Enhancing face-to-face evaluation using alternative optical mark recognition: A case study from the University of Cabuyao's college of education

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ABSTRACT

Technology is defined as the use of scientific knowledge to solve practical problems. However, educators' initiatives to integrate technology have been mostly prohibitively expensive. In this context, researchers proposed the automation of one of the most important processes but highly repetitive tasks among educators, the processing of student test results. The aim was to determine the alignment with evaluation standards and the acceptability of a cost-effective alternative. This study utilized a mixed-method approach, specifically concurrent triangulation. Quantitative and qualitative data were gathered concurrently, and then compared and combined the results to get a comprehensive understanding of the topic. Quantitatively, it involved the use of mean, standard deviation, t-test, and Cohen's d to evaluate Alternative Optical Mark Recognition (AOMR) according to the required educators' evaluation standards and its impact on reducing educators' clerical workload. Qualitatively, semi-structured interviews and thematic analysis were employed to elucidate educators' perspectives regarding the use of AOMR and the broader integration of technology as a whole. Results showed a one-hundred-thirty times efficiency compared to the manual process without losing the accuracy and reliability of data. Participants underscored the positive effect of AOMR in diminishing the labor-intensive nature of a crucial yet arduous clerical task for educators. Additionally, participants also emphasized unexpected benefits, including email results distribution, backup e-copies of sheets, ease of data management, class record integration, and automated student ranking. These findings offer valuable insights into the challenges surrounding the integration of technology in educational contexts in general, shedding light on the advantages of AOMR in the evaluation of student test results, in particular.

1. Introduction

The global education sector has faced unparalleled challenges due to the Covid-19 pandemic. In response, the sector has implemented diverse modalities to continue public education. In the Philippines alone, Filipino students have experienced and are still experiencing

modular education, online learning, blended learning, radio, and television-based instruction, mobile applications for learning, and other modalities. Technology integration in education has been a significant focus of academic institutions recently. Joaquin, Biana, and Dacela (2020) documented the policy measures implemented by various Philippine Higher Education Institutions (HEIs) in response to the Covid-19 pandemic and conducted a comparative analysis of these measures in relation to those adopted by HEIs in Indonesia, Thailand, and Vietnam. This study concluded that these remarkable adaptabilities involve technology integration in every aspect of the education process.

The University of Cabuyao (UC), where the research was conducted, has also implemented several systematic programs and services based on technology integration. On its part, UC equipped its personnel and students with technical knowledge and several software applications. Moreover, UC also developed a homegrown learning management system called *Pinnacle.* According to its internal guidelines, the Pinnacle is an online learning management system that "enables the students to access course materials, interact with teachers, and collaborate with their peers online regardless of their physical location" (University of Cabuyao, 2023, p. 1). It was already established that utilizing technologies in education has improved students' learning outcomes, especially during the pandemic and the transition to the new normal (Joaquin et al., 2020).

In the meantime, the Commission on Higher Education authorities have driven the higher education sector to go back or maintain face-to-face modalities of learning or a blend of both as a matter of transition to the new normal (Commission on Higher Education, 2022). In the implementation of face-to-face modality, educators face challenges, often with tedious, repetitive clerical tasks. During this transition to the new normal, educators will once again encounter most of the previous manual processes involved in delivering pedagogy and curriculum. One of the most important aspects of this delivery process and, at the same time, one of the most laborious clerical tasks for educators, even before the pandemic, was manually evaluating student test results. A study conducted in a Philippine public secondary school (Cuerdo, 2021) indicated that checking and analyzing test papers for an examination consisting of fifty (50) items for an average of forty (40) students would take an average of 5.67 hours. This calculation is based on spending an average of 8.5 minutes per test paper, multiplied by 40 test papers, resulting in 340 minutes or 5.67 hours. When multiplied by six (6) classes, which is the regular teaching load of a public secondary school teacher, the total hours would amount to thirty-four (34) hours. This is equivalent to 4.25 working days. Additionally, the same process is to be conducted quarterly per school year, excluding the other four minimum additional written works for students, such as quizzes and summative tests (Department of Education, 2020).

