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Development of Intelligent Tutoring System Model in the Learning System of the Indonesian National Armed Forces Completed with Bibliometric Analysis

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ABSTRACT

This research aims to develop and design an Intelligent Tutoring System (ITS) model to improve the efficiency and adaptability of the learning process using technology based on student personalization. This study employs a systematic literature review method, as well as bibliometric analysis and visualization using the VOSviewer application. We collected data from several well-known article databases. The results showed an intelligent tutoring system model to be connected to five components and 22 sub-components. These components consist of a student model, a pedagogical model, an interface model, a tutor model, and a domain model. Thus, these components and sub-components produce a responsive student model that can be used to develop a learning system within the Indonesian National Armed Forces. The responsive student model not only assesses students' visual, auditory, or kinesthetic learning styles but also gauges their emotions or concentration levels during the learning process. This development not only increases learning effectiveness but also improves student learning experiences and supports adaptive and sustainable academic growth.

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1. INTRODUCTION

The advancement of technology is now advancing at a swift and substantial pace. Education must adjust to these advancements as one of the industries impacted. Education is a well-organized framework that aims to cultivate several dimensions, including physical well-being, health, skills, cognitive abilities, emotional well-being, volition, social skills, and belief systems (Utami, 2018). E-learning is a technological innovation that enables knowledge acquisition without temporal or spatial limitations. Presently, the majority of educational establishments have embraced the use of Learning Management Systems (LMS) as a means to facilitate the process of learning. The transition from traditional manual learning to the use of technology, such as Learning Management Systems (LMS), offers enhanced ease in the dissemination of educational materials, grade management, and other facets of the learning experience. This technological advancement facilitates enhanced accessibility, more temporal flexibility, and enriched educational experiences for students by offering a range of interactive features and expanded learning materials (Cabrera *et al*., 2017). The present implementation of e-learning has the effect of promoting equitable opportunities among students and perhaps diminishing the extent of face-to-face engagement. Learning conditions are often structured via the allocation of tasks, with software serving as the predominant method of organization (Meleško & Kurilovas, 2018).

The presence of e-learning does entail some limitations, such as the potential for equalizing students' talents and the absence of teacher-student contact. Despite the use of LMS technology, the learning situation in Indonesia has not yet achieved its full potential. Hence, it is important to always strive towards enhancing the quality of the educational experience, including the optimization of Learning Management System (LMS) technology and the proactive resolution of any interruptions to learning. During the learning process, whether via traditional methods or online platforms facilitated by technology, every student has unique habits and motivations. Learning activities may be characterized by a seamless, focused, and passionate approach. However, sometimes it is not seamless and is characterized by a lack of focus and excitement. On one side, technology or online learning systems facilitate the acquisition of knowledge, although they are unable to deliver individualized instruction to pupils. In contrast, the Intelligent Tutoring System (ITS) is a kind of intelligent learning that can comprehend the individual attributes of students and tailor the instructional content to align with their specific qualities. ITS is an intelligent computer-assisted system designed to teach pupils without the need for human involvement. During the learning process, whether via traditional methods or online platforms facilitated by technology, every student has unique habits and motivations. Learning activities may be characterized by a seamless, focused, and passionate approach. However, sometimes it is not seamless and is characterized by a lack of focus and excitement. ITS is tutor who can engage with students, possess teaching expertise, and are knowledgeable about the subject matter being taught (Budianto & Yuana, 2019). Development of ITS technology in private universities (Kurniawan *et al*., 2024).

The systematic literature study reveals that foreign countries such as the United States, England, and Australia predominantly use ITS in the military domain. In the context of the Indonesian National Armed Forces, the use of ITS for educational purposes remains limited to the provision of learning guidelines and has not yet been fully included in the existing learning framework. It is important to design an educational system using ITS that incorporates student customization to assess the degree of saturation and tiredness experienced throughout the learning process inside the Indonesian National Armed Forces environment.

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The construction of an ITS might include the creation of a model that can effectively identify and quantify the degree of saturation and tiredness experienced by students during the learning process. In this research, the development of the ITS model is designed to improve the efficiency and adaptability of the learning process by using technology based on student personalization. In addition, the developed ITS model will be compared with other ITS models from the literature (Binh *et al.*, 2021). The contributions of this research can be summarized as follows:

(i) Components and sub-components of an ITS
(ii) ITS Model Designed to improve the efficiency and adaptability of learning process using technology based on student personalization
(iii) Bibliometric analysis to see research trends based on keywords.

Furthermore, given that this topic encompasses the intersection of physiology, information science, mathematics, and statistics within certain domains, we conducted a bibliometric study to investigate research patterns. The purpose of this endeavor is to enhance the depiction of advancements in the sector by using bibliometric indicators.

