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Acceptability of the Developed Spreadsheet-Based Item Analysis Tool

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Abstract — This study aimed to assess the acceptability of the developed spreadsheet-based item analysis tool for teachers in Calbayog 5 District, Department of Education, Schools Division of Calbayog City, Calbayog City, Samar, for the School Year 2024 – 2025 with the end view of proposing a spreadsheet-based item analysis tool. This study employed a descriptive-correlational research design that was performed on 30 alpha and 140 beta testing respondents, identified through stratified sampling. The survey questionnaires underwent reliability testing. The alpha testing questionnaire was composed of three domains – Functionality & Performance, Usability & Interface, and Security & Stability. The beta testing questionnaire was also composed of three domains – User Experience & Usability, Functionality and Performance, and Overall Satisfaction. Each of these domains was composed of 10 items. Results show that post-alpha testing respondents were extremely satisfied with the tool's functionality and performance, usability and interface, and security and stability. Post-beta testing results also show exceptionally high ratings across all domains. This implies that the tool can be widely adopted due to its high quality and user satisfaction. Non-parametric tests show that there are significant improvements in the perceived acceptability of the tool observed between pre- and post-testing phases across all domains. The tool effectively utilized Excel's features, enabling teachers to better understand student test results with reliability and efficiency. The tool's acceptability transcends demographic differences, indicating its potential for widespread adoption. It is recommended to continue to prioritize user interface improvements to ensure the tool remains intuitive and easy to navigate, and regularly assess the design based on user feedback to enhance usability and accessibility.

Keywords — Spreadsheet-based, Item Analysis Tool, Functionality and Performance, Security and Stability, User Experience and Overall Satisfaction

I. Introduction

Assessment is one of the most important gauges for teachers to measure the impact of their teaching. Through effective assessment, educators can evaluate learners' performances, allowing them to deliver constructive feedback and adjust teaching strategies according to the learners' needs. Thus, assessments must be done regularly to ensure quality education (Elgadal & Mariod, 2021). By analyzing the effectiveness of their assessments, teachers may know the areas where the instructional design or assessment tasks might be insufficient. Through this, they can refine their teaching practices and strategies and ensure that assessments are aligned with the learning objectives.

Assessment, specifically, the multiple-choice questions (MCQs), which several researchers have asserted as the most frequently used type of assessment worldwide (McKenna, 2019), needs to be evaluated through item analysis to provide input on the validity and reliability of items (Kumar et al., 2021). Item analysis is very important in recycling test items for later tests, and it also helps to remove misleading items in a test. Although item analysis is important in education, there are several reasons why teachers may not conduct it. Teachers lack the awareness to do item analysis and would only perform it if the supervisors ordered them to do so. Also, the conduct of item analysis is time-consuming and challenging. Thus, the use of computer programs is important. Although there are available software applications for item analysis, they are a bit costly and sometimes require special test paper for scanning. Because the specific software is not readily available or affordable for all teachers, they do not conduct item analysis, and this contributes to the poor quality of test items developed (Muhson et al., 2017).

Due to the critical role of item analysis in educational assessments, there is a need for a user-friendly, affordable, and accessible tool that can facilitate this process. Currently, there is a lack of research on the development and evaluation of spreadsheet-based item analysis tools that cater to the needs of educators and researchers. With this, research and innovation must be done to provide a solution to the existing problem.

In the Philippines, there is a law called Republic Act No. 11293 (2019), also known as the Philippine Innovation Act, that acknowledges innovation as a vital component of national development and sustainable economic growth. The goal of RA 11293 is to create an environment that supports and encourages innovation, driving sustainable economic growth and development in the Philippines. In addition, another act, the Republic Act No. 10533 (2013) or the Enhanced Basic Education Act of 2013, requires the Department of Education to continuously improve the quality of basic education through contextualization and innovation in its strategies, mechanisms, and processes for improved educational outcomes and services.

