**Automation Adoption as Predictors of Remote Education of Teachers in Public Elementary Schools**

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ABSTRACT

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| This study aimed to examine the significant relationship between automation adoption and the predictors of remote education among public elementary school teachers. A descriptive-correlational research design was utilized, involving 165 teachers from public schools in Baganga District, Division of Davao Oriental. Data were collected through standardized questionnaires administered via face-to-face surveys. The data were analyzed using mean, standard deviation (SD), multiple regression analysis, and correlation statistics. The findings revealed that teachers rated automation adoption and remote education certainty at a very high level. Correlation analysis revealed that automation adoption significantly relates the predictors of remote education. Moreover, multiple regression analysis indicated that institutional support and technological readiness significantly influenced predictors of remote education, while pedagogical integration did not show a statistically significant impact. Based on these results, it is recommended that school administrators focus on strengthening institutional support and technological readiness to improve teachers’ effectiveness in remote education. It is recommended also to investigate and enhance pedagogical integration further, as its lack of statistical significance may stem from limited teacher training, insufficient practical application in remote settings, or inadequate access to supportive instructional resources. |

*Keywords*: *Automation Adoption, Remote Education, Public Elementary School Teachers, Descriptive-Correlational, Education.*

1. INTRODUCTION

The sudden shift to remote education brought about by global disruptions such as the COVID-19 pandemic exposed significant challenges in the delivery of quality education, especially in public elementary schools (Oliveira et al., 2021). Teachers were compelled to adapt to various digital platforms without sufficient training, tools, or support systems (Bond, 2021). Many encountered difficulties in managing online classrooms, delivering instructional content, and maintaining student engagement (Green et al., 2020). This abrupt transition revealed gaps in preparedness among educators and institutions alike, raising concerns about the long-term sustainability and effectiveness of remote teaching practices.

Internationally, several countries have responded to these challenges in diverse ways. In China, strong digital infrastructure and continuous teacher training enabled a smoother transition to remote learning (Zhao et al., 2024). In contrast, teachers in India faced connectivity issues, lack of access to digital devices, and minimal institutional support, making remote education difficult to implement (Dayal, 2023). Meanwhile, the United States experienced a mixed scenario, where some school districts rapidly adopted technology and provided training, while others struggled due to socioeconomic disparities (Francom et al., 2021). These international experiences underscore the importance of systemic readiness and automation in supporting remote education across different contexts.

In the Philippines, public elementary school teachers experienced significant constraints in adapting to remote education, largely due to limited access to technology, weak internet connectivity, and lack of comprehensive digital training (Caratıquıt & Caratıquıt, 2022). The Department of Education implemented the Basic Education Learning Continuity Plan (BE-LCP) to address these concerns, but many educators still lacked adequate institutional support, technological readiness, and practical tools to effectively manage remote instruction (Jackaria, 2022). Consequently, the remote learning environment became a strain on both teacher performance and student learning outcomes, particularly in geographically isolated and disadvantaged areas (Alipio & Torres, 2023).

Automation adoption has become a critical factor in addressing the challenges of remote education (Aruleba et al., 2022). The integration of automated systems—such as learning management systems, content delivery platforms, and digital assessment tools—can enhance teaching efficiency and engagement (Selwyn et al., 2023). Institutional support, technological readiness, and pedagogical integration are vital dimensions of automation that influence a teacher’s ability to perform in a remote setting (Zou et al., 2021). Exploring how these components interact with remote education is essential to understanding how to improve learning delivery in public schools.

Despite various efforts and studies on remote education, there remains a research gap in examining how automation adoption serves as a predictor of effective remote teaching, particularly in the context of public elementary schools in the Philippines. Existing literature has often focused on student access and curriculum design, leaving out a comprehensive analysis of teachers' readiness and the role of automation in enhancing their instructional capabilities during remote learning.

This study aimed to examine the significant relationship between automation adoption and the predictors of remote education among public elementary school teachers in Baganga District, Division of Davao Oriental. It seeks to provide insights on how institutional support, technological readiness, and pedagogical integration affect teachers' capacity to deliver education remotely, thereby informing strategies that strengthen digital teaching practices in basic education (fig-1).