2. LITERATURE REVIEW

An ITS is a comprehensive system that includes a collection of applications that actively interactively use knowledge representations. The fundamental functionalities of an ITS include the capacity to adapt to the needs of the student, engage in dynamic control interaction with the student, and effectively possess and use domain knowledge (Paladines & Ramirez, 2020). Additional studies elucidate that an ITS is a computerized system specifically designed to provide personalized education or feedback to students without any human involvement or disruption. There are many modules inside the system, namely the communication module, instructional module, student module, and expert module. The communication module functions as the intermediary between the learner and the ITS, facilitating the exchange of information based on the student's input. A learning guiding technique is implemented by the instructional module, which serves as the central component of the ITS. The student module is equipped with an inference mechanism that enables the diagnosis of students' knowledge. The expert module serves as a reservoir of knowledge within a certain subject, including the ideas or tasks that are to be taught (Paladines & Ramirez, 2020). **Figure 1** shows the main components of the ITS.

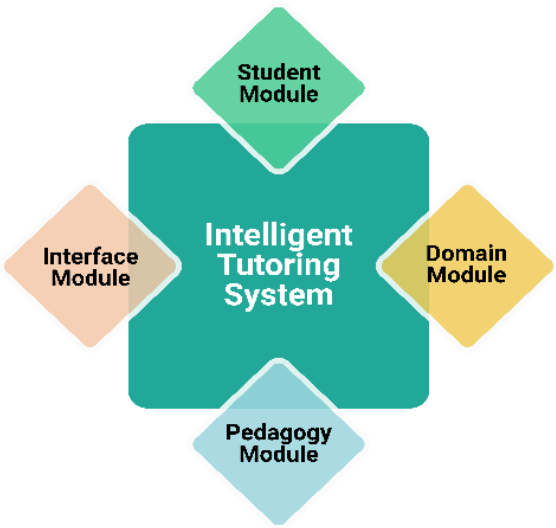

Figure 1. ITS components.

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Based on **Figure 1** of the ITS model in general, the Module domain refers to the concepts or standards used to evaluate student performance. These standards are aligned with the pedagogical methods laid out in the curriculum. This model covers the domain of knowledge, teaching or learning strategies, and relevant skills for topics that have been determined by the teachers. It includes the mastery of the necessary skills in the field that students must learn (Pai *et al.*, 2021). A student module is a framework that assesses the proficiency of students in acquiring skills (Pai *et al.*, 2021). This methodology entails analyzing student learning outcomes to enhance the efficacy of individual student development. The module encompasses comprehensive data on the learner, including their knowledge, behavior, learning capabilities, style, and other pertinent components. The student module serves the purpose of disseminating information on the optimal learning methodologies tailored to the unique needs of individual pupils (Pai *et al.*, 2021). The primary function of the Tutor Module is to ascertain the method and substance of education for students via the selection of techniques, provision of feedback, and allocation of suitable activities (Pai *et al.*, 2021). This model can select content, design guidance strategies, set and adjust the pace of learning, conduct learning evaluations, provide additional assistance, and take necessary actions (see https://api.semanticscholar.org/CorpusID:202766823). The interface module plays a crucial role within the ITS communication system by enabling effective interaction between the system and students (Pai *et al.*, 2021). The interface must possess the capability to effectively convey instructions and provide valuable feedback to participants or students during the process of learning. This particular architecture offers a diverse range of user interfaces that are capable of effectively communicating information and facilitating interaction. The user-system communication paradigm, also known as the graphical communication model, combines visual communication, social intelligence, interface components, and language-based communication (see https://api.semanticscholar.org/CorpusID:202766823).

3. METHODS

3.1. Systematic Literature Review

A Systematic Literature Review (SLR) is a methodological approach that involves the identification, evaluation, and interpretation of all existing research material to address particular research inquiries. Furthermore, given that this topic encompasses the intersection of physiology, information science, mathematics, and statistics within certain domains, we conducted a bibliometric study to investigate research patterns. The purpose of this endeavor is to enhance the depiction of advancements in the sector by using bibliometric indicators. The primary aim of a systematic literature review is to examine the existing body of literature about a certain field of study. This study employs data sourced from reputable scientific publications accessible via well-established journal databases such as IEEEEXplore Digital Library, ACM Digital Library, Emerald, Taylor & Francis Group, and Semantic Scholar to get complete outcomes. The findings from the issue identification process will serve as the basis for enhancing the development of the ITS model. The objective is to enhance the effectiveness and flexibility of the learning process through the use of technology that is tailored to individual students.

