

INTRODUCTION

In the era of digital transformation, universities worldwide are advancing toward becoming smart universities by integrating technology to enhance academic and administrative services (George & Wooden, 2023; Polin et al., 2023). Central to this development is the Management Information System (MIS), which serves as the backbone for managing critical student information and facilitating efficient communication between the institution and its stakeholders (Alzoubi et al., 2021; Huber et al., 2022). Rizal Technological University, in its pursuit to become a smart university, recognizes the need to strengthen its MIS to support academic processes, improve user experience, and foster institutional trust.

Despite the growing reliance on digital platforms, there is limited understanding of how students perceive the services provided by the MIS Office at Rizal Technological University (Al-Marroof et al., 2021; Songkram et al., 2023). Without a validated framework to assess these perceptions, it becomes challenging to identify areas of strength and opportunities for improvement in the MIS services (Asadzadeh et al., 2022). This gap hinders the university's efforts to enhance system functionality and responsiveness, which are essential for achieving the goals of a smart university.

For this study, the Management Information System (MIS) refers to the digital platform managed by the university's MIS Office that allows students to access academic records, receive notifications, and utilize other academic-related services (Giua et al., 2020; Tummers et al., 2020; Habib et al., 2020). Students' perceptions encompass their experiences, trust, satisfaction, and usability assessments related to the MIS services (Zaidi et al., 2023; Almaghrabi et al., 2024). The latent dimensions denote the underlying factors that explain students' perceptions and interactions with the MIS (Padrosa et al., 2020).

This study is grounded in psychometric theory and exploratory factor analysis, which propose that observable variables are manifestations of underlying latent constructs (Zagaria & Lombardi, 2024; Y. Y. Li et al., 2024; Geravandi et al., 2025). By applying factor analysis, the study seeks to identify and explain

these latent dimensions that influence students' perceptions of MIS services. Understanding these dimensions will provide insights into the structural components of the system and guide improvements aligned with user needs (Howard & O'Sullivan, 2024; Barrantes, 2025).

Previous research highlights the importance of usability, reliability, accessibility, and support services as key components in evaluating information systems in educational settings (García-Holgado et al., 2024; Teixeira et al., 2024). Studies have shown that these dimensions significantly impact user satisfaction and trust, which in turn affect system adoption and sustained use (Bastardo et al., 2024; Ntoa, 2024). Moreover, smart university frameworks emphasize the integration of reliable and user-centered MIS platforms to facilitate seamless academic operations and communication (Ştefan et al., 2024; Meesad & Mingkhwan, 2024).

Research Questions

The purpose of this study is to develop and validate a contextualized scale to assess students' perceptions of the MIS Office's services at Rizal Technological University. Specifically, the study aims to determine the suitability of the dataset for factor analysis, uncover the underlying latent dimensions of the MIS services, evaluate the reliability and validity of the developed scale, assess how well the extracted factor structure fits the data, and explain the extent to which the identified factors account for variations in students' perceptions of the university's MIS, hence the following questions:

1. Is the dataset suitable for factor analysis to uncover the underlying latent dimensions of the university's Management Information System (MIS)?
2. What are the underlying dimensions of services in the Management Information System Office at Rizal Technological University?
3. What are the reliability and validity measures of the developed contextualized scale for assessing the Management Information System Office's services?
4. How well does the extracted factor structure fit the data?

5. How do the identified factors explain the variation in students' perceptions of the university's Management Information System (MIS)?

LITERATURE REVIEW

The implementation of Management Information Systems (MIS) in higher education institutions has become essential for optimizing administrative functions, refining decision-making processes, and augmenting the overall educational experience for stakeholders (Meesad & Mingkhwan, 2024). As universities adopt technology innovations, MIS serves as a centralized system that underpins data-driven policies, enhances interdepartmental communication, and promotes efficient resource management (Sabri & Amir, 2024). At Rizal Technological University, the shift towards a smart university necessitates a meticulously crafted and adaptive Management Information System (MIS) that aligns with institutional objectives, promotes accountability, and empowers learners as well as administrators through accessible, dependable, and easy to use digital services.

Management Information System emphasizes accessibility, reliability, usefulness, and institutional support. Accessibility and trust in digital systems are seen fundamental, as emphasized by Pigola and De Souza Meirelles (2024), who highlighted system quality and user satisfaction as essential elements of effective information systems. The dependability and efficiency of systems, as articulated by Yarmilko et al. (2024), influence user engagement with institutional platforms, particularly during peak enrollment and academic reporting phases. Usability, encompassing intuitive navigation and device responsiveness, has been demonstrated to substantially influence user engagement, as indicated by Meesad and Mingkhwan (2024), who investigated student perceptions of e-government platforms in educational contexts. Moreover, responsive support systems, particularly those offering prompt troubleshooting and updates, enhance the whole experience of MIS users, as demonstrated by Vrančić et al. (2024) in their examination of university portals.

Notwithstanding the progress in MIS design and performance, numerous issues endure in the

educational sector. A primary issue is the inadequate utilization of data-driven features resulting from insufficient user guidance or design constraints of the system. Kerubo and Oliver (2024) discovered that in Kenyan universities, technological deficiencies and erratic user feedback systems resulted in diminished system acceptance rates among faculty and students. In Palagi and Javernick-Will (2020) examination of Philippine public universities, it was noted that antiquated infrastructures, inadequate mobile compatibility, and disjointed MIS policies impede optimal system utilization, especially in resource-limited contexts. The absence of real-time connection among departments exacerbates these difficulties, resulting in delays in academic and administrative activities and eroding user confidence in the system's responsiveness and reliability.

To correct these deficiencies, particular empirical evidence provides insights into how resilient Management Information Systems might enhance institutional performance. A study by Vetrivel et al. (2025) revealed that well maintained MIS systems increased the correctness of student records, improved transparency in grade submissions, and minimized errors in enrollment procedures. Similarly, Chen and Ge (2024) investigated the user experience of students at a university indicating that accessibility, mobile optimization, and responsive Management Information System support substantially impacted students' satisfaction and academic confidence. These studies highlight the necessity of synchronizing system design with user anticipations and organizational requirements.

Enhancing usability continues to be a primary focus in Management Information Systems development. A usability assessment by Denisova et al. (2024) revealed that students appreciated systems including intuitive dashboards, responsive helpdesks, and few login redundancies. They indicated that excessively intricate interfaces deterred sustained usage and frequently compelled students to depend on alternative, unofficial communication channels. Zhu et al. (2023) contended that the accessibility of Management Information Systems (MIS) strongly influences institutional trust, particularly in contexts related to financial aid, grading, and academic advising.