**Fig. 1. Conceptual Framework of the Study**

This study is anchored on the Technology Acceptance Model (TAM) by Davis (1989), which posits that an individual’s acceptance and usage of technology are primarily influenced by perceived usefulness and perceived ease of use. In the context of public elementary school teachers, automation adoption—such as the use of digital platforms, AI tools, and learning management systems—serves as a crucial determinant of their readiness and effectiveness in delivering remote education. The integration of automation in teaching practices reflects not only a response to technological advancement but also an adaptation to evolving pedagogical demands in a digitally mediated learning environment. Thus, the level at which teachers adopt automation tools can be seen as a significant predictor of their capability to engage in and sustain remote instruction.

**1.1 Statement of the Problem**

This study aimed to determine the relationship between the adoption of automation as a predictor of remote education of teachers in public elementary schools in Baganga District, Division of Davao Oriental. Specifically, it sought to answer the following questions:

1. What is the level of automation adoption of teachers in public elementary schools in terms of:

1.1 Technological readiness,

1.2 Institutional support, and

1.3 Pedagogical integration?

2. What is the level of Predictors of remote education of teachers in public elementary schools terms of:

2.1 Learning management systems,

2.2 Student support services, and

2.3 Teacher training?

3. Is there a significant relationship between automation adoption and predictors of remote education of teachers in public elementary schools?

4. Which domains in automation adoption significantly influence the predictors of remote education of teachers in public elementary schools?

**1.2 Hypotheses**

The null hypotheses were tested at 0.05 level of significance:

Ho1. There is no significant relationship between automation adoption and predictors of remote education of teachers in public elementary schools.

Ho2. The domains of automation adoption do not significantly influence the predictors of remote education of teachers in public elementary schools.

2. methodology

**2.1 Research Design**

This study employed a non-experimental quantitative research design utilizing the correlational method. This approach was deemed appropriate for examining the degree of association between automation adoption and the predictors of remote education among public elementary school teachers. As Pregoner (2025) emphasized, variables may be related either through shared patterns of variation or as a result of a common influencing factor. In this context, the correlational method enabled the researcher to determine whether levels of automation adoption—through institutional support, technological readiness, and pedagogical integration—are significantly associated with predictors of remote education. By analyzing the relationship between these dimensions, the study aimed to uncover meaningful insights that could guide technological planning, capacity-building, and instructional innovation among educators in the Baganga District, Division of Davao Oriental.

**2.2 Research Respondents**

The respondents of this study were 165 public elementary school teachers from the Baganga District, Division of Davao Oriental. All participating teachers were actively teaching during the data collection period and represented a diverse range of professional experiences, subject specializations, and school affiliations. The researcher employed universal sampling, thereby including the entire population of qualified teachers from the selected schools within the district. The respondents were fully informed about the nature and purpose of the study, and their participation was voluntary. Data collection was conducted during the academic year 2024–2025.

**2.3 Research Instrument**

The instruments used in this study were standardized survey questionnaires specifically developed to measure two main constructs: automation adoption and the predictors of remote education among public elementary school teachers in the Baganga District, Division of Davao Oriental. These questionnaires were adapted from existing tools that had been previously validated in studies related to digital readiness and instructional technology in education. Modifications were made to align the items with the specific research objectives of the present study. To ensure content and construct validity, the instrument underwent rigorous face and content validation by a panel of experts in the fields of Educational Technology, Research Methodology, and Instructional Systems Design. Based on expert feedback, necessary revisions were implemented to enhance the clarity, structure, and contextual relevance of the items.

