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RESEARCH ARTICLE

Development Assessment of a Thai University's Demonstration School Student Behavior Monitoring System

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ABSTRACT

This research and development initiative had three main objectives: 1) assess the quality of a behavior monitoring system (BMS) for Srinakharinwirot University Demonstration School (SUDS) students in Nakhon Nayok Province, Thailand, 2) design a student behavior monitoring system which leads to higher student success and retention levels, and 3) evaluate the Student Discipline Promotion and Development Committee's (SDPDC) satisfaction with the new behavior monitoring system. Tools used included a discussion record form and a system development satisfaction questionnaire analysed using descriptive statistics. The analysis from the study revealed two categories of requirements**: (**1) Issues with the current campus monitoring system, including challenges related to data recording, information retrieval, data processing, and report generation**. (**2) User requirements included the desire for a modern, computer-based system that simplifies data recording, ensures ease of use, facilitates rapid data management, minimizes redundant processes, ensures accurate report generation, and provides robust data security measures. This research successfully addresses SUDS's advanced behavior monitoring system needs, validated by positive SDPDC feedback on its comprehensive design and effectiveness.

INTRODUCTION

Addressing the persistent issue of student disengagement and its correlation with dropout rates is of paramount importance in educational settings. Studies by Kennelly and Monrad (2007) have consistently highlighted that students not actively participating in classroom activities are more likely to abandon their education prematurely. This problem necessitates vigilant monitoring by educators to identify potential issues and implement timely interventions. The significance of this matter extends across different educational levels, from elementary to university settings, impacting students and educational institutions alike.

In the realm of elementary education, research by Balfanz and Herzog (2006) and Neild and Balfanz (2006) has underscored the critical indicators of potential dropout, such as low attendance, behavioral issues, and academic struggles in math or English. Similarly, Alexander et al. (1997) emphasized the repercussions of students repeating a year in elementary school, indicating a high risk of subsequent dropout. These findings stress the need for continuous monitoring of student activities as a means to predict and address potential challenges.

Transitioning to the university level, dropout risks persist, as demonstrated by studies in Spain and Chile. Ortigosa et al. (2019) employed a predictive dropout risk model for online distance-learning undergraduate students, illustrating the efficacy of proactive measures in preventing dropout. Olaya et al. (2020) in Chile utilized 'Uplift' modelling to estimate individual-level dropout risk, emphasizing the importance of academic support in retaining students. The economic implications of student dropout, both in terms of university revenue and societal development, further highlight the need for effective monitoring and intervention strategies (Carlson, 2013).

Technology has emerged as a potential solution to streamline the monitoring process. Chiang et al. (2022) and Puckdeevongs et al. (2020) discussed the challenges of traditional attendance monitoring in universities and proposed innovative solutions using smartphone apps and Bluetooth Low Energy-based systems. Kamaraju and Kumar (2017) also explored the use of smartphones for student monitoring, emphasizing the importance of efficient information processing to enhance operational processes.

Acknowledging these challenges and opportunities, this study focuses on developing a student behavior monitoring system (SBMS) for the Srinakharinwirot University Demonstration School (SUDS) in Thailand. The existing manual data recording system at SUDS faces challenges in data management, reporting delays, and potential data corruption. To address these issues, a database system is proposed to enhance information management services, ensuring efficient data collection, processing, and retrieval. The objective is to create a high-quality system tailored to the needs of SUDS, facilitating more reliable and timely reporting.

COMCEPTUAL FRAMEWORK

The study developed a university demonstration school student behavior monitoring system (BMS). The following sections detail the methods for its development and implementation. To develop a behavior monitoring system for students at SUDS, the researchers employed a five-step System Development Life Cycle (SDLC) as a foundational guide for the research and development process (Aeimsiriwong, 2018; Champakul et al., 2022). The operational process is divided into two sequential steps: Step 1 - Research (R) and Step 2 - Development (D) (Figure 1).

Amornchantanakorn and Panpuang (2020) detailed their study's use of an SDLC framework. They reported that it consisted of a web application constructed using PHP and the Java programming language, which interfaced with an MYSQL database. Similarly, Pukdesree (2017) used the SDLC framework with collaborative learning to develop computer organization and architecture electronic courseware.

