

A Sustainable Approach to School Management: Introducing the Bold School Management System

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ABSTRACT

The dominant reliance on paper-based record-keeping systems in schools in Ghana is in contrast with the global inclination towards the use of electronic systems. The paper sheds light on the unintended environmental impact of the practice and proposes a sustainable alternative; the BoldSchool Management System. It utilises spreadsheets for academic data storage and MySQL database for other records, providing schools with a flexibility. The study demonstrates that the adoption of electronic system will address administrative inefficiencies and contribute to environmental sustainability. Primary data is taken from 18 schools, with a total learner population of 6792 learners.

Keywords

School Management, Electronic Systems, Environmental Sustainability, Paper-Based Processes, Education Administration

1. INTRODUCTION

The education sector in Ghana traditionally relies on record-keeping systems, primarily utilising paper-based methods. There is no official or reliable data available on the number of schools using electronic school management systems, but the unscientific study done by the team showed that less than 10% of schools use such digital tools nationwide. The result is that a vast and significant proportion of pre-secondary schools in Ghana still use paper and manual procedures for school administration, including academic and financial report generation. This article communicates a possible way out while showcasing the consequences of this practice, emphasising the impact on environmental sustainability. Previous studies [1, 2] have highlighted the inefficiencies and inaccuracies associated with paper-based management systems, but environmental considerations have been understated.

2. THE CHALLENGE

2.1 Environmental Impact of Paper-Based Systems

Studies indicate an average of between 8,000 to 10,000 sheets of paper per tree in the production process [3, 4]. In the ten schools studied as part of this communication, the study found that on average, basic schools use a minimum of ten (10) sheets of A4 paper per learner annually for reporting purposes alone. With a reported population of 8,507,142 learners in Ghana's basic school system as of the end of 2022 [5], the annual paper consumption for reporting alone translates to some 85,071,420 sheets of paper, resulting in the destruction of around 10,000 trees each year. This statistic excludes the additional paper required for testing and communication.

Despite the acknowledged benefits of digital solutions, barriers such as acquisition and maintenance costs, a shortage of skilled personnel [6], and a lack of understanding regarding the advantages of electronic systems [7] can impede the adoption of such technologies in schools.

In response to the identified challenges, these authors built, tested, and introduced the Bold School Management System as a viable solution. The system utilises spreadsheets for academic information storage and a MySQL database for staff and financial records. This dual-storage approach enhances portability and reduces the burden on the database, distinguishing the School Manager from other systems. Its adaptability to both local hosts and remote servers via registered domain names further facilitates ease of use and encourages schools that do not have the means to run online management systems to reduce paperwork as well. The HTML/PHP dominant technology used also makes it easier to remotely provide updates in the case of localhost implementations through third-party remote desktop applications.

As of the end of 2023, 18 schools, comprising a total population of 6,792 learners, have successfully implemented the Bold system for a minimum of two academic terms. The system's flexibility has motivated schools to embrace the solution, offering a promising possibility for moderating the environmental impact of paper-based processes. The relatively few schools that have already used the system have collectively saved 28 boxes consisting of 140 reams of A4 paper. This translates to the equivalent of 7 trees which have been saved, contributing to the reduction of carbon emissions.

The Bold School Management System presents a compelling alternative to traditional paper-based school management processes. Its successful implementation in 18 schools without any conscious or explicit marketing put in place demonstrates the potential for widespread adoption. This is perceived as birthing a more sustainable approach to education administration. It not only addresses the inefficiencies associated with paper-based systems, but also contributes to environmental conservation, aligning with global efforts towards sustainable practices in education.

3. THE SOLUTION

3.1 Application Architecture

The Bold School Management System was designed with flexibility and efficiency in mind. It thus takes advantage of both spreadsheet and relative database management technologies for data storage; spreadsheets for academic data and MySQL for staff and financial records. This dual-storage approach enhanced portability and reduces strain on the

database. The markup and scripting languages used also make it adaptable to both localhost and remote server implementation allowing for all kinds of institutions including those in resource-constrained areas to participate.

4. DEVELOPMENT & METHODOLOGY

4.1 Application Development Overview:

Starting as a hobby project and with self-generated funds, the vanilla-PHP coded system was developed with a focus on robust and efficient functionality, employing a combination of technologies to meet the desired requirements.

4.2 Programming Languages and Technologies:

PHP: The core and supporting functions of the software were primarily implemented in PHP. PHP provides a server-side scripting environment, enabling dynamic content generation and seamless integration with web applications.

JavaScript and HTML: To enhance the user interface and provide a dynamic user experience, JavaScript and HTML are employed. JavaScript, as a client-side scripting language, facilitates interactivity within the system, while HTML in combination with CSS and some limited use of XML structures the content, look and feel, to ensure responsiveness across devices types where implemented.

