicating most students had actually passed course while 9% (28/192) students had actually failed the course. However, as mentioned earlier, three student's data were null, indicating they had dropped out of the course. A further analysis was conducted using ANOVA to test the regression between two predictors BBB sessions and study mode on student performance. The dependent variable was the final mark while BBB sessions and study mode were the two independent predictors. With reference to the results generated, it depicts that there is significant positive effect on student performance through BBB sessions. However, it can also be noted, since the unit was also offered in online mode, thus face to face students found it easy to adapt to online mode of study. The analysis and results have also revealed that, BBB is a very effective way to conduct the virtual classes during such foreseen circumstances as students were forced to adapt to this change in order to conduct remote teaching effectively. There is no doubt that BBB was indeed helpful during unprecedented circumstances and our results are in line with findings of (Čižmešija & Bubaš, 2020).

## Conclusion

Finally, the results show that even though students and lecturers were forced to adapt to remote learning, it had proven to be more effective and positive on student performance for the purpose of this study. Additionally, the paper discussed the design of a predictive model using MLR which provided the analysis of using BBB remote teaching tool during COVID-19 restrictions. The two predictors BBB sessions and study mode showed significant effect on student performance, but it should be noted that

there could be other human centered variables that could mediate an effect on student performance. The findings also provide preliminary results of using BBB as remote teaching tool during times of COVID-19 crisis and its benefit towards USP as a whole. BBB has improved the performance of some students and also provided overview of easy adaptation of students from face-to-face mode to online mode. This study is limited to year 3 undergraduate Information systems course and there is room for future research in other disciplines exploring other mediating factors that could affect student performance. Moreover, the academics perceptions and attitudes towards using BBB as remote teaching tool can also be explored as a study on its own.

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