# Student Relationship Management with Adaptive AI

**Kanyamaat Sangounsak**
Sakon Nakhon Rajabhat University, Thailand, *kanyamaat@snru.ac.th*
**Saowaluck Boonrawd***
Rajamangala University of Technology Srivijaya, Thailand, *saowaluck.b@rmutsv.ac.th*
**Niramol Prasertphongkun**
Rajamangala University of Technology Lanna, Thailand, *niramol1405@rmutl.ac.th*
**Panisa Pikulhom**
SCM Technologies Company Limited, Thailand, *panisa@scmtechnologies.co.th*
**Radanut Phusomnuek**
Sakon Nakhon Rajabhat University, Thailand, *radanut@snru.ac.th*

*Corresponding author E-mail**: s**aowaluck.b@rmutsv.ac.th

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**ABSTRACT:** *The integration of Adaptive Artificial Intelligence (AI) into Student Relationship Management (SRM) has emerged as a transformative strategy for enhancing student engagement, retention, and academic success. By leveraging AI-driven technologies, educational institutions can personalize student interactions, anticipate academic challenges, and optimize decision-making processes. This study examines the role of Adaptive AI in SRM, utilizing a systematic review and bibliometric analysis to synthesize existing research on AI-driven SRM frameworks. A conceptual structure for the integration of Adaptive AI into student management strategies is proposed, highlighting its potential to create a more responsive and student-centric educational environment.*

*The findings emphasize the advantages of data-driven decision-making, predictive analytics, and personalized support mechanisms in improving institutional efficiency and student outcomes. Furthermore, this study explores key challenges associated with the implementation of AI in SRM, including technological constraints, ethical considerations, and data privacy concerns. As AI continues to shape the future of higher education, understanding its implications is critical for educators, policymakers, and institutional leaders. This research contributes to the growing body of knowledge on AI-enhanced SRM and provides valuable insights into best practices for integrating Adaptive AI into student support services. The study underscores the need for a strategic, data-informed approach to SRM, ensuring that AI-driven solutions align with institutional goals and student needs.*

**Keywords:** Student Relationship Management, Adaptive AI, Student Engagement, Student Retention

## 1. Introduction

In recent years, the integration of Artificial Intelligence (AI) has gained become increasingly important across various sectors, including business, industry, and education (Owoc et al., 2021). Within the educational domain, institutions are increasingly leveraging digital platforms and AI-driven tools to enhance student engagement and optimize learning experiences. One critical area where AI and digital technologies are being applied is Student Relationship Management (SRM). SRM encompasses the strategies and practices employed by educational institutions to manage interactions with students throughout their academic journey, spanning from initial enrollment to graduation and beyond.

The implementation of Adaptive AI in SRM has the potential to transform institutional operations by personalizing student experiences through the use of AI-driven algorithms. These systems analyze large-scale data on student behavior and academic performance to generate individualized recommendations and targeted support (Vashishth et al., 2024). By identifying patterns and making predictive assessments beyond human capability, Adaptive AI facilitates tailored student interactions, ultimately enhancing student satisfaction, improving retention, increasing institutional loyalty, and supporting academic success.

This study explores the concept of Adaptive AI in SRM and its capacity to transform educational institutions into intelligent, data-driven organizations. Specifically, the study examines the benefits of adopting Adaptive AI in SRM, the challenges associated with its implementation, and the ethical considerations that must be addressed. Institutions that integrate Adaptive AI into their SRM frameworks will be better equipped to meet the evolving needs of students while maintaining competitiveness in an increasingly complex and dynamic educational landscape.

Given these considerations, this study seeks to address the following research questions:

RQ1: What is the state of research with regard to implementing Adaptive AI in student relationship management?
RQ2: What conceptual framework should be developed for Adaptive AI-driven student relationship management?

To achieve these objectives, this study reviewed bibliographic references from publications on student relationship management with Adaptive AI, aiming to enhance the study's scope and establish research guidelines for future studies.

## 2. Literature Review

### 2.1 Student Relationship Management

Student Relationship Management (SRM) refers to the adaptation of Customer Relationship Management (CRM) strategies to the specific context of educational institutions (Gholami et al., 2018). The primary objective of SRM is to establish and sustain strong relationships between students and institutions (Srisakonsub et al., 2019). By leveraging tools, technologies, and systematic processes, SRM seeks to enhance student engagement, improve retention rates, and support academic success through continuous monitoring and support throughout the student lifecycle.