Database and Spreadsheet Management: The system relies on the MySQL database engine for efficient data storage. MySQL is a widely used relational database management system known for its reliability, scalability, and performance. It seamlessly integrates with PHP, enabling the application to store and retrieve data in a structured manner providing a secure and reliable foundation for the application. To minimize load on the database and to enhance portability of data, the system stores static academic records in Excel sheets. To achieve this, the PHP-Excel library is utilised. This library streamlines the handling and manipulation of Excel files, allowing for tasks such as reading, writing, and formatting data within spreadsheet documents without the need for low level time consuming coding.

The chosen technologies offer scalability, allowing the software to accommodate future growth and evolving requirements. As the project progresses, periodic evaluations of emerging technologies and updates to libraries will be considered to ensure the application remains current and optimised.

4.3 User Interface

A demo version of the system is available at <https://smis.boldtechgh.com/demo/> for testing and further understanding. For brevity, therefore, it is worth mentioning that user views and privileges are managed by an inbuilt access control feature. Only the Super Administrator, has access to the complete set of features on their dashboard as shown in Figure 1. Other customisable users include, Clerk, Finance Officer, Class Teacher, Headteacher, Parent. The Super Administrator

for example has access to the privilege of ‘creating’ subjects which can in turn be managed by the Class Teacher under the Subject Combination module as shown in Figure 4. Another key but flexible module is the Student Management Portal in Figure 2 which lists existing all students with key identifiers such as School Number and parent contact details. The modules’ flexibility lies in the fact that different users have access to its different functions. Clerk for example is able to use this module to receive payments from students whereas Manager may for example be able to use it to bill students or perform any of several actions associated with student management. The system has the ability to generate several types of reports ranging from administrative reports such as class and staff lists to financial reports and history of individual students or classes among several others to academic reports of individual or cohort in different formats. Figure 3 which shows some of the steps involved in retrieving academic reports is one of several options and wizards available for generating reports in the system. There are video demonstration on the youtube playlist at <https://tinyurl.com/BoldSchMngr>

4.4 User experience evaluation

Although the system has been tested by dozens of alpha, beta and real users since 2018, the feedback has been very anecdotal and qualitative. For this communication, the study chose to include and display independent quantitative feedback taken in 5 month period. Thus, show the user experience (UX) feedback in two formats;

- i) experience and perceptions of real users
- ii) UX experience from automated non-human user.

The responses from 39 and 26 users of the online and offline versions of the system respectively are demonstrated in Table 1, with **Error! Reference source not found.** showing the average time taken for 55 Action runtime tests of selected aspects of the system. As detailed in Table 1, there was 81.5% positive response or feedback from users who access the system via the online version and 76.48% positive response from offline users. This overwhelming endorsement by over 4 out of every 5 users, can provide for good word-of-mouth publicity of the system. For the authors, it is also an endorsement that the system is worth communicating to the scientific community.

The Action runtime testing was done using 55 sets of attempts with each set consisting the activities mentioned in **Error! Reference source not found.**. This study employed the Cogtool testing application [8] and methodology to simulate the activities of 60 users on the selected tasks. The process involved illustrating the tasks of interests using a storyboard format with drawings and pictures using CogTool’s widgets. At the click of a button, CogTool created a model that estimated how long it would take an average skilled user to finish those tasks. By using CogTool, different users could be simulated without having to deal with the logistics, time and inefficiencies involved in using actual end users.

