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Development and Assessment of Learning System with Analytics

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Abstract. This study focuses on exploring the feasibility and effectiveness of employing data analysis techniques in the development of learning systems. Through a comprehensive evaluation of existing learning systems, this research identifies their principal advantages and disadvantages. In response to these issues, a novel learning system is proposed, leveraging data analysis to optimize the learning process. Experimental verification demonstrates a significant enhancement in learning effectiveness and learner satisfaction with this innovative system. The research findings provide valuable guidance for the design and application of future learning systems, emphasizing the importance of considering factors such as cost-effectiveness, sustainability, and long-term benefits for successful development and implementation. Results from an acceptability score survey indicate positive ratings from end users for the Learning System with Analytics, covering functionality, performance efficiency, compatibility, usability, reliability, maintainability, and security. Users express satisfaction with the system's performance, reliability, ease of maintenance, and security. The developed system is recognized as functional, reliable, usable, efficient, maintainable, and portable according to user feedback. Additionally, user suggestions are deemed valuable for potential enhancements to the system in the future. Overall, this research contributes insights into the application of data analysis in learning systems, emphasizing user satisfaction and offering practical implications for system development and refinement.

Keywords: Analytics; Learning Development System; Learning System.

1.Introduction

The primary objective of this study is to develop a learning analytics system tailored to the unique context of Chongqing Vocational College of Construction Technology. The goal is to utilize this system to analyze student data effectively, generating personalized insights and recommendations that can significantly enhance academic performance.

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In recent years, learning analytics systems have exhibited substantial potential in positively influencing student learning outcomes. Leveraging techniques such as data mining, machine learning, and statistical modeling, these systems extract valuable insights related to individual and cohort engagement, motivation, strengths, and weaknesses (Ellis, 2021). This information proves valuable for teachers and administrators, enabling them to offer targeted support and interventions.

Despite the growing success of learning analytics systems, a notable gap exists in the customization of these solutions for vocational college settings, as highlighted by Wu et al. (2020). Moreover, the application of analytics within the Chinese education system is still in its nascent stages. These gaps underscore the necessity for a specialized analytics system aligned with the unique programs, student demographics, and institutional objectives of Chongqing Vocational College of Construction Technology.

In addition to the primary goal of developing a learning analytics system tailored for Chongqing Vocational College of Construction Technology, this study aimed to delve into the intricacies of vocational education and the specific challenges and opportunities it presented. The focus was on understanding the distinctive characteristics of vocational college programs, the diverse student population, and the unique objectives of the institution.

The research involved a thorough exploration of the curriculum, teaching methodologies, and assessment practices prevalent in vocational education. Understanding the intricacies of skill-based programs was essential for the effective design and implementation of the learning analytics system. Moreover, the study investigated how vocational students engaged with technology and online learning resources, considering the hands-on nature of their coursework.

Furthermore, the research explored the support mechanisms available to students in a vocational college setting. This included examining the roles of teachers and administrators, the effectiveness of existing academic support structures, and the challenges faced by students in the pursuit of their vocational goals.

The development of the learning analytics system was a collaborative effort, involving key stakeholders such as teachers, administrators, and IT specialists. The system not only analyzed academic performance but also considered factors such as apprenticeships, industry collaborations, and real-

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world applications of skills acquired. This holistic approach aligned with the comprehensive nature of vocational education, ensuring that the analytics system addressed the multifaceted aspects of student success in a vocational setting.

Moreover, the study assessed the potential barriers to the adoption of learning analytics in the Chinese education system. Cultural considerations, privacy concerns, and the integration of technology into traditional educational practices were examined to provide insights into the feasibility and sustainability of the proposed analytics system.

This study seeks to address these gaps by developing learning analytics solutions tailored specifically to the college's requirements. The system aims to enhance the visibility of data and patterns, providing personalized recommendations to boost learning achievement. By catering to the distinct needs of students, teachers, and administrators within the institution, the developed system aspires to contribute to superior student outcomes. The evaluation framework implemented in the study may not only assess the system's quality but also pinpoint opportunities for refinement.

Thus, this research endeavor is vital in bridging the existing gap by creating and evaluating a learning analytics system uniquely designed for the vocational college context. The ultimate aim is to contribute significantly to the improvement of student performance through personalized insights and recommendations.

2.Methodology

This study adopted a developmental-descriptive research design to assess and analyze the quality of the developed Learning System with Analytics. The descriptive evaluative approach facilitated a comprehensive evaluation of the learning analytics system using both quantitative and qualitative data. Quantitative metrics were captured to examine system performance across dimensions such as usability, reliability, and security based on ISO/IEC 25010 quality benchmarks. Additionally, qualitative feedback from end-users was gathered through questionnaires and interviews to assess user experiences and satisfaction. When developing a system, the first step is to clarify the system's goals and tasks. Select appropriate data sources and datasets based on the objectives, and determine the inputs and outputs of the system. Next, it is

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necessary to choose appropriate learning algorithms and techniques. In this article, we discussed the research and design of development systems, including selecting technologies, designing experiments, and evaluating metrics. By carefully designing research plans and implementation plans, efficient and reliable learning systems can be developed to support decision-making and problem-solving

The key stages of the descriptive evaluative methodology involved identifying quality metrics and acceptable threshold levels under ISO/IEC 25010 criteria. Metrics were quantified where possible, particularly for dimensions like functionality, efficiency, and compatibility. Evaluation instruments, including surveys, questionnaires, and prototypes, were developed to collect user perceptions, statistical usage data, and system capability demonstration results. A representative sample of end-users and IT experts participated in the system evaluation, and the results were analyzed across data points and evaluation dimensions to characterize performance against quality criteria.