The effective implementation of SRM is a critical consideration for educational institutions, as it directly influences students' learning experiences and their level of engagement with the institution. To facilitate this process, institutions often utilize relational technologies such as Customer Relationship Management (CRM) software and Enterprise Resource Planning (ERP) systems. These technologies enable the integration of student-related data, allowing for more efficient management and data-driven decision-making. The adoption of SRM not only contributes to student retention but also enhances institutional stability and long-term sustainability (Murtiningsih, 2020).

SRM strategies focus on managing student interactions from enrollment to graduation. By using data analytics, schools can understand student behavior, preferences, and academic performance. This helps tailor communication, offer personalized support, and address individual needs. For example, predictive analytics can spot students at risk of dropping out, allowing institutions to provide timely support to keep them engaged.

SRM also helps build a sense of community by encouraging meaningful interactions and engagement. Personalized support makes students feel valued and connected to the institution, improving their overall experience and boosting retention and success rates.

SRM is an essential strategy for higher education institutions looking to improve student engagement and success. By using CRM and ERP systems, such institutions can create personalized, data-driven approaches to managing student relationships, leading to better student experiences and long-term stability for the institution.

### 2.2 Adaptive AI

Adaptive AI is a type of AI that focuses on creating smart systems that can adjust to changing environments and user needs. Recently, it has become increasingly popular as researchers find ways to design AI systems that can automatically learn and adapt to new situations. These AI systems use data to improve their predictions and decisions without needing specific instructions on how to change.

Adaptive AI can be used in many areas, bringing important benefits to business efficiency and product development. (Loureiro et al., 2021). In decision-making, Adaptive AI improves accuracy and speed, helping businesses meet user needs and market demands more effectively (Sánchez et al., 2020). Additionally, in product development, Adaptive AI helps improve product designs by analyzing relevant data such as sales, user behavior, and customer feedback. By using Adaptive AI in decision-making, organizations can create smarter, data-driven strategies that improve overall efficiency. This ongoing analysis allows companies to improve product design and create features that better meet customer needs.

Moreover, Adaptive AI systems can learn and adjust on their own, making them useful for solving complex and unpredictable problems. In healthcare, for example, it can help diagnose diseases by learning from new medical data and improving over time. In finance, it can improve fraud detection by adapting to new fraud patterns and threats.

Adaptive AI is a breakthrough in artificial intelligence, capable of learning and adjusting to changing environments and user needs. It can be applied in many areas, including business, product development, healthcare, finance, education, and smart cities. By using Adaptive AI, organizations can create smarter, data-driven strategies that help them handle new challenges and opportunities more effectively.

### 2.3 Adaptive AI in SRM

Student Relationship Management (SRM) helps educational institutions manage student interactions, support services, and administrative processes. Traditional SRM systems rely on fixed rules and manual inputs, which can be slow and inefficient. However, Adaptive AI is transforming SRM by making it smarter and more responsive.

Adaptive AI uses advanced machine learning to continuously improve specific situations based on real-time data. It can analyze student needs, predict issues, and personalize services automatically. This can lead to faster service, greater accuracy, and increased student satisfaction.

By integrating Adaptive AI, institutions can reduce complex processes, minimize waiting times, and ensure a smooth, efficient experience for students. This introduction to Adaptive AI in SRM explores how AI-driven systems can enhance student services while optimizing administrative workflows.

## 3. Methodology

This study is structured into two distinct phases:

*Phase 1: Synthesis of an Approach to Student Relationship Management with the use of Adaptive AI*

The first phase aims to synthesize an approach for integrating adaptive AI into Student Relationship Management (SRM) by conducting a systematic review of the relevant literature. This phase consists of the following steps:

1. Conducting a comprehensive review of the academic literature and research related to SRM with the use of Adaptive AI, utilizing international databases for publications from 2020 to 2024.
2. Synthesizing key approaches and methodologies for the application of Adaptive AI in SRM based on the reviewed literature.

*Phase 2: Development of a Conceptual Structure for Student Relationship Management with the use of Adaptive AI*

The second phase focuses on developing a conceptual structure for SRM with the use of Adaptive AI through bibliometric analysis. This involves the, application of quantitative methods to scholarly publications to identify research trends and thematic developments in the field.

