

### **Evaluation of Developed Macro-enabled Spreadsheets and ZipGrade in Automating Paperwork of Teachers**

**RONNIE C. GONZALES, MAT,** 

Teacher III Southville 8b National High School, District of Rodriguez Division Of Rizal, Region 4-A Calabarzon Email: ronnie.gonzales001@deped.gov.ph

*Abstract* — This paper aimed to evaluate the developed macro-enabled spreadsheets and ZipGrade in automating paperwork of teachers in Southville 8B National High School in the School Year 2022-2023. ZipGrade is a paid application that could be used in the administration of formative and summative test. The shaded answer sheets of the students could be checked by scanning them using camera of smart phones. The generated results of the test in ZipGrade have compatibility with Microsoft Excel. The macro-enabled spreadsheets were developed using VBA, the programming language of Microsoft Excel. These electronic templates can generate and print the needed data in analysis of test and report cards. The result showed that the two groups of respondents, teachers with 6 years and below tenure and teachers with above 6 years tenure, evaluated the developed Macro-enabled spreadsheets and ZipGrade and strongly agree in terms of usability, maintainability, compatibility, format, accuracy, and productivity. There was also no significant difference between the evaluations of the two groups of respondents which implied that the developed Macro-enabled spreadsheets and ZipGrade were accepted by the two groups of respondents and could be used for the automation of paperwork of teachers.

#### I. Introduction

Paperwork presents a constant challenge for teachers. When numerous paperwork must be completed on time, the procedure might become an overwhelming process. However, the manual method or procedure for completing them is what adds to teachers' burden regarding paperwork. This approach has been in use for a while, but both teachers and students find it unreliable due to a variety of drawbacks. Teachers expend a great deal of time and energy, for instance, while documenting every student's performance. Because it is entirely paper-based, records can also occasionally get lost. Sometimes teachers find it tedious to manually record information, so they assign part of the work to the pupils (Boachie, 2016).

Technology advancements have a significant impact on many facets of human life in the age of globalization (Resuello, 2017). A basis for enhancing learning and teaching environments through the application of new technologies is provided by the quick development of wireless communications technology and electronics. Reducing paperwork burdens and allocating more time for enhancing instruction quality are significant factors from the standpoint of educators.



Automated electronic processing of test results is not a new concept. Standardized tests administered by the government in public and private schools, like The National Career Assessment Exam (NCAE), are utilizing it. There are also available applications or programs that could automate the administration of quarterly exams and harvesting of test results. The application Zipgrade for example is effective in the analysis of learning outcomes assessment according to several research.

The Department of Education provided teachers with Microsoft 365 accounts. Microsoft Office Software such as Microsoft Excel could be downloaded and used for free. This application is a powerful tool in developing electronic templates. By applying Visual Basics for Application (VBA), a programming language that runs in Excel, the data needed in test analysis and preparing report cards could be one click away.

Accomplishing the mentioned paperwork is part of the teacher's work inside the school aside from planning daily lessons, preparing instructional materials, and engaging with the learners. As part of the responsibilities of teachers, to be able to finish these workloads with less time and effort could enable them to be more efficient and effective in their workplace.

Teachers now require software or tools to facilitate their tasks and encourage greater efficiency, as the necessity for paperwork automation has risen. In this case, the proponent of this study initiated project APPLE (Automated Paperwork for Productive Learning Environment). Development of electronic templates using VBA (Visual Basic for Applications) in Microsoft Excel made test analysis, School Form 9 and School Form 10 easier to accomplish. Additionally, trainings and Learning Action Cells introduced ZipGrade, which totally automated the administration of formative and summative assessments. The teachers in Southville 8B National High School evaluated these instruments for completing paperwork.

#### **Literature Review**

In the study about the effectiveness of automation in evaluating test results of Cuerdo et. al. (2021), almost all public schools under the Department of Education still engage in manual processing of test results. The slow integration of automation can be attributed to several factors, including the elevated cost of purchase, servicing, and support.

Exams with automated scoring can be administered using a number of internet-based systems, but there are good reasons to stick with printed answer sheets in the meantime. One explanation is the availability of devices and an internet connection during the test. A less expensive option is to employ digital cameras and scanners equipped with image processing software (Catalan, 2017).

ZipGrade is one of the first innovations that uses a camera as a scanner and printed answer sheets. According to Estarez(2023), teachers' experiences with Zipgrade revealed that it is a very useful tool for analysing and grading students' tasks and exams. The application received positive



feedback from the respondents, who strongly recommended that teachers use it as a convenient way of evaluating student learning outcomes.