3.2. Research Question

Research questions serve to ensure that the literature evaluation remains focused. This significantly increases the efficiency of data search. The following are the research questions used to conduct this study.

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(i) RQ1: How to identify the components and sub-components that make up the ITS for the Indonesian National Armed Forces learning system?
(ii) RQ2: How to develop an ITS model for the Indonesian National Armed Forces learning system?

In this study, to search for articles related to the research question using keywords: **"Intelligent Tutoring System" AND ("Army" OR "Military")**. With inclusion and exclusion criteria are as follows:

(i) Published in International Journals, Books, Proceedings / Conferences
(ii) Focused on ITS Implementation in the Military
(iii) Publication Year Until 2022

3.3. Studies Selection

During the evaluation of the inclusion criteria, we categorized the keyword search results for each appropriate title in the source database as "Studies Found". We further elaborated on the aforementioned findings by analyzing the abstracts of each article to verify their pertinence or connection to the study goals. This process gave rise to what is often known as "Candidate Studies". The ultimate phase of the validation approach for inclusion criteria entails a comprehensive examination and assessment of all articles categorized as "Candidate Studies" to ascertain their capacity to address the research inquiry. The studies that meet the criteria will be designated as "Selected Studies". The methodology's inclusion criteria yielded a comprehensive set of 421 articles. The subsequent phase developed a total of 64 potential studies. Subsequently, the collection of works underwent further scrutiny according to the exclusion criteria, leading to a total of 39 pivotal studies that were subsequently designated as "Selected Studies". The following **Table 1** displays the chosen studies.

Table 1. Data extraction paper.

Source	Studies found	Candidate studies	Selected studies
Emerald	117	25	1
IEEE	9	0	0
ACM	154	0	0
Semantic	41	37	37
T & Francis	100	2	1
Total	**421**	**64**	**39**

3.4. Analysis Bibliometric

In conducting bibliometric analysis, there are four phases involving data collection using the Publish or Perish application, data processing, data mapping using the VOSviewer application, and analysis of the mapped data. Key terms used in the data collection included "intelligent tutoring system," "army," and "military." The research data used came from several well-known international scientific article databases such as IEEEXplore, Emerald, ACM Digital, Semantic Scholar, and Taylor & Francis, covering publications up to 2022. From the results of data collection from various international scientific article databases, a total of 421 relevant articles were identified according to the specified keywords. This was filtered by a study selection process that resulted in 39 papers being selected that addressed the application of Intelligent Tutor Inf System in the military field. The articles were then saved in *.ris and *.csv formats for further analysis. The collected articles in *.ris format will be used for data mapping using the VOSviewer application. Article data mapping is carried out using search results from a predetermined research database. This mapping is divided into three

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types, namely network mapping, density mapping, and overlay mapping. Further details on the bibliometric analysis process can be found in the fuller study (Al Husaeni & Nandiyanto, 2022).

4. RESULTS AND DISCUSSION

4.1. Analysis Bibliometric

Bibliometric analysis indicates that the research on the terms "intelligent tutoring system," "army," and "military" has seen annual fluctuations between 1993 and 2022. According to **Figure 2**, the number of publications chosen in 1993, 1995, 1998, 2000 to 2002, 2004, 2009, 2012, 2013, 2020, and 2022 was 1 article, which accounts for 2.56% of the total. The number had a growth of 2 (5.13%) articles in the years 1997, 2006, 2016, 2019, and 2021. In the years 2015, 2017, and 2018, there was a notable rise of 3 articles, accounting for 7.69% of the total. In both 2005 and 2014, there was a subsequent rise of 4.26 percent. During the period from 1993 to 2022, the average number of relevant publications was around 1.3, which is comparable to one article. This declaration highlights the considerable potential and ongoing advancement of research on smart tutor systems in the military.

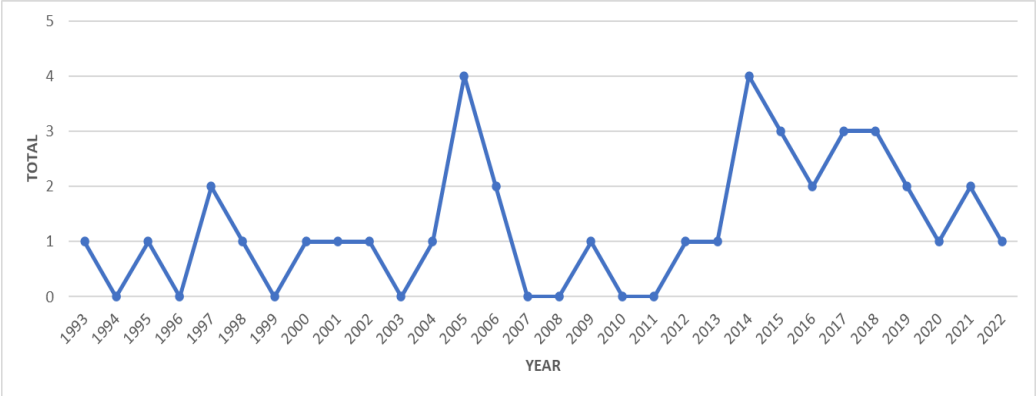

Figure 2. Publication development year range 1993 – 2022.