*1) Identification of Sources*

To ensure a rigorous and transparent literature review, this study follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework (Page et al., 2021). The search process is conducted using the Scopus database, a widely recognized academic repository for peer-reviewed research in higher education. Scopus was selected due to its comprehensive coverage of interdisciplinary journals and its relevance to AI-driven educational research.

To obtain a broad and representative dataset, a keyword-based search strategy was employed rather than limiting the search to specific journals. An initial exploratory search was conducted using keywords derived from the existing SRM

literature, resulting in a dataset of 15,084 documents. After refining the search criteria and filtering research articles and review papers, a final dataset of 53 relevant documents was obtained. The final keyword search string used was as follows:

(TITLE-ABS-KEY (student AND relationship AND management) AND TITLE-ABS-KEY (systems) AND TITLE-ABS-KEY (education) AND TITLE-ABS-KEY (artificial AND intelligence))

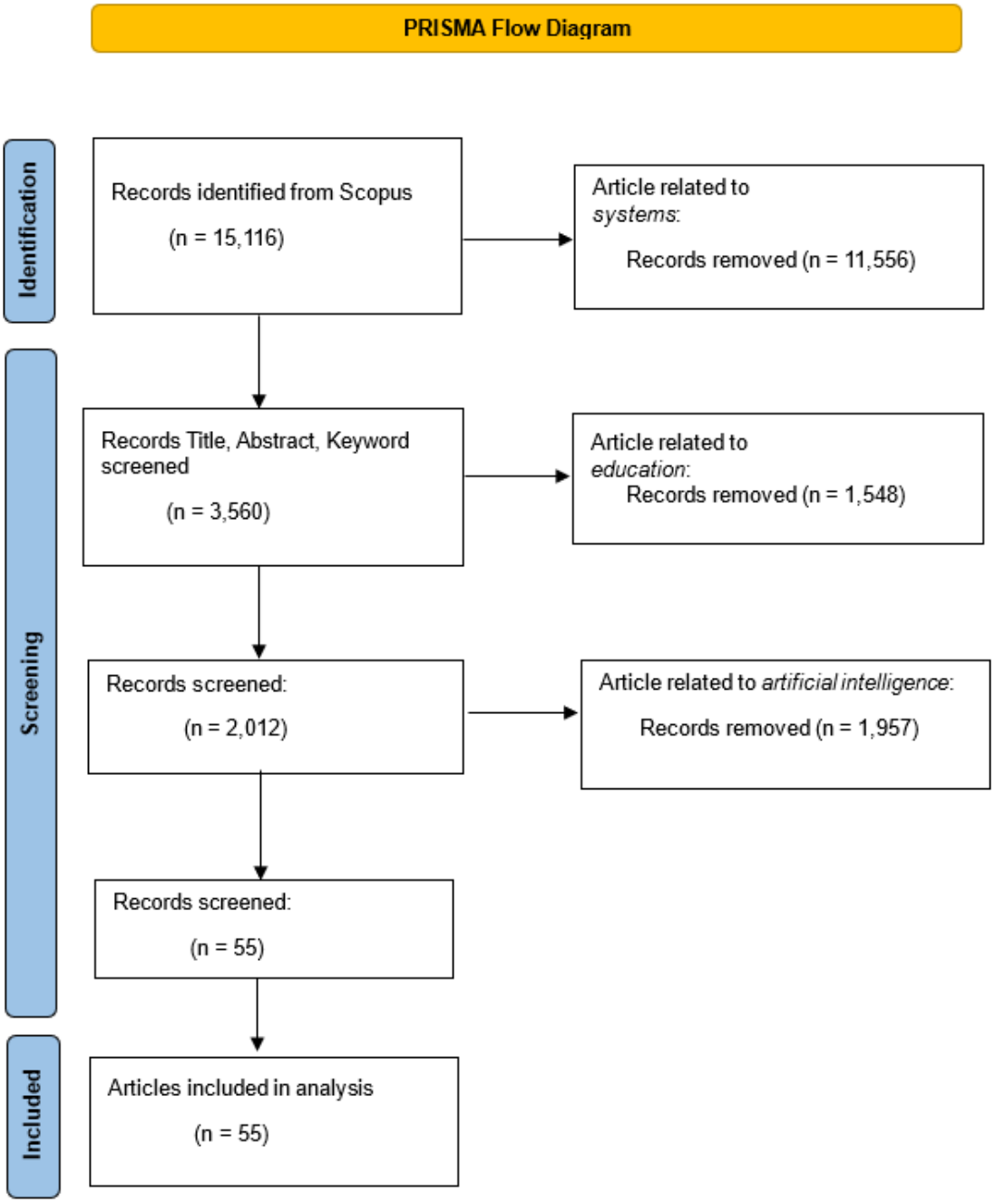


*Figure 1.* PRISMA flow diagram detailing steps in the identification and screening of sources