From a cognitive processing standpoint, the implementation of Cognitive Load Theory (Zhu et al., 2023) offers a crucial framework for comprehending student interactions with digital platforms. Cluttered or poorly designed MIS interfaces elevate superfluous cognitive load, distracting users from critical tasks like class registration or academic tracking. Adu and Van Biljon (2023) highlighted this in a study examining the usability of learning management systems in higher education institutions, highlighting the necessity to reduce distractions and build systems that facilitate rapid knowledge retrieval.

Notwithstanding these encouraging insights, obstacles to MIS adoption persist, especially in institutions experiencing digital change. A study conducted by Mushtaq et al. (2024) indicated that students in provincial campuses saw regular downtimes and unreliable access to essential MIS functionalities as a result of bandwidth constraints and software malfunctions. In the study by Singun (2025), university MIS personnel identified insufficient training and inadequate technical assistance as the principal factors contributing to the sluggish adoption of systems by faculty members, resulting in bottlenecks in academic workflows.

Subsequent research ought to investigate the equitable ramifications of MIS installation. As institutions endeavor to digitize operations, underprivileged students—especially those lacking reliable internet connection or digital devices—may encounter systematic disadvantages. Ghrbeia and Alzubi (2024) advocates for the integration of institutional investments in digital literacy, inclusive design methodologies, and feedback systems with MIS development, enabling students to collaboratively influence the systems they utilize. Furthermore, assessing the degree to which Management Information Systems (MIS) enhance data privacy and the ethical utilization of student information is a significant issue, especially given the increased surveillance and data breaches within educational institutions.

A critical research gap exists in understanding how MIS dimensions uniquely shape students' perceptions within institutions aiming to strengthen its digital infrastructure towards smart university transformation. Studies such as (Droush, 2025),

J. Li and Zhang (2025), and Alshibly et al. (2024) offer valuable empirical support for improving the usability and responsiveness of management information systems. An urgent need exists at Rizal Technological University for the creation of a contextualized, empirically verified scale that can identify critical performance areas, lead planned digital advancements, and capture the entire spectrum of student experiences with the MIS.

METHODOLOGY

Research Design

This research utilized an Exploratory Sequential Mixed Method design to comprehensively assess and quantify students' impressions of the Management Information System (MIS) services at Rizal Technological University (Esbo et al., 2024). Qualitative data were initially gathered through online interviews with key personnel from the MIS Office to obtain comprehensive insights on the services currently provided to stakeholders. These ideas informed the creation of a survey instrument, which was subsequently delivered to students to quantitatively evaluate their perceptions (Furno et al., 2024). This methodology, as articulated by Bradt (2021) enables the qualitative results to influence and refine the quantitative phase, guaranteeing that the survey items are contextually pertinent and accurately represent the MIS services encountered by students, thus augmenting the study's validity and practical importance.

Participants

The research employed purposive sampling for the qualitative component and convenience sampling for the quantitative component (Ahmad & Wilkins, 2024). For the qualitative component, three key individuals from the Management Information System Office (MISO) were intentionally chosen based on their direct engagement and proficiency in overseeing the office's services. During the quantitative phase, convenience sampling was utilized to collect responses from 234 students across diverse programs and academic levels at Rizal Technological University (Graf et al., 2024). No explicit quota or needed quantity of responses per program or level existed; participation was accessible to any student who had utilized the MIS services.

This method facilitated an extensive gathering of student perspectives, while also considering the accessibility and availability of participants throughout the survey duration.

Data Collection Instruments

The data collection for this study utilized two primary instruments that embody its mixed-methods methodology. In the qualitative phase, a solitary open-ended interview question was posed to key individuals in the Management Information System Office to produce comprehensive information regarding the spectrum of services they offer (Jayaratne & Jayatilleke, 2021). This method guaranteed a concentrated and lucid comprehension of the MIS services from the viewpoint of the participants directly engaged. In the quantitative phase, a survey questionnaire was constructed utilizing qualitative findings and existing literature to assess students' overall perceptions of the MIS services (Piotr et al., 2024). The survey included general items without delineating specific components, facilitating a comprehensive evaluation of the services as perceived by students across diverse programs and academic levels.

Procedure

The data collection for this study took place after an ethics clearance was secured issued by the University Research Ethics Committee with reference number of BAL-078-2025-188 during the second semester of the academic year 2024-2025 at Rizal Technological University in Mandaluyong City, Philippines. In the qualitative phase, three key personnel from the Management Information System Office (MISO) were asked using a single open-ended question aimed at producing a thorough overview of the office's services. The responses were thematically examined to find common service areas, which guided the creation of a survey instrument for the quantitative phase.

The quantitative phase was conducted online with 234 students from various programs and academic levels who have used MIS services. Participation was entirely optional, with no specified quotas set for distinct groups. The collected data was checked for completeness and accuracy. The data's suitability

for factor analysis was determined using the Kaiser-Meyer-Olkin (KMO) measure (Nikhil et al., 2023) and Bartlett's Test of Sphericity (Abuyadek et al., 2024). Exploratory Factor Analysis (EFA) (Krongthaeo et al., 2024) was then carried out with Principal Axis Factoring (Madaree, 2024) as the extraction method and Varimax rotation (Meghanathan, 2024) to provide a simpler and more interpretable factor structure. Only items with factor loadings of at least .50 were kept (Desbalo et al., 2024), assuring statistical significance and conceptual consistency. Items with low loadings or cross-loadings were methodically removed, leaving behind a refined collection of factors that captured the underlying aspects of students' impressions of MIS services.

Data Analysis

The data were analyzed guided by the exploratory sequential mixed-methods design. Thematic analysis was employed to examine qualitative data from interviews with key personnel of the Management Information System Office, aiming to find recurring patterns and themes related to the services provided. Thematic analysis is a systematic approach for identifying, examining, and presenting patterns within qualitative data (Braun & Clarke, 2023). The insights obtained from this step guided the creation of an initial pool of survey items designed to thoroughly include the range of MIS services, which were subsequently subjected to quantitative stage.