The Department of Education, Regional Office No. VIII released Regional Memorandum No. 1319 s. 2024 to adopt the innovation management guidelines. These guidelines provided directions on how to manage innovation projects at the regional, division, school, and office levels (DepEd Region VIII, 2024). Aligning with this was the innovation titled "Streamlined Item Analysis Tool," a spreadsheet-based item analysis tool developed by the researcher. Spreadsheets remain incredibly popular for data handling and analysis because they are easy to use and are readily accessible. Even though more sophisticated tools exist, many people still choose spreadsheets for their simplicity. James (2015) and Rahman et al. (2021) emphasize the versatility and ubiquity of spreadsheets across various domains, from business to personal and scientific applications. This widespread use highlights the importance of spreadsheet skills, which extend beyond business applications to include managing diets, scientific experiments, real estate inventory, grades, financial portfolios, and more.

This preference was particularly significant in the context of developing a spreadsheet-based item analysis tool for teachers in the Calbayog City Division. Such a tool leveraged the familiarity and widespread use of spreadsheets to provide an accessible and effective solution for educational assessment. By utilizing a platform that teachers were already comfortable with, the tool enhanced their ability to analyze test items, identify areas for improvement, and ultimately improve the quality of education. This approach ensured that the benefits of advanced data analysis were accessible to educators without the need for extensive training on new software, making it a practical and impactful innovation for the local education system.

To expand the use of the developed spreadsheet-based item tool from school-wide to district-wide, the researcher aims to assess the acceptability of the developed spreadsheet-based item analysis tool for teachers in Calbayog 5 District, Department of Education, Schools Division of Calbayog City, Calbayog City, Samar, for the School Year 2024 – 2025. This research evaluated how the teachers in the Calbayog 5 District, Schools Division of Calbayog City, accepted an improved spreadsheet-based item analysis tool. The goal was to determine if it could be implemented across the district and enhance educational assessment practices.

Literature Review

To address the students' needs in learning, assessment is one of the keys that teachers employ to determine education gaps. According to Forrester (2021), item analysis is the act of analyzing responses to individual test questions or items to make sure that their difficulty level is appropriate. This means that the items distinguish clearly between students of different performance levels. This process involves statistical procedures in determining learners' performance concerning the difficulty, discrimination, and reliability. Spreadsheet-based item analysis controls the functionalities of spreadsheet software to simplify the process.

According to Doctor (2017), examinations are crucial for institutions to evaluate the quality and competitiveness of their students. However, many instructors often prepare their exams at the last minute, leaving little time for review and reflection. This rushed preparation can result in exams that do not effectively address the objectives of the subject matter, thereby impacting the quality of the assessments in measuring students' knowledge, performance, and learning capabilities. To ensure the quality of exams administered by faculty, it is essential to conduct item analysis. Item analysis involves examining student responses to individual test questions to evaluate the quality of those questions and the overall test. This technique is a valuable tool for educators, helping them enhance their instructional methods. By using item analysis, instructors can improve their test construction skills, pinpoint areas of the course content that need more emphasis or clarity, and refine other classroom practices. Sharma (2021) defines item analysis as a technique that enables teachers to accept, reject, or adjust items to be included in the main study, which is an important tool to increase the effectiveness of the test. This process helps educators to easily sort the items needed to discard and retain items that best measure learners' performance. This process believes in the way spreadsheet-based item analysis improves the effectiveness of the

test; hence, it signifies the systematic evidence-based methods in assessing the test items, leading to ensuring test items' reliability efficiently and flexibly.

Spreadsheets are crucial for business and education. They make it easy to do calculations, analyze data, and create charts. Teachers use them to understand how students are doing and improve their teaching. For the past two decades, universities have focused on teaching Microsoft Excel because it was widely used and demanded by companies. However, since mid-2020, the use of Google Sheets has increased, leading some faculty to consider replacing Excel. Faculty needs to stay updated on what employers need and ensure their programs meet these expectations. This study looks at job postings from 2019 to 2021 for positions requiring two or fewer years of experience and examines the demand for spreadsheet skills. The results clearly show that Microsoft Excel is still the most sought-after spreadsheet application by employers. Therefore, the faculty should think carefully before changing Excel training or removing certifications (Rebman, 2023).