The synthesis of findings produced quality benchmark profiles, pinpointing areas falling under threshold levels and eliciting improvement recommendations. In summary, the developmental-descriptive design facilitated a robust, metrics-driven assessment of quality based on the internationally recognized ISO/IEC 25010 model. By gathering empirical evidence during the evaluation phase of development, critical insights were uncovered around enhancing system utility and user experience to better meet institutional objectives.

2.1. Data Gathering Procedure

The researcher conducted a comprehensive review of relevant studies and literature to inform this investigation. Subsequently, an appropriate survey was developed to collect the necessary data, with a focus on establishing the reliability and validity of the study instruments. Following adjustments, the questionnaire was disseminated, ensuring completion and thorough review.

The researcher secured approval from several participating industrial companies to conduct the evaluation of the energy consumption monitoring platform project. This involved sending a survey questionnaire to the managers of these companies.

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Upon obtaining the complete list of target respondents, samples were selected through deliberate sampling. The process included obtaining informed consent, and the active participation of the respondents was solicited throughout the study

2.2. Respondents

In this study, the researcher employed the stratified random sampling technique to select respondents. The target population for the sample was drawn from the student body of Chongqing Vocational College of Construction Technology, characterized by its diverse student population across various programs and academic levels. The population was described in terms of its size, composition, and relevant characteristics. The researcher used a Raosoft calculator to get the number of respondents with 5% degrees of error.

The stratified random sampling technique involved dividing the population into distinct strata or groups based on specific criteria, such as academic programs, academic levels, or other relevant factors. Within each stratum, a random selection of respondents was made to ensure representation from different segments of the population. The purpose of using stratified sampling was to guarantee that each subgroup was adequately represented in the final sample, allowing for more accurate and reliable data analysis. After dividing the population into strata, a random sample was taken from each subgroup, ensuring that the final sample represented a cross-section of the entire population, accounting for variability within different strata. This sampling method was particularly useful given known variations or differences within the population that could significantly impact the study's results.

2.2.1 Distribution of Respondents

In total, 135 respondents participated in the evaluation of the learning analytics system from both IT expert and end-user perspectives. The categorized distribution enabled assessment across technical and applied real-world usage contexts.

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Table 1 *Distribution of Respondents*

Category	Number of Respondents	Population Sample
IT Professionals	10	10
Students	134	100
Instructors	20	20
Administrators	5	5
Total	**169**	**135**

3. Results and Discussion

In this study, data were from different people using the teaching system, and found that the system meets the ISO/IEC 25010 product quality standard and is of great help to teachers and students in schools. The main points are as follows:

Improve teaching quality. As a teaching software, it provides rich teaching resources and diverse teaching methods, which can help teachers better complete teaching tasks and improve teaching quality. At the same time, it can record students' learning progress and achievements, facilitating teachers to better grasp students' learning situation, adjust teaching strategies in a timely manner, and improve teaching effectiveness.

Enhance student learning effectiveness. It not only provides diversified learning methods and rich learning resources, but also provides personalized learning advice and guidance for students. Students can access course materials, participate in discussions, complete assignments and tests, etc. at any time, which better consolidates knowledge and improves learning effectiveness. At the same time, it can also provide students with an online communication and interaction platform, stimulate students' learning enthusiasm and participation, and enhance their learning motivation.

Improve teaching management efficiency. Learning link has achieved digitalization and intelligence in teaching management, improving the efficiency and accuracy of teaching management. Teachers can conduct student management, curriculum management, and performance management through Learning Link, which facilitates the completion of various teaching management

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tasks quickly and easily. At the same time, it can provide schools with data analysis and decision support functions, helping schools better understand and manage teaching quality and student learning.

Improve students' autonomous learning ability. The system provides students with a platform and resources for autonomous learning. Students can independently choose learning content and learning methods through the teaching system, and develop the ability and habit of autonomous learning. At the same time, personalized learning suggestions and guidance can be provided for students to help them better plan their learning process and improve their learning efficiency.

Enhance the informatization level of schools. Teaching systems are the product of the deep integration of information technology and education and teaching. Using learning apps can improve the informatization level of schools and promote the digital transformation of schools. At the same time, it can also provide schools with data analysis and decision support functions, helping schools better understand and manage teaching quality and student learning.

4. Conclusions

Generally, according to the acceptability score survey, end users rated Learning System with Analytics positively in terms of functionality, performance efficiency, compatibility, usability, reliability, maintainability and security. They are satisfied with the system's performance, reliability, ease of maintenance and security. Utilization of the developed system is found functional, reliable, usable, efficient, maintainable and portable to the respondents. Suggestions of the respondents may be used in the future for the enhancement of the system.

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