Technology can be integrated into this huge amount of clerical work, which could be the result of the transition to a face-to-face modality. Overwhelming pieces of the literature suggest that the best way to implement this integration, particularly in student evaluation, is by using Optical Mark Recognition (OMR) devices. In Catalan (2017), the methodology for various exams utilizing OMR has been investigated and found to have high scoring accuracy and significantly increased the productivity of teachers. The study conducted by Palanas, Alinsod, and Capunitan (2019) in the City Schools Division of Calamba was highly instructive regarding the use of software applications for verifying and evaluating student responses. Dr. Virtus (2019) made an additional courageous effort to implement OMR that yielded highly favorable findings and recommendations.

Students' test results are routinely processed electronically and automatically at the national level. In fact, the Philippine national government utilized OMR in administering the National Achievement Test (NAT), National Career Assessment Exam (NCAE), Basic Education Exit Assessment (BEEA), and other national standardized tests in public and private schools (Department of Education, 2016). OMR is accomplished by detecting a reflection or a limited amount of light using a hardware device. OMR machines are typically used to scan forms or sheets where an examinee will use a pencil or ballpen to shade in a circle or other geometric shape on a paper to answer a question. However, while optical mark reader machines are highly accurate, efficient, and reliable, OMR was not widely used in Philippine public and private schools due to financial concerns; they are generally expensive to acquire and maintain (Catalan, 2017; Virtus, 2019).

This research project aimed to systematically integrate technology into education with the potential to enhance human welfare by reducing the burden of manual labor. Nevertheless, not the OMR system regularly used and extensively studied but a new OMR, an alternative. This research explicitly investigated Alternative Optical Mark Recognition (AOMR). As the name suggests, AOMR does not use expensive OMR devices. Instead, it employs a smartphone to automatically score hand-marked answers.

According to Statista (2023), out of the 111.6 million Filipinos, more than 80 million currently own smartphones. The projection is that there will be roughly 92 million smartphone owners by the year 2028. Smartphones can offer a considerably more effective and affordable solution for integrating automation into the processing of student exam results. This more affordable option is provided by smartphone cameras that are used in conjunction with image processing software (Catalan, 2017). The Google Play Store offers a huge number of free downloadable apps for AOMR. These AOMR programs are made to develop templates for question tests and generate instant exam reports by scanning answer sheets with a phone camera. The software used for this specific purpose is called Evalbee.

Educators have the capability to undertake essential technology integration through the utilization of cost-effective processes and equipment - an option that has the potential to fulfill the requirement for a cost-efficient alternative while ensuring adherence to established standards of quality (Cuerdo, Ison, & Oñate, 2021). Nevertheless, potential challenges might lead to inefficiency and confusion in educational processes. If an AOMR system is not accurate, it could lead to students receiving incorrect scores on their exams. This could have a negative impact on their grades and their academic progress. If the processed data from an AOMR system is not consistent, it could make grading difficult for teachers. This could also have a negative impact on student grades and academic progress. If an AOMR application is difficult to use, it could be time-consuming and frustrating for students and teachers. It could lead to teachers having to use multiple systems, which could be inefficient and confusing.

However, a notable deficiency exists within the existing body of literature regarding the efficacy of the AOMR system. Additionally, scholars have yet to empirically examine the perspectives and attitudes of educators with regard to the integration of automation in the educational process, particularly in the context of AOMR usage for test assessment.

Therefore, this study aimed to evaluate the effectiveness of integrating automation in evaluating student test results and explored the beliefs and attitudes of educators towards using AOMR in test evaluation. The research questions that guided this study were:

1. What is the average time spent using manual and AOMR procedures in checking test papers?

2. Is there a significant difference in the average time spent using manual and AOMR procedures in checking test papers?

3. What is the level of effectiveness in checking test papers using manual and AOMR procedures in terms of Accuracy and Reliability?

4. Is there a significant difference between the level of effectiveness using manual and AOMR procedures in terms of Accuracy and Reliability?

5. What are the beliefs and attitudes of educators in integrating automation in the educative process, explicitly using AOMR in test evaluation?