The literature selection process followed three systematic stages:

1. Identification
Relevant publications were identified from the Scopus database using the initial keyword search "student AND relationship AND management", applied to the Article Title, Abstract, and Keywords fields, yielding a total of 15,116 articles published up to July, 2024.

2. Screening
To refine the dataset, a stepwise screening process was conducted by progressively adding contextual keywords:

Step 1: The keyword "systems" was introduced to focus on SRM-related technologies, reducing the dataset to 3,560 articles.
Step 2: The keyword "education" was added to ensure relevance to educational institutions, further narrowing the dataset to 2,012 articles.
Step 3: The keyword "artificial intelligence" was incorporated to ensure alignment with AI applications in SRM, resulting in a refined dataset of 55 articles.

3. Inclusion
Following the systematic screening process, a final set of 55 articles was selected for in-depth analysis and synthesis. These articles serve as the foundation for the development of a conceptual structure for SRM with the use of Adaptive AI.

*2) Data Extraction and Analysis*
After identifying relevant sources and selecting articles for bibliometric analysis, the metadata of the documents was extracted and downloaded in Research Information Systems (RIS) format. The extracted data included key bibliographic information such as the author's name, institutional affiliation, article title, abstract, citation details, and other relevant metadata.

To conduct an advanced bibliometric analysis and generate a visual representation of research trends and conceptual relationships, VOSviewer software was utilized. Specifically, co-occurrence analysis was performed using the main keyword as the unit of analysis to identify patterns in keyword relationships. This approach enables the visualization of conceptual structures related to Student Relationship Management (SRM) with Adaptive AI, facilitating a deeper understanding of research developments and thematic connections within the field.

## 4. Results

### 4.1 Synthesis of Student Relationship Management Approaches with the use of Adaptive AI

Student Relationship Management (SRM) plays a crucial role in higher education by fostering positive interactions between institutions and students, thereby supporting both academic and personal development. Since 2020, the integration of Adaptive Artificial Intelligence (AI) in SRM has garnered increasing attention within the education sector. Numerous studies have examined the potential benefits, challenges, and implications of applying Adaptive AI in SRM. The following section synthesizes key findings from the existing literature, highlighting the evolving role of Adaptive AI in enhancing SRM strategies.

*Table 1.* Synthesization of Adaptive AI-based SRM approaches

| No | Topic | Objectives | Findings | References |
|---|---|---|---|---|
| 1 | Predicting academic success in higher education | This article discusses how machine learning algorithms can be used to predict student success in higher education. | The authors suggest that by analyzing data such as student demographics, academic performance, and engagement, institutions can identify at-risk students and provide targeted interventions. | (Alyahyan & Düştegör, 2020) |
| 2 | Artificial intelligence in higher education | This paper explores the potential benefits and challenges of using AI in | AI can help institutions personalize learning, improve retention rates, and enhance student engagement, | (Zeide, 2019) |