4.1.1. Keyword-based progress map

The VOSviewer tool was used to build data mappings consisting of articles or studies that are deemed relevant to the subject matter of this investigation. There are three kinds of visualizations involved in the mapping process: network visualization, overlay visualization, and density visualization. **Figure 3** depicts a network visualization illustrating the interconnections among frequently occurring phrases in research about the used keywords. The network visualization reveals the presence of clusters and phrases that are associated with the study keywords. The network visualization has found five clusters, which are displayed in **Table 2.**

According to **Table 2**, the phrase "intelligent tutoring system" is identified in Cluster 2, indicated by the green color. Additionally, the concept of an "intelligent tutoring system" is associated with several additional concepts. Based on the overlay visualization shown in **Figure 4**, it is evident that the phrase has been extensively studied or associated with study for a significant number of years. An extensive study was conducted in 2016 on the topics of "intelligent tutoring systems," "army," and "military." Data on the frequency of research on these keywords may be derived from **Figure 4**, where a darker hue indicates a higher frequency of study on the phrase. Based on the data shown in **Figure 5**, it can be inferred that among the three concepts used as keywords, the term "intelligent tutoring system" emerged as the most often utilized and the primary subject of investigation.

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The three nations from which the 39 papers originated are Australia, Indonesia, and the United States. Furthermore, there are additional publications whose originating nation remains unidentified. This observation implies that Indonesia has conducted a limited amount of research on the application of the ITS learning paradigm in the military context.

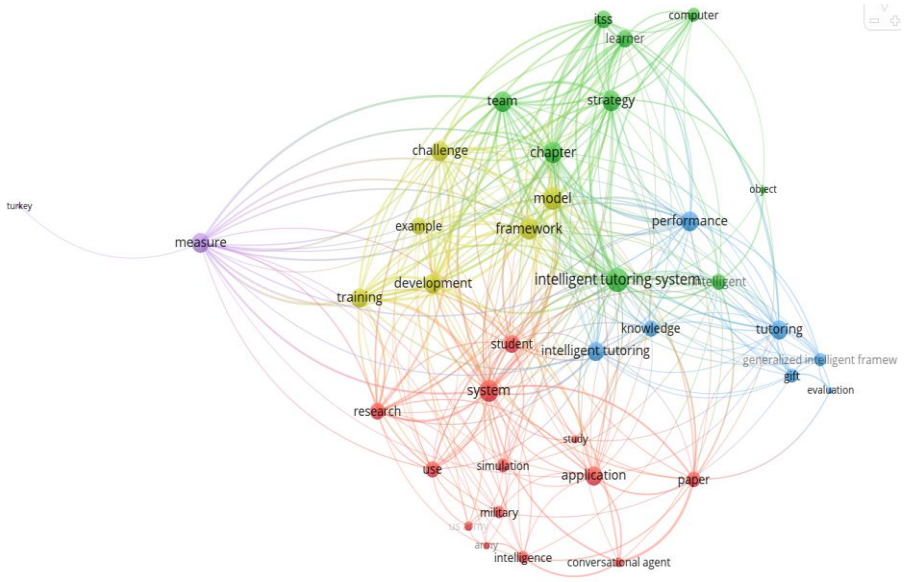

Figure 3. Network visualization based on keywords.

Table 2. Cluster-based on keyword visualization results.

