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Development of an intelligent platform for predicting curriculum management in higher education under the AUN-QA framework

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Abstract

This research aims to study and define the user requirements and operational capabilities required to develop an intelligent platform for forecasting and managing higher education courses under the AUN-QA framework using documentary research, platform design, and technology suitability assessment. The samples studied include personnel, instructors, course administrators, and IT specialists selected by the purposive method. Data were analyzed using statistics and standard deviation calculations. The results show that the developed platform should have five main components: user data control with AWS IAM and React, access security, SmartEduQA system for data storage and analysis, data presentation with Microsoft Power BI, and a serverless storage system. The platform is designed to meet the needs of administrators in forecasting the labor market and managing courses, instructors in analyzing data according to AUN-QA standards, and staff in managing data quickly and supporting interactive display. This platform can help make higher education course management efficient and aligned with AUN-QA standards.

Keywords: AUN-QA standard framework, Intelligent, Platform.

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1. Introduction

Quality assurance in curriculum development is a key factor affecting the overall quality of education. Well-developed curricula equip students with the skills and knowledge needed for future careers and lives and contribute effectively to society [1]. Sound teaching management systems improve the quality of learning and promote interactions between teachers and students, leading to better educational outcomes [2]. Effective curriculum management also provides a clear framework for teachers and creates an environment that promotes student academic success [3].

The provision of curriculum management under the AUN-QA framework is challenged by its complexity and the need to integrate diverse educational standards. The AUN-QA framework requires comprehensive curriculum management, including digitizing course content and ensuring alignment with expected learning outcomes. This complexity arises from continuous assessment and improvement to maintain academic quality [4]. Aligning curricula to desired outcomes is also challenging, as it must respond to the diversity of study programs and student needs [5].

Integrating AI and big data technologies in education systems enables innovation and improves the learning experience. Intelligent platforms are increasingly used for curriculum forecasting and planning, where technologies such as AI, big data, and the semantic web enable personalized learning recommendations, accurate grade predictions, and appropriate course recommendations [6]. Big data analytics also allows customized learning plans, grade predictions, and subject group recommendations based on learners' indicators [7]. Learning algorithms such as RFM and K-means models classify learning scenarios and develop targeted teaching strategies [8]. In addition, intelligent cloud platforms help improve the utilization of hardware and software resources in institutions, enabling more efficient allocation of teaching resources [9].

Curriculum management under the AUN-QA framework is complicated by data inconsistencies, which make extracting accurate statistics and results brutal [10]. Predicting curriculum management requires the integration of educational quality indicators, curriculum alignment with quality assurance standards, stakeholder engagement, and adaptation to continuous education reforms [11]. This research aims to study user needs, including analyzing the challenges and constraints in platform development, defining the necessary functions and features of the platform, and assessing the suitability of technologies and tools used in the development of an intelligent platform for forecasting course management in higher education under the AUN-QA standard framework. The obtained data can be used as a guideline for developing a platform to improve the efficiency of course management through in-depth analysis and integration of AI technology with big data, enabling real-time forecasting of educational needs, promoting innovation and practical skills that are consistent with the context of innovative education [12].

2. Literature Review

2.1. Study on the ASEAN University Network-Quality Assurance (AUN-QA) Higher Education Quality Assurance Framework

The ASEAN University Network (AUN) has established the AUN-QA Framework to certify the quality of higher education in the region, focusing on harmonizing the quality of education internally and externally in institutions aligned with regional and international standards [13]. The AUN-QA Framework enhances the quality of teaching, learning, and assessment in line with curriculum learning outcomes, affecting graduates' quality. In terms of internal quality assurance, it focuses on setting standards at the university, faculty, and department levels in line with the vision and mission of the institution. In contrast, external quality assurance is guided by international standards such as WFME to elevate quality to global standards [14]. The AUN-QA Framework supports the integration of regional education systems, promotes the sustainability and resilience of higher education, and enhances the competitiveness and attractiveness of ASEAN higher education institutions on the global stage [15]. AUN-QA focuses on clearly defined learning outcomes aligned with a program's educational objectives [16]. These outcomes are important for assessing the effectiveness of a program and ensuring that students achieve the desired competencies [17].

