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A Data-Driven Information Kiosk for Enhanced Educational Governance: Integrating Visualization and Geolocation in the DepEd Davao Del Norte Division

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ABSTRACT

This study aimed to create and assess a holistic, online Interactive Information Kiosk featuring Data Visualization and Geolocation for the Davao Del Norte Division of the Department of Education (DepEd). The initiative addresses the chronic information shortage and the slow data-gathering process between the Division and its stakeholders to support educational governance and operational efficiency. The project was executed applying the Agile Methodology and involved continuous communication with the Planning Office and IT staff throughout the whole process to obtain highly tailored and locally relevant results. School data, including performance indicators, facility inventories and staff information, can be easily and comprehensively uploaded and maintained by the planning officers assigned. The system offers a number of advanced functionalities, including the dynamic data visualization of education metrics, geolocation features powered by the Google Maps API for accurate school mapping, instant weather updates, and performing high-level predictive analysis based on the AAA Exponential Smoothing model to predict future performance indicators. The system was also thoroughly evaluated according to the ISO 25010 Software Quality Framework, a globally recognized standard for software quality assessment. Evaluation by internal users produced an exceptional overall Grand Average Weighted Mean (GAWM) of 4.98 out of 5.00, thereby confirming the system's excellent quality across functional suitability, usability, and security. The findings very strongly suggest the system's ability to not only rectify the information shortage but also to propel data-driven decision-making in educational administration and to set a good example of ICT-based educational governance modernization.

INTRODUCTION

In today's interconnected world, where information flows freely across borders and technologies evolve rapidly, ensuring universal access to information remains both a pivotal challenge and an indispensable cornerstone of democracy and human empowerment. Access to information is a fundamental human right acknowledged by the Universal Declaration of Human Rights, guaranteeing individuals the freedom to seek, receive, and share information without boundaries (United Nations, 1948). This right enables people to stay informed, make decisions, and hold institutions accountable. Its implications across various domains, such as education, healthcare, and socio-economic development, allow individuals to improve their lives and contribute to the progress of society. In the digital era, efforts to bridge the information divide and promote universal access to information have gained prominence, with technological advancements playing a vital role in enhancing information accessibility (Warschauer & Matuchniak, 2010; Thierer & Crews, 2003). By promoting transparency and holding institutions accountable, access to information contributes to the integrity of governance and fosters fair development.

Information is not uniformly available, and various challenges hinder access for different demographics

and communities. Marginalized groups, people with disabilities, and individuals living in remote areas often face significant barriers to accessing critical information (Ndiwalana & Gebe, 2018). Factors such as lack of infrastructure, linguistic diversity, digital illiteracy, and socio-economic disparities contribute to the information divide, limiting these groups' ability to participate fully in societal affairs and access essential services (Alper & Duguay, 2015; Warschauer & Ames, 2010). Navigating the intricacies of the digital era, it is crucial to advocate for initiatives that guarantee that everyone can pursue knowledge and empowerment without exclusion.

Interactive multimedia and hypermedia technology have become crucial components of the education process, employed in formal and informal settings. While the primary utilization of this technology in education is typically formal, such as for instructing specific subject matter using multimedia, there is a recent trend where multimedia-based public access systems like the World Wide Web, interactive exhibits, and entertainment systems are gaining prominence as a fresh approach to interactive multimedia usage. This development represents a new era of employing interactive multimedia (Kearsley & Heller, 1995). Multimedia public access systems, spanning a diverse range of subjects, are commonly located in venues such as museums (Daly, 1993), parks (Betts, 1994), libraries

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(Fitzgerald, 1994), department stores, supermarkets (Leinfuss, 1993), hotels (Slater, 1992), airports (Weiss, 1995), and college campuses (Wilson, 1992). They offer engaging and immersive experiences that cater to diverse audiences, enhancing learning opportunities beyond the confines of traditional classrooms.

A kiosk exemplifies interactive media and hypermedia technology. It serves as a prime illustration of this technology in action. Kiosks have been used in various public environments for several years, including airports, retail stores, train stations, and various customer service points (Slack & Rowley, 2002). They have been used to provide and collect information, advertise, and facilitate transactions (Ni & Ho, 2005). Analyzing the utilization of information kiosks allows us to grasp how information technology systems play a crucial role in bridging the information divide between an organization and individuals.

The advancement of innovative technology in education signifies a major innovation poised to enhance the learning environment (Chatty *et al.*, 2012). E-learning and web-based education systems have reshaped traditional classrooms into virtual ones, eliminating the necessity for physical presence. Course management systems and online communication tools facilitate e-learning across diverse educational institutions (Cole & Foster, 2007), gathering extensive digital data on students' Learning Management System (LMS) usage patterns concurrently. Educational Data Mining (EDM) and Learning Analytics (LA) are distinct research domains investigating the potential of historical data to enhance education quality (Merceron, 2015). EDM employs computerized techniques to identify patterns in large educational datasets, drawing insights from LMS data using data mining methods (Baker *et al.*, 2010). The information gathered by these systems is a proxy for assessing students' learning behavior. Analyzing these data enables us to derive valuable insights to enhance student performance. With these insights, stakeholders can gain a deeper understanding of the learning process, leading to improved managerial decision-making.