Cluster	Color	Item
1	Red	system, student, research, study, use, simulation, application, paper, military, us army, army, intelligent, conversational agent
2	Green	team, chapter, ITS, learner, computer, strategy, intelligent tutoring system
3	Blue	performance, knowledge, intelligent tutoring, tutoring, generalized intelligent framework, evaluation
4	Yellow	training, development, example, framework, model, challenge
5	Purple	measure, turkey

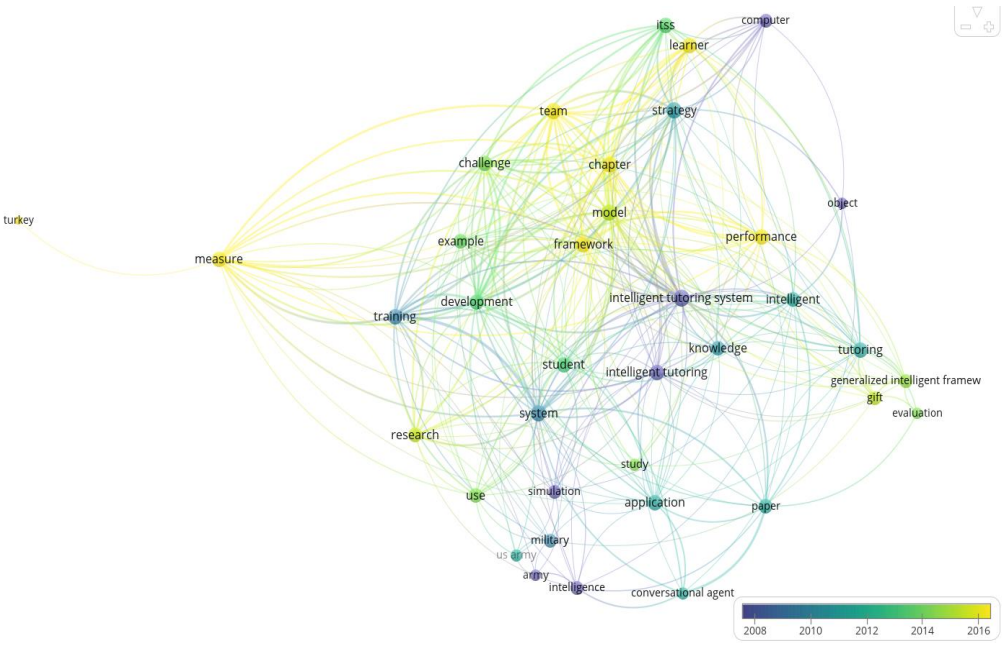

Figure 4. Visualization of overlays based on keywords.

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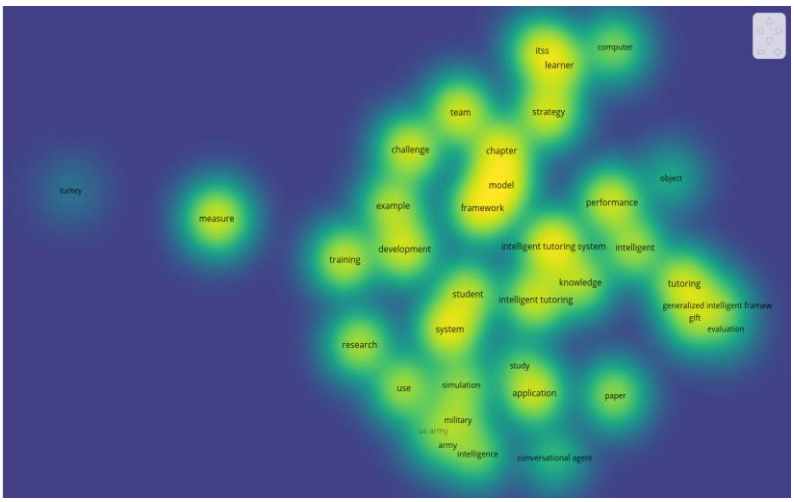

Figure 5. Density visualization based on keywords.

4.2. Components of an ITS

The key elements to consider while building an ITS are the student model, pedagogical model, interface model, and tutor model. The provided **Table 3** delineates the constituent elements and sub-elements of an ITS.

Table 3. Components and sub-components of ITS shaping.

ITS Components	Sub-components
Student Model	1. Preferred learning strategy
	2. Concentration level
	3. Learning style
	4. Cognitive
Pedagogical Model	1. Learning & Teaching Strategies
	2. Learning Materials
	3. Learning Evaluation
	4. Assessment
Interface Model	1. System menu display
	2. Question display
	3. Dialog recording
	4. Response type.
Tutor Model	1. Personalized Guidance
	2. Feedback
	3. Active interaction
	4. Collaborative Learning
Domain Model	1. Concept
	2. Rules
	3. Procedures
	4. Object
	5. Attributes
	6. Behavior

Student models include a wide range of individual attributes, such as knowledge, skills, mistakes, misunderstandings, cognitive and emotional traits, motivation, and preferences for learning styles (Thinakaran & Chuprat, 2022). The objective of this strategy is to oversee the advancement of students, detect mistakes, and provide immediate feedback and suggestions. Wu (2019) emphasized the utilization of Bayesian networks in the development of student models, which possess the capability to impartially assess students' cognitive aptitudes and deduce their subsequent actions. Huang & Chen (2016) underscored the significance of

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student models in enhancing the efficacy and cognitive capabilities of tutoring systems. In student models, it is crucial to take into account several factors, including their preferred learning methodologies, degrees of focus, learning styles, and cognitive abilities, including information processing, memory, problem-solving, critical thinking, and decision-making (Thinakaran & Chuprat, 2022).

