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# Integrated Student Information System with Descriptive Analytics

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**Abstract** **Original Research Article**

This study designed and developed an Integrated Student Information System with Descriptive Analytics, featuring the following technical features: a course eligibility evaluation portal, a grading portal, a curriculum management and design tool, and a descriptive analytics and insights dashboard. The system was developed using the Agile Software Development Life Cycle (SDLC) methodology and evaluated through functionality testing using test cases and usability evaluation using the Post-Study System Usability Questionnaire (PSSUQ). The respondents consisted of five (5) faculty evaluators, fifteen (15) students from the BSIS, BSIT, and BSCS programs, and one (1) registrar staff member, for a total of twenty-one (21) respondents. Results showed that the system achieved a 100% passing rate in functionality testing and was found to be functional and operational. The usability evaluation yielded an overall mean score of 1.17, indicating very high acceptability for system usefulness, information quality, interface quality, and overall usability. In addition, a user manual was developed to provide guidance on proper system use. Recommendations include integrating the system with existing enrollment platforms, improving the grading portal for easier grade uploads, implementing real-time notifications, and expanding the application of Decision Tree Prediction for student evaluation and curriculum insights. Further studies are recommended to improve the stability and accuracy of predictive analytics for enrollment evaluation and course eligibility assessment. The Integrated Student Information System with Descriptive Analytics provides valuable support in improving academic management, enrollment evaluation, and data-driven decision-making in educational institutions.

**Keywords:** Integrated Student Information System, Descriptive Analytics, Course Eligibility Evaluation, Grading Portal, Curriculum Management, Agile SDLC, PSSUQ, Decision Tree Prediction



## INTRODUCTION

The increasing complexity of academic programs and rising student populations have created a demand for more efficient and intelligent academic management systems in higher education institutions (Gonugunta & Leo, 2024). At Iloilo Science and Technology University (ISAT-U), the current Student Information System (SIS) offers only basic functionality for enrollment and academic tracking, but lacks essential features such as automated prerequisite checking, monitoring of failed subjects, and tracking of incomplete (INC) grades. These deficiencies result in a manual evaluation process during enrollment periods, which is time-consuming, error-prone, and inefficient.

To address these issues, this study focuses on developing an Integrated Student Information System with Descriptive Analytics. The proposed

system aims to modernize enrollment processes through an automated eligibility evaluation portal, along with modules for student information management, curriculum design, student grade management, and user-role control. In a recent study, Li, Gao, and Xu (2023) designed and implemented a novel Student Information Management System that emphasized integrated data handling and improved administrative efficiency. Their findings highlighted the benefits of centralized student information access, real-time academic record tracking, and system scalability to accommodate future educational innovations. The case study demonstrated that well-structured SIS architectures significantly enhanced data flow, reduced redundancy, and supported better decision-making for academic stakeholders.

In a study on Learning Analytics Dashboards, Susnjak, Ramaswami, and Mathrani (2022) found that most educational dashboards primarily rely on descriptive analytics to present student data in visual and interpretable formats that support decision-making among students and educators. The study emphasized that descriptive analytics enables the transformation of raw academic data into meaningful visual insights such as performance trends and learning behavior patterns, allowing stakeholders to identify at-risk students and make timely academic interventions. However, the authors also highlighted that while descriptive analytics is widely implemented, more advanced analytical capabilities, such as predictive and prescriptive analytics, remain limited in most existing systems, indicating a gap in fully data-driven academic decision support tools. Similarly, earlier findings from Tang, Toh, and Leow (2019) at the Singapore University of Social Sciences revealed that implementing data dashboards significantly improved administrative efficiency and decision-making by enabling real-time data visualization and filtering, allowing program heads to independently monitor application trends and respond more quickly to institutional needs. Together, these studies highlight that descriptive analytics dashboards enhance accessibility, monitoring, and responsiveness in academic and administrative processes, while also emphasizing the need for more advanced analytical integration in higher education systems. Recent advances in academic data systems and analytics have shown promise for reducing administrative work, improving data accuracy, and enhancing academic services. However, many institutions still use fragmented or manual enrollment and student evaluation methods. These issues delay decisions, disrupt academic planning, and sometimes allow students to miss important prerequisites by mistake. This study aligns with the United Nations Sustainable Development Goals (SDGs). It supports SDG 4: Quality Education by improving access to timely, accurate academic information. This information helps students follow clear learning paths and reduces enrollment barriers. The study also addresses SDG 9: Industry, Innovation, and Infrastructure by encouraging innovative digital infrastructure for education management. Finally, it supports SDG 16: Peace, Justice, and Strong Institutions by making academic processes more transparent, accountable, and efficient through automation and data-driven decisions.tems.

In response, the researcher has created the Integrated Student Information System with Descriptive Analytics to help ISAT-U modernize academic management. Through real-time enrollment eligibility evaluation, alerts for academic issues, unified management of users and curricula, and a robust analytics dashboard, the system is intended to directly address the root problems: inefficient enrollment, undetected academic risks, and lack of comprehensive oversight. Its features enable academic standards, student support, and data-driven decisions—delivering on the central goal of transforming ISAT-U's academic management processes.