2.2. Intelligent Platforms and Predictive Analytics

Predicting educational outcomes using machine learning techniques is an important topic in academic research, providing insights into student performance and appropriate interventions. Various models such as Logistic Regression, Random Forest, Gaussian Naive Bayes, k-nearest Neighbors, and Support Vector Regression have been evaluated to predict academic outcomes, and these models have been applied to specific courses to assess their accuracy and reliability [18]. Key factors affecting academic performance, such as cumulative GPA and year of enrollment, effectively predict student success and identify risk groups. Neural networks have accurately predicted outcomes using these features [19]. In addition, feature selection techniques can improve predictive models by identifying the most relevant variables. This process involves data extraction, aggregation, and machine learning applications to increase educational predictions' accuracy [20].

2.3. Application of AI in Education

The integration of AI in education systems has transformed education delivery, assessment, and curriculum management, with AI tools and platforms enabling greater accessibility, efficiency, and personalization of learning for learners. AI, such as transformer models like BERT and GPT-3, translate educational content between English and native languages, reducing language barriers and promoting education in developing countries [21]. Generative AI tools like ChatGPT are transforming digital teaching by fostering human-technology collaboration and making education more accessible and cost-effective [22]. In assessment, AI improves accuracy and efficiency by providing personalized feedback, creating tests, grading, and adapting teaching strategies to learners' needs, leading to better educational outcomes [23]. However, AI also faces challenges, such as ethical issues, data privacy, and regulatory frameworks [24]. Addressing these issues requires collaboration between educators, policymakers, and stakeholders to ensure responsible and sustainable AI integration in education [25].

2.4. Quality Assurance in Higher Education

Quality assurance in higher education is a process that aims to ensure that curricula meet standards and are continuously improved, using strategies and frameworks appropriate to the educational context. The study by Bui and Yasri emphasizes the importance of the AUN-QA framework, which consists of eight criteria, such as learning outcomes and teaching approaches, in line with the Plan-Do-Check-Act (PDCA) cycle to support continuous improvement [16]. Regarding

professional development, Ramos and Codilla point out that important strategies include needs assessment, teaching training, and feedback mechanisms, which help improve teaching quality and align with quality assurance goals [26]. However, challenges such as resource constraints and stakeholder engagement remain major obstacles that need to be addressed to make quality assurance in higher education more effective.

2.5. Technology Adoption in Higher Education

Adopting new technologies in higher education is influenced by a multidimensional set of factors, including technology, pedagogy, society, and economy, which affect the integration of technologies and their acceptance by stakeholders such as students, faculty, and administrators. Technological factors, such as performance expectations and enabling conditions, are important predictors of adopting technologies such as ChatGPT, with students intent to use them when they see their effectiveness and appropriate support [27]. Pedagogical Perceptions The effectiveness of technology integration depends on the perceptions of stakeholders, which may vary by context and discipline [28]. Institutional Readiness and Support: Lack of technical support and institutional readiness can hinder the adoption of online learning technologies. Economic, social, and digital competence factors also play a role [29]. Despite these factors being important, challenges such as lack of technical skills in faculty and rapid technological changes continue to be obstacles, requiring continuous adaptation and evaluation to ensure that technologies meet the evolving needs of higher education institutions [30].

3. Materials and Method

1. Study and analyze documents and research related to curriculum management in higher education, covering the AUN-QA framework, artificial intelligence (AI) technology, and machine learning.
2. Design an intelligent platform for forecasting curriculum management in higher education under the AUN-QA standard framework.
3. Evaluate the appropriateness of the platform using descriptive statistics such as percentage, mean, standard deviation, and a 5-level rating scale based on the Likert Scale concept.
4. Population: Officers, lecturers, lecturers in charge of the curriculum/administrators in educational institutions, and IT specialists with at least 5 years of experience
5. Sample: Officers, 30 people, lecturers, 50 lecturers in charge of the Executives and those responsible for the curriculum, and 20 IT specialists with at least 5 years of experience