The pedagogical model component of ITS has significant importance due to its promotion of personalized educational tactics (Caro *et al.*, 2015). This model considers the cognitive aspects of learning from a pedagogical perspective and deduces the consequences of learning activities on students' abilities and course objectives (see https://api.semanticscholar.org/CorpusID:18853168). The use of Bayesian Networks in assessing user knowledge and preferences and suggesting pedagogical choices is an enhancement to this model. The goal is to provide personalized and adaptive tutoring to students, with a focus on improving learning outcomes and engagement. The pedagogical model emphasizes the integration of technology (Machado *et al.*, 2022) and discusses the complexity of pedagogical models becoming the focus of attention (see https://api.semanticscholar.org/CorpusID:158043696). The role of assessment in teaching planning and implementation is also emphasized, the teacher's ability to interact with students is a fundamental aspect of learning and teaching strategies in the pedagogical model. These studies highlight the importance of learning and teaching strategies, learning materials, learning evaluation, and assessment as sub-components of the pedagogical model.

The interface model component is also important in ITS, facilitating effective interaction between the system and the user (see https://api.semanticscholar.org/CorpusID:202766823). The interface model includes standardization in data exchange between ITS components, with an emphasis on dialogue styles, such as menus and question-and-answer formats (see https://api.semanticscholar.org/CorpusID:57639679). The development of interaction models, including using natural language and multimodal systems, is emphasized by van Schooten in 1999 (see https://api.semanticscholar.org/CorpusID:5382585). A graphical model for the task structure and integration of dialogue components in natural language processing systems. These studies highlighted the importance of menu displays, question displays, dialogue recordings, and response types in the interface model.

The tutor model component plays a vital role in the system's functionality. The tutoring system's student model tracks the student's progress and provides real-time feedback. Huang and Chen (2016) supports this view by identifying the cognitive student model as one of the five models in the system. To improve efficiency, Chang *et al.* (2020) introduced the use of data mining to extract rules for tutor models automatically. The use of models for student tracking in tutoring systems, paying attention to learning styles, and the ability to personalize the learning process. Personalized tutoring is a key aspect of the tutor model, to deliver tailored and adaptable instruction to pupils. To do this, the system employs a user module that constructs and revises a user model according to the student's degree of knowledge, psychological attributes, and preferred method of learning. Furthermore, the system employs multi-media instructional resources to depict and revise domain expertise. Additionally, it incorporates a pedagogical module that dynamically produces customized learning modules by using the data supplied by the user model and domain knowledge repository. In order to enhance learners' confidence and engagement, the guidance module actively engages with them throughout the learning process (Li *et al.*, 2008). This sub-component aims to improve teaching and learning activities in the tutoring system by providing quick and efficient solutions to students' learning problems.

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4.3. Development of ITS Model

The acquired publications demonstrate the extensive adoption of ITS. In 2022, Binh *et al.* (2021) performed a study that used the ITS paradigm, a student-centered method known for its responsiveness and adaptability to several learning modalities. There are three primary components comprising the system: a user component, a responsive model component, and a developed ITS (Binh *et al.*, 2021). The user component under examination consists of three main parts: ability, performance, and profile. The model's responsive component has two distinct elements, namely learning style and cognition. The ITS has three crucial elements: educational resources, evaluations, and questionnaires. Therefore, we can deduce that the responsive model involves categorizing students based on their unique learning preferences and level of focus during the learning process. Several methods, such as the distribution of questionnaires or surveys, can effectively use WinITS. In order to enhance the process of acquiring knowledge, students may participate in collaborative teaching and use customized resources that cater to their specific areas of interest. Assessment is performed by administering examinations or assignments to evaluate students' skills and accomplishments before and during the implementation of the ITS.

Additional investigation into ITS may be undertaken by augmenting the student population engaged in the educational process. Furthermore, this approach has the potential to be expanded to include the evaluation of students' emotional well-being during the process of live learning. The proposed educational framework entails the creation of an internet-based platform using an ITS. The suggested intelligent system aims to enhance student customization by using video sensors to monitor their physical state throughout the learning process. Our objective is to use webcams to evaluate students' emotional states, such as boredom and exhaustion, during the learning process. **Figure 6** depicts the ITS Indonesian National Armed Forces process business model, which has been developed via a comprehensive assessment of relevant literature and the widely used ITS model theory. There are three crucial components, namely input, processing, and output.