Step 1 - Research (R) encompasses stages 1 and 2 of the system development

To investigate the behavior monitoring system requirements, the researcher utilized a framework for comprehending user characteristics, actual needs, and system usage levels and selecting suitable features based on user needs. This also includes identifying influencing factors, challenges, and obstacles in the work environment (Andra et al., 2023; Prathuangsit et al., 2018).

Step 2 - Development (D) encompasses stages 3 to 5 of system development

The development of the proposed behavior monitoring system (BMS) for SUDS uses the Microsoft Access database management program, using Aeimsiriwong's (2018) SDLC concepts. The BMS quality assessment process used evaluation scores from four aspects, including (1) alignment with user needs, (2) a functional requirements test, (3) a function test, and (4) a usability test.

To gauge satisfaction among the Student Discipline Promotion and Development Committee (SDPDC) regarding the student BMS, the researchers utilized Chaipanya's (1999) concepts, employing a satisfaction questionnaire assessment containing three aspects including a (1) a functional requirements test, (2) a function test, and a (3) usability test.

Statement of the problem

In recent decades, various studies have underscored the critical need for effective student monitoring. However, these same studies highlight the potential for tragic outcomes if student behavior monitoring is neglected or proves ineffective without timely intervention. Compounding this issue, many educational institutions have grappled with overcrowding, rendering traditional monitoring procedures obsolete and overly time-consuming.

Fortunately, the advent of information communication technology (ICT) has sparked a digital revolution in class attendance record-keeping. While these digital tools offer enhanced efficiency, they simultaneously bring forth a host of challenges and issues. These include concerns related to the security of medical and personal data, privacy considerations, difficulties in technical support, associated software and hardware costs, database accessibility and connectivity, and the overarching challenges associated with managing and filtering 'big data.'

Against this backdrop, this study seeks to address the pressing issues that educators and administrators universally face, providing valuable insights and potential solutions to the multifaceted challenges posed by the integration of digital tools in student monitoring.

Objectives

1. Conduct an in-depth analysis of the requirements for implementing a student behavior monitoring system in the Srinakharinwirot University Demonstration School at Thailand's Ongkharak University.
2. Design and create a high-quality student behavior monitoring system tailored to the needs of SUDS, ensuring efficient monitoring and management of student behavior.
3. Evaluate the level of satisfaction among members of the SDPDC regarding the effectiveness and functionality of the student behavior monitoring system at SUDS.

(1)

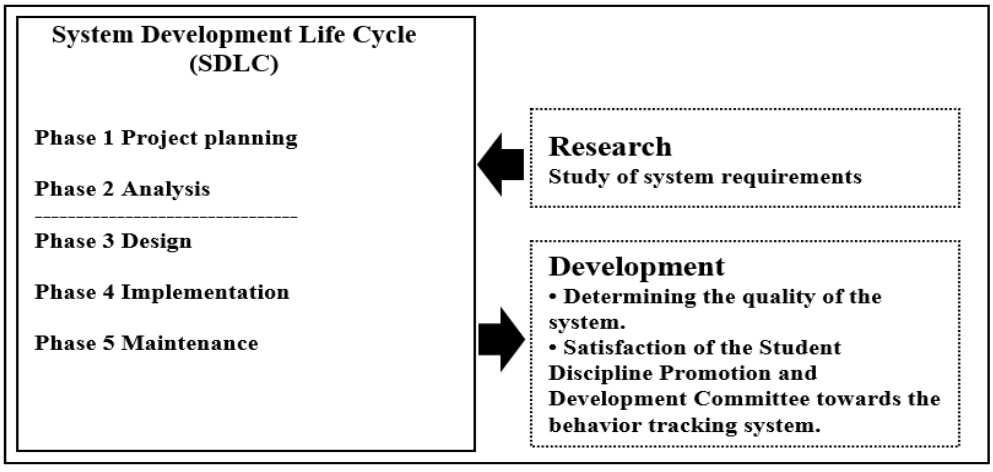

Figure 1: Conceptual framework for developing a student behavior monitoring system

MATERIALS AND METHODS

Population and sample

Step 1 Research: R

Population for the study consisted of individuals appointed to the SUDS Student Discipline Promotion and Development Committee (SDPDC) at Srinakharinwirot University's Ongkharak Campus in Nakhon Nayok Province, Thailand.

Step 2 Development: D

Finding system quality was accomplished using a target group of three technology experts tasked with determining BMS system satisfaction. The population included the appointed SUDS SDPDC. The sample group included ten individuals appointed to the SUDS SDPDC in the 2021 academic year.