## Objectives of the Study

The main objective of the study is to develop an Integrated Student Information System with Descriptive Analytics. Specifically, this study aimed to:

1. Design and develop an Integrated Student Information System with Descriptive Analytics with the following features:

a. course eligibility evaluation portal
b. grading portal
c. curriculum management and design tool
d. descriptive analytics and insights dashboard

2. Test the functionality of the aforementioned system's technical features.
3. Evaluate the usability of the developed system in terms of:
    a. system usefulness;
    b. information quality;
    c. interface quality; and
    d. overall usability.
4. Formulate a user's manual.

## MATERIALS AND METHODS

### *Research Design*

This study follows both descriptive and developmental research approaches. It adopts the Development and Technology Research framework, which systematically investigates systems, tools, and processes to yield reliable, actionable findings for both practitioners and researchers (Richey & Klein, 2005). The descriptive research approach is used to identify, document, and analyze the current enrollment process, including existing issues such as manual evaluation of prerequisites, delayed assessment of student eligibility, and inconsistent handling of failed and incomplete grades. This phase provides a clear understanding of the system requirements and user needs, grounded in actual institutional practices.

On the other hand, the developmental research approach is applied in the design, creation, and iterative improvement of the Enrollment Eligibility Evaluation Portal. It focuses on building and refining the system based on findings from the descriptive phase, ensuring the developed solution directly addresses the identified problems. Through this approach, the system is systematically implemented to automate eligibility checks based on academic records such as subject prerequisites, failed grades, and incomplete statuses, resulting in a more efficient and accurate enrollment evaluation process.

The system was developed using the Agile Software Development Methodology, which emphasizes iterative development, frequent feedback, and stakeholder collaboration. Agile enables flexible adaptation to user requirements and ensures that the evolving system remains aligned with institutional goals throughout the development cycle.

In the developmental phase, the system's functionality was verified using structured test cases. These test cases were created based on user stories and the system's expected behaviors to validate that all features perform as intended across various scenarios.

For the descriptive phase, usability evaluation was conducted using the Post-Study System Usability Questionnaire (PSSUQ) developed by IBM. This standardized instrument assesses users' perceived satisfaction with system usability across dimensions such as system usefulness, information quality, and interface quality. The responses were measured on a Likert scale, and descriptive statistics—including means, standard deviations, and frequency distributions—were used to summarize and interpret the results. As stated by Kaliyadan and Kulkarni (2019), descriptive statistics provide an effective way to explain relationships among variables and evaluate user satisfaction.

As emphasized by Asenahabi (2019), research design is the backbone of a successful study, ensuring that research questions are transformed into measurable outcomes through well-structured processes. The integration of functional testing and usability evaluation ensures that the system meets both technical and user-centered objectives.

### *Respondents of the study*

The study's respondents will consist of five (5) IT experts, fifteen (15) students, five (5) faculty

evaluators, and one (1) registrar's staff member.

Table 1 presents the distribution of respondents for the usability testing. The study included five (5) Faculty Evaluators, fifteen (15) students from three (3) programs (BSIS, BSIT, BSCS), and one (1) registrar staff member. Overall, there are twenty-one (21) respondents.

**Table 1.** *Respondents of the usability testing*

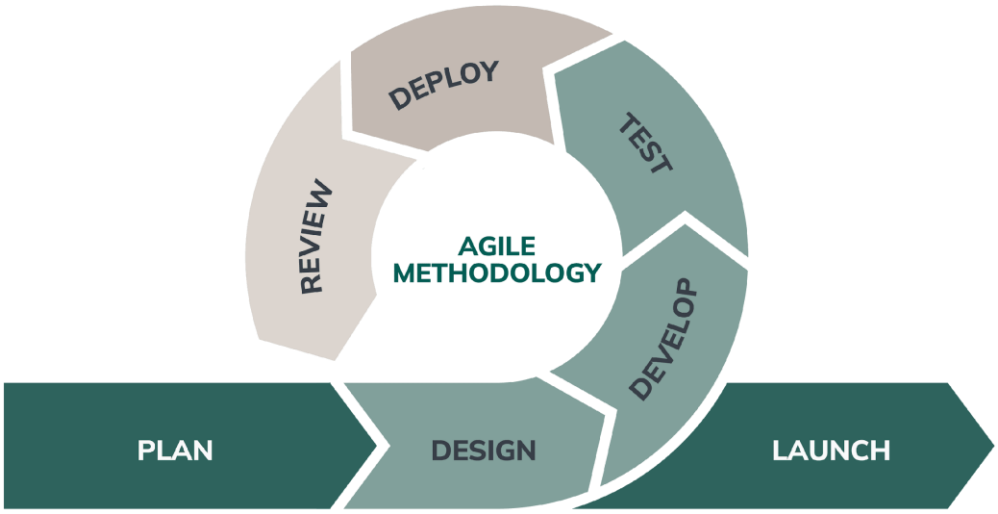
| Respondents of the Study | F |
|---|---|
| Faculty Evaluators<br>Students<br>Registrar Staff | 5<br>15<br>1 |
| Total | 21 |

***Software Development Life Cycle (SDLC)***

The Software Development Life Cycle (SDLC) is a structured framework for planning, analyzing, designing, developing, testing, deploying, and maintaining software systems. It gives organizations and developers a systematic approach to software development. This systematic process helps ensure quality, efficiency, and successful project implementation. Different SDLC methodologies are chosen based on project size, complexity, resources, and organizational needs. Common SDLC models include Waterfall, V-Model, Iterative, Agile, and Hybrid methodologies. Each offers unique advantages and limitations for information systems project management. Choosing the right SDLC methodology is crucial for project success, adaptability, and decision-making in information systems development (Hossain, 2023).