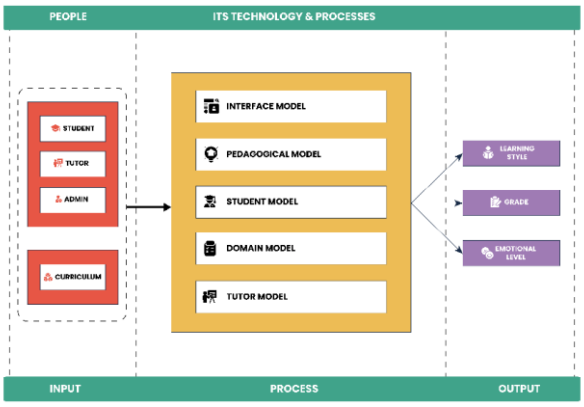

Figure 6. ITS Indonesian national armed forces business process model.

In the input stage, we collect initial data to initiate the response. Academic databases conduct field surveys to acquire the data, ensuring the precision of the study findings. The dataset contains details about the student body and faculty members of the Indonesian Defense University (UNHAN), with the administrative personnel responsible for overseeing the ITS application and curriculum. In the process stage, the results from the literature study and ITS theory were used to form the components of the ITS Indonesian National Armed Forces, including the interface model, pedagogical model, student model, domain model, and tutor model.

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The interface model enables visual interaction, the pedagogical model assists learning planning, the student model details student characteristics, the domain model describes the knowledge structure, and the tutor model provides learning assistance. The Output stage is the last stage of the data processing process, which aims to produce three main outputs following the research objectives. First, this output will provide information about students' learning styles. Second, this output will include the scores obtained when students use the ITS Indonesian National Armed Forces application. Finally, this output will also measure the influence of students' emotional level in the learning process. Thus, this output stage plays an important role in evaluating the effectiveness of the developed learning system.

Based on the explanation of the ITS Indonesian National Armed Forces business model, the focus of this research is on the development of a responsive student model, the Responsive Student Model ITS Indonesian National Armed Forces, for the application of intelligent learning systems in the military environment. The adaptive model for the development of an ITS targeted for use in a military environment has several elements, including student models, learning styles, cognitive factors, and ITS Military Applications. **Figure 7** shows the ITS student responsive model, which is proposed as an innovation in an intelligent learning system to be implemented in an online learning platform.

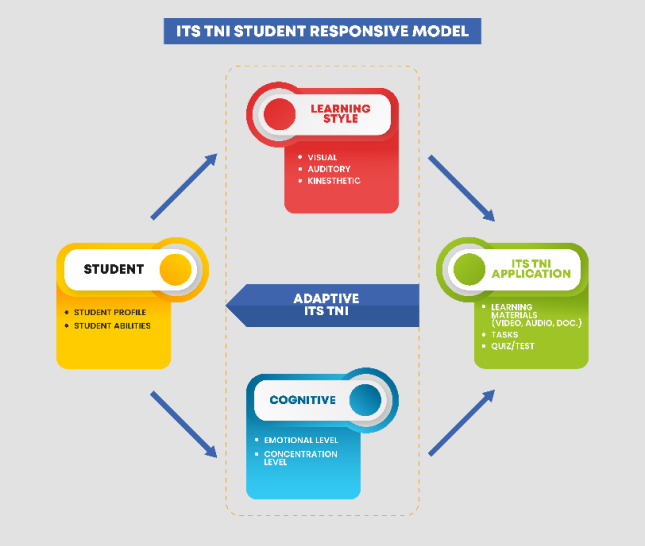

Figure 7. ITS Indonesian national armed forces student responsive model.

The responsive model shown in **Figures 6** and **7** consists of several modules including:

(i) The Student Model is a learning module that caters to the specific needs of students. The learning used will be tailored to the unique abilities of each student. To achieve this, a student profile must first be recorded, which includes information such as name, NIM, age, and other identifying attributes that may be available in the existing student database at the military school. Additionally, the system organizes an initial pilot test to evaluate the student's abilities or their prior knowledge of the delivered material. The assessment of this student model relies on two main standards: students' learning styles and their cognitive abilities.

(ii) Learning style is an important component of this model. Before starting the lesson material, the system asks each student to fill out a learning style questionnaire. The system will use this questionnaire to determine each student's preferred learning style or character, which will guide the presentation of the material based on the student's understanding level. Furthermore, students will be grouped based on how they participate in learning, using visual, auditory, or visual learning styles.