The quantitative phase utilized Exploratory Factor Analysis (EFA) to identify the fundamental characteristics of student views of MIS services. Prior to factor extraction, the dataset's appropriateness was assessed utilizing the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity, which collectively determine the adequacy of sample size and inter-item correlations for factor analysis, as well as whether the correlation matrix significantly deviates from an identity matrix (Pilatin & Dilek, 2023). Principal axis factoring was subsequently employed to identify latent variables while considering measurement error (Berman & Fish, 2024). To enhance interpretability, varimax rotation was employed to optimize variance among factor loadings, with a threshold of 0.50 to retain

only significant item-factor associations (Azarmehr et al., 2024).

After factor extraction, the reliability of each factor was evaluated using Cronbach’s alpha and McDonald’s omega, the latter providing a more reliable estimate particularly when item loadings differ (Nasiri-Amiri et al., 2025; Barrio-Torres et al., 2024). The overall model fit was assessed by analyzing the residual correlation matrix, communalities, and the total variance explained. An effective EFA model is characterized by minimal residuals, significant communalities, and cumulative variance that meets or surpasses the established social science benchmark of approximately 60%, signifying that the factor structure accurately reflects the data (Vella & Richiardi, 2024). The comprehensive measures validated and explained the factor structure based on students’ impressions of Rizal Technological University’s MIS services.

RESULTS

The thematic analysis of qualitative data from key personnel at the Management Information System Office (MISO) of Rizal Technological University revealed five major themes that encapsulate the extensive range of services provided by the office. Themes uncovered through reoccurring response patterns constituted the basis for the subsequent item generation procedure in the quantitative phase (Table 1).

The concept of System Functionality and Design highlighted user-centric navigation, accessible interfaces, and structured system architecture, underscoring a significant emphasis on usability. System Reliability and Performance focused on stability, speed, and accessibility across devices, especially during peak demand, demonstrating a commitment to consistent service delivery. Information & Communication emphasized the necessity of delivering precise, prompt, and comprehensive academic information, encompassing updates on grades, announcements, and schedules.

Support and Resources encompassed several user assistance tactics, including help desks, training, and feedback channels, which MISO officials deemed crucial for resolving technical issues and facilitating seamless system operation. In due course, Overall Experience and Impact encompassed wider factors including student satisfaction, data security, and the perceived academic advantages of the MIS, signifying that the office acknowledges its responsibility in improving educational results and institutional credibility. These themes collectively depict MISO as a service-oriented unit, strongly associated with the university’s strategic objective of evolving into a smart institution.

The dataset’s appropriateness for factor analysis was initially evaluated by Bartlett’s Test of Sphericity and the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy. Bartlett’s Test of Sphericity produced a

Table 1: Thematic Analysis Results

Themes	Description
System Functionality and Design	Encompasses the ease of use, intuitiveness, organization, and accessibility of specific features within the MIS portal.
System Reliability and Performance	Reflects the system’s availability, stability, speed, and performance across different devices and during peak usage times.
Information and Communication	Focuses on the accuracy and completeness of academic information, as well as the timeliness and relevance of communications and notifications.
Support and Resources	Encompasses the quality and availability of technical support, troubleshooting instructions, updates about system changes, feedback mechanisms, training, and user resources.
Overall Experience and Impact	Captures students’ general satisfaction with MIS services, their trust in data security and responsible handling of personal information, the system’s contribution to academic success and organization, and their likelihood of recommending the services.

chi-square value of 10,458.99 with 496 degrees of freedom, demonstrating statistical significance at $p < .001$. This outcome signifies that the correlation matrix is not an identity matrix, so affirming that adequate intercorrelations among the variables justify the application of factor analysis. The test decisively refutes the null hypothesis of variable independence, hence confirming the existence of underlying latent constructs.

Table 2: Exploratory Factor Analysis Suitability Assessment Result

Tests	Values
Bartlett's Test of Sphericity	$\chi^2 = 10458.99$
df	496
p	$< .001$
KMO	0.97

The overall KMO measure was determined to be 0.97, deemed "marvelous" according to Kaiser's (1974) standard. A KMO score of this magnitude indicates that the sample is sufficiently strong and that the correlation patterns are sufficiently concentrated to yield trustworthy and unique factors. The large fraction of common variance among the variables suggests the suitability of extracting latent dimensions from the data.

The combined results of Bartlett's Test and the KMO index offer compelling statistical evidence that the data are highly amenable to factor analysis. The initial diagnostics validate the appropriateness of utilizing principal axis factoring, and the derived factors may be confidently interpreted.

The Principal Axis Factoring with Varimax Rotation identified four independent and theoretically significant factors influencing students' evaluations

Table 3: Factor Loadings based on Principal Axis Factoring and Varimax Rotation

Items	Factor 1	Factor 2	Factor 3	Factor 4
Item 29	0.792			
Item 41	0.782			
Item 21	0.756			
Item 35	0.752			
Item 37	0.715			
Item 20	0.715			
Item 7	0.699			
Item 39	0.696			
Item 26	0.688			
Item 38	0.661			
Item 25	0.637			
Item 2	0.625			
Item 40	0.597			
Item 19	0.563			
Item 1	0.563			
Item 28	0.548			
Item 31	0.546			
Item 24	0.543			
Item 17	0.508			
Item 44		0.724		

Items	Factor 1	Factor 2	Factor 3	Factor 4
Item 34		0.687		
Item 43		0.632		
Item 33		0.621		
Item 32		0.608		
Item 45		0.577		
Item 22		0.574		
Item 30		0.537		
Item 42		0.506		
Item 3			0.818	
Item 23			0.568	
Item 4			0.586	
Item 6			0.545	
Item 5			0.505	
Item 8			0.488	
Item 12				0.668
Item 10				0.59
Item 13				0.567
Item 18				0.549
Item 16				0.538
Item 15				0.518

of the university's Management Information System (MIS). Per psychometric norms, only items with factor loadings of 0.50 or above were deemed significant. This criterion guarantees that every kept item significantly contributes to its corresponding latent construct, hence improving the reliability and interpretability of the factor structure (Table 3).

Factor 1, designated as *System Accessibility and Trust*, appeared as the most prominent among the four, encompassing the greatest number of items and reflecting a broad spectrum of judgments concerning the usability and trustworthiness of the MIS. The highest loading item in this factor (0.792) indicates the ease with which students access academic records, while comparably elevated loadings are noted for the simplicity of viewing grades, the trust students have in the MIS Office to manage their personal information, and the security of login procedures. This element encompasses favorable experiences with system navigation, contentment with service

quality, and assurance in the system's continuous enhancement. The extensive conceptual range of this factor indicates that students link usability to institutional trust, potentially necessitating a subsequent second-order factor analysis to ascertain if it can be further subdivided into components such as usability and confidence in management.