Figure 1 shows the SDLC used, which is the Agile Methodology model. Agile is an iterative and incremental software development approach. It emphasizes flexibility, continuous improvement, rapid delivery, and close collaboration between developers, stakeholders, and customers. Unlike traditional linear models, Agile divides projects into short cycles, or sprints. These sprints usually last 1 to 4 weeks and deliver functional software increments after each iteration. This structure allows development teams to adapt quickly to changing requirements and feedback. Agile is well-suited to projects with evolving requirements because it encourages responsiveness, teamwork, and customer involvement (Beck, 2001; Highsmith, 2000).

***Figure 1.*** *Agile Methodology Model*




**Software Development Phases**

The software development phases of the study include planning, design, development, testing, deployment, review, and launch.

**a. Planning**

During the planning phase, evaluation activities are primarily exploratory and driven by requirements. Stakeholder consultations involving IT experts, registrar staff, faculty evaluators, and students were conducted to identify system requirements and existing workflow issues. No formal instruments were administered at this stage; instead, qualitative data, such as interview responses, observations, and documented institutional needs, were collected. These inputs served as baseline requirements for system design and future validation criteria.

**b. Design**

In the design phase, evaluation focused on validating system structure and usability direction before development. Prototype workflows, UI mockups, and database schemas were reviewed by stakeholders to ensure alignment with enrollment processes, eligibility rules, and curriculum structures. The data gathered primarily consisted of qualitative feedback and design revision comments, which guided refinements to system architecture and interface design.

**c. Development**

During development, evaluation was integrated into iterative debugging and module verification. Each system module—Enrollment Management, Eligibility Evaluation, Curriculum Management, Analytics Dashboard, and Notification System—was tested using developer-level functional checks. The primary data gathered included system logs, error reports, and expected vs. actual outputs. These ensured that core functionalities were correctly implemented prior to formal testing.

**d. Testing**

The testing phase served as the primary formal evaluation stage, involving both technical evaluation and usability assessment.

The technical evaluation was conducted by IT experts using structured test cases to validate the system's functionality, accuracy, and performance across all modules, including the Enrollment Management System, Eligibility Evaluation Portal, Curriculum Management Tool, Descriptive Analytics Dashboard, and Automated Notification System. The data gathered during this process included expected versus actual results, response-time measurements, validation outcomes, and system reliability indicators. These metrics were used to determine whether the system operated correctly under defined conditions and met the required specifications.

On the other hand, the usability evaluation used the Post-Study System Usability Questionnaire (PSSUQ), which assessed system usefulness, information quality, interface quality, and overall user satisfaction. The questionnaire was administered to 21 participants, comprising 5 faculty evaluators, 15 students from BSIS, BSIT, and BSCS programs, and 1 registrar staff member. The collected data included quantitative results such as mean scores and standard deviations, which were used to analyze the overall user experience and identify areas for improvement in system usability and design.

### e. Deployment

In the deployment phase, a pilot implementation was conducted in a controlled environment. Evaluation data were gathered from real-time system usage, including system accessibility, performance under actual user load, and initial user interaction behavior. Minor issues, if any, were recorded through user reports and system monitoring logs to support final adjustments before full rollout.

### f. Review

The review phase focused on post-deployment evaluation involving stakeholders. Feedback was collected on system effectiveness, eligibility evaluation accuracy, usability, and overall satisfaction in real operational settings. The data gathered included structured feedback forms, interview summaries, and performance observations, which were compiled into a system evaluation report identifying strengths, limitations, and recommended enhancements.

### g. Launch

During the launch phase, evaluation shifted toward operational readiness and user adoption. Data were gathered from training sessions, user onboarding feedback, and initial system usage behavior in live academic operations. This included qualitative feedback on system clarity, ease of use, and effectiveness of training materials, ensuring smooth transition to full institutional adoption.

## Functionality Testing

To test the system's technical features, a total of 142 test cases were executed, each designed to verify compliance with the system's functional specifications. The test cases covered various system modules, user access roles, and functional features involving the Registrar, Students, and Faculty Evaluators. Each test case outlined the test scenarios, procedures, input data, expected outcomes, actual outcomes, and corresponding pass/fail remarks. The testing process used a structured test case approach and technical feature validation to ensure that all system components and user functionalities operated in accordance with the intended system requirements.

## Usability Testing

The system's usability evaluation was conducted using the standardized Post-Study System Usability Questionnaire (PSSUQ) Version 3 with 21 respondents from the academic sector, comprising 5 faculty evaluators, 15 students, and 1 registrar staff member. The PSSUQ instrument comprises 16 items across four dimensions: system usefulness, information quality, interface quality, and overall usability. Responses were gathered using a 7-point

Likert scale with an additional "not applicable" option.