In terms of usability and interface, the developed spreadsheet-based item analysis tool used the MS Excel interface. An Excel or spreadsheet is a tool with powerful features for both data analysis and visualization (Albaruni, 2024). These Excel tips—using data validation for accuracy, refreshing pivot tables after dataset updates, and careful range selection with the Data Analysis add-in—are directly relevant to the development of a spreadsheet-based item analysis tool for teachers. Data validation prevents errors in student responses, ensuring accurate analysis. Automatic pivot table refreshes provide teachers with up-to-the-minute results as they input data. Precise range selection in data analysis functions guarantees that the tool correctly calculates item statistics (difficulty, discrimination, etc.), providing teachers with reliable information about student performance on individual test items. In short, these tips improve the reliability and efficiency of the item analysis tool.

This present study and the study of Sani et al. (2019) share the common theme of utilizing spreadsheet applications: one for teachers in performing item analysis and the other for SMEs in conducting financial and stock calculations. In the cited study, usability testing was done to assess the degree of use of spreadsheets in terms of Learnability, Efficiency, Memorability, Errors, and Satisfaction. In this present study, the researcher assesses the acceptability of the developed item analysis tool in terms of Functionality, Performance, Usability, Interface, Security, Stability, User Experience, and Overall Satisfaction.

User satisfaction is a critical measure of success in end-user application development. Ariana et al. (2020) investigated user satisfaction with the technical and operational performance of a spreadsheet-based financial accounting application and identified the dominant aspects that influence it. The findings from the financial accounting application study are highly relevant to developing a spreadsheet-based item analysis tool for teachers. Key connections include ensuring high user satisfaction by focusing on both technical and operational performance, emphasizing simplicity and ease of use to make the tool accessible to teachers with varying levels of technical

expertise, and ensuring the tool can generate meaningful insights while making teachers feel confident using it. By applying these insights, the development of the item analysis tool can be optimized to enhance user satisfaction and effectiveness.

The study by Etobro et al. (2024) at Lagos University in Nigeria investigated the use of Microsoft Office Excel Data Analysis Tools for item analysis in a Psychological Testing course. This study demonstrated the effectiveness of using Excel for item analysis, highlighting its ability to determine item difficulty, discrimination power, and effectiveness. By adopting similar tools and methodologies, the present study can ensure that the developed spreadsheet-based item analysis tool for teachers is capable of providing reliable and valid assessments. This connection underscores the importance of using proven data analysis tools to enhance the accuracy and effectiveness of item analysis in educational settings.

Another study was conducted that analyzed item quality in a test administered to 247 first-year Diploma in Education students at Cape Coast Polytechnic, focusing on the relationship between difficulty index (p-value), discrimination index (DI), and distractor efficiency (DE). The results suggested that 60% of the test items were reasonably good based on their DI, emphasizing the importance of integrating items with average difficulty, high discrimination power, and effective distractors into future assessments to enhance quality (Quaigrain & Arhin, 2017). The study underscores the importance of integrating items with average difficulty, high discrimination power, and effective distractors into assessments. This is highly relevant to the development of a spreadsheet-based item analysis tool for teachers, as it highlights the need for such tools to accurately evaluate and improve the quality of test items. By incorporating these principles, the spreadsheet-based tool can help teachers create more reliable and valid assessments, ultimately enhancing the educational outcomes for their students.

Furthermore, a certain study investigated the levels of difficulty (LD) and discriminating power (DP) of multiple-choice (MC) test items created by an English teacher for a reading comprehension assessment. This study emphasizes the importance of conducting item analysis to enhance the quality of teacher-made MC test items (Karim et al., 2021). This investigation is directly relevant to the development of a spreadsheet-based item analysis tool for teachers, as it highlights the need for such tools to identify and refine test items. By incorporating item analysis features, the spreadsheet-based tool can help teachers ensure their assessments are of high quality, with appropriate difficulty levels and strong discriminating power, ultimately enhancing the effectiveness of their evaluations.