To address this challenge, this study proposes and evaluates the DepEd Davao Del Norte Information Kiosk with Data Visualization and Geolocation. This innovation aims to provide a centralized, interactive, and user-friendly platform for stakeholders to access vital educational information.

The main objective of this study is to develop an application that bridges the information gap between the DepEd Division of Davao Del Norte and its stakeholders. The specific objectives were to:

1. Enable planning and school planning officers to upload and manage relevant school data, including performance indicators and facilities.
2. Allow information officers to manage news and events data.
3. Implement geolocation services to help users find the nearest schools.
4. Integrate real-time weather updates and forecasts.

5. Utilize predictive analysis and data visualization techniques on school performance indicators.

6. Generate essential administrative and directory reports.

The implementation of this system is significant for DepEd as it serves as a pilot initiative for educational improvement that can be replicated across other divisions, promoting transparency, accountability, and improved academic outcomes.

LITERATURE REVIEW

Litsey *et al.* (2015) conducted a study that involved a comprehensive examination of the implementation of interactive kiosks at Texas Tech University Libraries. The study highlighted the effectiveness of kiosks, particularly in providing directional assistance. Furthermore, they observed a reduction in queries directed at the service desk. For instance, the number of inquiries related to adding funds to print accounts decreased significantly, from 6,274 between August 2012 and December 2012 to 4,643 between August 2013 and December 2013, a decrease of almost 25%. They concluded that interactive kiosks are a valuable means of instructing students and visitors on how to optimize their use of the library while simultaneously alleviating the service desk's workload.

On a related note, a study conducted by Ni and Ho (2005) examines the challenges associated with the introduction of e-government services by investigating the development of information kiosks. They emphasized the importance of kiosk development through their analysis of the GeorgiaNet kiosk project and the Boston-I kiosk pilot project. Their findings highlighted the potential value of information kiosks in providing citizens with convenient access to information and services while addressing the digital divide in society. However, they also underscored the need to consider numerous factors when implementing such technology. The study concluded that most kiosk projects do not typically fail due to technical issues but rather due to managerial challenges. The study also suggested that for a successful kiosk project, it is crucial to have a realistic plan, enhance communication among partners, secure the necessary investment for the back-end support of kiosk projects, and, notably, implement cost accounting measures for kiosk projects.

Hirumi, Savenye, and Allen (1994) investigated creating, implementing, and assessing an interactive videodisc kiosk that highlights desert ecology at the San Diego Natural Museum. This program aimed to deliver information about various desert species, ecological relationships, and typical behaviors. According to their on-site evaluation, approximately one-third of museum visitors were engaged with the program. Those who used it spent more time interacting with the videodisc kiosk than other exhibits within the museum. The evaluation underscored the effectiveness of employing sound, video, and animation to engage and attract visitors while also offering them alternative navigation options.

Moreover, a study conducted by Wang and Shih (2009)

explored the reasons behind the usage of information kiosks, highlighting three principal factors. Firstly, performance expectancy, where kiosks are more likely to be accepted if they help users access information efficiently and gain a competitive edge. Secondly, ease of use (effort expectancy), as user-friendliness and simplicity attract users. Lastly, social influence plays a significant role, with people more likely to use kiosks if they see others in their social circles doing so. These findings underline the pivotal role of these factors in promoting the use of information kiosks.

In the Department of Education Schools Division of Davao del Norte, a consistent commitment to its programs has stood the test of time. The division has effectively managed its projects and initiatives by addressing the needs of both internal and external stakeholders. Schools Division Office (SDO) - Davao del Norte is committed to delivering high-quality curriculum and instruction, as well as efficient school governance and operations. It aims to support various activities, programs, interventions, and strategies aimed at enhancing learning outcomes and school-based management across its 264 schools.

Today, as the education landscape evolves, the division is preparing to meet new challenges and international standards. SDO - Davao Del Norte remains optimistic about achieving the goal of ensuring that all Filipinos can reach their full potential and contribute meaningfully to a united nation. This aligns with the aspirations outlined in the DepEd's Basic Education Development Plan (BEDP) 2030, which includes four key pillars: Access, Quality, Equity, and Resiliency and Well-being. These pillars are further reinforced by Enabling Mechanisms Governance, which seeks to modernize and streamline the department's governance and management processes for greater efficiency and resilience.