| No | Topic | Objectives | Findings | References |
|---|---|---|---|---|
| | | higher education, including with regard to SRM. | but the author also caution against the risks of algorithmic bias and privacy concerns. | |
| 3 | Integration of modern technologies in higher education on the example of artificial intelligence use | The research aims to study the impact of artificial intelligence technologies in higher educational institutions of the People's Republic of China on improving education systems. | The results obtained confirm the need for the modern technology integration on the example of the artificial intelligence introduction in the education system of the People's Republic of China and other countries. | (Zhou, 2023) |
| 4 | The Student Relationship Management system process with Intelligent Conversational Agent Platform | Design the SRM system process with intelligent conversational agent platform | The study findings suggested that the component of SRM system process with intelligent conversational agent platform base on intelligent student relationship management consists of 8 components: (1) SRM strategy, (2) Student life cycle, (3) Student retention, (4) Student services (5) Student identify, (6) Valued student experience (7) Value proposition development and (8) Network development. | (Phuengrod et al., 2021) |
| 5 | Intelligent Student Relationship Management Platform with Machine Learning for Student Empowerment | Design and develop an intelligent SRM platform using machine learning prediction for student empowerment | Presents two approaches to student empowerment: using artificial intelligence technology from the intelligent SRM platform and empowering teachers | (Issaro & Wannapiroon, 2023) |
| 6 | AI-Driven Adaptive Learning Systems: Enhancing Student Engagement | To explore the key components of adaptive learning systems, emphasizing the role of AI in creating dynamic learning paths and providing real-time feedback. | The study highlights that AI enables the development of personalized learning experiences by dynamically adjusting content based on individual student performance. This adaptability leads to increased student engagement and improved learning outcomes. | (Olusegun et al., 2024) |
| 7 | The Efficacy of Artificial Intelligence-Enabled Adaptive Learning | A meta-analysis examining the overall effect of AI-enabled adaptive learning systems on students' cognitive learning outcomes compared to non-adaptive methods. | The meta-analysis reveals that AI-enabled adaptive learning systems significantly enhance students' cognitive learning outcomes, demonstrating the effectiveness of personalized learning paths in fostering deeper understanding and retention of material. | (Wang et al., 2024) |
| 8 | Adaptive Learning through Artificial Intelligence | To explore how AI can be integrated into adaptive learning systems to individualize education. | The article discusses the integration of AI into adaptive learning systems, emphasizing its potential to tailor educational content to individual learners' needs, thereby enhancing the personalization and effectiveness of education. | (Joshi, 2024) |

| No | Topic | Objectives | Findings | References |
|---|---|---|---|---|
| 9 | AI-Driven Adaptive Learning for Sustainable Educational Transformation | To scrutinize how adaptive learning technologies and AI are transforming education by making it personalized, accessible, and efficient, contributing to sustainable development. | The paper discusses the transformative potential of AI-driven adaptive learning in creating personalized educational experiences. It highlights how these technologies can make education more accessible and efficient, thereby contributing to sustainable educational practices. | (Strielkowski et al., 2024) |
| 10 | Influence of AI in Education on Adolescents' Social Adaptability | To identify the influence of AI in education on adolescents' social adaptability via social support. | The study found that AI in education has a negative impact on adolescents' social adaptability, significantly correlating with decreased family support. It suggests that while AI can enhance learning, it may inadvertently reduce interpersonal interactions critical for social development. | (Lai et al., 2023) |

This study aimed to explore the implementation of Adaptive AI in SRM by addressing two key research questions. The results are presented in response to these research questions, highlighting findings derived from the systematic review and bibliometric analysis.

*RQ1: What is the state of research with regard to implementing Adaptive AI in student relationship management?*
The bibliometric analysis of existing literature indicates that research on AI-driven SRM has been growing steadily, particularly in the last five years. Key findings related to this research question include:
1. Increased Adoption of AI in SRM
AI technologies, including machine learning, predictive analytics, and intelligent conversational agents, have been widely explored for improving student engagement, academic success, and retention.
2. Predictive Capabilities for Student Success
Studies show that Adaptive AI can analyze student behavior and academic performance in order to predict dropout risks and recommend personalized interventions.
3. AI-Powered Student Support Systems
Intelligent chatbots and recommendation systems are being integrated into SRM frameworks to provide real-time assistance, academic counseling, and administrative support.
4. Institutional Benefits
AI enhances decision-making by enabling institutions to optimize resource allocation, refine learning programs, and improve service delivery based on data-driven insights.
5. Challenges and Ethical Considerations
While AI offers numerous advantages, concerns related to data privacy, algorithmic bias, and ethical transparency remain significant obstacles to widespread adoption. Institutions must implement robust governance frameworks to ensure responsible AI use.

These findings suggest that Adaptive AI has strong potential to revolutionize SRM by providing personalized and data-driven student services. However, institutions must address technological, ethical, and policy challenges to maximize AI's effectiveness in SRM.

**4.2 The conceptual structure of SRM using Adaptive AI**
The conceptual structure of Adaptive AI in Student Relationship Management (SRM) is represented through a relationship map derived from co-occurrence analysis, in which keywords serve as the unit of analysis. This method identifies patterns in keyword associations, providing insights into the thematic connections within the research domain. The resulting relationship map, illustrating the conceptual framework of Adaptive AI in SRM, is presented in Figure 2.