From the study, the analysis of documents and related research for the design of the working model of the intelligent platform for forecasting curriculum management in higher education under the AUN-QA standard framework is detailed in Figure 1 as follows:

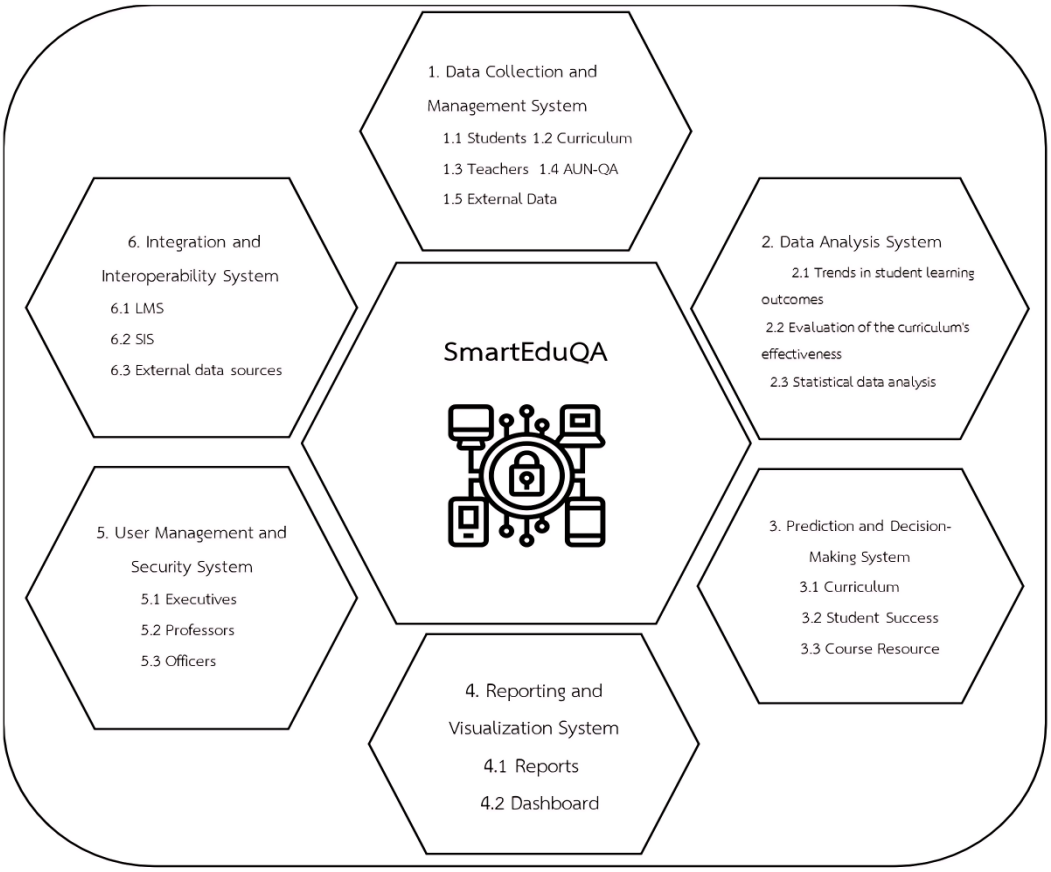

Figure 1.
Conceptual diagram of developing an intelligent platform for forecasting curriculum management in higher education under the AUN-QA framework.