However, despite the Division of Davao del Norte's commendable efforts and commitment to excellence, there remains a noticeable information gap between the organization and its stakeholders. Information is often not readily available and can be challenging for external parties

to access. This gap hinders effective communication and collaboration between the division and its various stakeholders, including parents, students, teachers, and the broader community. Bridging this information divide and improving transparency in the dissemination of educational data and updates are important aspects that the division should address to enhance its programs and initiatives further, ensuring that all stakeholders are well-informed and engaged in the pursuit of quality education. To address the information gap issue, this study is taking a proactive step by introducing an innovative solution: the DepEd Davao del Norte Information Kiosk with data visualization and geolocation technology. This forward-thinking initiative aims to provide stakeholders with easy access to vital educational information in a user-friendly and interactive manner. The kiosk will serve as a centralized platform where stakeholders can access a wealth of data, including school performance metrics, enrollment statistics, curriculum updates, and educational initiatives. The integration of geolocation technology and real-time weather data will enable stakeholders to visualize data on a map, making it easier to identify and understand specific locations and conditions of the schools. The kiosk will also display data on news and events within the division. This innovation also aligns with the Department of Education's Basic Education Development Plan (BEDP) 2023 and resonates with United Nation's Sustainable Development Goals (SDGs), particularly Goal 4, Quality Education. By implementing this Information Kiosk, DepEd Davao del Norte is not only bridging the information gap but also empowering stakeholders with the tools they need to actively participate in and support the improvement of education in the province.

MATERIALS AND METHODS

System Development Method

The Agile Software Development Life Cycle (SDLC) was the methodology used in the research to make sure the system was flexible, user-centric and highly adaptable