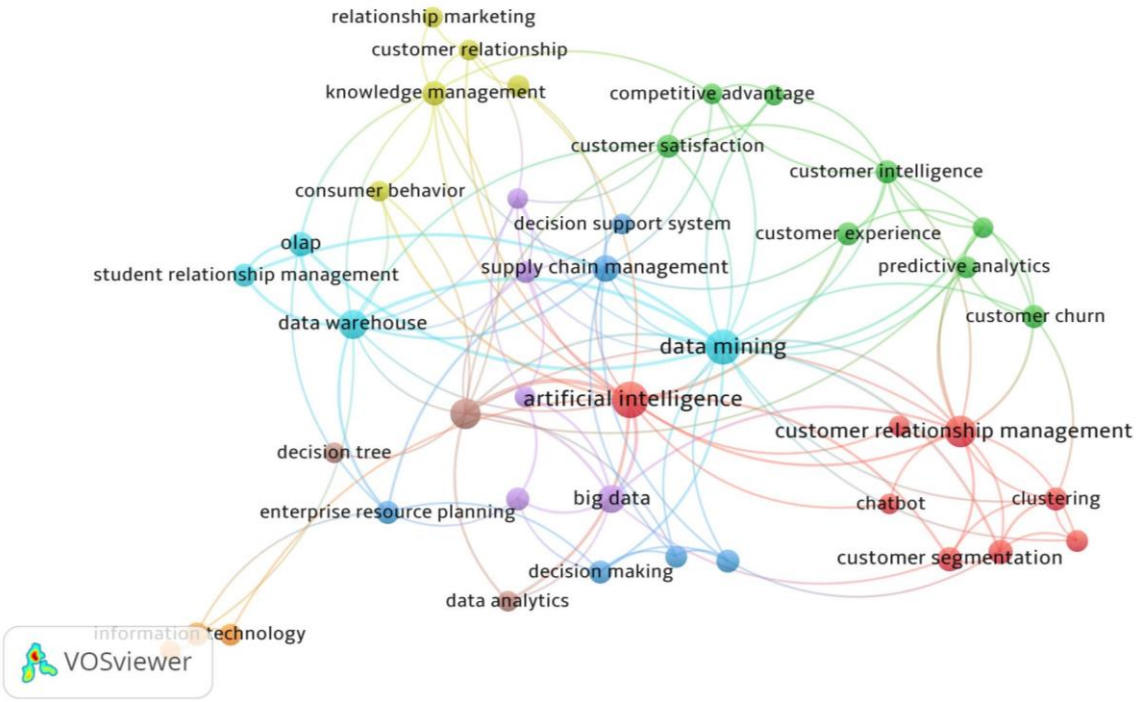


*Figure 2.* Conceptual framework of student relations management with Adaptive AI

Figure 2 illustrates a conceptual framework created using VOSviewer, which maps the co-occurrence of terms or keywords in academic research.

*Central Theme:* At the heart of the network, AI and data mining are the central themes, underscoring their pivotal roles as foundational technologies that interlink various research domains.

*Key Domains:* The framework is segmented into several clusters, each representing a related research domain. These clusters are color-coded and interconnected based on term co-occurrence.

*Cluster 1 (Red): Customer Relationship Management (CRM)*
Key terms are customer relationship management, customer segmentation, chatbot, clustering. This cluster highlights how AI and data mining improve CRM. By analyzing customer data, businesses can segment their customers into different groups, predict their behavior, and personalize interactions. For example, chatbots can provide tailored responses based on customer profiles.

*Cluster 2 (Green): Customer-Centric Analytics*
Key terms are customer satisfaction, customer intelligence, customer experience, predictive analytics, customer churn. This area focuses on using analytics to enhance customer satisfaction and loyalty. By understanding customer behavior and preferences, businesses can improve the overall customer experience and reduce churn rates. Predictive analytics help in anticipating customer needs and addressing issues proactively.

*Cluster 3 (Blue): Data and Decision Support*
Key terms are data warehouse, student relationship management, OLAP (Online Analytical Processing), decision support system. This cluster deals with the tools and infrastructure needed to manage large datasets and support decision-making. Data warehouses store vast amounts of information, while OLAP tools help analyze this data. This is particularly useful in contexts such as managing student relationships in educational institutions.