To answer the problems above, the following null hypotheses were tested:

1. There is no significant difference in the average time spent using manual and AOMR procedures in checking test papers.

2. There is no significant difference between the level of effectiveness using manual and AOMR procedures in terms of Accuracy and Reliability.

2. Theoretical basis

The theoretical assumptions that guided this paper were the principles that technological advancement has become almost historically inevitable. It assumes that technological advancement has aided and continues to aid humans in their struggle for a better future. These assumptions clearly demonstrate a techno-optimistic perspective.

A balanced presentation of techno-optimistic perspective was presented in a paper examining the implications of big data in the public sector. The authors, Vydra and Klievink (2019), introduce two contrasting narratives: techno-optimism, emphasizing improved insights and faster decision-making, and policy-pessimism, underscoring challenges and risks. They assert that both perspectives have merits but are imbalanced. A realist approach is proposed, advocating context-specific considerations, data sources, and skills development to harness big data's potential in public policymaking effectively.

In a published paper by the prestigious Pew Research Center, Anderson and Lee (2018) examined the future of well-being in an era dominated by technology. The authors deliberated on the prospective advantages and drawbacks of digital technology. Some authorities anticipate that digital technology will enhance individuals' lives through connectivity and access to information and resources. Conversely, concerns are raised about potential adverse effects on mental and physical health. This article concluded with the exploration of strategies to alleviate potential challenges associated with digital technology.

Gonella et al. (2019) conducted a study from discussions about technology optimism within one of the thematic working groups at the Biennial International Workshop Advances in Energy Studies (BIWAES) 2017. The paper reaffirmed the widely accepted definition of technology as the application of scientific knowledge to address practical challenges. The focus of the study revolves around technology's role in addressing global issues, encompassing diverse viewpoints on technology and the necessity for a shared comprehension of its objectives. The authors contend that technology, rather than being a neutral instrument, reflects the values and priorities of the society responsible for its development.

The study of Tomczyk et al. (2020) offered insights into the adoption of new educational technologies, drawing from the perspectives and experiences of educators across eight countries: Bolivia, Brazil, the Dominican Republic, Ecuador, Finland, Poland, Turkey, and Uruguay. It encompassed various dimensions, such as educators' attitudes towards integrating new media in education, their experiences with diverse e-learning formats, restrictions on smartphone usage in educational settings, self-assessment of digital proficiency, and utilization of cyberspace. In sum, the study predominantly observes a notable level of techno-optimism among teachers.

In the meantime, according to the reports of the Philippine Statistics Authority (2020), the Philippines has continually lost teachers. According to Cabigas (2019), who cited the Philippines Statistics Authority, 132 individuals leave the teaching profession annually. This indicates that more teachers are leaving the profession than entering it. The same author investigated the initiated systematic reform of the Philippine government into the education system. Contrary to expectations, it was discovered that after a year of implementation, the number of teachers leaving the profession had increased compared to the number of new teachers entering it. There are various factors that influence teachers' decisions to leave the profession, including, among other things, excessive workload (Cabigas, 2019). In addition to the standard full-time teaching burden mandated by the Magna Carta for Public School Teachers (Republic of the Philippines, n.d.), each teacher's job description includes additional administrative duties or learner support services. Participating in extracurricular activities such as attending seminars and training sessions, decorating classrooms, and engaging in various public services like mass vaccinations, community surveys, conditional cash transfers, nutrition programs, demographic censuses, and anti-drug election campaigns constitutes an additional burden. This issue perpetually overburdens the Philippines' educators. Such positions limit the time available for actual instruction, significantly impacting the quality of education in the Philippines. The Philippine government, through the Philippine Institute of Developmental Studies, David, Albert, and Vizmanos (2019), has also confirmed that low wages, heavy workloads, and long work hours are among the causes of this phenomenon.

Meanwhile, applied science or technology can enhance individuals' quality of life by reducing their reliance on manual labor. According to Encyclopedia Britannica (Groover, 2023), automation generally refers to the integration of machines into tasks that were previously completed by humans. Furthermore, automation has revolutionized the fields in which technology is applied. There is rarely a part of modern life that has not been influenced by it. Techopedia, on the same ground, defines automation as the development and use of technology to manufacture and provide goods and services with little or no human involvement. Many tasks that were formerly carried out by people are now more productive, dependable, and/or quick because of the use of automation technologies, techniques, and processes (Techopedia, 2023).