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(iii) In this model, the cognitive aspect includes the representation of students' emotions and concentration as they access the online learning materials. Webcam cameras will identify the facial expressions of each student accessing the materials to detect this level of emotion and concentration. This will make it possible to understand students' emotions and concentration during the learning process.

(iv) The ITS Indonesian National Armed Forces application is a multi-featured platform that aims to connect the student interface with learning styles and cognitive aspects. Features include learning material access pages, assignments, quizzes, exams, and assessments. The ITS Indonesian National Armed Forces app will develop a website that will help students and teachers run lessons.

The study conducted a systematic literature review and bibliometric analysis, which resulted in the identification of five key components and sub-components that comprise the ITS model in the Indonesian National Armed Forces. The components comprise: 1. The student model comprises preferred learning strategies, levels of concentration, learning, and cognitive aspects. 2. The pedagogical model includes learning and teaching strategies, learning materials, learning evaluation, and assessment. 3. The interface model consists of menu displays in the system, question displays, dialogue recordings, and response types. 4. The tutor model encompasses personal guidance, feedback, active interaction, and collaborative learning. 5. The domain model incorporates concepts, rules, procedures, objects, attributes, and behavior.

The five components and sub-components identified serve as the foundation for constructing a model of an ITS in the Indonesian National Armed Forces learning system. The Indonesian National Armed Forces ITS incorporates student customization, specifically by evaluating the learner's focus and emotions. This approach comprises student models, learning styles, cognitive factors, and an ITS inside the Indonesian National Armed Forces. (1) The student model's design personalizes the learning experience by tailoring the modules to each student's skills. We first create student profiles by extracting information from the student database, including the student's name, ID, age, and other relevant characteristics. Furthermore, the system conducts a preliminary assessment to evaluate the pupils' initial aptitude or understanding of the subject matter. We then separate the student model into two evaluation criteria: learning style and student cognitive ability. (2) This learning style involves students completing a questionnaire to choose their preferred way of learning before they can access the learning content. The choice of learning style will determine the appropriate learning approach that aligns with each learner's individual qualities. Next, we will categorize pupils into groups based on their visual, auditory, or kinesthetic learning styles (VAK), tailoring their comprehension to their individual learning preferences. (3) Cognitive refers to the emotions and attention levels of students while they are accessing learning resources online. A webcam records the facial expressions of each individual accessing educational content to gauge students' emotional and cognitive engagement throughout the learning process. The Indonesian National Armed Forces use an intelligent coaching system. The program aims to establish a connection between student interfaces, learning styles, and cognition. The outcomes of the analysis of the components and subcomponents of the ITS in the Indonesian National Armed Forces, as well as the model derived from them, will serve as the foundation for developing an ITS application specifically designed for the Indonesian National Armed Forces environment. This tool is accessible to all stakeholders at the Indonesian National Armed Forces school, including students, instructors, and administrators. Its purpose is to enhance the teaching and learning experience, ensuring greater comfort and alignment with the objectives of the Indonesian National Armed Forces Unit.

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5. CONCLUSION

This research employs a systematic literature review method, along with bibliometric analysis and visualization through the use of the VOSviewer application. This method aims to enhance the formulation of the problem, delve into previous research on ITS, and track the evolution of such systems in the military field. Researchers collected data from several well-known article databases, including IEEExplore, Emerald, Semantic Schoolar, ACM, and T&Francis, using the keyword "Intelligent Tutoring System in Army or Military" from 1993 to 2022. Of the 421 articles selected, there are 39 that match the topic of this research. The 39 selected papers generate components and sub-components that serve as a foundation for the establishment or development of an ITS model within the Indonesian National Armed Forces learning system. The components consist of a student model, a pedagogy model, an interface model, a tutor model, and a domain model. To measure the effectiveness of the system and the student learning process, the ITS model adds features to the student model, taking into account the student's level of concentration and emotions during the learning process. The ITS model develops learning styles based on student conditions, requiring students to fill out a learning style questionnaire before accessing learning materials. The chosen learning style will determine the way of learning that suits each student's characteristics. Next, we will group students according to their visual, auditory, or kinesthetic (VAK) learning styles to enhance their understanding and align with their learning preferences. An intelligent learning system based on student personalization that can measure the level of boredom and physical fatigue provides significant benefits. By taking into account students' conditions, the system can adjust the learning approach to maintain an appropriate level of challenge without overwhelming or boring students. As such, it not only increases learning effectiveness but also improves students' learning experiences and supports adaptive and sustainable academic growth.

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7. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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