Research instruments

Step 1 - Research: R

This stage of the research consisted of a '*Group Discussion Record Form*,' which was used by the SUDS SDPDC to ascertain the requirements and conclude the obstacles in developing a new BMS.

Step 2 - Development: D - Student Behavior Monitoring System (BMS)

The three experts determined the system quality assessment form to have a content validity between 0.8-1.00. Values were obtained by using the index of the Item-Objective Congruency (IOC) method (Ditsuwan & Sukkamart, 2022). The SUDS SDPDC BMS satisfaction questionnaire was determined to have an index of Item-Objective Congruency (IOC) values between 0.67-1.0. Items having IOC values of ≤ .50 were deleted or revised (Hambleton and Rovinelli, 1986).

Data collection

Step 1 - Research: R

Step 1 involved studying the operating procedures of the current system, collecting data, and studying the details of information from the Student Discipline Promotion and Development Department for analysis and design of a student behavior monitoring system. To accomplish these tasks, the following steps were used:

Phase 1: Problem definition

(1) Study the current work system.
(2) Study potential obstacles in developing and implementing a new BMS.
(3) Gather requirements from each SUDS SDPDC member to help understand the promotion and development of student discipline.
(4) Summarize the cause of the problem and summarize the needs according to the group discussion points.

Phase 2: Analysis

(1) Analyze problems from previous work in the BMS's development.
(2) Analyze needs, which consists of the process of gathering requirements from users.

Phase 3: Design

(1) Develop a flowchart of system operation.
(2) Design a Data Flow Diagram (DFD).
(3) Design an entity relationship diagram (ER-Diagram) (Gupta et al., 2021).
(4) Design the User Interface Design working screens.

Phase 4: Development
(1) Develop the system according to the needs of the SUDS SDPDC and develop the student BMS using the SDLC steps to guide system development.
(2) Use of system testing to check functionality.
(3) During Phase 4's process, the use quality of the BMS was evaluated by three in technology.

Phase 5: Maintenance
Use the information obtained from Phase 4's quality assessment and improve any noticed weaknesses. Select and supervise a pilot test of BMS users from the SUDS Student Discipline Promotion and Development Committee (SDPDC) on Srinakharinwirot University's Ongkharak Campus in Semester 1 (June) in Academic Year 2021. After the pilot test, each participant was asked to complete a questionnaire on their satisfaction with using the student BMS. From the ten participants, seven returned completed surveys, representing 70% of the total sample. From the seven completed questionnaires, the data was analyzed and summarized.

Data analysis
Step 1 - Research: R
The data obtained from the Focus Group Discussion included various opinions and suggestions concerning obstacles to the proposed BMS system and additional requirements for using the system (Figure 2). Gill et al. (2008) have stated that qualitative research is often conducted using interviews and focus groups in the data collection process.

Step 2 - Development: D
During Step 2's development phase, the experts analyzed the data quality, reporting results as descriptive statistics. This included their satisfaction levels in using the student BMS and the overall quality of the BMS system.