In terms of applying automation in education, specifically, OMR, the educational environment in the Philippines has only recently begun its course. Catalan (2017) establishes a methodology for various exams utilizing computer images and diverse processing techniques. According to the same author, OMR is utilized in various applications, including examination evaluation, automatic attendance recording, voting, and group surveys. However, acquiring and maintaining these devices can be prohibitively expensive. The study by Dr. Virtus (2019) in the City Schools Division of Batangas was an additional courageous effort to implement the same mechanization that yielded highly favorable findings and recommendations on using OMR. According to the same author, the action was consistent with the Department of Education's advocacy for a shared comprehension of quality instruction, learning, and objective assessment

goals. Galgo and Balbagiuo's (2022) contribution to the evaluation of the EvalBee application in its checking capacity for the module was a welcome event. To the best of the authors' knowledge, they made the second attempt to evaluate an AOMR system, and coincidentally, they used the same application for this evaluation. The study, though limited to the evaluation of the efficiency of EvalBee, provided confirmation of the application's efficiency in speeding up the process of checking pupils' modules delivered by the Department of Education (Galgo & Balbagiuo, 2022).

OMR researchers concluded that OMR machines were effective at processing student test results and quickly providing accurate evaluation results. Additionally, these researchers strongly advise teachers to employ OMR machines for scanning student test results. This recommendation is based on the machines' effectiveness in autonomously scoring hand-marked responses and their ability to provide evaluation results quickly and accurately. On the other hand, the same researchers concluded that OMR machines were prohibitively expensive to acquire and not equally less to maintain.

The process, therefore, required an integration of technology that eliminates the costly restriction, i.e., an alternative. An alternative that qualifies for such leverage but is accessible to the mass of educators. An alternative that should fulfill the need for a less expensive option but provide functionality within the parameters of standard quality.

3. Research method

3.1. Research design

A mixed-methods approach called concurrent triangulation research design has been adopted to address the problem and determine the effectiveness of automation using AOMR in evaluating student test results. The researchers simultaneously collected and analyzed quantitative and qualitative data from multiple sources to comprehensively address the subject of this research.

A quantitative-evaluative research design was used to evaluate the effectiveness of manual and AOMR processing of student test results. The research methodology is based on the operational definition of effectiveness, which is the tripartite level of measured efficiency, accuracy, and reliability of planned activities and/or results. It was evaluated according to efficiency: the ability to do something with the least amount of time and resources; reliability, the consistency of measured output; and accuracy, the state of being precise or correct.

It involved two groups: a control group that used the manual procedure and an experimental group that used the AOMR procedure. The manual procedure involved checking each test paper by hand using an answer key and recording the score on a spreadsheet. The AOMR procedure involved downloading the Evalbee software from Google Play Store, scanning or taking a picture of each test paper using an Android smartphone, and downloading the results as a spreadsheet.

The qualitative component of this research design was implemented through semi-structured interviews using open-ended questionnaires to determine educators' beliefs and attitudes toward integrating automation in the educational process, specifically using AOMR in test evaluation.

3.2. Subjects and participants of the study

The total subject of this study consisted of two hundred (200) seventy-item-student-test-paper (70) from the students at the College of Education, University of Cabuyao (Pamantasan ng Cabuyao). The study participants were five (5) faculties from the College of Education. Each

teacher participant had processed twenty (20) test papers for manual checking and (20) test papers for automated AOMR in checking test papers.

3.3. Instruments of research

This study's quantitative research instrument consisted of three (3) components. The first section contained the profile of the participants. The second section contained questionnaires to record the exact time spent manually and with AOMR evaluating test papers. The third section consisted of a 5-point Likert scale to ascertain the accuracy and reliability of manual and AOMR in checking test papers.

Semi-structured open-ended questionnaires were used to determine educators' beliefs and attitudes regarding integrating automation into the educational process, explicitly using AOMR in test evaluation.