Factor 2, designated as *System Reliability and Efficiency*, signifies students' anticipations for firm system performance, particularly throughout pivotal academic intervals. Factors include the lack of delays, rapid response times, system dependability during peak demand, and the accessibility of required forms exhibited significant factor loadings (up to 0.724). The incorporation of elements related to tutorial accessibility and structured layout indicates that efficiency is perceived not just in technological aspects but also as a result of coherent design and supportive user resources. This component indicates students' valuation of systems that facilitate

academic duties without interruption, highlighting the operational dependability of the MIS.

Factor 3, designated as *System Navigation and Mobile Experience*, encompasses students' experiences with portal navigation and access across several platforms. It encompasses high-priority factors such as minimal navigational difficulties (0.818), infrequent system crashes, reliable accessibility during peak periods, and adequate mobile access. The results indicate increasing student expectations for seamless access across devices and for systems that are both stable and intuitive, particularly on mobile platforms. One element of this factor—concerning the timing of announcements—exhibited a marginally lower loading (0.488), suggesting that its contribution to the latent factor is relatively smaller and may be enhanced in subsequent evaluations.

Factor 4, designated as *Support and Responsiveness*, includes the quality of user assistance and institutional communication. Factors such as the professional management of student issues (0.668), timely technical support, transparent maintenance updates, awareness of support contacts, and sufficient training or orientation all shown substantial loading on this factor. This aspect emphasizes that, in addition to system performance, the availability of responsive and empathic human help is essential for user happiness. Students appreciate receiving guidance, being listened to, and being informed, particularly during technical difficulties.

The internal consistency of the four extracted factors was assessed using Cronbach's alpha (α) and McDonald's omega (ω), which measure the reliability of item clusters in measuring a singular latent construct.

The factor *System Accessibility and Trust* had exceptional dependability, with both α and ω values of 0.973, signifying a very high level of internal consistency among the items. This indicates that the items significantly align with a shared underlying dimension concerning students' impressions of usability, security, and trust in the university's Management Information System (MIS). Likewise, *System Reliability and Efficiency* demonstrated exceptional internal consistency, with $\alpha = 0.944$ and $\omega = 0.946$, affirming that this factor reliably encapsulates the functioning and stability of the MIS, especially during essential academic intervals.

The third factor, *System Navigation and Mobile Experience*, produced $\alpha = 0.872$ and $\omega = 0.877$, indicating extremely good dependability. These results affirm the consistency of the items in representing students' experiences with system navigation and access across several devices. Lastly, *Support and Responsiveness* exhibited $\alpha = 0.790$ and $\omega = 0.804$, signifying acceptable to good reliability. Although marginally lower than the other factors, these values remain within acceptable limits and indicate that students continually regard the support services as a significant aspect of their MIS experience. The results confirm that the extracted factor structure is psychometrically sound, offering valid assessments of many aspects of MIS perception—crucial as the university progresses towards its objective of being a smart university.

To evaluate the fitness of the derived factor structure in relation to the data, various model fit indices were analyzed.

Table 4: Reliability Test Result of the Extracted Factor Structure

Factors	Cronbach's α	McDonald's ω
System Accessibility and Trust	0.973	0.973
System Reliability and Efficiency	0.944	0.946
System Navigation and Mobile Experience	0.872	0.877
Support and Responsiveness	0.790	0.804

Table 5: Model Fit Evaluation Result

Model Fit Measures	Value
RMSEA	0.065
90% CI Lower	0.0606
90% CI Upper	0.0699
TLI	0.895
BIC	-2826.16
χ^2	2681.6
df	496
p	< .001

The Root Mean Square Error of Approximation (RMSEA) was 0.065, signifying an adequate match between the proposed model and the observed data, as values below 0.08 are typically regarded as satisfactory for model fit. The 90% confidence interval for RMSEA spanned from 0.0606 to 0.0699, remaining well within acceptable thresholds, hence bolstering the model's strength. The Tucker-Lewis Index (TLI) was 0.895, which, although marginally below the optimal threshold of 0.90, indicates a satisfactory fit, particularly in the premise of exploratory study. The Bayesian Information Criterion (BIC) was -2826; whereas BIC values are routinely employed for model comparison, larger negative values typically signify a superior match when evaluating alternative models. The chi-square goodness-of-fit statistic was significant, $\chi^2(816) = 1626$, $p < .001$. Nonetheless, considering the established sensitivity of the chi-square test to large sample sizes, its significance does not inherently suggest inadequate model fit. Overall, these findings endorse the model's acceptance, indicating that the four-factor approach offers a cohesive and interpretable framework for comprehending students' views of the university's Management Information System.

Table 6 displays the factor loadings along with the respective percentage of variance explained by each of the four factors in the model. The factor loadings signify the potency of each factor in explaining the underlying data structure, whereas the percentage of variance denotes the extent to which each factor accounts for the total diversity in students' impressions of the MIS.

The factor designated as *System Accessibility and Trust* exhibits the largest sum of squared loadings (SS Loadings) at 12.042, accounting for 26.75% of the overall variance. This feature is crucial in influencing students' overall experience and trust in the system,

encompassing critical aspects of accessibility, usability, security, and institutional reliability. Its predominant variance contribution indicates it is essential to student satisfaction.

System Reliability and Efficiency follows, exhibiting an SS loading of 8.101, accounting for 18% of the variance. This element emphasizes students' perceptions of the system's efficacy, namely its reliability during peak times and its capacity for rapid user response. Although it contributes significantly less than the preceding factor, it still represents a significant amount of the variation, accentuating the importance of system operation for students' overall satisfaction.

The third factor, *System Navigation and Mobile Experience*, has a standardized loading of 5.151, representing 11.45% of the variance. This element is essential in understanding student interactions with the system, highlighting navigation simplicity and mobile accessibility. Despite contributing less variance than the initial two criteria, its significance in enhancing cross-platform usability and stability is undeniable.

Finally, *Support and Responsiveness* accounts for 9.07% of the variation, with a sum of squares loading of 4.089. This factor highlights the significance of efficient communication and assistance from the MIS Office in influencing students' perspectives. Although it adds minimally to the overall variation, it significantly influences student satisfaction by addressing problems and offering appropriate support.

The cumulative percentage column reveals that the four factors collectively account for 65.27% of the total variance in students' perceptions of the Management Information System (MIS). This indicates a significant percentage of the variance, implying that the model offers a strong and consistent framework for comprehending the aspects that affect students' experiences with the system.