The finalized self-made questionnaire consisted of two subscales: Automation Adoption and Predictors of Remote Education, each comprising 15 items. The items were constructed to capture relevant practices, perceptions, and conditions influencing each construct. The Automation Adoption subscale included items assessing the extent to which teachers utilize automated tools such as grading systems, learning management systems, AI-assisted educational applications, and other technologies that improve instructional efficiency. Meanwhile, the Predictors of Remote Education subscale included items related to technological access, digital literacy, professional development support, online teaching confidence, and overall attitudes toward remote learning environments. To facilitate consistent and quantifiable responses, the questionnaire employed a 5-point Likert scale format. Respondents rated each item using the following scale: 5 – Strongly Agree/Always, 4 – Agree/Often, 3 – Neutral/Sometimes, 2 – Disagree/Rarely, and 1 – Strongly Disagree/Never. This scaling system allowed for graded evaluations of agreement or frequency, which provided a comprehensive overview of participants’ behaviors and perceptions. Prior to full implementation, the questionnaire was pilot tested with 30 public elementary school teachers from a neighboring district who were not part of the main study. This process aimed to test the instrument's reliability and ensure its appropriateness for the target population. The reliability analysis using Cronbach’s Alpha revealed a high level of internal consistency, with a coefficient of 0.914 for the Automation Adoption subscale and 0.927 for the Predictors of Remote Education subscale. These results confirm that the instrument was a valid and reliable tool for data collection in the context of this study.

**2.4 Data Gathering Procedure**

# The data for this study were collected through a series of methodical and ethically sound procedures. Initially, the researcher sought an endorsement from the Dean of the Graduate School and obtained ethical clearance from the institution’s Ethics Review Committee to ensure compliance with ethical research standards. Following this, a formal request letter was submitted to the Office of the Schools Division Superintendent of Davao Oriental. Upon approval, the Division Office released an endorsement letter addressed to the School Heads within the Baganga District, granting authorization for the conduct of the study.

# The researcher then conducted a pilot test to validate the instrument’s reliability and functionality. Participants of the pilot test were briefed on the study’s objectives and given clear instructions for completing the survey. Based on pilot feedback, necessary revisions were made. The finalized survey questionnaires were distributed to the 165 target respondents using the universal sampling method. After completion, the researcher personally retrieved all the answered questionnaires. The collected data were forwarded to a professional statistician for encoding, tabulation, and statistical analysis in accordance with the study’s objectives.

# 2.5 Data Analysis

To analyze the data collected and effectively address the research questions of this study, the following statistical tools were utilized:

Mean. This was used to determine the levels of automation adoption and predictors of remote education among public elementary school teachers. It provided a summary of the overall responses and helped identify trends across dimensions such as institutional support, technological readiness, and pedagogical integration.

Pearson Product-Moment Correlation Coefficient (Pearson r). This statistical tool was used to determine the strength and direction of the relationship between automation adoption and the predictors of remote education. It assessed whether a statistically significant correlation existed between the variables.

Multiple Regression Analysis. This analysis was utilized to identify which dimensions of automation adoption significantly predicted the levels of remote education readiness among teachers. It provided insights into the extent to which institutional support, technological readiness, and pedagogical integration influenced teachers’ preparedness in remote education delivery.

3. results and discussion

**3.1 Level of Automation Adoption among Public Elementary School Teachers**

**Table 1. Level of Automation Adoption among Public Elementary School Teachers**

|  |  |  |  |
| --- | --- | --- | --- |
| **Domains**  | **SD** | **Mean** | **Descriptive Level** |
| Technological Readiness | 0.46 | 4.68 | Very High |
| Institutional Support | 0.47 | 4.63 | Very High |
| Pedagogical Integration | **0.47** | 4.68 | Very High |
| **Overall** | **0.46** | **4.66** | **Very High** |

Presented in Table 1 is the summary of the domains in the level of automation adoption among teachers in public elementary schools, including technological readiness, institutional support, and pedagogical integration, based on the mean scores and standard deviations. The domains technological readiness and pedagogical integration received the highest mean scores of 4.68, categorized as "very high," while institutional support obtained a slightly lower mean score of 4.63, still categorized as "very high." The overall mean of 4.66 is described as "very high," indicating that teachers generally report a strong level of automation adoption across these domains.

The overall standard deviation of 0.46 indicates that the responses were closely clustered around the mean. This finding suggests that teachers are highly prepared to utilize digital tools and automated systems, are supported by their institutions, and are actively integrating these technologies into their instructional practices. These high levels of automation adoption imply that teachers are well-positioned to deliver quality education through technology-enhanced methods, particularly in remote learning environments.