3.4. Data collection

A letter of request which contains the purpose and scope of the study, the data collection procedure, and the expected outcomes has been submitted, seeking approval from the university administration.

In the initial stage, the researchers identified a representative sample of student test results from a specific course or subject area. It was done by selecting a sample of student test results representative of the population of interest. Once the sample was identified, the data was collected by manually checking and using AOMR for the student test. The data was collected, standardized, and consistently monitored to ensure accuracy and reliability.

The time duration was measured by recording the start time and end time for the manual and AOMR procedures. Efficiency was measured by calculating the average time spent on each procedure and comparing the result; the less time spent, the more efficient. Accuracy was measured by comparing the scores obtained from each procedure with each other, should there be discrepancies, the subject test paper would be processed for double-checking to determine the correct score. Reliability was measured by repeating the process of checking and comparing the consistency of the measured output.

The interviews were conducted after the experiment to elicit the educators' opinions and experiences using AOMR in test evaluation. The interviews focused on the participants' experiences using AOMR, such as benefits, challenges, concerns, thoughts on comparing both processes, insights on the impacts of AOMR in their workloads, and their apprehension on integrating AOMR into the existing methodology.

3.5. Data analysis

Statistical tools such as the mean, standard deviation, paired sample t-test, and Cohen's d were used to analyze the quantitative data. The result of the study led to determining the result of a data set with a statistically significant level of effectiveness. The result of the study also led to determining how tightly all the various examples were clustered around the mean in a data set. Cohen's d was the statistic used to determine the study's outcome, which assessed how large the significance between the two-group means that could be attributed to such attributes, as well as whether the data sets were normally distributed and contained variability.

The data collected from the semi-structured interviews were analyzed using qualitative data analysis techniques through thematic analysis. The thematic analysis involved transcribing,

coding, categorizing, and interpreting the interview data to identify common patterns and themes. The analysis has identified common themes and patterns in the participants' responses, which provide insights into the attitudes and beliefs of educators towards the use of automation through AOMR in evaluating student test results.

The findings from the qualitative part of the research were triangulated with the quantitative data collected. The triangulation of data has provided a comprehensive understanding of the effectiveness, meaning, efficiency, accuracy, and reliability of AOMR in evaluating student test results, as well as the attitudes and beliefs of educators towards these technologies.

To ensure the quality of the data, the researchers established clear criteria for checking the student test results, ensuring that the data were collected and analyzed in a consistent and standardized manner. The researchers also checked for errors and inconsistencies in the data and took steps to correct them.

3.6. Data privacy

All data were kept confidential and anonymous to protect the students' privacy. The students' test results were assigned pseudonyms or codes that ensured that their identities were not revealed in the analysis or reporting of the data.

On the part of Google Play Store, it protects subscribers' information by using encryption, security measures, and policies that limit access to their data. It also respects subscribers' choices and preferences regarding how subscribers' information is used and shared. Google Play Store also requires every app published by the Google Play Store to have a privacy policy that declares how it collects, protects, and handles private user data. Google Play Store policy also complies with various laws and regulations that protect the privacy of its subscribers, such as the Children's Online Privacy Protection Act (COPPA), the General Data Protection Regulation (GDPR), and the California Consumer Privacy Act (CCPA). Google Play Store also follows the Mobile Unwanted Software (MUwS) principles that prohibit apps that are deceptive, malicious, or intended to abuse or misuse any network, device, or personal data (Google Play Terms of Service, n.d.).

The EvalBee application, on the other hand, subscribed to the same privacy policy as the Google Play Store. Moreover, Evalbee added the following points as part of its internal privacy policy: The app uses personal information to provide and improve the service. It does not share it with anyone except the third-party service providers who help the app with its functions or analysis. Confidentiality obligations bind the third-party service providers, and they cannot use the information for other purposes.

The app does not target or collect information from children under 13. If the app learns that a child under 13 has provided personal information, it will delete it immediately and ask the parent or guardian to contact the app.