In connection with the increase in student learning, a study that investigates the correlation between teachers' demographic profiles and students' academic achievement was conducted by Crawford (2017). A study examined the teaching skills of 58 primary science teachers in the Tinoc District, Ifugao, Philippines, and how these skills affect students' performance in science. It aimed to tackle the low scientific knowledge and achievement levels in the district. Using a survey, the results showed that teachers considered professionalism very important for their teaching, along

with effectiveness, personal skills, planning, and management abilities. However, there were no significant differences in teaching skills based on the teachers' gender, age, education level, or years of experience. The students' average scores in science were low, indicating a lack of scientific understanding, and the study found no link between the teachers' skills and the students' academic success.

Aligned with this present study is the local study on spreadsheet-based test items' functionality and performance of Doctor and Benito (2020), titled "Development and Acceptability of an Integrated Item Analysis Application: An Enhancement to Adamson University Integrated Educational Management Tool," which concentrated on creating a web-based system for item analysis that automates various academic processes. The study revealed that the system has been successfully tested on its functional suitability, performance efficiency, usability, reliability, security, and portability with results that revealed that the developed application supports the educational institutions` examination, item analysis, student grading, curriculum, and outcome-based education syllabus management system for efficiency, reliability, and accessibility. The spreadsheet-based item analysis shares similar goals of augmenting the quality and effectiveness of educational assessments through strong functionality and reliable performance.

The study about Spreadsheets Application in Teaching Data Management in Mathematics of the Modern World: Effects on Students' Performance was explored by Mulle (2023). It is concluded that the Spreadsheet Application is a very important and effective tool in teaching Data Management in Mathematics of the Modern World to first-year college students. Its application tremendously increases students' performance from the pre-test to the post-test. Connecting this to the development of a spreadsheet-based item analysis tool for teachers, the significance is clear. Just as the spreadsheet application improved student performance in Mulle's study, a spreadsheet-based item analysis tool can enhance teachers' ability to analyze and improve student performance. The effectiveness of spreadsheets in teaching complex subjects like data management suggests that similar tools can be highly beneficial in educational settings, providing teachers with powerful means to assess and address student needs. The positive impact on student performance indicates that users (in this case, teachers) will likely feel more confident and capable when using a well-designed spreadsheet tool, leading to better educational outcomes. By leveraging the insights from Mulle's study, the development of the spreadsheet-based item analysis tool can be optimized to significantly improve teaching and learning experiences.

Another local study with the same purpose was conducted by Silao and Luciano (2021). The study aimed to design, develop, and evaluate an Automated Test Item Analysis System (ATIAS) using Optical Mark Recognition (OMR) to enhance test quality in the educational system, specifically at Calancuasan National High School in Cuyapo, Nueva Ecija, Philippines. The findings highlighted the need for efficient and effective methods for test item analysis in educational settings. Similarly, the present study focuses on developing a spreadsheet-based item analysis tool for teachers, addressing the challenges of traditional, labor-intensive processes. Both

studies aim to enhance test quality and reduce the workload on educators. While the ATIAS utilizes Optical Mark Recognition (OMR) for automation, the spreadsheet-based approach offers a more accessible solution for teachers, enabling them to conduct item analysis effectively and efficiently. Together, these initiatives contribute to improving assessment practices in education.

This spreadsheet-based item analysis tool significantly improves educational assessment in Calbayog District 5. It uses spreadsheets to efficiently and accurately analyze student performance, reducing teacher workload and errors. This leads to more reliable results and better-informed teaching strategies, ultimately improving student outcomes. The gathered related studies underscore the importance of this development, highlighting the effectiveness of similar tools in various educational contexts. These studies provide a strong foundation and validation for the implementation of the spreadsheet-based Item Analysis tool, demonstrating its potential to significantly improve the efficiency and accuracy of educational assessments.

II. Methodology

This study employed a descriptive-correlational research design. The descriptive component described the demographic profile of the respondents, and the perceived acceptability of the developed tool during both alpha and beta testing phases. The correlational component explored the relationships between the demographic profile of the respondents and the perceived acceptability during the alpha and beta testing, as well as the differences in perceived acceptability between pre and post testing phases. The respondents of the study were taken from the Calbayog 5 District. During the alpha testing, all the master teachers, school heads, and principals are considered as respondents. No sampling was done since the population is small, and each school should be properly represented in the data gathering. During the beta testing, the respondents are the Teacher I-III. The respondents were identified using stratified sampling, ensuring each school in the district was represented in the sample to provide diversity and reduce bias. The researcher utilized survey questionnaires for alpha and beta testing. The alpha testing questionnaire is composed of three domains – Functionality & Performance, Usability & Interface, and Security & Stability, with 10 items in each domain. The beta testing questionnaire is also composed of three domains – User Experience & Usability, Functionality and Performance, and Overall Satisfaction. Each of these domains is also composed of 10 items.