Figure 1, in the study of the development model of the intelligent platform for forecasting curriculum management in higher education under the AUN-QA standard framework, is a study of the working model consisting of the following essential subsystems:

1. Data Collection and Management System To obtain the data used in forecasting, researchers must collect data from various sources using the central database of the institution related to curriculum management to be able to use it for analysis and forecasting, consisting of subcomponents: student data module, curriculum data module, teacher data module, quality assurance data module, and external data module.
2. Data analysis system is the process of analyzing the collected data. It consists of sub-components, including the module for analyzing student learning trends, the module for evaluating course efficiency, and the module for analyzing related statistical data.
3. Forecasting and decision-making systems This section introduces an approach to effective curriculum management using data obtained from analysis and forecasting to support administrators' decision-making. It comprises sub-components, including a curriculum demand forecasting module, a student success forecasting module, and a curriculum resource forecasting module.
4. The reporting and display system consists of sub-components: a reporting module that creates reports covering forecast data and suggestions for course management so that users can use them as information for course improvement and a data analysis module that displays analysis results in dashboard format.
5. User management and security system: This system defines safe access and usage and comprises subsystems. The User rights management module Defines access rights to data and various platform functions according to the system user's role, such as administrator, teacher, and Officer rights.
6. Integration and connection system: This system provides API services for connecting to other systems and creates Web Services to connect to other platforms. It consists of sub-components: modules that connect to other systems, such as the Education Management System (LMS), Student Registration System (SIS), and external data sources, to collect necessary data.

Design of the work by studying the suitability of the intelligent platform for forecasting curriculum management in higher education under the AUN-QA standard framework, with the system overview as shown in Figure 2 as follows:

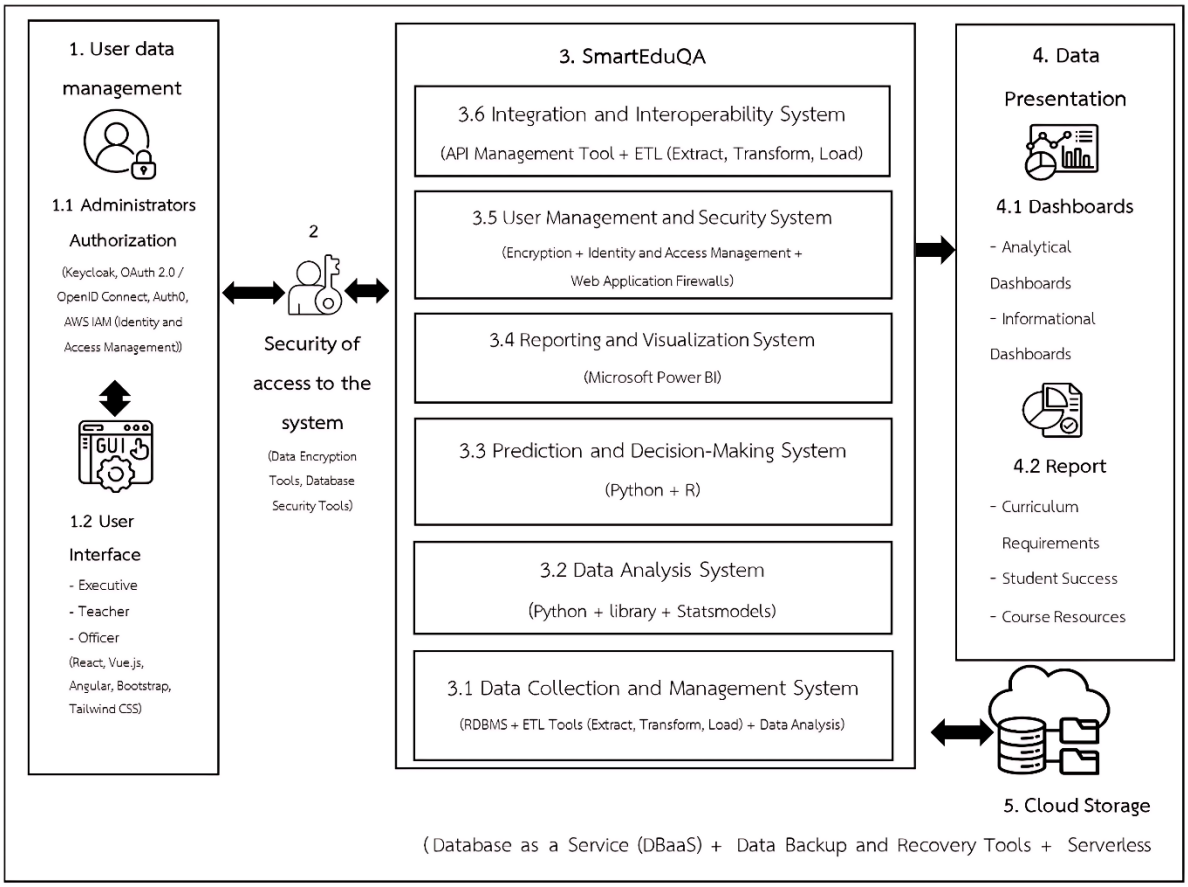

Figure 2.
Shows the overall study of the operation of the intelligent platform for forecasting curriculum management in higher education under the AUN-QA standard framework.

1. User data management: Administrators manage and control the platform's operation. They can access and manage various system parts through the User Interface, divided into three levels: officers, lecturers, and lecturers in charge of the curriculum/administrators in educational institutions.

2. Security of access to the system Control of security of data access and platform operation to ensure that data is accessible only to authorized persons.
3. Management of SmartEduQA system under the AUN-QA standard framework Components of the innovative platform for forecasting course management in higher education under the AUN-QA standard framework This system is divided into six modules, as shown in Figure 2.
4. Appropriateness of Presentation Data
5. Cloud storage This system can be connected to the platform's primary storage.

4. Results and Discussion

The results of the evaluation of the overall suitability of the smart platform for forecasting curriculum management in higher education under the AUN-QA standard framework have the following research results:

The results of the analysis of research data from groups involved in the development of an intelligent platform for forecasting curriculum management in higher education under the AUN-QA standard framework are divided into three groups: the group of teachers responsible for the curriculum/administrators, the group of lecturers, and the group of officers. The topics studied are identifying the needs and expectations of users, analyzing the challenges and limitations in curriculum management, and determining the functions and necessary features of the platform. The details are in Table 1 as follows:

Table 1.
Summary of research data analysis results.

Sample	Identifying needs	Challenges and limitations	Functions and features
1. Lecturers in charge of the curriculum/ administrators in educational institutions	1. Forecasting the labor market (68%) 2. Simplifying curriculum management (60%) 3. Using labor market trend data (72%)	1. Problems of lack of external data connectivity (46%) 2. Managing data from multiple sources (58%) 3. Linking data from workplaces (56%)	1. Analyze statistics to improve the curriculum (66%) 2. In-depth report according to AUN-QA standards (48%) 3. Report results according to AUN-QA standards (42%)
2. Lecturers	1. Curriculum-AUN-QA relationship analysis system (58%) 2. Security system for access control (64%) 3. Integration with internal quality assessment system (40%)	1. Lack of cooperation from data sources (64%) 2. Inaccurate and outdated data (52%) 3. Disconnected and inconsistent data (58%)	1. Quality assessment reports based on AUN-QA (70%) 2. Forecasting curriculum development trends (40%) 3. Customizable interactive dashboard (54%)
3. Officers	1. Fast curriculum/course updates (57%) 2. Student data management (53%) 3. Track curriculum development (57%) 4. Interactive data presentation (57%)	1. Align curriculum data with AUN-QA standards (100%) 2. Lack of tools for curriculum tracking and analysis (70%) 3. Plan curriculum development based on future trends (87%) 4. Lack of technical support and training (70%)	1. Forecast market demand to enhance curriculum (57%) 2. Evaluate curriculum based on AUN-QA (87%) 3. Summarize data in a quick-tracking dashboard (53%)

Table 1 divides the groups involved in developing an intelligent platform for forecasting course management in higher education under the AUN-QA standard framework into three groups. Each group has identified the needs and problems related to course management, including the features that should be in a platform used to manage courses, which can be summarized as follows:

1. The lecturers in charge of the curriculum/ administrators in educational institutions needed the development of an intelligent platform for forecasting course management in higher education under the AUN-QA standard framework, namely, focusing on predicting data for use in decision-making, such as forecasting trends in course development and using data to forecast trends. The need for real-time data is high. The problems found in the research study are that the available data cannot be linked to be consistent and needs to be updated slowly, which is a limitation in course management. However, the desired features in the platform should be a system that can display assessment reports and various trends to help improve the course.
2. Lecturers need a platform linked to AUN-QA standards and efficient data management, such as data access security systems and connections to internal quality assessment systems. Research studies have found problems with the need for more accurate data and sources of information—outdated or updated data results in consistent course management and consistent issues with administrators and course responsibilities. Regarding the desired features in the platform, we would like a system that can process course development according to future trends and a system that displays data in a customizable dashboard format.