Table 6: Factor Summary

Factors	SS Loadings	% of Variance	Cumulative %
System Accessibility and Trust	12.042	26.75	26.75
System Reliability and Efficiency	8.101	18	44.75
System Navigation and Mobile Experience	5.151	11.45	56.2
Support and Responsiveness	4.089	9.07	65.27

The cumulative percentage column reveals that the four factors collectively account for 65.27% of the total variance in students' perceptions of the Management Information System (MIS). This indicates a significant percentage of the variance, implying that the model offers a strong and consistent framework for comprehending the aspects that affect students' experiences with the system.

DISCUSSION

This study aimed to explore the underlying dimensions of services offered by the Management Information System Office (MISO) as perceived by students, with the objective of creating a dependable evaluation instrument to assess these services and enhance the university's digital infrastructure, thereby facilitating Rizal Technological University's progress into a smart university. According to the findings of the Exploratory Factor Analysis (EFA), there are four strong factors that jointly explain 65.27% of the total variance. These factors are *System Accessibility and Trust*, *System Reliability and Efficiency*, *System Navigation and Mobile Experience*, and *Support and Responsiveness*. There was a high level of internal consistency among all of the factors, which is an indication of excellent construct reliability and coherence among the items. Based on these findings, it appears that the experiences that students have with the management information system (MIS) are multidimensional. These experiences are determined not only by the functionality of the MIS, but also by its responsiveness, accessibility, and interface design.

In light of the fact that *System Accessibility and Trust* were the factors that contributed the most to the variance, it is important to emphasize the significance of having access to information that is accurate, timely, and secure in order to cultivate system credibility. According to Davis's (1989) Technology Acceptance Model as cited by Ma et al. (2024), which states that perceived usefulness and ease of access are factors that are essential for user adoption, this is in agreement with the aforementioned statement. In addition, the significance of *System Reliability and Efficiency* highlights the requirement for a dependable management information system, particularly during high-stakes activities such as the encoding of

grades or enrollment. According to the Information Systems Success Model, which places an emphasis on the relationship between system reliability, user satisfaction, and organizational success, technical issues that occur during these periods bring about a decrease in student confidence and are a reflection of broader concerns regarding the quality of the system (Mijač et al., 2024).

Furthermore, the advent of *System Navigation and Mobile Experience* brings to light the growing expectation among students for mobile responsiveness and user interfaces that are easy to understand. These requirements are heightened by the digital habits of today's students. The findings of Arias-Flores et al. (2024) provide evidence in favor of this assertion, demonstrating that mobile-optimized platforms considerably improve the usability of systems in academic environments. In conclusion, the aspect known as Support and Responsiveness, which demonstrates the importance that students place on prompt assistance, clear communication, and efficient feedback methods, is highlighted. As a result, this is consistent with theories of service quality such as SERVQUAL (Saleem et al., 2024), which emphasize the importance of responsiveness and assurance as primary factors that contribute to user satisfaction in technology-mediated services.

These findings are extremely significant for RTU's shift into a framework that is more conducive to smart universities. The foundation of digital transformation in higher education is a management information system (MIS) that is responsive, reliable, and user-friendly (Mexhuani, 2024). As the use of digital systems to mediate academic and administrative transactions becomes more widespread, it is becoming increasingly important to pay attention to the user experience, the trustworthiness of the system, and inclusive support services (Bach et al., 2022). In addition to having an effect on operational efficiency, these dimensions also have an effect on the manner in which students interact with the processes of the institution, which in turn has an effect on student retention, satisfaction, and the reputation of the institution (Rincón et al., 2024). Through the course of this research, a validated structure was built, which provides useful insights for continuous

management information system evaluation as well as strategic system enhancements that are directly informed by user experience.

CONCLUSION

The study significantly identified and validated four latent factors that underlie students' views of the services offered by the Management Information System Office (MISO) at Rizal Technological University. Thematic analysis and exploratory factor analysis (EFA) identified essential constructs—*System Accessibility and Trust*, *System Reliability and Efficiency*, *System Navigation and Mobile Experience*, and *Support and Responsiveness*—that collectively encapsulate the complex nature of students' MIS experiences. The findings indicate that students prioritize not just the system's usability and performance but also the institutional transparency, communication, and technical assistance related to its functioning.

The strong psychometric characteristics of the identified components, evidenced by high internal consistency and satisfactory model fit indices, confirm the reliability of the created evaluation instrument. This application provides a data-driven framework for the regular evaluation of MIS services, yielding actionable insights for institutional planning and digital transformation. This study ultimately supports the university's overarching objective of evolving into a smart institution by establishing a vigorous basis for responsive, evidence-driven improvements to its digital service infrastructure.

RECOMMENDATIONS

In light of the study's findings and limitations, numerous recommendations are put forth. Future study should incorporate multiple stakeholder groups, including faculty, administrative staff, and MIS personnel, to obtain a comprehensive picture of the Management Information System's efficacy throughout the university. Secondly, confirmatory factor analysis (CFA) is advised in future studies to authenticate the factor structure established during this exploratory phase and to examine measurement invariance across user groups. Third, longitudinal designs may be utilized to evaluate temporal changes in perceptions and to investigate

potential causal links between system improvements and user satisfaction. Furthermore, combining objective system performance metrics (e.g., login frequency, response times, technical issue reports) with perception-based assessments could yield more profound insights. Ultimately, extending the research to additional institutions with diverse digital maturity levels would improve the generalizability of the instrument and facilitate the benchmarking of MIS services within the wider framework of evolving into smart university ecosystems.

Declaration of AI Use

Specific generative artificial intelligence tools, including ChatGPT, Gemini, SciSpace, and QuillBot, were used solely to enhance clarity, coherence, and linguistic structure. All data are authentic, with no fabrication involved, and all analyses were conducted entirely through human judgment and interpretation.