The use of ZipGrade requires very little training. It is efficient as a tool for improving student assessment outcomes. It is not necessary for teachers to bring the student's answer sheet at home. When students finish answering all the questions, the teacher can correct them when the students leave the class or test site (Suhendar et. al. 2020).

An automated test item analysis system with optical mark recognition was also developed in the research conducted by Silao and Luciano (2021). It is true that teachers are using an Item Analysis System that still needs the manual input of students' test scores. This is a tedious task that gives teachers additional burden which could be improved using the automation.

It is not impossible for teachers to automate paperwork that includes computation and printing of reports. Through Microsoft Excel-based VBA (Visual Basic for Application), report cards and test analysis reports can be accomplished using developed electronic templates. In the study conducted by Ruqoyyah and Wijaya (2020), VBA or the programming language of Microsoft Offices has positive effect when use in education.

Boachi (2016) in his study "The Effectiveness of Microsoft Excel to Improve Students Continuous Assessment in Secondary Schools in Ghana" examined how effectively Microsoft Excel has specifically been used in keeping records. It is suggested that teachers must further use computerized system of keeping students records through Microsoft Excel. This system advances the ability to store, retrieve, and analyze student's performance. It has wide useful functions that could be utilized to help teachers on their paperwork and lessen their workloads to focus more on improving the quality of their teaching.

Therefore, the goal of this study is to enable teachers in the Department of Education to maximize the potential of automation to lessen their burden in doing paperwork and improve the time they spend at work and at home.

#### **Research Questions**

The general problem of this study was to evaluate the developed macro-enabled spreadsheets and ZipGrade in automating paperwork of teachers in Southville 8B National High School in the School Year 2022-2023.

Specifically, it sought answers to the following questions:

1. What paperwork of teachers were automated using the developed macro-enabled spreadsheets and ZipGrade based on Project APPLE (Automated Paperwork for Productive Learning Environment) of Southville 8B National High School in the School Year 2022 – 2023?

2. What was the evaluation of the teachers with 6 years and below tenure and teachers with above 6 years tenure in Southville 8B National High School on the developed Macro-enabled spreadsheets in terms of the following aspects?

a. Usability

- b. Maintainability
- c. Compatibility
- d. Format
- e. Accuracy; and
- f. Productivity

3. What was the evaluation of the teachers with 6 years and below tenure and teachers with above 6 years tenure in Southville 8B National High School on Zipgrade in terms of the following aspects?

- a. Usability
- b. Maintainability
- c. Compatibility
- d. Format
- e. Accuracy; and
- f. Productivity

4. Was there a significant difference between the evaluations of the two groups of respondents on the developed macro-enabled spreadsheets in terms of Usability, Maintainability, Compatibility, Format, Accuracy, and Productivity?

5. Was there a significant difference between the evaluations of the two groups of respondents on ZipGrade in terms of Usability, Maintainability, Compatibility, Format, Accuracy, and Productivity?

6. Did the developed macro-enabled spreadsheets and ZipGrade helped teachers ease their burden in doing paperwork?

7. What comments and suggestions were offered by the two groups of respondents in the improvement of using the developed macro-enabled spreadsheets and ZipGrade?he



#### II. Methodology

The research applied Quantitative Research Methods wherein numerical data was taken from the result of the survey questionnaire that was tabulated and analyzed. The following are the statistical treatments that were used in the study:

**Weighted Mean**. This was used to determine the respondents' evaluation of the developed macro-enabled spreadsheets and ZipGrade in terms of Usability, Maintainability, Compatibility, Format, Accuracy, and Productivity.

**Independent-Samples t Test**. It was used to determine whether or not there is a significant difference between the two groups' evaluations.

#### Samples and Sampling Technique

The developed macro-enabled spreadsheets and ZipGrade were evaluated by fifty (50) teachers in Southville 8B National High School. Stratified random sampling was used to select twenty-five (25) teachers with 6 years and below tenure in the current school and another twenty-five (25) teachers with above 6 years tenure in the current school.

#### **Research Instruments**

The main instrument in the study was the survey questionnaire validated by the subject leaders and grade level coordinators of Southville 8B National High School. With the approval of the principal, it was administered to the teachers in the same school.