3. Officers need a platform for rapid course data updates, student data management, and curriculum development tracking. Problems found in the research study are data management in line with AUN-QA standards and the need for tools for tracking and analyzing curriculum data. Regarding the platform's desired features, the system should have a dashboard reporting system that summarizes data for rapid tracking and forecasting market demand trends to improve the curriculum.

The summarized data can be used as a guideline for developing a platform consistent with curriculum-related needs. Focus on creating a data management and forecasting system that helps each user group make decisions. The system also needs to support connectivity with AUN-QA standards to respond to quality and curriculum development needs.

The results of the analysis of data on the appropriateness of technology used in the development of an intelligent platform for forecasting curriculum management in higher education under the AUN-QA standard framework of experts are detailed in Table 2 as follows:

Table 2.
Mean and standard deviation of the platform used to develop an intelligent platform for forecasting course management in higher education.

Assessment list	Mean	S.D.	Opinions
The platform used to develop an intelligent platform for forecasting course management in higher education			
1. User data management	4.90	0.294	Excellent
2. Security of access to the system	4.81	0.393	Excellent
3. Management of SmartEduQA system under the AUN-QA standard framework	4.90	0.294	Excellent
4. Data Presentation	4.95	0.213	Excellent
5. Cloud Storage	4.90	0.294	Excellent
Total	4.90	0.306	Excellent

Table 3.
Mean and standard deviation of technologies used in developing the user management platform.

Assessment list	Mean	S.D.	Opinions
1. User data management			
1.1 Administrators authorization			
1. Key cloak	4.62	0.486	Excellent
2. OAuth 2.0 / OpenID connect	4.62	0.486	Excellent
3. Auth0	4.62	0.486	Excellent
4. AWS IAM (Identity and access management)	4.71	0.452	Excellent
Total	4.64	0.479	Excellent
1.2 User Interface			
1. React	4.90	0.294	Excellent
2. Angular	4.05	0.722	Good
3. Bootstrap	4.48	0.499	Good
4. Tailwind CSS	4.43	0.66	Good
Total	4.43	0.615	Good
2. Security of access to the system			
1. Data encryption tools	4.62	0.486	Excellent
2. Database security tools	4.71	0.452	Excellent
Total	4.67	0.471	Excellent
3. Management of SmartEduQA system under the AUN-QA standard framework			
3.1 Data Collection and Management System			
1. RDBMS	4.90	0.294	Excellent
2. ETL Tools (Extract, Transform, Load)	4.71	0.452	Excellent
3. Data analysis includes Python (pandas, NumPy, SciPy), R, and BI (Business Intelligence)	5.00	0.000	Excellent
Total	4.87	0.333	Excellent
Assessment list	Mean	S.D.	Opinions
3.2 Data analysis system			
1. Python	5.00	0.000	Excellent
2. Library	4.43	0.66	Good
3. Stats models	4.52	0.663	Excellent
Total	4.65	0.595	Excellent
3.3 Prediction and decision-making system			
1. Python uses scikit-learn for machine learning forecasting	5.00	0.000	Excellent
2. R (Caret, Forecast, Random Forest)	4.43	0.66	Excellent
Total	4.65	0.595	Excellent
3.4 Reporting and visualization system used Microsoft power BI	4.71	0.452	Excellent
Total	4.71	0.452	Excellent
3.5 User management and security system			
1. OAuth 2.0/ OpenID Connect	4.67	0.471	Excellent
2. Apache Shiro	4.19	0.587	Good
3. SSL/TLS	4.62	0.486	Excellent
Total	4.49	0.560	Good