REFERENCES

1. Abuyadek, R., ElHafeez, S. A., Tahoun, M. M., Othman, S. S., Omran, A., Fathy, N., & Ghazy, R. M. (2024). Development and validation of an Arabic tool for assessment of post-vaccination confidence in COVID-19 vaccines (ARAB-VAX-CONF). *Journal of the Egyptian Public Health Association*, 99(1). <https://doi.org/10.1186/s42506-024-00174-8>
2. Adu, A. S. Y., & Van Biljon, J. (2023). Perceived usability in learning management systems' adoption: A study of higher education institutions in Ghana. *In Communications in computer and information science* (pp. 251-266). https://doi.org/10.1007/978-3-031-28472-4_16
3. Ahmad, M., & Wilkins, S. (2024). Purposive sampling in qualitative research: a framework for the entire journey. *Quality & Quantity*. <https://doi.org/10.1007/s11135-024-02022-5>
4. Alhassan, A. I. (2024). Analyzing the application of mixed method methodology in medical education: a qualitative study. *BMC Medical Education*, 24(1). <https://doi.org/10.1186/s12909-024-05242-3>
5. Almaghrabi, H., Soh, B., & Li, A. (2024). Using ML to Predict User Satisfaction with ICT Technology for Educational Institution Administration. *Information*, 15(4), 218. <https://doi.org/10.3390/info15040218>

6. Al-Marouf, R. S., Alnazzawi, N., Akour, I. A., Ayoubi, K., Alhumaid, K., AlAhabbi, N. M., Alnaimi, M., Thabit, S., Alfaisal, R., Aburayya, A., & Salloum, S. (2021). The Effectiveness of Online Platforms after the Pandemic: Will Face-to-Face Classes Affect Students' Perception of Their Behavioural Intention (BIU) to Use Online Platforms? *Informatics*, 8(4), 83. <https://doi.org/10.3390/informatics8040083>
7. Alshibly, H. H., Alwreikat, A., Morgos, R., & Abuadous, M. Y. (2024). Examining the mediating role of customer empowerment: the impact of chatbot usability on customer satisfaction in Jordanian commercial banks. *Cogent Business & Management*, 11(1). <https://doi.org/10.1080/23311975.2024.2387196>
8. Alzoubi, H. M., Alshurideh, M., & Ghazal, T. M. (2021). Integrating BLE Beacon Technology with Intelligent Information Systems IIS for Operations' Performance: A Managerial Perspective. In *Advances in intelligent systems and computing* (pp. 527-538). https://doi.org/10.1007/978-3-030-76346-6_48
9. Arias-Flores, H., Borja-Galeas, C., & Piedra, M. (2024). Smart Signage with Augmented Reality: Inclusive Coworking. In *Communications in computer and information science* (pp. 3-11). https://doi.org/10.1007/978-3-031-61947-2_1
10. Asadzadeh, A., Mohammadzadeh, Z., Fathifar, Z., Jahangiri-Mirshekarlou, S., & Rezaei-Hachesu, P. (2022). A framework for information technology-based management against COVID-19 in Iran. *BMC Public Health*, 22(1). <https://doi.org/10.1186/s12889-022-12781-1>
11. Azarmehr, T., Kordbagheri, A., Sadat, E., & Kordbagheri, M. (2024). Psychometric properties of the Persian version of the Principal Instructional Leadership Scale for High School Principals (PILS): translation, psychometric properties, and network analysis. *The Asia-Pacific Education Researcher*. <https://doi.org/10.1007/s40299-024-00933-3>
12. Bach, T. A., Khan, A., Hallock, H., Beltrão, G., & Sousa, S. (2022). A Systematic Literature Review of User Trust in AI-Enabled Systems: An HCI Perspective. *International Journal of Human-Computer Interaction*, 40(5), 1251-1266. <https://doi.org/10.1080/10447318.2022.2138826>
13. Barrantes, B. S. L. (2025). Exploratory factor analysis of bibliometric indicators for the Sustainable Development Goals. *Scientometrics*. <https://doi.org/10.1007/s11192-025-05256-8>
14. Barrio-Torres, J., Sebastián-Viana, T., Fernández-Pérez, C., Pérez-Fernández, C., Martínez-Escribano, B., Gutierrez-Junquera, C., Román, E., & Cilleruelo, M. L. (2024). Transcultural adaptation to Spain of the CDPQOL questionnaire specific for coeliac children. *European Journal of Pediatrics*, 183(8), 3233-3241. <https://doi.org/10.1007/s00431-024-05589-1>
15. Bastardo, R., Pavão, J., & Rocha, N. P. (2024). Methodological Quality of User-Centered Usability Evaluation of digital applications to promote citizens' engagement and participation in public governance: a systematic literature review. *Digital*, 4(3), 740-761. <https://doi.org/10.3390/digital4030038>
16. Berman, Z. L., & Fish, J. N. (2024). A preliminary exploratory factor analysis of the BDSM counselor competency scale. *Archives of Sexual Behavior*, 53(4), 1487-1498. <https://doi.org/10.1007/s10508-023-02788-z>
17. Bradt, J. (2021). Where are the mixed methods research studies? *Nordic Journal of Music Therapy*, 30(4), 311-313. <https://doi.org/10.1080/08098131.2021.1936771>
18. Braun, V., & Clarke, V. (2023). Thematic analysis. In *Springer eBooks* (pp. 7187-7193). https://doi.org/10.1007/978-3-031-17299-1_3470
19. Carignani, Ş. S., & Burchi, S. (2022). Preparing for online interviews during Covid-19: the intricacies of technology and online human interaction. *SN Social Sciences*, 2(10). <https://doi.org/10.1007/s43545-022-00498-2>
20. Chen, B., & Ge, W. (2024). Design and optimization strategy of electricity marketing information system supported by cloud computing platform. *Energy Informatics*, 7(1). <https://doi.org/10.1186/s42162-024-00366-8>
21. Denisova, E., Tiribilli, E., Luschi, A., Francia, P., Manetti, L., Bocchi, L., & Iadanza, E. (2024). Enabling reliable usability assessment and comparative analysis of medical software: a comprehensive framework for multimodal biomedical imaging platforms. *Health and Technology*, 14(4), 671-682. <https://doi.org/10.1007/s12553-024-00859-2>