The app will notify users of changes by posting the new policy on this page. Users are advised to review the policy periodically to stay informed of any changes (EvalBee, n.d.).

4. Research results

The findings of the quantitative part of the study, specifically the level of effectiveness of each procedure in terms of efficiency (the ability to do something with the least amount of time and resources), accuracy (the state of being precise or correct), and reliability (the consistency of measured output) are presented below:

Table 1

Average time spent in checking test paper manually and using AOMR

Mode	Time	Interpretation
Manual	6.57 Minutes	Inefficient
AOMR	.05 Minute	Very Efficient

Note: 1 = (1 min or less) Very Efficient
2 = (2 mins.) Efficient
3 = (3 mins.) Moderately Efficient
4 = (4 mins.) Somewhat Inefficient
5 = (more than 5 mins.) Inefficient

The findings presented in Table 1 underscore a substantial discrepancy in the average time invested in two distinct methods of evaluating test papers, manual and AOMR, with a mean time of (M = 6.57 and 0.05) respectively. The evidence highlights a notable efficiency gap between these approaches. Specifically, manual checking was revealed to be inherently inefficient, while AOMR-based assessment emerged as very efficient.

This study's outcomes clearly indicate that the implementation of AOMR technology offers a pronounced enhancement in grading efficiency when compared to traditional manual methods. The capacity of AOMR to process answer sheets quickly by examining marked responses allows for efficient score calculations and rapid result production. The study of Calaguas and Consunji (2022) revealed the same result. The empirical data strongly supports the notion that integrating technology into educational assessment practices, exemplified by AOMR termed by the author as mobile OMR, can yield substantial gains in efficiency.

Table 2

The difference in the measure of effectiveness of checking test papers manually and using AOMR in terms of efficiency

Measures of Effectiveness	Procedure	df	Mean	SD	Mean Difference	Computed t-value	Cohen's *d*-value	Effect Size
Efficiency	Manual	199	6.57	.99	6.39	63.84	1.00	Large
	AOMR	199	0.05	.16				

Note: If Cohen's d = 0.20-0.49 = Small Effect Size
0.50-0.79 = Medium Effect Size
≥ 0.80 = Large Effect Size

In Table 2, a substantial effect size is unveiled concerning the difference in time spent between manual test paper evaluation and AOMR technology, with ($t(199) = 1.15$, $p < .05$, and $d = 1.00$). This finding unequivocally indicates that utilizing AOMR for assessing test papers has a large effect in reducing the time spent compared to the manual process.

This outcome highlighted the noteworthy advantage of the EvalBee application in the context of efficiency. This result identically corresponds with Galgo and Balbaguio's (2022) study that the most notable advantage of this integration was its efficiency or the capacity to produce the same result with minimal energy input.

Substantial to the study of Sahin and Ilkin (2018), the findings affirmed the high efficiency of AOMR by considerable time savings. This underscores the transformative potential of technology, in this case, AOMR, in expediting the educational assessment procedures.

Table 3

The level of measure of effectiveness of checking test paper manually and using AOMR in terms of accuracy and reliability

Measure of Effectiveness	Mode of Checking	Mean	SD	Interpretation
Accuracy	Manual	1.15	.36	Very Accurate
	AOMR	1.10	.30	Very Accurate
Reliability	Manual	1.22	.42	Very Reliable
	AOMR	1.12	.33	Very Reliable

Note: 1 = (0-1 Error) Very Accurate
2 = (2 Errors) Accurate
3 = (3 Errors) Moderately Accurate
4 = (4 Errors) Somewhat Accurate
5 = (more than 5 Errors) Not Accurate
1 = (0-1 Discrepancy) Very Reliable
2 = (2 Discrepancies) Reliable
3 = (3 Discrepancies) Moderately Reliable
4 = (4 Discrepancies) Somewhat Reliable
5 = (more than 5 Discrepancies) Not Reliable

Table 3 sheds light on the accuracy and reliability of two distinct approaches for evaluating test papers, AOMR and manual procedures. On the one hand, the accuracy of AOMR and manual procedure with (M = 1.15 and 1.10) and (SD = 0.30 and 0.36), respectively, attest to the accuracy of outcomes. This means that both procedures were very accurate in checking students' test papers. On the other hand, the data also reveals that both methods also yield very high-reliability results, as indicated by (M = 1.12 and 1.22) and (SD = 0.33 and 0.42) for AOMR and manual procedures respectively.