The system usefulness dimension (Items 1–6) evaluated the system's ease of use, learnability, and task completion efficiency. Information quality (Items 7–12) assessed the clarity of information presented, the effectiveness of error handling, and the quality of system feedback. Interface quality (Items 13–16) measured the visual appearance, layout, and effectiveness of the system interface and features. Overall usability was determined through the combined responses to all 16 questionnaire items, reflecting the respondents' general experience and satisfaction with the system.

### Development of the User Manual

The user manual for the Integrated Student Information System with Prescriptive Analytics was developed to provide comprehensive, organized, and user-friendly documentation that supports the effective operation and utilization of the system. The manual contains step-by-step procedures and guidelines for major system functionalities, including user authentication, dashboard navigation, student information management, enrollment eligibility evaluation, grade management, curriculum management, descriptive analytics viewing, account management, and report generation.

A complete system walkthrough was included to demonstrate the platform's overall workflow and navigation across different user access levels, specifically for the Registrar, Faculty Evaluators, and Students. The walkthrough presents the actual sequence of system interactions, from logging into the system, accessing modules, managing academic records, evaluating enrollment eligibility, viewing analytics, and generating reports. This serves as a practical reference that helps users understand the system's operational flow and interface behavior.

The user manual was derived directly from the system's implemented features and technical functionality to ensure consistency, reliability, and technical accuracy. It was designed using a user-centered approach to accommodate users with varying levels of technical knowledge and familiarity with the system. The documentation aims to improve usability, minimize operational errors, and support efficient system adoption and navigation among stakeholders within the academic institution.

## RESULTS AND DISCUSSION

The primary goal of the Integrated Student Information System with Descriptive Analytics (ISISDA) is to streamline and enhance academic data management by providing a centralized, efficient, and intelligent platform for handling student records, grades, curriculum information, and enrollment-related processes. It aims to reduce manual, fragmented academic workflows by integrating key institutional functions into a single system that supports data accuracy, consistency, and accessibility across user roles such as students, faculty evaluators, and registrar staff.

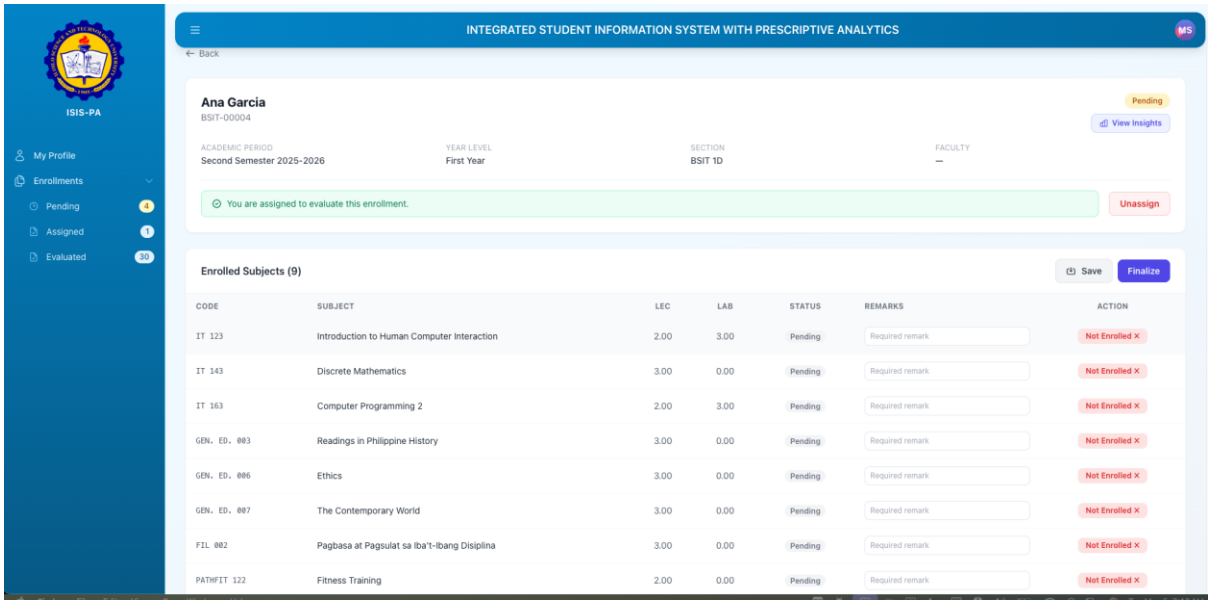
In addition to operational efficiency, ISISDA is designed to support data-driven decision-making through descriptive analytics. By transforming raw academic data into meaningful insights, the system enables administrators and educators to monitor student performance trends, evaluate curriculum effectiveness, and identify academic risks early. Ultimately, the system's primary goal is to improve institutional productivity, support academic planning, and enhance the overall quality of educational management.

The first objective of the study was to design an Integrated Student Information System with Descriptive Analytics. The researcher determined an appropriate system design that defines the overall usability and functionality of the proposed solution, ensuring that academic processes are structured, consistent, and data-driven.