III. Results and Discussion

Perceived Acceptability of the Developed Tool during the Alpha Testing. The perceived acceptability of the developed item analysis tool in terms of functionality and performance, usability and interface, and security and stability were gathered from alpha testing respondents in two different time frames: pre-alpha and post-alpha.

Table 1. Overall Perceived Acceptability of the Developed Tool During the Alpha Testing

Factors	Pretest			Posttest		
	Mean	**Desc**	**SD**	**Mean**	**Desc**	**SD**
Functionality & Performance	4.64	SA	.582	4.98	SA	.140
Usability & Interface	4.70	SA	.533	5.00	SA	.058
Security & Stability	4.64	SA	.553	4.99	SA	.100
Overall Weighted Mean and SD	4.66	SA	.557	4.99	SA	.105

Legend:

Scale	Description
4.51 – 5.00	Strongly Agree (SA)
3.51 – 4.50	Agree (A)
2.51 – 3.50	Neutral (N)
1.51 – 2.50	Disagree (D)
1.00 – 1.50	Strongly Disagree (SD)

As shown in Table 1, the developed spreadsheet-based item analysis tool has achieved a high level of perceived acceptability in terms of functionality and performance, usability and interface, and security and stability during the alpha testing, as evidenced by an overall weighted mean of $\bar{X}$ = 4.99 (SD = .105). This aligned with the findings of Etobro et al. (2024), implying that the high acceptability and effectiveness of these tools indicate that they are valuable resources for educators, providing powerful means to assess and address student needs. By leveraging the insights from both studies, the development and implementation of spreadsheet-based item analysis tools can be optimized to further improve teaching and learning experiences.

Perceived Acceptability of the Developed Tool during the Beta Testing. The perceived acceptability of the developed item analysis tool in terms of user experience and usability, functionality and performance, and overall satisfaction was gathered from Beta testing respondents in two different time frames: pre-beta and post-beta. The collected data are presented in Table 2.

Table 2. Overall Perceived Acceptability of the Developed Tool during the Beta Testing

Factors	Pretest			Posttest		
	Mean	Desc	SD	Mean	Desc	SD
User Experience & Usability	4.55	SA	.608	4.98	SA	.127
Functionality & Performance	4.46	A	.638	4.98	SA	.132
Overall Satisfaction	4.64	SA	.551	4.98	SA	.135
Overall Weighted Mean and SD	4.55	SA	.557	4.98	SA	.132

Legend:

Scale	Description
4.51 – 5.00	Strongly Agree (SA)
3.51 – 4.50	Agree (A)
2.51 – 3.50	Neutral (N)
1.51 – 2.50	Disagree (D)
1.00 – 1.50	Strongly Disagree (SD)

The developed spreadsheet-based item analysis tool yielded positive feedback from the teachers in Calbayog 5 District in terms of user experience and usability, functionality and performance, and overall satisfaction indicated by an overall weighted mean of $\bar{X}$ = 4.98 (SD =

.132), as shown in Table 2. These findings underscore the importance of user-friendly design and helpful features in enhancing teacher support and improving instructional practices. The findings made parallel to the research of Sani et al. (2019) on spreadsheet applications show that a well-designed tool can be very user-friendly and efficient. Their long-lasting, automated item analysis tool, built using Microsoft Excel, received high marks for usability and user satisfaction, showing that such tools can significantly save time and effort while providing accurate results.