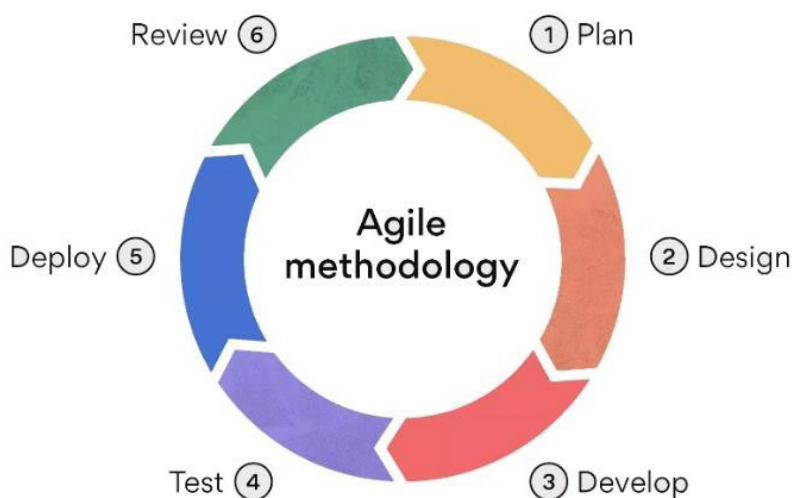


Figure 1: Process of Agile Methodology

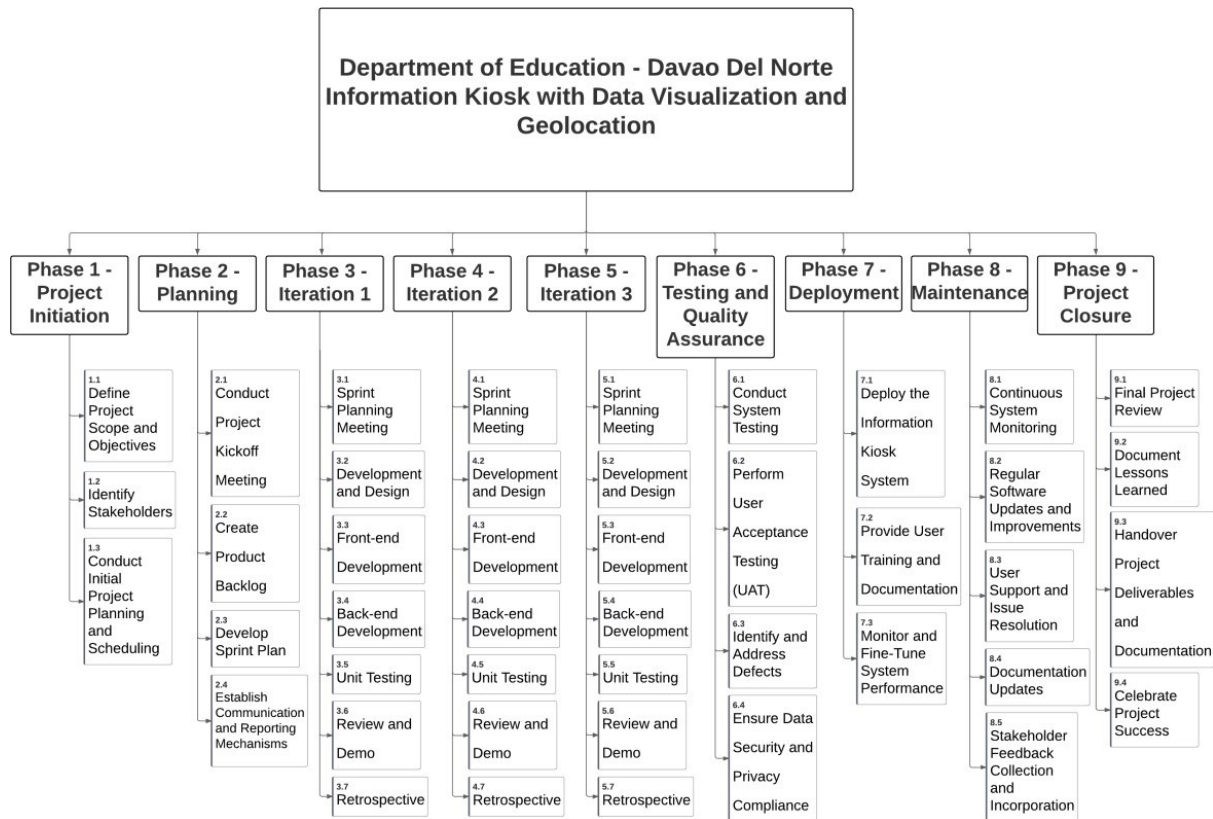


Figure 2: Diagram of Work Breakdown Schedule (WBS)

to the DepEd Davao Del Norte Division’s specific operational needs. This iterative approach was necessary for creating a specialized institutional system, as it would allow for gradual refinement based on the input of experts. The whole development process was divided into several sprints, with each sprint starting off with a Sprint Planning meeting in which tasks were chosen from a list of prioritized tasks in the product backlog. The execution of the sprint involved collaboration among developers and was supported by daily stand-up meetings to ensure that everyone was aligned and to quickly resolve any technical problems that might arise. At the end of each sprint, a Review and Demonstration was held, during which the main stakeholders, consisting of the Administrative Officer II, the IT Officer, and the Planning Section staff, tried out the working increment and gave very important feedback. Then there was a Retrospective session for the development team to discuss how they did and where they could improve for the next sprint. The very process of constant planning, developing, reviewing, and adapting contributed a lot to assuring the final system’s strength, functional adequacy, and compliance with the agency’s data governance standards.

System Planning and Feasibility Assessment

Project execution was managed using a Work Breakdown Schedule (WBS) as shown in Figure 2, which broke down the project into nine phases: Project Initiation, Planning, three Iterative Development phases, Testing and Quality Assurance, Deployment, Maintenance, and

Project Closure. A Gantt chart was used to provide a visual, structured overview of the project timeline and task durations.

Before development, a comprehensive feasibility study was conducted, examining economic, technical, and operational aspects.

Economic Feasibility was determined via a Cost-Benefit Analysis. The system was projected to significantly reduce the processing time for educational data requests from five days, two hours, and 10 minutes to two days, two hours, and 10 minutes. The analysis showed expected benefits surpassed associated costs, yielding a Return on Investment (ROI) of 165.9% with a payback period of 4.51 months.

Technical Feasibility confirmed that necessary hardware (e.g., 55-inch touch kiosk with specific display and processor specs) and software (e.g., Laravel version 9+, MySQL 8.0+, Google Maps API, OpenWeather API) were easily obtainable and aligned with SDO – Davao del Norte’s existing IT infrastructure. The system utilizes open-source development tools.

Operational Feasibility focused on the practicality of implementation and sustainability, including the requirement for an easy-to-understand interface and necessary end-user and administrator training.

System Analysis

Conceptual Framework

The conceptual framework depicted in Figure 3 illustrates the structure of the DepEd Davao Del Norte

Information Kiosk, which incorporates data visualization and geolocation. This framework served as the basis for comprehending and structuring the project's concept, encompassing aspects from data sourcing to data processing and the integration of various technologies

to present comprehensive information through the kiosk. It offered a visual representation of how the project was designed to collect, process, and present information seamlessly, underscoring the importance of this framework in achieving the project's goals.