#### **III. Results and Discussion**

ZipGrade is a paid application that could be used in the administration of formative and summative test. The shaded answer sheets of the students could be checked by scanning them using the camera of a smart phone. The generated results of the test in ZipGrade have compatibility with Microsoft Excel.

The macro-enabled spreadsheets were developed using VBA, the programming language of Microsoft Excel. These electronic templates can generate and print the needed data in analysis of test and report cards.

### Table 1. Implementation Plan of Project APPLE (Automated Paperwork for ProductiveLearning Environment) for the School Year 2022 – 2023

PROJECT     OUTPUTFOR       OBJECTIVE     THE YEAR       ACTIVITIES     RESPONSIBLE       SCHEDULE/VENUE
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To automate the	1. Developed electronic	1. LAC	Project Team	September 2022 to
administration	templates in accomplishing	sessions for	And Teachers	February 2023
of test and	paperwork of teachers (SF9,	every		(Conference Room/
accomplishment	SF10, Mean Profile, Item	Department		Covered Court)
of test analysis,	Analysis, and Least Mastered	about		
School Form 9,	Skills)	Zipgrade		
and School	2. Paid subscription of	2. Workshop		
Form 10 by	teachers to an application for	in the INSET		
training 75% of	automated harvesting of test	on using the		
teachers in	result (Zipgrade)	developed		
using developed	3. Conducted training of	electronic		
electronic	teachers through LAC	templates		
templates and	Sessions or INSETS	3. Evaluation		
provided	4. Consolidated Feedback of	of teachers in		
programs.	teachers for improvement of	using the		
	the program.	developed		
		electronic		
		templates and		
		Zipgrade		

Based on the implementation plan of project APPLE of Southville 8B National High School in the School Year 2022 - 2023, the selected paperwork to be automated were the administration of test and accomplishment of test analysis, School Form 9 and School Form 10.

### Table 2. Respondents' Evaluations on the Developed Macro-enabled Spreadsheets as to Usability

	Respondents				
Indicators		6 years and below tenure		Above 6 years tenure	
		VI	WM	VI	
1. The spreadsheets are easy to access/download.	4.84	SA	4.80	SA	
2. The spreadsheets' interface is user-friendly.	4.84	SA	4.96	SA	
3. The spreadsheets run smoothly.	4.80	SA	4.84	SA	
Overall Weighted Mean	4.83	SA	4.87	SA	
Standard Deviation	0.02		0.08		
Note: WM – Weighted Mean VI – Verbal Interpretation S.	A – Stron	gly Ag	ree		

## Table 3. Respondents' Evaluations on the Developed Macro-enabled Spreadsheets as to Maintainability

	Respondents
Indicators	6 years and Above 6 below tenure years tenure



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	WM	VI	WM	VI
1. The spreadsheets are protected with accidental encodes.	4.80	SA	4.84	SA
2. The spreadsheets automatically correct erroneous encodes.	4.60	SA	4.72	SA
3. The spreadsheets are protected through passwords.	4.80	SA	4.80	SA
Overall Weighted Mean	4.73	SA	4.79	SA
Standard Deviation	0.12		0.06	
Note: WM – Weighted Mean VI – Verbal Interpretation	SA – Stron	gly Ag	ree	

### Table 4. Respondents' Evaluations on the Developed Macro-enabled Spreadsheets as to Compatibility

Indicators		Respondents				
		6 years and Ab below tenure yea				
	WM	VI	WM	VI		
1. The spreadsheets are compatible to most of the existing operating system (Windows).	4.72	SA	4.84	SA		
2. The spreadsheets are compatible to Microsoft Office Excel with VBA (2010 and above).	4.80	SA	4.80	SA		
3. The spreadsheets are transferrable to other computers.	4.80	SA	4.88	SA		
Overall Weighted Mean	4.77	SA	4.84	SA		
Standard Deviation	0.05		0.04			

Note: WM – Weighted Mean VI – Verbal Interpretation SA – Strongly Agree

### Table 5. Respondents' Evaluations on the Developed Macro-enabled Spreadsheets as to Format

Indicators		Respondents				
		and nure	Above 6 years tenure			
	WM	VI	WM	VI		
1. The spreadsheets followed format standard to the needed reports.	4.84	SA	4.80	SA		
2. The spreadsheets' format is protected to unwanted changes.	4.72	SA	4.88	SA		
3. The spreadsheets' format is not affected when hiding or unhiding cells.	4.80	SA	4.84	SA		
Overall Weighted Mean	4.79	SA	4.84	SA		
Standard Deviation	0.06		0.04			