The Enrollment Assessment, as shown in Figure 2, was designed to dynamically assess student enrollment eligibility in real time by validating academic period availability, preventing duplicate enrollments, enforcing prerequisite requirements, and automatically identifying eligible subjects based on the student's curriculum standing. It also

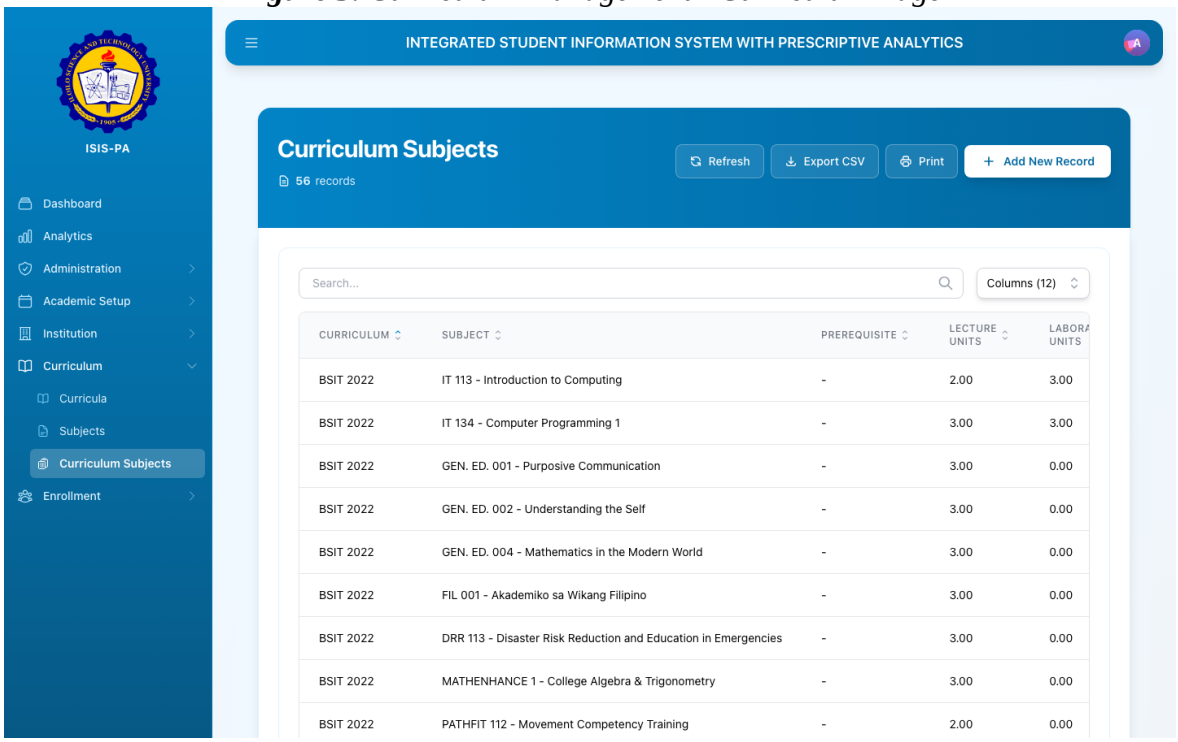
supported automatic subject loading for regular students and implemented multi-layered validation to ensure accuracy and academic integrity during enrollment.

***Figure 2.*** *Course Eligibility Portal - Enrollment Assessment Page*



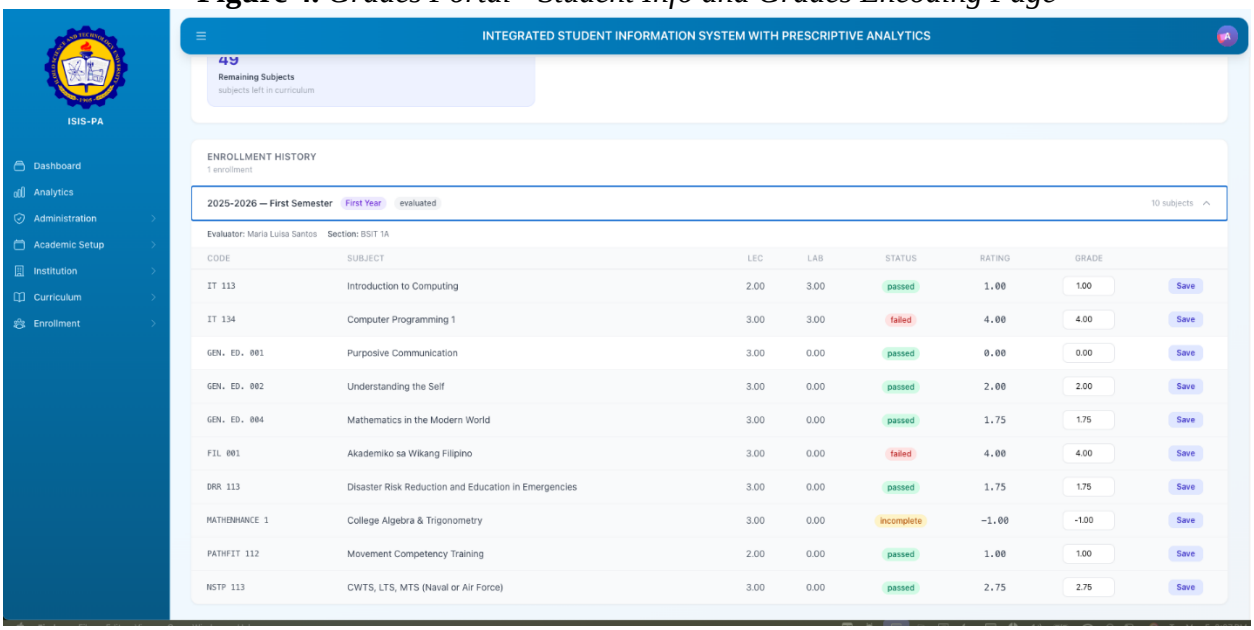

The Curriculum Management and Design Tool, as shown in Figure 3, served as the system's structural foundation by defining curriculum versions, subject sequencing, academic load limits, and semester-based subject distribution. It also encoded prerequisite relationships and subject attributes such as units, contact hours, fees, and passing thresholds, ensuring that curriculum policies are consistently applied across different academic programs and student batches.