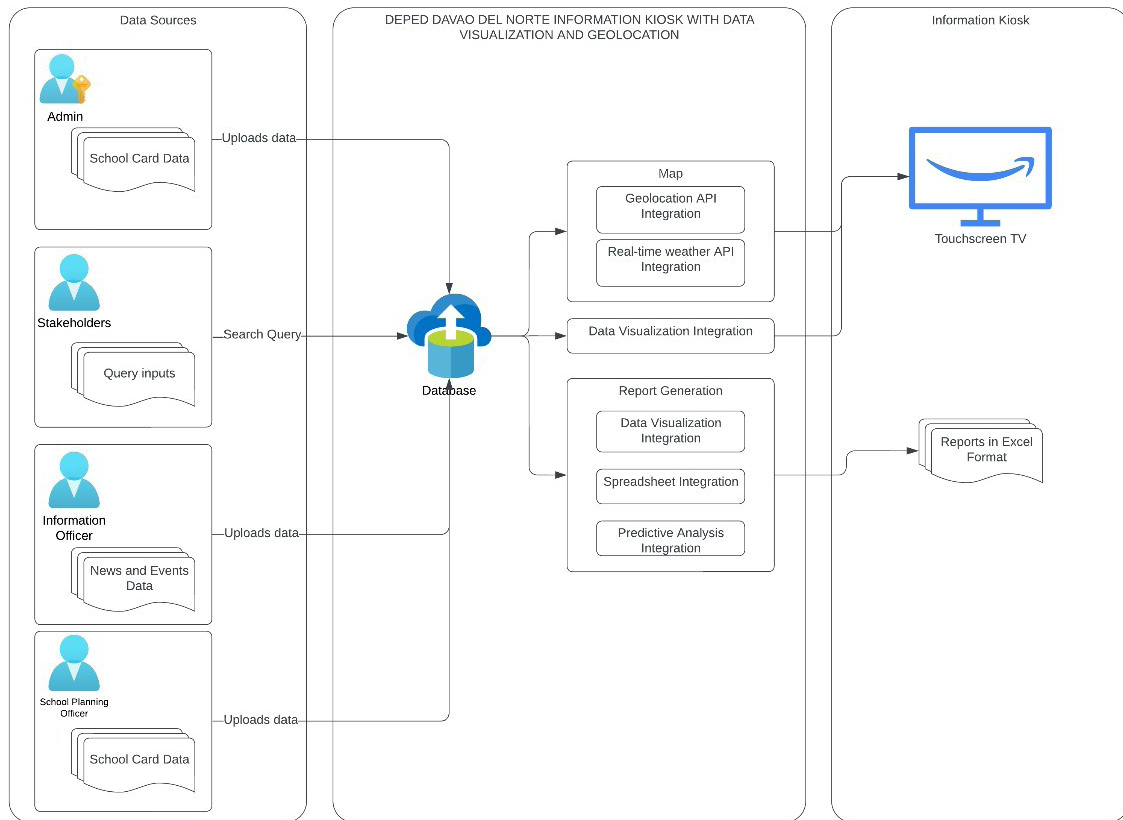


Figure 3: Conceptual Framework of DepEd Davao del Norte Information Kiosk with Data Visualization and Geolocation

Business Process Optimization and System Requirements

The system implementation required optimizing the previous business process for educational data requests, which suffered from a lack of readily available data and a time-consuming collection process involving remote schools. The optimized process mandates schools to submit data by a deadline for upload to a readily accessible data bank in the kiosk. This eliminated the need for the Planning section to contact schools for every request, allowing them to generate requested information directly from the data bank.

The system's requirements were defined by Functional Requirements for different user roles (Administrator/ Planning Office, Information Officer, School Planning Officer, and the Information Kiosk itself) and Non-functional Requirements covering User Authentication, Functional Suitability, Usability, Reliability, Performance Efficiency, Security, Maintainability, and Interoperability. Use Case Diagrams as shown in Figure 4 detailed the interactions for Stakeholders, Administrator, Information Officer, and School Planning Officer. For the Predictive Analysis feature, three algorithms AAA Exponential

Smoothing, Linear Regression Analysis, and ARIMA were tested for enrollment data forecasting. Although ARIMA showed the highest accuracy with the lowest error indicators (e.g., Mean Absolute Error of 556.77 and Mean Absolute Percentage Error of 0.43%) the developer opted for the AAA Exponential Smoothing method, as it is the standard and required forecasting algorithm of DepEd.

System Design and Technologies

The system design for the DepEd Davao del Norte Information Kiosk prioritized a cutting-edge User Experience (UX) and an intuitive interface. The structure and navigation were guided by Sitemap Diagrams detailing the features accessible to Stakeholders, the Administrator, the Information Officer, and the School Planning Officer. On the front end, several key concepts and technologies were incorporated to enhance interactivity and engagement:

Hierarchy of Information was employed in the UI/ UX design to prioritize content, facilitate user-friendly navigation, and improve the clarity and efficiency of information retrieval; Touch interactions were utilized to