This finding corresponds with the research of Timotheou et al. (2023), who emphasized that technological readiness and pedagogical integration are key enablers of digital transformation in education. Their study revealed that teachers who are confident in using automation tools are more likely to deliver effective and engaging instruction. Similarly, Palacios-Rodríguez et al. (2023) found that strong institutional support enhances teachers’ motivation and capacity to adopt educational technologies. Additionally, Latifah et al. (2022) highlighted that when teachers receive consistent support and training, they become more efficient in managing automated systems that streamline classroom tasks, communication, and content delivery.

**3.2 Level of Predictors of Remote Education among Public Elementary School Teachers**

**Table 2. Level of Predictors of Remote Education among Public Elementary School Teachers**

|  |  |  |  |
| --- | --- | --- | --- |
| **Domains** | **SD** | **Mean** | **Descriptive Level** |
| Learning Management Systems | 0.49 | 4.63 | Very High |
| Student Support Services | 0.49 | 4.62 | Very High |
| Teacher Training | 0.44 | 4.74 | Very High |
| **Overall** | **0.45** | **4.66** | **Very High** |

Presented in Table 2 is the summary of the domains in the level of predictors of remote education among teachers in public elementary schools, including learning management systems, student support services, and teacher training, based on the mean scores and standard deviations. The domain teacher training received the highest mean score of 4.74, categorized as "very high," followed by learning management systems with a mean of 4.63. Student support services obtained a mean score of 4.62, also categorized as "very high." The overall mean of 4.66 is described as "very high," indicating that teachers perceive these predictors as highly present and effective in supporting their remote education efforts.

The overall standard deviation of 0.45 signifies that the responses were consistently close to the average, suggesting uniform agreement among the teachers regarding the importance of these remote education predictors. This result implies that teachers are well-equipped in terms of professional training, access to digital platforms, and availability of services that support student learning in remote settings.

This finding supports the study of Bond (2021), which found that consistent and relevant teacher training plays a critical role in the successful delivery of remote education. Likewise, the research of Oliveira et al. (2021) emphasized that user-friendly learning management systems and responsive student support services significantly enhance teaching effectiveness and student engagement in virtual learning environments. Furthermore, the study of Green et al. (2020) highlighted that these predictors not only improve instructional delivery but also reduce teacher burnout and student dropout rates. Thus, strengthening these predictors is essential for sustaining the quality of education in remote settings across public elementary schools.

**3.3 Significant Relationship between Automation Adoption and Predictors of Remote Education among Public Elementary School Teachers**

**Table 3. Significant Relationship between Automation Adoption and Predictors of Remote Education among Public Elementary School Teachers**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Mean** | **SD** | **R** | **R²** | **Degree of Relationship** | **p-value** | **Decision** |
| Automation Adoption | 4.66 | 0.46 |  |  |  |  |  |
|  |  |  | 0.64 | 0.41 | High | 0.000 | Reject Ho₁ |
| Predictors of Remote Education | 4.66 | 0.45 |  |  |  |  |  |

Presented in Table 3 is the correlation analysis between automation adoption and the predictors of remote education among public elementary school teachers. The analysis yielded a correlation coefficient (R) of 0.64 and a p-value of 0.000, which is below the 0.05 level of significance. This indicates a high and statistically significant positive relationship between automation adoption and the predictors of remote education. The R² value of 0.41 reveals that 41% of the variation in the predictors of remote education can be attributed to automation adoption. Given that the p-value is less than 0.05, the null hypothesis (Ho₁) is rejected, confirming that automation adoption significantly relates to the predictors of remote education.

This result implies that as automation adoption increases, the effectiveness and presence of predictors that support remote education—such as learning management systems, teacher training, and student support services—also improve. This highlights the value of institutional investments in automation technologies, as these innovations enable teachers to better adapt to remote learning environments and enhance educational delivery. Teachers who are supported by well-integrated automation systems are more likely to engage in efficient, accessible, and flexible remote education practices.