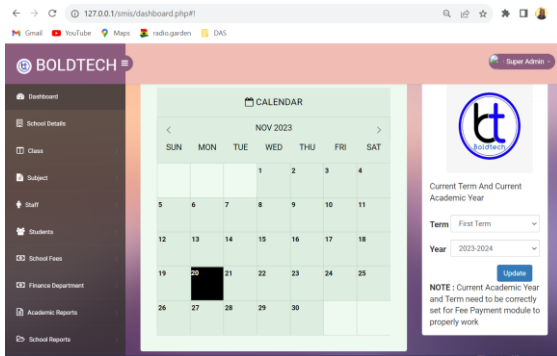


Figure 1: Administrator Dashboard Interface

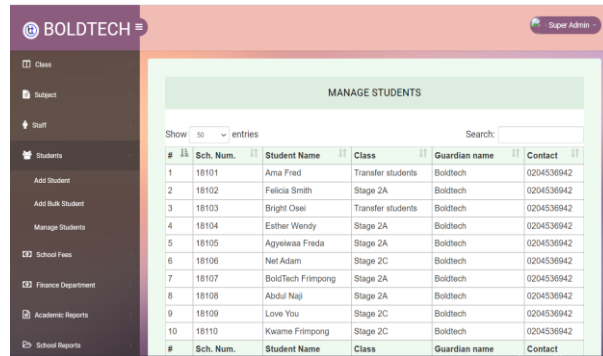


Figure 2: Student Management Portal

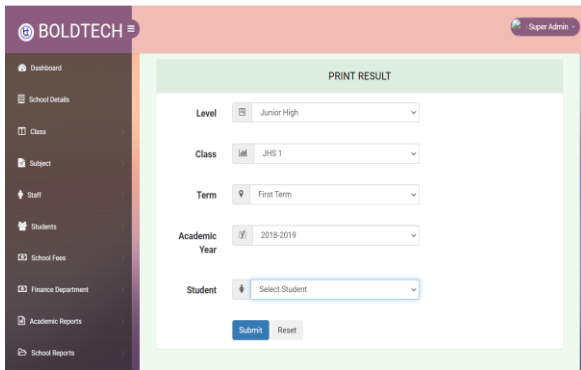


Figure 3: Class Results Printout Wizard

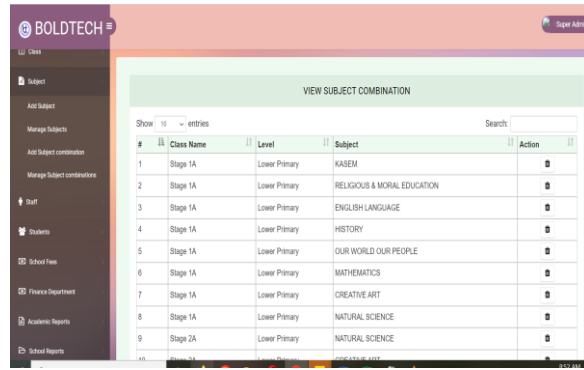


Figure 4: Subject Combination Module

Table 1: Users Experience and Perceptions of System

	Online			Offline		
	Yes	No	% Positive	Yes	No	% Positive
It saves us administrative time	31	8	78.5	22	4	84.6
Overall it was a god decision to invest in the system	27	12	69.2	20	6	76.9
Money is saved on paper and stationery	37	2	94.8	22	6	78.6
It is easy to navigate	25	14	64.1	17	9	65.4
It is environmentally friendly	39	0	100	20	6	76.9
Average			81.5			76.48

Table 2: System Test Results using Cogtool

Average time taken to (s):	Remote	Local host
Sign in	2.41	1.72
Add New User	12.83	9.87
Upload Students in Bulk ¹	7.31	4.87
Delete individual record	2.84	2.37
Upload Scores from excel file ¹	9.65	6.89
View Class Results	8.09	5.78
Generate Individual Financial History	14.88	9.92

4.5 User Feedback and Adaptation

The team has over the years received feedback from school proprietors, teachers and parents. **Proprietors** have been more concerned about data security and made input that has led to

¹ This requires a prefilled Excel file to be uploaded. Time recorded here does not include the time used for preparing same.

the development of a an automated backup script which sends a .sql backup of data to a designated email at a set time every 24 hours. This is in addition to existing security features.

Teachers feedback has largely concentrated on the user experience with regards to recording and reporting student academic and progress reports. A major response to this feedback has been allowing individual teachers to upload scores on assigned subjects. In the initial phases of the application, only designated staff could upload results for entire classes or school.

Parents feedback has centered on making student academic progress and financial reports easy to access and permanently available. The feedback led to the improvement of the system to allow for the sending of bulk SMS with customized URLs for parents to download PDFs of reports on their devices without need to login.

5. POTENTIAL IMPACT OF APPLICATION

5.1 Environmental Sustainability:

Reduction in Paper Consumption: The assessment of the use of the system so far, through our interactions with school administrators in 18 institutions has indicated a reduction in paper usage. This directly translates to saving trees and contributing to lower carbon emissions as targeted in the UN Sustainable Development Goal on conservation efforts and minimising deforestation and reducing waste [9,10].

5.2 Educational Institution Efficiency and Effectiveness:

User feedback has largely pointed to the time-saving benefits, streamlining of academic, financial and administrative reporting and therefore enhancing overall efficiency. According to Luz et al. [11] one of the major strategic reasons for organisations investing in technology is Operational Excellence. Thus, educational institutions that use the school management system or any other similar systems are ultimately protecting their own existence and enhancing their viability and competitiveness

6. LIMITATIONS AND FUTURE WORK

Sub-optimal responsiveness: The system was built to work ideally on localhost networks and from remote web servers both accessible through any modern browsers. Although extensive effort has been put into making the user interface responsive, the authors cannot guarantee that all pages will work responsively on all browsers. To offset the net effect of this, the research recommends future work should integrate or rewrite the code using any popular and well supported framework which would have already taken the nitty-gritty into consideration. The development of a mobile app user interface for parents is further recommended.

Cost Implications: While the system aims to reduce paperwork and streamline processes, initial hardware acquisition, configuration and maintenance costs might pose entry barriers especially for small sized resource-constrained institutions.

Tech savviness and perceptions: The study anticipates some possible resistance or hesitation arising from some users due to a lack of understanding or familiarity with electronic systems. Hence, needs-based training especially for school staff before implementation in any institution is highly recommended.

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