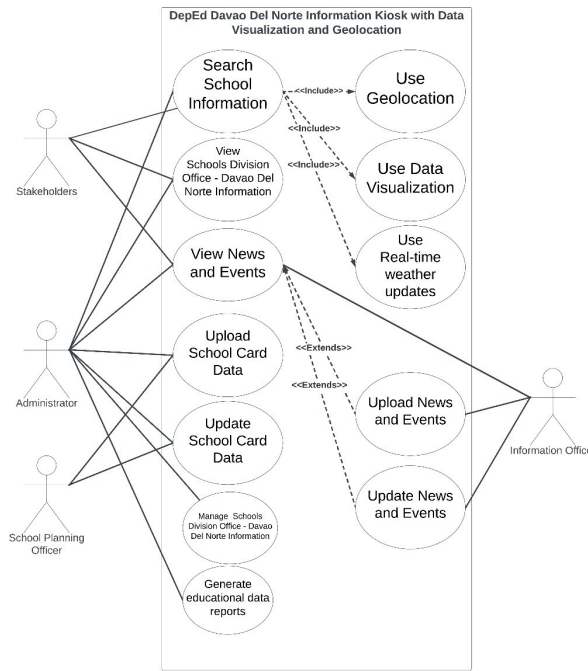


Figure 4: Use Case Diagram of the Implemented System

create intuitive navigation and ensure buttons and icons were correctly sized and positioned for easy use on the touchscreen kiosk ; and Bootstrap, an open-source front-end framework, was used to develop a responsive and user-friendly interface that adapts seamlessly to various screen sizes. For the back end, specialized concepts and technologies were integrated to elevate the kiosk’s functionality : Geographic Information Systems (GIS) and the Google Maps API were instrumental in integrating and displaying geographical data, including school location and zoning information based on coordinates; Chart.js, an open-source JavaScript library, was used to create interactive and visually compelling charts for visualizing school data and performance indicators ; the OpenWeather API was integrated to deliver real-time weather forecasts and information relevant to school locations, enhancing the kiosk’s utility and safety planning ; and Laravel, a popular PHP web application framework, served as the key technology for building a dynamic and secure server-side web application and for integrating the various APIs like the map and weather APIs.

System Implementation and Evaluation

The implementation involved a 3-week user acceptance testing phase. User training began with face-to-face sessions for the planning office staff. Issues identified

during training (e.g., errors in adding schools, incorrect data display, lack of sort/search options) were promptly addressed, and a new feature for uploading PDF forms was added based on user suggestions.

System evaluation was conducted using the ISO 25010 standard with 97 evaluators selected via purposive sampling. Evaluators included 92 school planning officers, four planning office staff, and one information officer. Following successful testing, a user manual was prepared, and the system was formally turned over to the IT officer for management, with the developer providing free maintenance as long as they remain employed at SDO – Davao del Norte.

RESULTS AND DISCUSSION

The assessment of the system that has been developed emphasizes the results of its implementation and its effectiveness in meeting its main goals, mainly via user satisfaction and performance metrics.

Key System Objectives and Performance

The system was evaluated based on several functional requirements, as shown in Table 1 with an overall Grand AWM of 4.98 (Strongly Agree) across the ISO 25010 Software Quality Framework, indicating high user satisfaction in areas like Functional Suitability (4.96),

Table 1: Summary of User Rating based on ISO 25010 Software Quality Framework

Quality Characteristics	Mean	Descriptive Equivalence
Functional Suitability	4.96	Strongly Agree
Usability	4.97	Strongly Agree
Reliability	4.98	Strongly Agree
Performance Efficiency	4.98	Strongly Agree

Security	4.96	Strongly Agree
Maintainability	4.99	Strongly Agree
Interoperability	5	Strongly Agree
Grand AWM	4.98	Strongly Agree

Usability (4.97), Reliability (4.98), Performance Efficiency (4.98), and Security (4.96).

Data Upload and Management

The system successfully achieved its objective of allowing Planning Officers and School Planning Officers (SPOs)

to upload relevant school data. The features for managing school card data, including school basic information, personnel, performance indicators, and facilities inventory, received a mean score of 4.95 (Strongly Agree) as shown in the table below.

Table 3: Regression Model with Significant Predictors for NBFIs

Assessment Description		Respondent Rating			AWM	Descriptive Equivalent
		Information Officer	Planning Office	School Planning Officer		
1.	The system provides all the necessary features and functionalities required for managing school card data effectively.	-	5	4.84	4.92	Strongly Agree
2.	The system's interface for managing school card data is intuitive.	-	5	-	5	Strongly Agree
3.	The system's features for uploading end-of-school-year data are user-friendly for School Planning Coordinators.	-	-	4.89	4.89	Strongly Agree
4.	The system's features for uploading end-of-school-year data are user-friendly for School Planning Coordinators.	-	-	4.91	4.91	Strongly Agree
5.	The system's features for setting and managing deadlines for data submission are user-friendly.	-	5	-	5	Strongly Agree
6.	The system is dependable in validating and approving submitted end-of-school-year data for each school.	-	5	-	5	Strongly Agree
7.	School Planning Coordinators rely on the system to accurately capture and store end-of-year data.	-	-	4.86	4.86	Strongly Agree
8.	The system is dependable in providing timely reminders for data submission deadlines.	-	-	5	5	Strongly Agree
9.	The system is responsive when uploading and submitting end-of-school-year data.	-	-	4.9	4.9	Strongly Agree
10.	The system is secure in ensuring that only authorized personnel can access and manage school data.	-	5	-	5	Strongly Agree
11.	The system has an adequate measure in place to protect confidential information stored within the system.	-	5	-	5	Strongly Agree