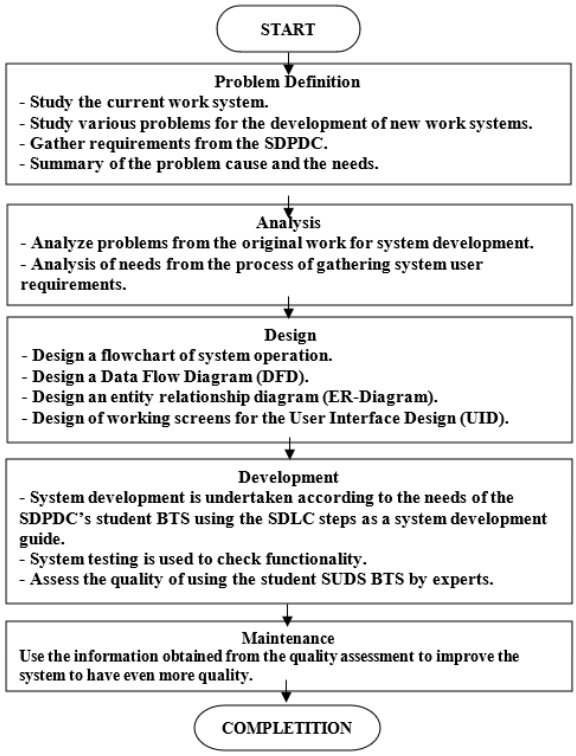

Figure 2: Student behavior monitoring system development steps

RESULTS AND DISCUSSION

Researchers utilized System Development Life Cycle (SDLC) principles to develop and implement a student behavior monitoring system (BMS) (Anwer, 2021). The initial design phase involved convening a focus group meeting to explore how the Student Discipline Promotion and Development Department (SDPDD) at Srinakharinwirot University Demonstration School (SUDS) on the Ongkharak campus could effectively implement and utilize the system.
Subsequently, it became apparent that the SDPDD's requirements could be categorized into two primary areas: issues with the current system and user needs.

Issues with the Current System

Data Recording Problem
It was observed that instructors on daily duty recorded data manually in notebooks or on paper, resulting in excessive paper usage. This practice posed challenges in data preservation and risked data damage or loss.

Information Retrieval Challenges
Searching for information to resolve issues or archive data proved cumbersome due to the vast amount of recorded paper-only data.

Processing Bottlenecks
Preparing summary reports of student scores took much work due to the extensive and redundant data. Individual student misconduct incidents contributed to a significant volume of processing errors.

Report Printing Difficulty
Generating reports requires handling each student's data individually, consuming considerable time and compromising data credibility.

User needs

A comprehensive study of the requirements by the ten members of the Student Discipline Promotion and Development Department (SDPDD) Committee yielded the following key insights:
The SDPDD committee requires a computer-based system that facilitates systematic and real-time data recording. This system should be user-friendly, enabling swift data management operations such as data addition, editing, and deletion while minimizing redundancy in processing. Accurate report generation is also essential. Moreover, robust security measures are necessary to prevent unauthorized access or data manipulation.
The findings from the analysis of the existing work system served as the foundation for defining the scope of the new system. The system's design phase involved creating various visual aids, including flowcharts to illustrate system operations, Data Flow Diagrams (DFD) to depict process workflows, and Entity-Relationship Diagrams (ER-Diagram) to represent data relationships and guide database design.
System development encompassed programming and rigorous testing based on the outcomes of system analysis and database design. Microsoft Access was utilized to facilitate system management, with the system divided into four key components:

(1) A repository for student behavior data.
(2) A repository for all score data.
(3) A module for adding new student data.

(4) A section dedicated to administrative teacher data.

This systematic approach ensured the successful development of the system, aligning it with the identified user needs and operational requirements.
Three technology experts evaluated the SUDS BMS quality (Ongkharak Campus) and found that the overall quality was judged at an excellent level (mean = 4.90, SD = 0.27). Moreover, the *function test* evaluation was also judged to be at an excellent level (mean = 4.83, SD = 0.38), as was the *usability test* evaluation (mean = 4.96, SD = 0.20) and *functional requirement test* evaluation (mean= 4.89, SD = 0.32).

Results of the trial use of the system and evaluation of the user's satisfaction by seven Student Discipline Promotion and Development Department (SDPDD) Committee members determined that the users' overall satisfaction had the highest mean (mean = 4.99, SD = 0.12). Moreover, all three aspects after user evaluation were judged at the highest levels. These included the ability to work according to duties (*function test*) (mean= 4.98, SD = 0.15), quality in terms of ease of use (*usability test*) (mean= 5.00, SD = 0.00), and finally, user needs (*functional requirement test*) (mean= 5.00, SD = 0.15).

Data analysis results
The study of the requirements for using the student behavior monitoring system at Srinakharinwirot University Demonstration School (Ongkharak Campus), utilizing the SDLC framework, provided a comprehensive understanding of the system's requirements. The study covered three main aspects:
(1) User requirements (functional requirement test) - The research identified the system's functional needs from the users' perspective.
(2) System Functionality (function test) - The study examined how the system functions and operates.
(3) Usability (usability test) - The research assessed the system's ease of use.

Requirement categories
The analysis revealed two primary categories of requirements:
(1) Issues with the current campus system - Several problems were identified within the previous operational system, including challenges related to data recording, information retrieval, data processing, and report generation.
(2) User requirements - The users expressed their needs, which included the desire for a modern, computer-based system that simplifies data recording, ensures ease of use, facilitates rapid data management, minimizes redundant processes, ensures accurate report generation, and provides robust data security measures.