22. Desbalo, M. T., Woldeesenbet, A. K., Bargstädt, H., & Yehualaw, M. D. (2024). Critical factors that influence the effectiveness of facility maintenance management practice in public university buildings in Ethiopia: an exploratory factor analysis. *Cogent Engineering*, 11(1). <https://doi.org/10.1080/23311916.2024.2307150>
23. Droush, N. M. S. A. (2025). The role of Artificial intelligence in Enhancing user experience in information Systems for E-Business: An Applied Study on Jordanian commercial companies. In *Studies in systems, decision and control* (pp. 745-759). https://doi.org/10.1007/978-3-031-76011-2_52
24. Esbo, S. R., Ghaffari, F., Fotokian, Z., Nikbakht, H., & Saadati, K. (2024). Development and psychometric evaluation of uncertainty about disease and treatment scale in hemodialysis patients: a sequential-exploratory mixed-method study. *BMC Psychology*, 12(1). <https://doi.org/10.1186/s40359-024-01685-x>
25. Furno, A., Zanella, A. F., Stanica, R., & Fiore, M. (2024). Spatial and Temporal Exploratory factor analysis of urban mobile data traffic. *Data Science for Transportation*, 6(1). <https://doi.org/10.1007/s42421-024-00089-y>
26. García-Holgado, A., Moreira, F., & Fonseca, D. (2024). Sustainable development, usability and accessibility in educational strategies during the global pandemic. *Universal Access in the Information Society*, 23(3), 993-999. <https://doi.org/10.1007/s10209-024-01121-2>
27. George, B., & Wooden, O. (2023). Managing the Strategic Transformation of Higher Education through Artificial Intelligence. *Administrative Sciences*, 13(9), 196. <https://doi.org/10.3390/admsci13090196>
28. Geravandi, S., Emamgholipour, S., Pakdaman, M., Sari, A. A., & Esmaeili, A. (2025). Principal components of type 2 diabetes risk: an exploratory factor analysis in an Iranian cohort. *BMC Public Health*, 25(1). <https://doi.org/10.1186/s12889-025-21814-4>
29. Ghrbeia, S. B., & Alzubi, A. (2024). Building Micro-Foundations for Digital Transformation: A Moderated Mediation Model of the Interplay between Digital Literacy and Digital Transformation. *Sustainability*, 16(9), 3749. <https://doi.org/10.3390/su16093749>
30. Giua, C., Materia, V. C., & Camanzi, L. (2020). Management information system adoption at the farm level: evidence from the literature. *British Food Journal*, 123(3), 884-909. <https://doi.org/10.1108/bfj-05-2020-0420>
31. Graf, I., Bock, N. C., Bartzela, T., Röper, V., Schumann, U., Reck, K., Helms, H., Hofer, K., Fritz, U., Wolf, M., Wiechmann, D., Jost-Brinkmann, P., Ruf, S., & Braumann, B. (2024). Quality of orthodontic care—A multicenter cohort study in a German convenience sample. *Journal of Orofacial Orthopedics / Fortschritte Der Kieferorthopädie*. <https://doi.org/10.1007/s00056-024-00528-z>
32. Habib, M. N., Jamal, W., Khalil, U., & Khan, Z. (2020). Transforming universities in interactive digital platform: case of city university of science and information technology. *Education and Information Technologies*, 26(1), 517-541. <https://doi.org/10.1007/s10639-020-10237-w>
33. Howard, M. C., & O'Sullivan, R. (2024). A systematic review of exploratory factor analysis in marketing: providing recommended guidelines and evaluating current practices. *The Journal of Marketing Theory and Practice*, 1-22. <https://doi.org/10.1080/10696679.2024.2385377>
34. Huber, R., Oberländer, A. M., Faisst, U., & Röglinger, M. (2022). Disentangling Capabilities for Industry 4.0 - An Information Systems Capability perspective. *Information Systems Frontiers*. <https://doi.org/10.1007/s10796-022-10260-x>
35. Jayaratne, M., & Jayatilleke, B. (2021). Predicting job-hopping motive of candidates using answers to open-ended interview questions. *Journal of Computational Social Science*, 5(1), 611-628. <https://doi.org/10.1007/s42001-021-00138-4>
36. Kerubo, J., & Oliver, M. (2024). Revising academic cultures to improve integrity in Kenyan universities. *Educational Review*, 1-21. <https://doi.org/10.1080/00131911.2024.2402802>
37. Krongthaeo, S., Partiprajak, S., Piaseu, N., Ckumdee, S., Taaon, C., & Kongsuwan, A. (2024). Prevalence and exploratory factor analysis of long COVID-19 symptoms among experienced infected population in Bangkok, Thailand. *BMC Public Health*, 24(1). <https://doi.org/10.1186/s12889-024-20275-5>

38. Li, J., & Zhang, B. (2025). The role of interaction design based on fuzzy decision support system in improving user experience. *International Journal of Fuzzy Systems*. <https://doi.org/10.1007/s40815-024-01918-6>
39. Li, Y. Y., Tong, L. K., Au, M. L., Ng, W. I., Wang, S. C., Liu, Y., Zhong, L., Shen, Y., & Qiu, X. (2024). Psychometric evaluation of the study interest questionnaire-short form among Chinese nursing students based on classical test theory and item response theory. *BMC Nursing*, 23(1). <https://doi.org/10.1186/s12912-024-02390-1>
40. Ma, J., Wang, P., Li, B., Wang, T., Pang, X. S., & Wang, D. (2024). Exploring User Adoption of ChatGPT: A Technology Acceptance Model Perspective. *International Journal of Human-Computer Interaction*, 1-15. <https://doi.org/10.1080/10447318.2024.2314358>
41. Madaree, S. (2024). Exploring the principal factors driving the volatility structure of stock trade levels in New Zealand: a Covid-19 perspective. *New Zealand Economic Papers*, 1-12. <https://doi.org/10.1080/00779954.2024.2415140>
42. Meesad, P., & Mingkhwan, A. (2024). Knowledge Graphs in smart digital libraries. In *Studies in big data* (pp. 327-389). https://doi.org/10.1007/978-3-031-69216-1_9
43. Meghanathan, N. (2024). Varimax Rotation-Based Exploratory Factor Analysis of Crime Dataset. In *Lecture notes in networks and systems* (pp. 41-50). https://doi.org/10.1007/978-3-031-70518-2_4
44. Mexhuani, B. (2024). Adopting digital tools in higher Education: opportunities, challenges and theoretical insights. *European Journal of Education*. <https://doi.org/10.1111/ejed.12819>
45. Mijač, T., Jadrić, M., & Ćukušić, M. (2024). Measuring the success of information systems in higher education - a systematic review. *Education and Information Technologies*, 29(14), 18323-18360. <https://doi.org/10.1007/s10639-024-12564-8>
46. Mushtaq, S. U., Sheikh, S., Idrees, S. M., & Malla, P. A. (2024). In-depth analysis of fault tolerant approaches integrated with load balancing and task scheduling. *Peer-to-Peer Networking and Applications*, 17(6), 4303-4337. <https://doi.org/10.1007/s12083-024-01798-5>
47. Nasiri-Amiri, F., Bakhtiari, A., Safary, E., & Esbo, S. R. (2025). Translation and psychometrics of the HPV impact profile in Iranian women. *BMC Women's Health*, 25(1). <https://doi.org/10.1186/s12905-025-03678-3>
48. Nikhil, K., Kumar, V. U., Pandey, K., Ravichandiran, V., & Murti, K. (2023). Development and Validation of Knowledge Attitudes and Practices Questionnaire (Nu-KAPQ): for the assessment of Knowledge, Attitudes, and Practices Associated with Arsenic. *Biological Trace Element Research*, 202(8), 3465-3474. <https://doi.org/10.1007/s12011-023-03939-y>
49. Ntoa, S. (2024). Usability and User experience evaluation in Intelligent Environments: A review and reappraisal. *International Journal of Human-Computer Interaction*, 1-30. <https://doi.org/10.1080/10447318.2024.2394724>
50. Padrosa, E., Bolívar, M., Julià, M., & Benach, J. (2020). Comparing precarious employment across countries: Measurement invariance of the Employment Precariousness Scale for Europe (EPRES-E). *Social Indicators Research*, 154(3), 893-915. <https://doi.org/10.1007/s11205-020-02539-w>
51. Palagi, S., & Javernick-Will, A. (2020). Discrepancies between Postdisaster Relocation Policy and Implementation in the Philippines. *Journal of Management in Engineering*, 36(4). [https://doi.org/10.1061/\(asce\)me.1943-5479.0000790](https://doi.org/10.1061/(asce)me.1943-5479.0000790)
52. Pigola, A., & De Souza Meirelles, F. (2024). Unraveling trust management in cybersecurity: insights from a systematic literature review. *Information Technology and Management*. <https://doi.org/10.1007/s10799-024-00438-x>
53. Pilatin, A., & Dilek, Ö. (2023). Investor intention, investor behavior and crypto assets in the framework of decomposed theory of planned behavior. *Current Psychology*, 43(2), 1309-1324. <https://doi.org/10.1007/s12144-023-04307-8>
54. Piotr, R., Krzysztof, K., Ewa, N., Katarzyna, B., Klaudia, A., & Tomasz, H. (2024). Expectations of Katowice residents regarding the program assumptions of the European city of science Katowice 2024 in the field of medical and health sciences - questionnaire survey results. *BMC Public Health*, 24(1). <https://doi.org/10.1186/s12889-024-19641-0>