***Figure 3.*** *Curriculum Management - Curriculum Page*




The Grading Portal, as shown in Figure 4, was designed to manage student academic performance at the subject level through a standardized grading structure that includes numeric grades, categorical ratings, status indicators, and faculty remarks. It enforced consistent evaluation rules aligned with Philippine grading standards while allowing flexible handling of incomplete and failed subjects. It also enabled systematic identification of back subjects, which serve as critical inputs for academic tracking and performance evaluation.

**Figure 4.** *Grades Portal - Student Info and Grades Encoding Page*

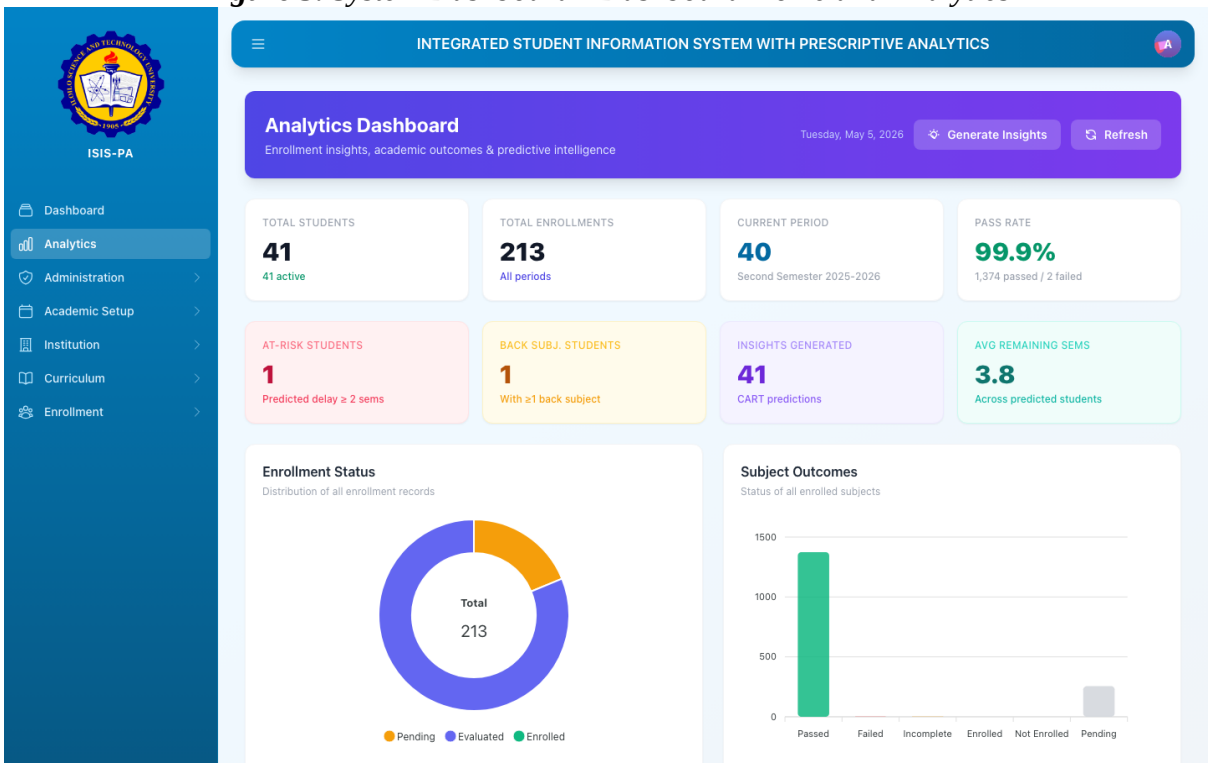



The Descriptive Analytics and Insights Dashboard, as shown in Figure 5, provides predictive capabilities by analyzing key academic indicators, including remaining subjects, back subjects, academic load limits, and curriculum progression requirements. Using a decision tree model, the system generated predictions of graduation delays and categorized students by their likelihood of delay. These insights were presented through visual summaries, including analyses of at-risk student identification and delay distribution, allowing administrators to make informed, data-driven academic interventions.

Together, these components formed a comprehensive and intelligent academic information system that enhances enrollment evaluation, curriculum control, grading consistency, and predictive academic planning, ultimately improving institutional decision-making and student progression monitoring.

The Grading Portal, shown in Figure 4, manages student academic performance at the subject level. It uses a standardized structure with numeric grades, categorical ratings, status indicators, and faculty remarks. Consistent evaluation rules match Philippine grading standards. The system allows flexible handling of incomplete and failed subjects and enables systematic identification of back subjects for academic tracking and performance evaluation.