Note: WM – Weighted Mean VI – Verbal Interpretation SA – Strongly Agree

# Table 6. Respondents' Evaluations on the Developed Macro-enabled Spreadsheets as to Accuracy

	Respondents		
Indicators	6 years and	Above 6	
	below tenure	years tenure	
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	V	WM	VI	WM	VI
1. The spreadsheets provide accurate computation.	4	1.80	SA	4.80	SA
2. The formula is secured and protected with any user manipulation.		1.76	SA	4.88	SA
3. The spreadsheets have command buttons for easy computation.	4	1.84	SA	4.84	SA
Overall Weighted Mean	4	1.80	SA	4.84	SA
Standard Deviation	C	0.04		0.02	
Note: WM – Weighted Mean VI – Verbal Interpretation	SA-S	Strong	gly Ag	ree	

### Table 7. Respondents' Evaluations on the Developed Macro-enabled Spreadsheets as to Productivity

Indicators		Respondents			
		6 years and		6	
		below tenure		years tenure	
	WM	VI	WM	VI	
1. The spreadsheets are easy to print.	4.84	SA	4.84	SA	
2. The spreadsheets can be manipulated on printer's setting.	4.80	SA	4.84	SA	
3. The spreadsheets have dropdown buttons to easily change the specific data that needs to be printed.	4.84	SA	4.92	SA	
Overall Weighted Mean	4.83	SA	4.87	SA	
Standard Deviation	0.02		0.05		

Note: WM – Weighted Mean VI – Verbal Interpretation SA – Strongly Agree

### Table 8. Summary of Respondents' Evaluations on the Developed Macro-enabledSpreadsheets

	Respondents					
Criteria	6 years and below tenure		Above 6 years	s tenure		
	OWM	VI	OWM	VI		
Usability	4.83	SA	4.91	SA		
Maintainability	4.73	SA	4.79	SA		
Compatibility	4.77	SA	4.84	SA		
Format	4.79	SA	4.88	SA		
Accuracy	4.80	SA	4.87	SA		
Productivity	4.83	SA	4.87	SA		
Grand Weighted Mean	4.79	SA	4.86	SA		

Note: OWM - Overall Weighted Mean

It is therefore completely evident that the developed Macro-enabled Spreadsheets have aspects that are extensively practiced based on both group of respondents as evidenced by the grand weighted mean of 4.79, and 4.86, respectively.

#### Table 9. Respondents' Evaluations on ZipGrade as to Usability

Indicators	Respondents



	6 years below ter	and and	Above years te	6 enure
	WM	VI	WM	VI
1. ZipGrade can be used in formative and summative test.	4.80	SA	4.88	SA
2. Students fill in ZipGrade's answer sheets easily using pencils, pens, or markers.	4.80	SA	4.92	SA
3. ZipGrade make it easy for teachers to quickly correct student test answers	4.80	SA	4.80	SA
Overall Weighted Mean	4.80	SA	4.87	SA
Standard Deviation	0		0.06	
Note: WM – Weighted Mean VI – Verbal Interpretation SA	- Strong	gly Ag	ree	

#### Table 10. Respondents' Evaluations on ZipGrade as to Maintainability

	Respondents				
Indicators	6 years	and	Above 6		
	WM	VI	WM	VI	
1. ZipGrade is accessible and inexpensive.	4.68	SA	4.68	SA	
2. Zipgrade can be learned quickly.	4.72	SA	4.76	SA	
3. Zipgrade can be learned independently.	4.64	SA	4.64	SA	
Overall Weighted Mean	4.68	SA	4.69	SA	
Standard Deviation	0.04		0.06		
Note: WM – Weighted Mean VI – Verbal Interpretation SA	A – Strong	gly Agı	ree		

#### Table 11. Respondents' Evaluations on ZipGrade as to Compatibility

	Respondents					
Indicators	6 years below te	Above 6 vears tenure				
	WM	VI	WM	VI		
1. ZipGrade is compatible to any smart phones.	4.76	SA	4.84	SA		
2. ZipGrade can provide summarized results in pdf and csv format	4.84	SA	4.84	SA		
3. ZipGrade account can be used or open in other devices.	4.64	SA	4.84	SA		
Overall Weighted Mean	4.75	SA	4.84	SA		
Standard Deviation	0.1		0			
Note: WM – Weighted Mean VI – Verbal Interpretation	SA – Strong	gly Ag	ree			