55. Polin, K., Yigitcanlar, T., Limb, M., & Washington, T. (2023). The Making of Smart Campus: A review and Conceptual framework. *Buildings*, 13(4), 891. <https://doi.org/10.3390/buildings13040891>
56. Rincón, A. G., Soloaga, P. a. S., Barbosa, R. L. C., & Barragán-Moreno, S. P. (2024). Satisfaction with the institution as a predictor of the intention to drop out in online higher education. *Cogent Education*, 11(1). <https://doi.org/10.1080/2331186x.2024.2351282>
57. Sabri, R., & Amir, T. S. (2024). Data management and Analytics in finance. In *Emerald Publishing Limited eBooks* (pp. 93-118). <https://doi.org/10.1108/978-1-83608-106-720241007>
58. Saleem, S. M. U., Taib, C. A., Ikram, M., & Mehmood, W. (2024). A comprehensive analysis of service quality: a systematic literature review. *Total Quality Management & Business Excellence*, 35(9-10), 1124-1166. <https://doi.org/10.1080/14783363.2024.2357805>
59. Singun, A. (2025). Unveiling the barriers to digital transformation in higher education institutions: a systematic literature review. *Discover Education*, 4(1). <https://doi.org/10.1007/s44217-025-00430-9>
60. Songkram, N., Chootongchai, S., Osuwan, H., Chuppunnarat, Y., & Songkram, N. (2023). Students' adoption towards behavioral intention of digital learning platform. *Education and Information Technologies*, 28(9), 11655-11677. <https://doi.org/10.1007/s10639-023-11637-4>
61. Ștefan, A., Rusu, N., Ovreiu, E., & Ciuc, M. (2024). Empowering Healthcare: A comprehensive guide to implementing a robust Medical Information System—Components, benefits, objectives, evaluation criteria, and seamless deployment strategies. *Applied System Innovation*, 7(3), 51. <https://doi.org/10.3390/asi7030051>
62. Teixeira, P., Eusébio, C., & Teixeira, L. (2024). Understanding the integration of accessibility requirements in the development process of information systems: a systematic literature review. *Requirements Engineering*, 29(2), 143-176. <https://doi.org/10.1007/s00766-023-00409-8>
63. Tummers, J., Kassahun, A., & Tekinerdogan, B. (2020). Reference architecture design for farm management information systems: a multi-case study approach. *Precision Agriculture*, 22(1), 22-50. <https://doi.org/10.1007/s11119-020-09728-0>
64. Vella, M., & Richiardi, M. (2024). Mind vs matter: Economic and psychologic determinants of take-up rates of social benefits in the UK. <https://www.econstor.eu/handle/10419/306911>
65. Vetrivel, S. C., Arun, V. P., Ambikapathi, R., & Saravanan, T. P. (2025). Automated grading systems. In *CRC Press eBooks* (pp. 41-61). <https://doi.org/10.1201/9781003470304-3>
66. Vrančić, A., Zadravec, H., & Orehovački, T. (2024). The Role of Smart Homes in Providing Care for Older Adults: A Systematic Literature Review from 2010 to 2023. *Smart Cities*, 7(4), 1502-1550. <https://doi.org/10.3390/smartcities7040062>
67. Yarmilko, A., Rozlomii, I., & Naumenko, S. (2024). Dependability of embedded systems in the industrial Internet of things: information security and reliability of the communication cluster. In *Lecture notes on data engineering and communications technologies* (pp. 235-249). https://doi.org/10.1007/978-3-031-71804-5_16
68. Zagaria, A., & Lombardi, L. (2024). Bayesian versus Frequentist approaches in Psychometrics: a bibliometric analysis. *Discover Psychology*, 4(1). <https://doi.org/10.1007/s44202-024-00164-z>
69. Zaidi, S. F. H., Kulakli, A., Osmanaj, V., & Zaidi, S. a. H. (2023). Students' Perceived M-Learning Quality: An Evaluation and directions to improve the quality for H-Learning. *Education Sciences*, 13(6), 578. <https://doi.org/10.3390/educsci13060578>
70. Zhu, Z., Liu, Y., Wei, J., & Li, X. (2023). Perceiving IT affordances through the lens of multi-identity goals in rural governance information system. *Industrial Management & Data Systems*, 124(2), 509-540. <https://doi.org/10.1108/imds-02-2023-0102>