Test for significant difference between the perceived acceptability of the pre- and post-alpha testing. The data in Table 3 shows significant improvements in all three domains of perceived acceptability between the pre- and post-alpha testing. Specifically, Functionality & Performance ($Z = -3.633$, $p = .000$), Usability & Interface ($Z = -3.308$, $p = .001$), and Security & Stability ($Z = -3.650$, $p = .000$) all show statistically significant positive changes. Thus, the null hypothesis (Ho) is rejected, indicating that the tool's acceptability significantly improved after the alpha testing. There is a significant difference between the perceived acceptability of the pre- and post-alpha testing. The significant differences observed between the pre- and post-alpha testing indicate that the improvements made to the item analysis tool had a real, measurable impact on its perceived acceptability. The item analysis tool uses Excel's data analysis and visualization features to help teachers understand student test results more easily and accurately. Specific Excel techniques, like data validation, automatic pivot table updates, and precise data selection, ensure the tool is reliable and efficient, providing teachers with accurate information about student performance on individual test items (Albaruni, 2024).

Table 3. Wilcoxon Signed Ranks Test in Perceived Acceptability of the Developed Tool between Pre- and Post-Alpha Testing

Domain (Posttest vs Pretest)	N	Negative Ranks	Positive Ranks	Ties	Z	Asymp. Sig. (2-tailed)	Int
Functionality & Performance	30	0	17	13	-3.633[b]	0.000	Reject Ho
Usability & Interface	30	0	14	16	-3.308[b]	0.001	Reject Ho
Security & Stability	30	0	17	13	-3.650[b]	0.000	Reject Ho

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

Test for significant difference between the perceived acceptability of the pre- and post-beta testing. The results in Table 4 show significant differences in perceived acceptability between pre-beta and post-beta testing for all three domains, as the p-values are all less than 0.05. This means that there is a significant difference between the perceived acceptability of the pre- and post-beta testing. The result implies that the improvements made to the item analysis tool significantly increased user satisfaction and effectiveness, similar to how Mulle's (2023) study showed spreadsheets improved student learning. This confirms that well-designed spreadsheet tools can greatly benefit teachers and students, leading to better teaching and learning outcomes.

Table 4. Wilcoxon Signed Ranks Test in Perceived Acceptability of the Developed Tool between Pre- and Post-Beta Testing

Domain (Posttest vs Pretest)	N	Negative Ranks	Positive Ranks	Ties	Z	Asymp. Sig. (2-tailed)	Int
User Experience & Usability	140	0	82	58	-7.877[b]	0.000	Reject Ho
Functionality & Performance	140	0	93	47	-8.385[b]	0.000	Reject Ho
Overall Satisfaction	140	0	69	71	-7.267[b]	0.000	Reject Ho

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

IV. Conclusion

The study on the acceptability of the developed spreadsheet-based item analysis tool for teachers in Calbayog 5 District, Department of Education, Schools Division of Calbayog City, Calbayog City, Samar, for the School Year 2024-2025 had come up with the following conclusions:

1. School administrators and educational leaders of Calbayog 5 District were satisfied with the tool's ability to perform item analysis tasks efficiently. The spreadsheet-based item analysis tool's interface was well-received, making it easy to navigate and use. The tool was also perceived as secure and stable, which is essential for handling sensitive data. The high level of acceptability indicates that the tool is well-designed and effective in meeting the needs of its users. This positive evaluation during alpha testing provides a strong foundation for further development and implementation of the tool.

2. Teachers from Calbayog 5 District found the developed spreadsheet-based item analysis tool easy to navigate and use. The high level of satisfaction from the user indicates the tool's potential to support instructional practices. The tool's success can be attributed to its user-friendly interface and helpful features, which can enhance teacher support and improve instructional practices in Calbayog 5 District and beyond.

3. A statistically significant improvement in the perceived acceptability of the tool was observed between pre- and post-alpha testing across all domains (Functionality & Performance, Usability & Interface, and Security & Stability). This confirms that the modifications made to the item analysis tool had a measurable impact on its acceptability. These enhancements ensure that educators receive accurate information about student performance on individual test items, ultimately supporting improved teaching outcomes.

4. Wilcoxon Signed Ranks test results indicate significant differences in perceived acceptability between pre-beta and post-beta testing across all domains, with p-values less than 0.05. This indicates that the modifications made to the tool substantially enhanced

user satisfaction and effectiveness. The results confirm the potential of well-designed tools to positively impact teaching and learning outcomes.

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