#### Table 12. Respondents' Evaluations on ZipGrade as to Format

Indicators	Respondents					
	6 years below ter	and nure	Above years te	6 nure		
	WM	VI	WM	VI		



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1. The teacher can create a variety of objectives and exam types (true-false questions, multiple-choice questions, and matching) in ZipGrade.	4.84	SA	4.72	SA
2. Answer sheets can be rendered automatically by ZipGrade.	4.84	SA	4.80	SA
3. The number of test items can be controlled easily.	4.80	SA	4.80	SA
Overall Weighted Mean	4.83	SA	4.77	SA
Standard Deviation	0.02		0.05	
Note: WM – Weighted Mean VI – Verbal Interpretation SA	A – Strong	gly Ag	ree	

#### Table 13. Respondents' Evaluations on ZipGrade as to Accuracy

	Respondents					
Indicators	6 years and below tenure		Above 6 years tenure			
	WM	VI	WM	VI		
1. ZipGrade provides valid assessment of data, and really measures student achievement	4.60	SA	4.64	SA		
2. ZipGrade provides high accuracy for correcting the results of tests anywhere and anytime using a smartphone	4.56	SA	4.72	SA		
3. Zipgrade enables teachers to accelerate the grading process and assessment.	4.76	SA	4.84	SA		
Overall Weighted Mean	4.64	SA	4.73	SA		
Standard Deviation	0.11		0.1			
Note: WM – Weighted Mean VI – Verbal Interpretation SA – Strongly Agree						

### Table 14. Respondents' Evaluations on ZipGrade as to Productivity

	Respondents					
Indicators	6 years below ter	and and	Above 6 vears tenure			
	WM	VI	WM	VI		
1. Answer sheets can be easily personalized and printed.	4.84	SA	4.72	SA		
2. ZipGrade reduces the number of test papers to be printed.	4.84	SA	4.88	SA		
3. ZipGrade reduces the time in printing test materials.	4.80	SA	4.84	SA		
Overall Weighted Mean	4.83	SA	4.81	SA		
Standard Deviation	0.02		0.08			

Note: WM – Weighted Mean VI – Verbal Interpretation SA – Strongly Agree

#### Table 15. Summary of Respondents' Evaluations on ZipGrade

	Respondents				
Criteria	6 years and below tenure		Above 6 years tenure		
	OWM	VI	OWM	VI	



Usability	4.80	SA	4.87	SA
Maintainability	4.68	SA	4.69	SA
Compatibility	4.75	SA	4.84	SA
Format	4.83	SA	4.77	SA
Accuracy	4.64	SA	4.73	SA
Productivity	4.83	SA	4.81	SA
Grand Weighted Mean	4.76	SA	4.79	SA

Note: OWM - Overall Weighted Mean

It is therefore completely evident that using ZipGrade as assessment tool have aspects that are extensively practiced based on both group of respondents as evidenced by the grand weighted mean of 4.76, and 4.79, respectively.

### Table 16. Summary of Test of Difference between the Evaluations of the Two Groups ofRespondents on the Developed Macro-enabled Spreadsheets

Criteria	6 years and below tenure		Above 6 years tenure		t <sub>computed</sub> Decision		Interpretation
	WM	S	WM	S	value		
Usability	4.83	0.02	4.87	0.08	0.80	Fail to Reject the H <sub>o</sub>	Not Significant
Maintainability	4.73	0.12	4.79	0.06	0.71	Fail to Reject the $H_o$	Not Significant
Compatibility	4.77	0.05	4.84	0.04	1.88	Fail to Reject the H <sub>o</sub>	Not Significant
Format	4.79	0.06	4.84	0.04	1.26	Fail to Reject the H <sub>o</sub>	Not Significant
Accuracy	4.80	0.04	4.84	0.02	1.22	Fail to Reject the H <sub>o</sub>	Not Significant
Productivity	4.83	0.02	4.86	0.05	1.34	Fail to Reject the H <sub>o</sub>	Not Significant

Note: Critical t Value = 2.02

It can be found in the table that the computed t values for the usability, maintainability, compatibility, format, accuracy and productivity are less than the critical t value of 2.02, hence, the null hypothesis is "failed to reject." Consequently, the evaluations of the two groups of respondents on the developed Macro-enabled Spreadsheets do not differ significantly.