12.	The system is secure in protecting sensitive school data, such as personnel information, school health information, and performance indicators.	-	-	4.88	4.88	Strongly Agree
13.	The system has adequate measures in place to ensure the confidentiality and integrity of uploaded data.	-	-	4.88	4.88	Strongly Agree
14.	School Planning Coordinators easily review and verify submitted data before final submission.	-	-	4.97	4.97	Strongly Agree
15.	Updating and maintaining school card data within the system is easy and straightforward.	-	5	4.96	4.98	Strongly Agree
16.	School Planning Coordinators easily review and verify submitted data before final submission.	-	-	4.97	4.97	Strongly Agree
				Mean	4.95	Strongly Agree

The soaring rating is a clear indicator that the system has all the necessary features and functionalities along with a user-friendly interface for planning officers (using Excel files) and an intuitive interface for SPOs to support efficient data management. The system is also seen as reliable in the processes of validating and approving the submitted data, as well as providing timely reminders for the data submission deadlines. The system keeps up with the stringent security controls for sensitive data that are vital for making the decision process more effective through inter-platforms integration.

News and Events Management

The Information Officer reviewed and evaluated the system's capacity to handle the data of news and events and scored it perfectly with a mean value of 5.0 (Strongly Agree) as presented in Table 3. This shows that all the required features have been provided and the system has reached its goal. In addition, the system is very easy to use, provides correct information and there are no delays in publication or updating of the information, and security is very robust. Besides that, the system is simple and it takes no time at all to remove or update old news and to import news data from outside sources.

Table 3: Regression Model with Significant Predictors for NBFIs

Assessment Description		Respondent Rating			AWM	Descriptive Equivalent
		Information Officer	Planning Office	School Planning Officer		
1.	The system provides all the necessary features and functionalities required for managing news and events data effectively.	5	-	-	5	Strongly Agree
2.	The system's interface for managing news and events data is intuitive.	5	-	-	5	Strongly Agree
3.	The system's features for uploading and editing news articles are intuitive for the Information Officer.	5	-	-	5	Strongly Agree
4.	Information Officers depend on the system to accurately display news and event data.	5	-	-	5	Strongly Agree
5.	The system is dependable in ensuring that published news are accessible to stakeholders.	5	-	-	5	Strongly Agree

6.	The system does not experience any slowdowns when publishing or updating news articles.	5	-	-	5	Strongly Agree
7.	The system is secure in preventing unauthorized access to sensitive news and events data.	5	-	-	5	Strongly Agree
8.	The system has an adequate measure in place to ensure the integrity of published news articles.	5	-	-	5	Strongly Agree
9.	Updating and maintaining news and events data within the system is easy and straightforward.	5	-	-	5	Strongly Agree
10.	Information Officers can quickly edit or remove outdated news articles from the system.	5	-	-	5	Strongly Agree
11.	Information Officers can import from external platforms to streamline content management.	5	-	-	5	Strongly Agree
				Mean	5	Strongly Agree

Geolocation and Real-time Weather Integration

The purpose of putting in place geolocation services (for finding the nearest schools along with directions and maps) and integrating real-time weather updates (for the Province of Davao del Norte) was accomplished with a brilliant average score of 5.0 (Strongly Agree). Personnel

from Planning Office evaluated geolocation services, especially for confirming the location of new schools by using longitude and latitude data. The flawless rating suggests that the system shows correct information about schools and gives trustworthy real-time weather updates to every interested party.

Table 4: Summative Quantitative Results of System’s Objective in Integrating Geolocation and Real-time Weather Data

Assessment Description		Respondent Rating			AWM	Descriptive Equivalent
		Information Officer	Planning Office	School Planning Officer		
1.	The system's geolocation services are implemented accurately, providing reliable directions and maps to users.	-	5	-	5	Strongly Agree
				Mean	5	Strongly Agree

Data Analysis and Reporting Capabilities Predictive Analysis and Data Visualization

Table 5 presents the system’s objective of using predictive analysis and data visualization on school card data, specifically performance indicators, also received a

perfect mean rating of 5.0 (Strongly Agree). The system uses the DepEd’s forecasting standard. The underlying AAA Exponential Smoothing algorithm demonstrated high accuracy, successfully achieving the objective.