The same findings as Virtus (2019), this study underscored the reliability and accuracy of both AOMR and manual procedures in the context of test paper checking. The proximity of mean values suggests that these methods produce comparable outcomes in terms of accuracy and reliability. Moreover, the convergence of results signifies a consistent application of grading standards.

Table 4

The difference in the level of accuracy & reliability in checking test papers manually and using AOMR

Measures of effectiveness	Procedure	df	Mean	SD	Computed t-value	Computed p-value	Decisionon H_o	Interpretation
Accuracy	Manual	199	1.15	.36	1.15	.25	Failed to Reject	Not Significant
	AOMR	199	1.10	.30				
Reliability	Manual	199	1.22	.42	1.85	.07	Failed to Reject	Not Significant
	AOMR	199	1.12	.33				

Note: If $p < 0.05$, reject the null hypothesis; otherwise, fail to reject

Table 4 shows an important finding regarding the comparison between accuracy and reliability levels in manually checking test papers versus utilizing AOMR. The statistical outcomes indicate that there is no substantial difference in accuracy ($t(199) = 1.15$, $p > .05$) and reliability ($t(199) = 70.82$, $p > .05$) between the two methods.

These findings were in line with prior research by Virtus (2019) and Calaguas and Consunji (2022), where it was observed that the accuracy and reliability of OMR-based processes for evaluating student test results closely approximate those achieved through manual methods. This suggests that the utilization of AOMR technology can effectively uphold the established quality standards in terms of accuracy and reliability. The results affirm the AOMR's capability to efficiently process a large volume of manually filled forms with speed and precision, further emphasizing its advantage.

Beliefs and attitudes of educators on the implementation of AOMR

The qualitative data gathered through semi-structured interviews provided valuable insights into educators' attitudes and beliefs toward using Alternative Optical Mark Recognition (AOMR) to understand the challenges and opportunities of integrating automation in education and to identify the factors that will influence the successful implementation of automation in education. Thematic analysis revealed several key themes from the participants' responses:

Theme 1: Challenges and concerns about AOMR

Participants identified various challenges and concerns associated with the use of AOMR technology. These included concerns about the quality of the printed answer sheet, the need for precise camera positioning to ensure accurate results and eliminate errors, the importance of ensuring the correctness of student numbers, and the need to educate students on the proper shading of answers. These findings highlight the importance of addressing these technical and procedural challenges to ensure the effective implementation of AOMR technology.

Theme 2: Benefits of AOMR

Participants acknowledged several benefits associated with using AOMR in evaluating face-to-face test results. They highlighted the time-saving aspect of AOMR, as it relieves teachers from the burden of manually checking test papers. The accuracy and reliability of AOMR-generated results were also recognized, along with the ease of correcting the answer key and the automatic adjustment of students' scores. Additionally, participants emphasized the user-friendly nature of AOMR, which simplifies the process of test result evaluation. The Other benefits identified included the convenient distribution of test results to students' registered email addresses, the availability of corrected answer sheets, the ease of data management and integration with class records, and the automatic calculation and distribution of student rankings. These findings indicate the potential of AOMR technology to streamline the evaluation process and enhance efficiency in educational settings.

Theme 3: AOMR vs. traditional manual checking methods

AOMR was consistently perceived as a superior alternative to traditional manual checking methods. Participants preferred AOMR due to its enjoyable nature and the reduced stress associated with it, in contrast to the tedious and time-consuming nature of manual checking. The efficiency of AOMR was emphasized, as it eliminates the inefficiencies inherent in manual checking. Moreover, the consistently accurate performance of AOMR, irrespective of the number of test papers, was highlighted, whereas human errors in manual checking were acknowledged. The ease of correcting

the answer key and the automatic recording of scores in AOMR were also noted as advantages over manual checking. These findings underscore the potential of AOMR to overcome the limitations of manual checking and enhance the accuracy and efficiency of test result evaluation.