This implies that the developed Macro-enabled Spreadsheets are accepted by the two groups of respondents. Also, this denotes that the developed spreadsheets can be used for the automation of test analysis and accomplishment of report cards.

### Table 17. Summary of Test of Difference between the Evaluations of the Two Groups ofRespondents on ZipGrade



Criteria	6 yea below te	rs and enure	Above tenure	б years	t <sub>computed</sub>	Decision	Interpretation
	WM	S	WM	S	value		
Usability	4.80	0	4.87	0.06	1.88	Fail to Reject the $H_o$	Not Significant
Maintainability	4.68	0.04	4.69	0.06	0.31	Fail to Reject the H <sub>o</sub>	Not Significant
Compatibility	4.75	0.10	4.84	0	1.6	Fail to Reject the H <sub>o</sub>	Not Significant
Format	4.83	0.02	4.77	0.05	1.78	Fail to Reject the $H_o$	Not Significant
Accuracy	4.64	0.11	4.73	0.10	0.10	Fail to Reject the $H_o$	Not Significant
Productivity	4.83	0.02	4.81	0.08	0.27	Fail to Reject the $H_0$	Not Significant

Note: Critical t Value = 2.02

It can be found in the table that the computed t values for the usability, maintainability, compatibility, format, accuracy and productivity are less than the critical *t* value of 2.02, hence, the null hypothesis is "failed to reject." Consequently, the evaluations of the two groups of respondents on the developed Macro-enabled Spreadsheets do not differ significantly.

This implies that ZipGrade is accepted by the two groups of respondents and can be used for the automation of test.

 Table 18. Automation of Test, Test Analysis, School Form 9 and School Form 10

	Weighted Mean	Verbal Interpretation
Automation eased the teacher's burden in paperwork.	4.71	SA
Automation help the teacher avoids committing errors/mistakes.	4.71	SA
Automation provide fast and presentable output.	4.77	SA
Automation lessen the workloads in preparing forms and reports.	4.79	SA
Automation allows the teachers to be more productive in preparing the lesson, learning materials, having more time for socialization and family matters.	4.75	SA
Gen. WM	4.75	SA

Note: SA - Strongly Agree

The General Weighted Mean of 4.75 with verbal interpretation of Strongly Agree reflected in the Table reveals that automation of test, test analysis, School Form 9 and School Form 10 lessen the teachers' burden in paperwork. It helps the teachers avoid committing errors and mistakes. Outputs are presentable and fast to provide. Automation lessen workloads in preparing forms and reports and more importantly, it allows the teachers to be more productive in preparing the lesson, learning materials, having more time for socialization and family matters.



### Table 19. Summary of Comments Provided by the Two Groups of Respondents on the Automation of Paperwork

#### COMMENTS

- 1. It helps the teacher to make all the task easier.
- 2. it lessens the time needed to do all the paperwork.
- 3. It is highly effective tool in assessing and evaluating students' outputs.
- 4. ZipGrade is really a big help in checking.
- 5. Developed automated spreadsheets are very usable and teacher friendly.
- 6. This project helps the teacher of Southville 8B National High School to work faster, efficient, and less hassle.
- 7. This project eased the teacher's burden in paper works.
- 8. It is a very helpful applications for teachers in minimizing time in checking outputs and examinations.
- 9. It helps us to be efficient and lessen our burden for paper workloads.
- 10. It is a useful, efficient, and teacher-friendly project.

### Table 20. Summary of Suggestions Provided by the Two Groups of Respondents on the Automation of Paperwork

SUGGESTIONS	
1.	Add button for printing the spreadsheets.
2.	Make online video tutorials.
3.	Make an interactive manual.

#### **IV.** Conclusion

The following were concluded in the study.

- 1. The developed Macro-enabled Spreadsheets have given high approval of utilization based on its quality as a result of the respondents' evaluation.
- 2. The application ZipGrade has also high approval of utilization based on its quality as a result of the respondents' evaluation.
- 3. Automation of paperwork increases the efficiency of teachers.

#### V. Recommendations

In view of the findings and conclusion drawn, the researcher recommends the following:

- 1. The developed Macro-enabled spreadsheets may be further validated and evaluated by ICT experts and teachers in other institutions.
- 2. ZipGrade may be introduce to other institutions or schools through Learning Action Cells or In-Service Trainings.
- 3. Future researchers may consider to develop Macro-enabled spreadsheet in automating other paperwork.



4. Future researchers should conduct parallel studies in other educational institutions to validate the findings of this research.

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