Assessment list	Mean	S.D.	Opinions
3.6 Integration and interoperability system			
1. API management tool	4.71	0.452	Excellent
2. ETL (Extract, Transform, Load)	4.90	0.294	Excellent
Total	4.81	0.393	Excellent
4. Data presentation			
4.1 Dashboards for displaying data analytical dashboards, informational dashboards			
1. Dashboards for displaying data Analytical Dashboards Informational Dashboards include Microsoft Power BI.	4.52	0.499	Excellent
2. Report for displaying information on curriculum requirements, student success, and course resources, including Microsoft Power BI.	4.52	0.499	Excellent
Total	4.52	0.499	Excellent
5. Cloud storage			
1. Database as a service (DBaaS)	4.48	0.663	Good
2. Data backup and recovery tools	4.52	0.663	Excellent
3. Serverless	4.62	0.486	Excellent
Total	4.56	0.611	Excellent

The data in Table 3 shows the summary of the study results of technology used in developing an intelligent platform for forecasting curriculum management in higher education under the AUN-QA standard framework, dividing the system into 5 main parts with the tools used in each part as follows:

1. User data governance centers on the administration of user information and the optimization of interface efficacy. AWS IAM (Identity and Access Management) exhibits an average rating of 4.71, whereas React demonstrates a superior average rating of 4.90.
2. Access Security Guarantees the integrity of system access via comprehensive and effective instruments. The average rating for Database Security Instruments is 4.71.
3. SmartEduQA integrates the processes of data acquisition, analytical evaluation, and strategic decision-making. The average proficiency in data analysis is recorded at 5, while the mean score for Python is also 5. The average for R, encompassing packages such as Caret, Forecast, and Random Forest, is calculated at 4.71, and the average for Microsoft Power BI is similarly 4.71. Furthermore, the mean score for OAuth 2.0 and OpenID Connect stands at 4.67, whereas the average for ETL (Extract, Transform, Load) processes is at 4.90.
4. Data Presentation encompasses the dissemination of information via visual interfaces and analytical instruments. The average rating for Microsoft Power BI is 4.52.
5. Cloud Storage offers scalable and effective cloud storage alternatives. Serverless average rating= 4.62

5. Conclusion

From the study of the need for developing an innovative platform for forecasting and managing courses in higher education, in line with the AUN-QA framework, this research presents a comprehensive overview of appropriate technologies and tools for platform design, which is divided into five main components: 1. User data control focuses on data management and user performance, using AWS IAM and React tools, which have an average score of 4.71 and 4.90, respectively. 2. Access security focuses on protecting system integrity using database security tools, with an average score of 4.71. 3. SmartEduQA covers data collection, analytical assessment, and decision-making, with Python having the highest average score of 5.00, while R and Microsoft Power BI are at 4.71. In addition, OAuth 2.0 and OpenID Connect have an average score of 4.67, and the ETL process is at 4.90. 4. Data presentation focuses on publishing data through a visual interface, with Microsoft Power BI having an average score of 4.52. 5. Cloud data storage Offers highly flexible storage options with serverless technology with an average rating of 4.62.

In terms of the study of the needs of the user groups, including administrators/professors responsible for the curriculum, lecturers, and staff, the summary of key points for the development of an intelligent platform that supports curriculum management in higher education to support efficient and standardized curriculum management is as follows: The group of administrators and curriculum makers want the platform to have a labor market forecasting function, reduce the complexity of curriculum management, and link data from multiple sources to enable comprehensive reporting and improvement according to AUN-QA standards. The group of lecturers wants the platform to have a function to analyze relationships with AUN-QA standards, along with a secure rights management and access system, as well as a link to internal quality assessment systems and support reporting and forecasting for effective curriculum development. The group of staff wants the platform to update and manage data quickly, support interactive display, and have tools to help forecast and track curriculum development, including assessments consistent with AUN-QA standards.

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