Table 5: Regression Model with Significant Predictors for NBFIs

Assessment Description		Respondent Rating			AWM	Descriptive Equivalent
		Information Officer	Planning Office	School Planning Officer		
1.	The system generates an accurate predictive analysis and visualization of school performance indicator data.	-	5	-	5	Strongly Agree

2.	The system does not experience any performance issues when generating predictive analysis and data visualization of school performance indicators.	-	5	-	5	Strongly Agree
3.	Updating and maintaining school card data within the system is easy and straightforward.	-	5	-	5	Strongly Agree
4.	The system integrates seamlessly with other educational platforms or databases for data exchange.	-	5	-	5	Strongly Agree
				Mean	5	Strongly Agree

The performance matrix for the algorithm showed minimal errors compared to actual data as depicted in Table 6. The Mean Absolute Percentage Error (MAPE) was only 0.56%, indicating the forecasted data are very close to the actual data, with a forecasted value of

128,711.73 compared to the actual data of 127,999. The low Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE) of 712.73 further support the algorithm's accuracy and the system's reliability in generating and displaying predictive analysis.

Table 6: Performance Matrix for the AAA Exponential Smoothing Algorithm

Algorithms	Forecasted Data	Actual Data	Mean Absolute Error	Mean Squared Error	Root Squared Error	Mean Absolute Percentage Error
AAA Exponential Smoothing	128,711.73	127,999	712.73	508,263.02	712.73	0.56%

Report Generation

The system's function to generate various reports (e.g., enrollment, personnel, school building, and directories)

was met with a perfect mean score of 5.0 (Strongly Agree) by the Planning Office personnel as shown in Table 7, to wit:

Table 7: Summative Quantitative Results of System's Objective in Generating Reports

Assessment Description		Respondent Rating			AWM	Descriptive Equivalent
		Information Officer	Planning Office	School Planning Officer		
1.	Administrators rely on the system to generate accurate reports such as enrolment and school building reports.	-	5	-	5	Strongly Agree
2.	The system is responsive when managing user data, including school head data and user management.	-	5	-	5	Strongly Agree
3.	The system does not experience any performance issues when generating reports or managing deadlines.	-	5	-	5	Strongly Agree
4.	Administrators access relevant information from external sources to enhance decision-making.	-	5	-	5	Strongly Agree
				Mean	5	Strongly Agree

Users expressed satisfaction with the filtering capabilities, finding them intuitive for customizing reports to meet

specific needs. The high rating confirms that the Planning Office can rely on the system to accurately generate

reports, especially school performance indicators, without performance issues, which enhances decision-making.

The near-perfect scores across all evaluated objectives and the high Grand AWM of 4.98 suggest that the system is a highly functional, usable, and secure solution for the agency's data management and information dissemination needs²⁵. The achievement of its objectives especially in data uploading (mean 4.95), managing news and events (mean 5.0), geolocation (mean 5.0), predictive analysis (mean 5.0), and reporting (mean 5.0) highlights its potential to significantly enhance efficiency and data-driven decision-making.

The low MAPE of 0.56% for the AAA Exponential Smoothing algorithm is particularly noteworthy, indicating that the system's forecasting capabilities are highly reliable for school performance indicators. This minimal error suggests that the predictive function can be confidently used by stakeholders to anticipate trends and allocate resources, showcasing the system's novelty in leveraging standardized forecasting methods for educational data. The initial identification of bugs, while requiring resolution, does not undermine the robust features and high user perception of the system's core functionalities and security. The system's successful integration of geolocation and real-time weather, along with its capability to generate custom, accurate reports, positions it as a dependable, multi-faceted platform designed to meet the specific requirements of its diverse user base (Planning Officers, SPOs, and Information Officers).

CONCLUSION

This research delivered a streamlined platform enabling Planning Officers and School Planning Officers to efficiently manage educational data. High user ratings confirm the system achieved its objectives through core functionalities: data visualization, predictive analysis aligned with DepEd forecasting standards, geolocation routing, and real-time weather updates. These features significantly enhanced planning and decision-making capabilities.

The system's primary contribution is integrating geolocation and weather data into educational information systems, establishing technological standards for the sector while supporting accurate school data reporting. Its ability to provide comprehensive environmental context improves communication and coordination across the educational landscape, with seamless platform integration demonstrating flexibility and scalability potential.

Key recommendations for maintaining optimal performance include establishing user feedback mechanisms and developing a mobile kiosk application to increase accessibility. Enhanced customization through adjustable report settings and drag-and-drop visualization tools is proposed.

Most critically, implementing a heat index notification system is advised to automatically alert schools when conditions warrant cancelling face-to-face classes, with

guidelines for transitioning to asynchronous learning. This prioritizes student and staff safety during extreme weather while ensuring educational continuity. These enhancements will solidify the system's position as an essential, safety-oriented, accessible, and user-friendly educational tool.

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