*Cluster 4 (Brown): AI and Decision Processes*
Key terms are decision tree, enterprise resource planning (ERP), big data, decision-making. This cluster explores how AI techniques, such as those involving decision trees and big data, are integrated into decision-making processes and

ERP systems. These tools help organizations make informed decisions by analyzing large datasets and identifying patterns.

*Cluster 5 (Yellow): Knowledge Management and Marketing*
Key terms are knowledge management, relationship marketing, competitive advantage. This cluster emphasizes the role of AI in knowledge management and marketing strategies. By leveraging AI-driven insights, organizations can manage knowledge more effectively and develop marketing strategies that provide a competitive edge.

*Cluster 6 (Orange): Information Technology Infrastructure*
The key term is information technology. This cluster serves as the foundation for implementing AI, data mining, and analytics across various domains. It includes the necessary IT infrastructure which support these technologies.

*Interconnections and Relationships*
The clusters are interconnected, indicating strong interdependencies. For example, data mining links CRM with customer-centric analytics by extracting meaningful insights. AI acts as a cross-cutting technology, connecting areas such as decision-making, predictive analytics, and knowledge management. This interconnectedness shows how different aspects of AI and data analytics work together to enhance business processes and decision-making.

*Application Contexts*: The presence of terms such as student relationship management and enterprise resource planning highlights specific application areas, such as education and organizational management, where these technologies play a crucial role.

*RQ2: What conceptual framework should be developed to support Adaptive AI-driven student relationship management?*
Based on the co-occurrence analysis of keywords and the synthesis of existing research, a conceptual framework should integrate the following elements:
1. Core AI and Data Processing Layer
    - Artificial Intelligence (AI): Serves as the foundation for automation and decision-making.
    - Data Mining: Extracts patterns from student data to enhance relationship management.
    - Big Data & Data Analytics: Enables predictive modeling for student needs and behavior.
2. Student Interaction and Engagement Layer
    - Customer Relationship Management (CRM): Applied to student management for personalized support.
    - Chatbots & AI Assistants: Provide real-time communication and support.
    - Customer Intelligence & Segmentation: Groups students based on behavior, needs, and preferences.
3. Decision-Making and Optimization Layer
    - Decision Support Systems and Predictive Analytics: Assist in proactive student interventions.
    - Supply Chain & Resource Planning: Optimizes resource allocation for student services.
4. Outcome and Performance Measurement
    - Customer Satisfaction & Experience: Measures student engagement and service quality.
    - Competitive Advantage: Ensures AI-driven student services enhance institutional success.

The results indicate that an effective AI-driven SRM framework must integrate these components to maximize efficiency, personalization, and institutional success while addressing ethical challenges.

## 5. Discussion

The findings highlight the intricate relationships between various concepts related to SRM, AI, and Adaptive AI. The implications of these relationships and their potential impact on educational institutions are as follows;

*Enhancing Student Engagement and Retention*
The integration of SRM with AI and Adaptive AI offers significant opportunities for enhancing student engagement and retention. By leveraging data mining techniques, educational institutions can gather and analyze vast amounts of student data to identify patterns and trends. This data-driven approach enables institutions to provide personalized support and resources tailored to individual student needs (Orji et al., 2023). For instance, predictive analytics can be used to identify students at risk of dropping out and to implement targeted interventions to improve their academic outcomes.

*Personalized Learning Experiences*
Adaptive AI plays a crucial role in creating personalized learning experiences for students. These AI systems can continuously adjust their behavior and learning processes based on new data and experiences, providing tailored educational content that meets the unique needs of each student (Halkiopoulos & Gkintoni, 2024). This adaptability ensures that students receive the appropriate level of challenge and support, fostering a more engaging and effective learning environment.

*Decision Support Systems in SRM*
Decision Support Systems (DSS) are integral to the effective implementation of SRM. These systems analyze data and present actionable insights, aiding educators and administrators in making informed decisions. The connection between DSS and AI underscores the importance of integrating advanced analytical tools to support strategic planning and operational efficiency in educational settings (Langeveldt, 2024). By utilizing DSS, institutions can optimize resource allocation, improve student services, and enhance overall institutional performance.