These findings serve as a valuable foundation for further system development and improvement. In future iterations, transitioning to an online platform and integrating real-time student data from the registrar's office are recommended. Additionally, it is advisable to explore the development of complementary systems in various departments facing similar challenges.

Student Behavior Monitoring System at the SUDS's Ongkharak Campus

Three qualified technology experts conducted the quality assessment of the student BMS at SUDS (Ongkharak Campus). Their evaluation found that the system operates swiftly and includes a pre-login security check, requiring username and password verification. The system is divided into four key components:
(1) Student Behavior Data Recording.

(2) Comprehensive Score Data Management.
(3) Adding New Student Information.
(4) Administrative Teacher Data Management.

The overall quality of the developed system, which was influenced by using the SDLC framework, was rated overall as excellent (mean=4.90, SD=0.27). Also, the research team successfully developed a web application program to provide various user interfaces and used Microsoft Access as the database management system for designing the database. The research process followed a five-phase approach as part of using an SDLC approach, including Phase 1's project planning, Phase 2's analysis, Phase 3's design, Phase 4's implementation, and Phase 5's maintenance. This systematic methodology ensured the system was responsive and effectively met user requirements.

During Phase 1, the research team studied the issues with the previous system and the requirements of the SDPDD. In Phase 2, data from the previous system were analyzed and adapted to align with the new system's needs. Phase 3's design focused on gathering facts about the encountered issues and using this information to design the system. After system development, extensive testing was conducted to ensure accuracy before implementation.

This approach aligns with the research conducted by Auksorncherdchoo and Sukstrienwong (2018), who developed a Memorandum Report System (MRS) for monitoring student attendance and behavior, and Pattharawongthana (2017). who studied information systems development for community development planning. Both studies employed SDLC and found that the developed systems were of the highest quality. The research and development process followed best practices, resulting in a highly effective system that meets user needs and maintains data security.

It is also important to note that institutions can start at something other than the 'beginning' in developing a student BMS. As other studies have pointed out, schools collect numerous early risk indicators (ERIs) daily (Moss et al., 2013). These ERIs can include grade reporting systems, academic achievement test scores, discipline referrals, attendance scores, and school and class lateness. When institutions can analyze this data and create reports, it can identify learners who might be showing difficulty indicators from which early intervention and problem resolution are possible.

CONCLUSION

The overall satisfaction with the Student Behavior Monitoring System at Srinakharinwirot University Demonstration School, Ongkharak Campus, is the highest possible (mean=4.99, SD=0.12). This exceptional level of satisfaction can be attributed to a comprehensive research process, where the researchers' identified issues with the previous system and gathered user requirements. Subsequently, they used these findings to design a system that perfectly met user needs.
The information system developed by the research team aligns with user requirements and offers swift and user-friendly access. The system's qualities match those of Bhalla et al. (2013), who emphasized the importance of fulfilling user requirements.
These findings reflect the success of the Student Behavior Monitoring System, which not only fulfills user needs but also ensures a seamless and satisfying user experience.

RECOMMENDATIONS FOR IMPLEMENTING RESEARCH FINDINGS

- **Training:** It is advisable to provide training to individuals involved in the system to ensure they have a clear understanding of its operation before actual implementation.
- **User manuals:** System users should thoroughly study the user manuals to understand their functionality.

- **Data backup:** Since the system operates offline, regular data backups are critical to prevent data loss in case of computer malfunctions or unavailability.

RECOMMENDATIONS FOR FUTURE RESEARCH

- **Online transition:** For future system development, it is recommended to transition to an online platform. This would facilitate real-time data integration with the student registration system, ensuring up-to-date information.
- **Additional system enhancements:** Consider developing other systems within various departments to address similar issues, improving overall efficiency.

Authors' contributions

Soraphet Saleekongchai (SS), Suwanna Bengthong (SB), Kanchana Boonphak (KB), Krissana Kiddee (KK), Paitoon Pimdee (PP)

Authors' contributions: Conceptualization, SS and SB; Software, KB, PP; Validation, PP, KK; Formal analysis, KK, PP; Investigation, SS and SB; Resources, SS and SB; Writing—original draft preparation, SS and KB; Writing—review and editing, KK and KB; Supervision, PP, KK; All authors have read and agreed to the published version of the manuscript.

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