***Figure 5.*** *System Dashboard - Dashboard Home and Analytics*




The second objective of the study was to test the functionality of the system's technical features. Table 2 presents the results of the test cases that evaluated the system's core functionalities. It outlines the test scenarios, test steps, input data, expected outcomes, actual outcomes, and corresponding pass/fail remarks. A total of 142 test cases were executed, each designed to verify the system's compliance with its functional specifications. Based on the actual results, the system successfully passed all functionality tests as evaluated by five (5) primary users, who are IT experts. Using a structured test case approach and technical feature validation, the Integrated Student Information System with Descriptive Analytics achieved a 100% pass rate, confirming its full functionality and operational status.

**Table 2.** *Summary of the Functionality Test Results*

| No. | Features | Results | Remarks |
|---|---|---|---|
| 1 | Course Eligibility Evaluation Portal | 100% | Passed |
| 2 | Grading Portal | 100% | Passed |
| 3 | Curriculum Management and Design Tool | 100% | Passed |

| | | | |
|---|---|---|---|
| 4 | Descriptive Analytics and Insights Dashboard | 100% | Passed |

The third objective of the study was to evaluate the usability of the developed system in terms of system usefulness, information quality, interface quality, and overall usability. The results of the usability evaluation are presented in Tables 28-32 using the third version of the Post-Study System Usability Questionnaire (PSSUQ v3). This questionnaire uses a 7-point Likert Scale, where 1 indicates very highly acceptable, and 7 indicates highly unacceptable. Thus, a mean score closer to 1 reflects a higher level of user acceptability. The results of the evaluation for the Integrated Student Information System with Descriptive Analytics showed the following mean scores: 1.10 for System Usefulness, 1.18 for Information Quality, 1.26 for Interface Quality, and 1.17 for Overall Usability. These scores demonstrate a very high level of acceptability across all usability dimensions. Additionally, the results were compared with the PSSUQ-3 Norms (Table 3), which provide lower and upper limits and mean values for each question at a 99% confidence interval, based on data from 21 studies with 210 participants. By comparing the current study's mean scores to these norms, it was confirmed that the system exceeds industry usability benchmarks, thereby validating its design quality and user-centered approach (Lewis, 2018).

**Table 3.** *Mean Scores on the Level of Usability of the Integrated Student Information System with Descriptive Analytics*

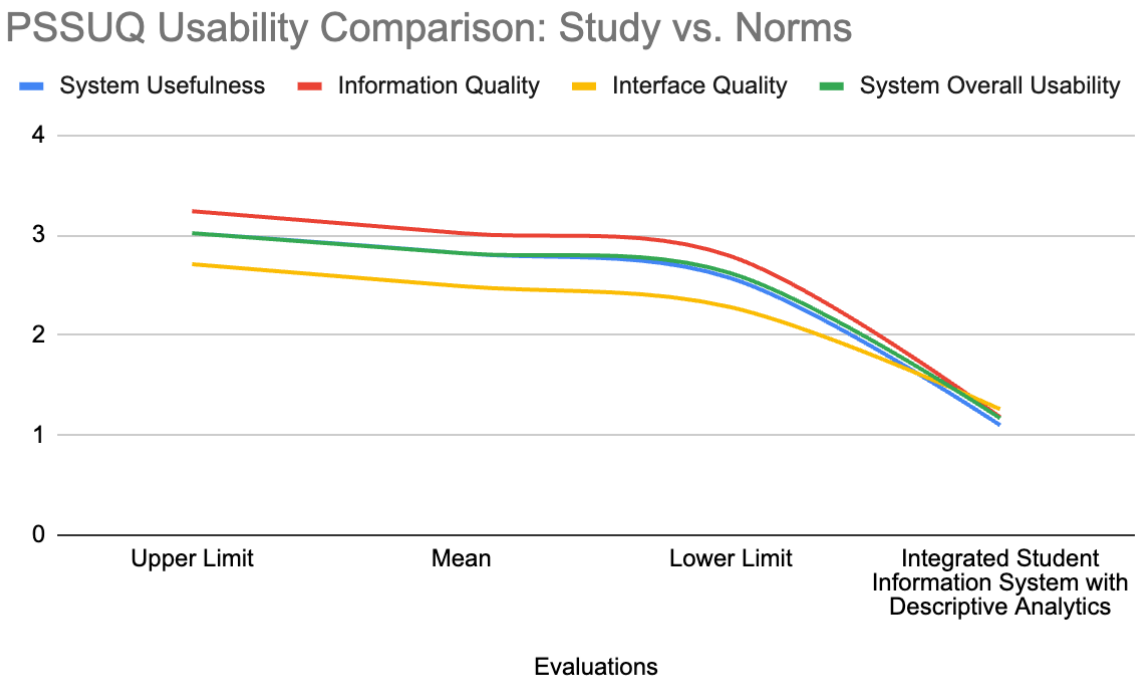
| PSSUQ Criteria | Mean | Mean Norms | Interpretation |
|---|---|---|---|
| System Usefulness | 1.10 | 2.82 | Strongly Agree |
| Information Quality | 1.18 | 3.02 | Strongly Agree |
| Interface Quality | 1.26 | 2.49 | Strongly Agree |
| Overall Usability | 1.17 | 2.82 | Strongly Agree |

To provide an objective interpretation of the results, the computed mean scores were compared against established PSSUQ v3 normative benchmarks. These norms, derived from multiple prior usability studies, provide reference mean values and confidence intervals that serve as industry standards for system evaluation. The results of the Integrated Student Information System with Descriptive Analytics showed the following mean scores: 1.10 for System Usefulness, 1.18 for Information Quality, 1.26 for Interface Quality, and 1.17 for Overall Usability.