This finding is supported by the study of Aruleba et al. (2022), which emphasized that higher levels of automation adoption correlate with greater teacher adaptability and instructional success in remote learning settings. Similarly, Zou et al. (2021) revealed that when institutions provide robust technological infrastructure and support systems, teachers become more confident and effective in using digital tools for remote education. Furthermore, Al- Selwyn et al. (2023) highlighted that the integration of automation in education boosts institutional readiness and teacher competence, ultimately leading to better student outcomes and smoother transitions in blended or remote learning environments.

**3.4. Domains of Automation Adoption that Significantly Influence Predictors of Remote Education among Public Elementary School Teachers**

**Table 4. Domains of Automation Adoption that Significantly Influence Predictors of Remote Education among Public Elementary School Teachers**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Domains** | **B** | **BE** | **Beta** | **t-stat** | **p-value** | **Decision** |
| Constant | 3.15 | 0.84 |  | 7.45 | 0.000 | Significant |
| Technological Readiness | 0.78 | 0.66 | 0.54 | 6.22 | 0.000 | Significant |
| Institutional Support | 0.74 | 0.65 | 0.57 | 6.50 | 0.000 | Significant |
| Pedagogical Integration | 0.76 | 0.63 | 0.56 | 6.33 | 0.000 | Significant |
| **Regression Model** |
| Predictors of Remote Education = 3.15 + 0.78 (Technological Readiness) + 0.74 (Institutional Support) + 0.76 (Pedagogical Integration) |
| R = 0.66; R² = 0.44; F = 69.80; p-value = 0.000 |

Presented in Table 4 is the regression analysis examining how different domains of automation adoption—technological readiness, institutional support, and pedagogical integration—significantly influence the predictors of remote education among public elementary school teachers. The regression model, which predicts remote education readiness based on these domains, is expressed by the equation: Predictors of Remote Education = 3.15 + 0.78 (Technological Readiness) + 0.74 (Institutional Support) + 0.76 (Pedagogical Integration). This model accounts for 44% of the variance in the predictors of remote education, as indicated by the R² value of 0.44. The model’s statistical validity is supported by an F-value of 69.80 and a p-value of 0.000, indicating a highly significant overall relationship.

These findings imply that automation adoption substantially influences the effectiveness of remote education predictors. Teachers with strong technological readiness, robust institutional backing, and well-integrated pedagogy are more likely to exhibit better preparedness and performance in remote teaching environments. Among the domains, technological readiness yields the highest unstandardized coefficient (B = 0.78), highlighting the importance of teacher access to and proficiency with digital tools. Institutional support and pedagogical integration also play vital roles in ensuring teachers are equipped to deliver quality education remotely.

This result aligns with the study of Alharbi (2023), who emphasized that teachers with high technological readiness and organizational support demonstrate greater competency in navigating online platforms and managing virtual classrooms. Likewise, the findings of Mutambik (2024) showed that institutions that offer training, resources, and pedagogical alignment significantly enhance teachers' ability to conduct effective remote instruction. Furthermore, Şahin et al. (2022) underscored that pedagogical integration ensures that technology use in education is not merely operational but transformative, enhancing student engagement and learning outcomes. Strengthening all three domains of automation adoption is therefore critical to the sustained success of remote education in public elementary schools.

**4. CONCLUSIONS**

Based on the findings of the study, the following conclusions were formulated:

Firstly, the level of automation adoption among public elementary school teachers is always observed, with teachers demonstrating a very high level of technological readiness, institutional support, and pedagogical integration. This indicates that teachers are well-equipped with the necessary technological skills, receive adequate support from their institutions, and effectively incorporate technology into their teaching practices. A strong foundation in automation adoption enables teachers to adapt quickly to digital innovations, streamline instructional delivery, and enhance classroom efficiency. When teachers are technologically prepared and institutionally supported, they are more confident, effective, and resilient in implementing technology-driven instruction.

Secondly, the level of predictors of remote education among teachers is always observed, particularly in the areas of learning management systems, student support services, and teacher training. This finding suggests that teachers are proficient in managing online learning platforms, capable of providing academic and emotional support to students, and regularly participate in relevant professional development programs. High levels in these domains contribute to successful implementation of remote education. When teachers are trained and supported in remote instruction, they are more likely to deliver engaging, accessible, and inclusive education to students in virtual settings.