Theme 4: Impact on teacher workload

Participants unanimously recognized the significant impact of AOMR on reducing teacher workload. By automating the process of evaluating face-to-face test results, AOMR allows teachers to allocate their time more effectively to other tasks and strategies for teaching and learning. Reducing the time spent on manual checking enables teachers to focus on preparing instructional materials and improving teaching strategies. These findings highlight the potential of AOMR technology to enhance teacher productivity and contribute to a more efficient and effective educational environment.

Theme 5: Integration of AOMR into teaching methodology and process

Participants expressed positive views regarding integrating AOMR into the existing methodology and process of teaching. They anticipated that AOMR integration would alleviate the burden of checking and recording students' test responses. It would enable teachers to dedicate more time to enhancing their instructional materials and developing effective teaching and learning strategies. Furthermore, integrating AOMR was expected to motivate teachers to evaluate student learning, as it would no longer be burdensome. These findings suggest that integrating AOMR into the existing teaching methodology and process holds promise for improving the overall teaching and learning experience.

5. Conclusion

The study evaluated Alternative Optical Mark Recognition (AOMR) according to the standards of efficiency, accuracy, and reliability as compared to manual procedures in checking test papers and its impact on reducing educators' clerical workload. Semi-structured interviews and thematic analysis were employed to elucidate educators' perspectives regarding the use of AOMR and the broader integration of technology as a whole.

Considering the questions that guided this research, the quantitative results found that the average time spent using manual procedures to check test papers was significantly higher than the average time spent using AOMR procedures. As a result, the null hypothesis was rejected, indicating that there was a significantly large difference between manually checking test papers and employing AOMR in terms of efficiency. The outcome clearly showed that AOMR was far more effective than doing it manually, averaging an advantage of one-hundred-thirty times efficiency. The study also discovered that there was no significant difference in the accuracy and reliability of manual and AOMR processes hence, the null hypothesis was failed to be rejected. This finding suggests that AOMR was as accurate and reliable as the time-honored manual procedures for checking test papers.

Finally, the qualitative results found that educators were unanimously positive about the use of AOMR in test evaluation. The participants believed reasonably based on the quantitative outcome of the study that AOMR required the least amount of time and resources without sacrificing the accuracy of data and the reliability of test evaluation. Moreover, participants emphasized the positive impact of AOMR on reducing educators' workload and the unexpected added benefits including email results distribution, backup e-copies of sheets, ease of data management, class record integration, and automated student ranking.

The success of AOMR in analyzing test results was quantitatively and qualitatively established in this study. Consequently, we are now offering the following suggestions:

1. Apply AOMR for processing student test results:

AOMR has proven to be effective in analyzing test results. Faculty members can benefit from using this technique to assess student test results, which can significantly reduce the time and effort spent on manual processing. This automation offers a practical solution to streamline one of the most tedious and repetitive clerical tasks of educators.

2. Automate educational processes:

Aligned with the need for educators to acquire 21st-century skills and adapt to technological advancements, the authors encourage educators to embrace automation in the delivery, implementation, and assessment of educational processes. By automating some or all of these tasks, educators can focus more on their core responsibilities, such as teaching and research, rather than administrative or clerical work.

3. Promote AOMR for student exam assessment:

University administrators can play a pivotal role in improving the efficiency of public education by endorsing the use of AOMR for assessing student exam results. AOMR has proven to be successful, and its adoption can reduce the administrative burden on faculty members while ensuring standardized and efficient evaluation methods.

4. Develop educators' technological skills for the 21st century:

In the era of technological advancements, it's essential for faculty members to continuously update their skills. The formulation of a skills development initiative, encompassing instructional training in software applications such as EvalBee, serves as a manifestation of the university administration's dedication to augmenting the competencies of educators. This recommendation aligns with the broader goal of preparing educators for the challenges of the 21st century.

These recommendations are based on the proven success of AOMR and the need to modernize educational practices. They aim to enhance efficiency, reduce educators' burdens, and promote the adoption of technology in education while also considering the specific needs of different educational contexts.

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