When compared with the PSSUQ v3 normative values, all obtained mean scores were consistently lower, indicating superior usability performance relative to established benchmarks. This suggests that users perceived the system as

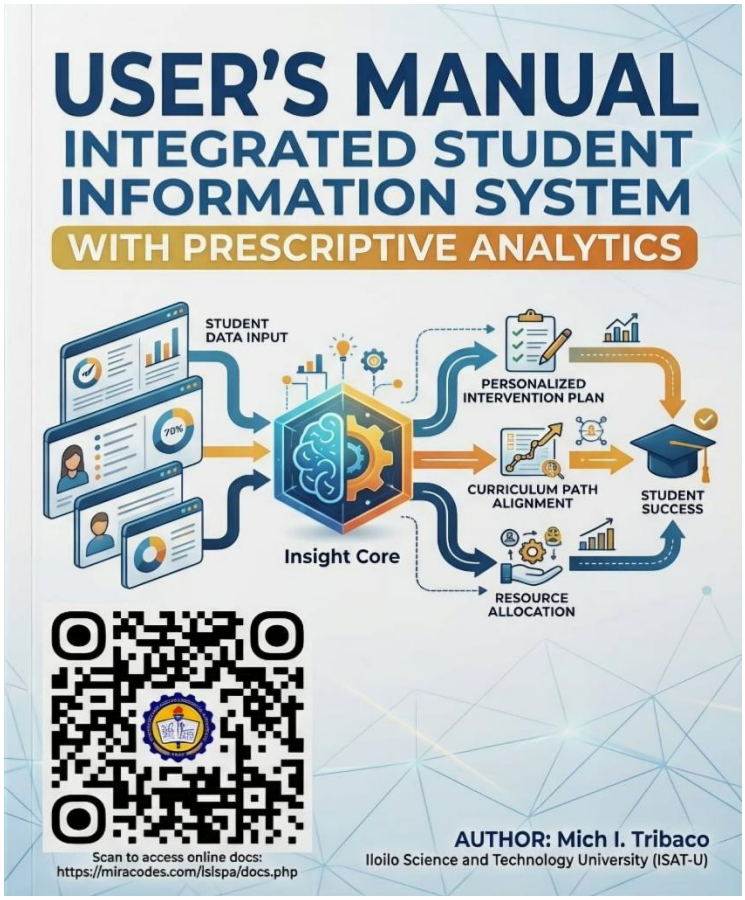
highly efficient, easy to use, and well-designed in terms of information presentation and interface interaction. The comparative analysis with PSSUQ norms confirms that the system meets and exceeds standard usability expectations, thereby validating its strong design quality and user-centered development approach (Lewis, 2018).

**Figure 6.** *PSSUQ Mean Results vs. Current Mean Norms (Lewis, 2018): Control Chart Comparison*
*Note: Lower scores indicate higher usability in PSSUQ.*




The fourth objective of the study is to develop a user manual of the Integrated Student Information System with Descriptive Analytics. Figure 7 below shows the cover page of the system's user manual. The user manual is created to assist users in operating the system. The system user's manual will guide users through a step-by-step approach to accessing and navigating the system. It is a simplified form for all the users that makes it easy to understand.

**Figure 7.** *The cover design of the Integrated Student Information System with Descriptive Analytics user manual.*




## CONCLUSIONS

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

1. The Integrated Student Information System with Descriptive Analytics has distinct technical features that allow the following: course eligibility evaluation portal, grading portal, curriculum management and design tool, and descriptive analytics and insights dashboard.

2. Using a test case, the Integrated Student Information System with Descriptive Analytics is 100% pass, and it is functional and operational.

3. The Integrated Student Information System with Descriptive Analytics has a high usability index and is acceptable in terms of usability, including system usefulness, information quality, interface quality, and overall usability.

4. The Integrated Student Information System with Descriptive Analytics user manual was developed to provide assistance and guidance related to the usage of the software system.

## RECOMMENDATIONS

The following recommendations were formulated according to the summary of the findings and conclusions.

1. Integrate the system with existing enrollment and academic management platforms to establish a seamless and centralized student information process across institutional operations.
2. Enhance the Grades Portal by implementing well-defined class and subject structures that enable faculty members to upload grade sheets directly and efficiently.
3. Expand the system's real-time communication capabilities by providing automated notifications and alerts to students, faculty evaluators, and registrar personnel regarding important activities such as enrollment updates, evaluation results, announcements, and grade postings.
4. Further improve the application of Decision Tree Prediction techniques by incorporating advanced predictive analytics for student performance evaluation, academic risk assessment, and curriculum-based insights to support institutional decision-making.

**Acronyms:** ISISDA – Integrated Student Information System with Descriptive Analytics; PSSUQ – Post-Study System Usability Questionnaire; ISAT-U – Iloilo Science and Technology University.

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