*Data Privacy Concerns and Regulatory Frameworks*
SRM involving Adaptive AI enhances student engagement but raises concerns regarding privacy, security risks, algorithmic bias, and transparency (Wang et al., 2024; Zeide, 2019). The Personal Data Protection Act (PDPA) regulatory framework mandates data protection, informed consent, and the ethical use of AI (Wu et al., 2024). Educational institutions must implement privacy-centric and explainable AI, along with regular audits, to ensure compliance and fairness. Responsible AI governance is essential for balancing technological advancements with the security and trustworthiness of student data (Halkiopoulos & Gkintoni, 2024).

## 6. Conclusions

Student Relations Management (SRM) constitutes a critical component of higher education institutions, emphasizing the importance of the cultivation and maintenance of positive student relationships to enhance satisfaction, engagement, retention, and overall success. The integration of Adaptive AI with SRM represents a transformative advancement, offering personalized and proactive support tailored to the unique needs and preferences of individual students.

Bibliometric analysis serves as a pivotal research methodology, enabling scholars to systematically identify and evaluate the existing literature on the application of Adaptive AI in SRM. This analytical approach facilitates the exploration of diverse perspectives and methodologies, thereby enriching the current body of knowledge and fostering the development of novel insights and findings. Through bibliometric analysis, researchers can pinpoint research gaps and areas necessitating further investigation.

The integration of SRM with AI and Adaptive AI presents significant opportunities for enhancing student engagement, retention, and personalized learning experiences. The use of data mining, predictive analytics, and decision support systems can support informed decision-making and strategic planning in higher educational institutions. As educational leaders and policymakers embrace these technologies, it is essential to address ethical considerations and ensure that data privacy and security are maintained. Future research should continue to explore the impact and challenges of AI-driven SRM systems to fully realize their potential in transforming higher education.

## 7. Limitations and future research

This study presents a conceptual framework for integrating Adaptive AI into SRM. However, the findings may not be easily applicable to institutions with advanced digital infrastructures, as those with limited resources or strict regulations may face challenges when it comes to implementation (Zhou, 2023). Ethical concerns, including data privacy, algorithmic bias, and transparency, remain key issues that require further investigation (Lai et al., 2023). Additionally, the ability of Adaptive AI to scale and adapt across different educational settings is still uncertain, as factors such as institutional size, student demographics, and policies can influence its success (Loureiro et al., 2021). Lastly, the long-term impact and sustainability of AI-driven SRM requires on-going research to evaluate its effectiveness over time, particularly in terms of student engagement, retention, and overall institutional performance.

To address these limitations, future research should focus on several key areas. First, real-world case studies and practical implementations of Adaptive AI in SRM should be explored to validate the proposed framework and identify

best practices for its deployment (Gholami et al., 2018). Additionally, research should establish an ethical AI governance framework to ensure fairness, transparency, and data security, while also addressing concerns related to student bias and privacy (Zeide, 2019). Moreover, the integration of Adaptive AI with emerging technologies such as blockchain for secure student data management and IoT for smart university applications should be explored (Orji et al., 2023). Lastly, future studies should focus on Thai student data to analyze factors such as engagement, retention, and academic success in that this could greatly benefit the Thai education sector. By applying advanced data analytics techniques such as machine learning or Adaptive AI, researchers could identify key factors influencing student outcomes, including engagement in learning activities, teacher support, and social influences. This would allow for the development of more personalized education strategies, tailored to the unique needs of Thai students, ultimately improving retention rates and academic performance. The insights gained could inform educational policies and practices, enhancing the overall quality and sustainability of higher education in Thailand (Loureiro et al., 2021).

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## 9. Authors' information

**Kanyamaat Sangounsak** is a lecturer in the Faculty of Humanities and Social Sciences, Sakon Nakhon Rajabhat University, Thailand.

**Saowaluck Boonrawd** is a lecturer in the Faculty of Management Technology, Rajamangala University of Technology Srivijaya, Thailand.

**Niramol Prasertphongkun** is a lecturer in the Faculty of Arts and Architecture, Rajamangala University of Technology Lanna, Chiang Mai, Thailand.

**Panisa Pikulhom** is a chief marketing officer in SCM Technologies Company Limited, Thailand

**Radanut Phusomnuek** is a lecturer in the Faculty of Humanities and Social Sciences, Sakon Nakhon Rajabhat University, Thailand.

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