Thirdly, a significant relationship between automation adoption and predictors of remote education was observed. This indicates that teachers who excel in automation adoption are more likely to perform well in remote education. Readiness in using technology, coupled with institutional and pedagogical support, plays a vital role in enabling teachers to facilitate effective virtual instruction. When teachers are confident in using digital tools and supported by a responsive educational environment, they become more capable of fostering dynamic online learning experiences and ensuring student engagement and success.

Finally, the domains of automation adoption significantly influence the predictors of remote education. Among these, technological readiness emerged as the strongest factor, followed by institutional support and pedagogical integration. This highlights the importance of enhancing teachers’ digital literacy, providing ongoing institutional backing, and ensuring that pedagogy is aligned with technological integration. Schools that emphasize these domains create an environment where remote education can thrive. By reinforcing automation adoption in the educational system, teachers become more adaptive, innovative, and effective in delivering education across digital platforms, ensuring continued success in both traditional and remote learning modalities.

**5. RECOMMENDATIONS**

Based on the findings and conclusions of this study, the following recommendations were proposed:

For DepEd officials, it is recommended to provide sustained investments in infrastructure and policy that support automation adoption and remote education. This includes developing comprehensive digital transformation frameworks, institutionalizing regular teacher training programs on emerging technologies, and promoting policy integration of technological readiness and instructional adaptability in teacher evaluation and development systems. These strategic initiatives will ensure that technology-enhanced teaching and remote education remain resilient, inclusive, and future-ready across public schools.

School administrators are advised to strengthen institutional support systems that facilitate both automation and remote learning. This involves offering structured digital literacy programs, establishing dedicated ICT support units, and implementing school-based learning management systems (LMS) tailored to the needs of teachers and learners. Administrators should also promote pedagogical integration by organizing collaborative lesson planning, technology-driven demonstration teaching, and data-informed instruction workshops. Fostering a supportive school climate that values innovation and collaboration will empower teachers to effectively embrace automation and remote teaching modalities.

For teachers, the study recommends active engagement in capacity-building opportunities related to technological readiness and remote teaching strategies. This includes participation in specialized trainings on LMS platforms, peer mentoring on digital pedagogies, and involvement in school-wide tech integration initiatives. Teachers are encouraged to adopt reflective practices that assess their instructional approaches in both face-to-face and virtual environments. By becoming digitally literate and pedagogically adaptive, teachers can enhance student engagement, personalize instruction, and deliver high-quality learning experiences.

Lastly, for future researchers, it is recommended to investigate the long-term impact of automation adoption on teaching effectiveness, student learning outcomes, and educational equity. Future studies could explore comparative analyses across urban and rural schools, evaluate the effectiveness of different institutional support models, and examine the role of teacher attitudes in the sustained implementation of remote education. Expanding the scope of research to include diverse educational settings and integrating mixed-methods designs may yield comprehensive insights that inform national education technology reforms.

Ethical approval and Consent

The study was conducted in full compliance with recognized ethical guidelines to protect the rights, dignity, and well-being of all participants. Before initiating data collection, the researcher obtained all required approvals from relevant institutional authorities, including an endorsement from the Dean of the Graduate School and ethical clearance from the designated Ethics Review Committee. The research process adhered to the ethical framework established by Pregoner et al. (2025), aligning with current standards for studies involving human participants in educational contexts. Participation was completely voluntary, with each participant being fully informed about the study’s purpose, procedures, and their right to refuse or withdraw at any point without penalty. Informed consent was secured to confirm participants’ understanding and willingness to participate. To uphold confidentiality and anonymity, no personally identifiable information was collected, and all data were handled with strict confidentiality. The information gathered was used solely for academic purposes. These safeguards ensured the study was ethically sound, transparent, and respectful to all contributors.

Disclaimer (Artificial Intelligence)

The author(s) hereby declare that generative AI technologies have been used during the writing and editing of this manuscript. The details of the AI usage are as follows:

1. Grammarly: Used for grammar and spellchecking, as well as suggestions for improving sentence structure and overall clarity.
2. Quillbot: Employed for paraphrasing and refining sentence flow to enhance readability and coherence.

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