

Intelligent Tutoring and Counselling Systems in Education: A Comprehensive Review of AI-Driven Personalized Learning and Career Guidance

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Abstract

Intelligent Tutoring System (ITS) and **AI-based counselling systems**, as the result of Artificial Intelligence (AI) application in education, are designed to help improve the efficiency of the teaching and learning processes. This technology has been applied in these systems to deliver adaptive instruction, personalized feedback, and informed career guidance using machine learning, natural language processing, learning analytics, and predictive modelling. **Intelligent Tutoring Systems** emulate the human tutoring process by adapting learning plans according to the performance of the students whereas AI-based counselling systems are used in assisting them make academic, emotional and career related decisions. This paper presents an in-depth overview of AI-based educational technologies, conversational agents, and emotional AI, and how they facilitate the functions of enhancing student engagement, learning outcomes, and decision support.

Nonetheless, the introduction of these systems is also associated with multiple problems such as issues with data security, ethical concerns, bias in algorithms, and emotional intelligence restriction. Moreover, existing systems tend to be in separated mode and there is no integration of tutoring and counselling features and hence, student fragmentation in the system. In this paper, the research gaps that are identified are explainable AI, greater emotional adaptability and the application of real-time and multimodal data to make correct predictions. The paper concludes that the educational system in the future ought to be directed to creating all- encompassing, clear, and scalable AI-driven solutions that would offer comprehensive support to learners at academic, emotional, and professional levels.

Keywords: Intelligent Tutoring Systems, Artificial Intelligence, Personalized Learning, AI- Based Counselling Systems, Conversational AI, Emotional AI, Educational Data Mining.

1. Introduction

The advancement of artificial intelligence technologies is causing a great shift in the education. It has been the conventional education systems founded on the normal teaching methodologies that have proven inefficient in achieving the differentiated learning needs of the students. This has seen the development of intelligent tutoring and counselling systems. **Intelligent Tutoring Systems (ITS)** is one of the **first**

computational programs where artificial intelligence is applied in the education field [2]. Under this system, the performance of the students is evaluated by a human tutor who consequently develops a personalised learning system. ITS has been characterized as an efficient means of improving learning outcome of a student in terms of providing individual feedback as well as adaptive learning strategies [1]. At the same time, AI-assisted counselling services are developed to address the issues that exist with the academic guidance, counselling and career guidance services. The **services rely on the application of data analytics to provide individual guidance according to the interests, talents, and accomplishments of the student** [13]. Tutoring services and counselling incorporated into AI-based systems is a novelty in the field of educational technology [11]. Such systems may provide an integrated system such as academic, counselling and guidance service [14]. With the rapid development of these systems, most of the solutions provided are operating independently despite the fact that they are available. ITS platforms are predominantly cognitive based and the counselling systems are more emotional and career based. This dissection brings the divided support of students and limits the application of AI in learning. Therefore, one will have to explore the potential of transforming AI-based ecosystems that have integrated tutoring, emotional intelligence, and counselling into a single system.

2. Literature Review

The recent developments in Artificial Intelligence (AI) have dramatically changed the education sector as it allows making the process of learning flexible and personalized. The researchers have experimented with different AI-based design such as **Intelligent Tutoring Systems (ITS)**, conversational agents, emotional AI and AI-based counselling systems to facilitate the overall learning process. Nonetheless, according to the existing body of literature, such technologies tend to operate independently, instead of being a unified ecosystem. One of the most popular AI uses in education is Intelligent Tutoring Systems (ITS), which is intended to mimic the role of a human tutor by modifying its instructional techniques according to the performance and behaviour of a particular learner [10]. In general, the main elements of ITS include the domain model, student model, pedagogical model, and user interface, which allow customized learning and adaptive feedback [1].

Research indicates that ITS greatly enhances the learning experiences by providing personalized instructions as well as real-time feedback. Another area of interest has been conversational AI and chatbots that can be used to facilitate academic support, administration, and student engagement with the help of **Natural Language Processing (NLP)** [14]. They use interactive communication systems and assist learners with the answers to questions and directions of academic activities [3]. Nevertheless, such shortcomings as deficiency of contextual insight and emotional intelligence are still major obstacles [8], [4]. Moreover, there is a tendency to utilize technologies of emotional AI and affective computing to study the emotions of students on the basis of facial expressions, voice, and data on behaviour, allowing to timely provide interventions and achieve better learning outcomes [4], [15]. Regardless of their advantages, data privacy concern, ethical issues, and data management remain to be limiting their use [14]. The **AI-driven counselling systems also help students in academic and career decision-making**, as the data are analysed, including academic performance, interests, and trends in the labour market [13]. Such systems enhance efficiency in the decision making process and minimise human bias particularly in learning institutions of higher magnitude [11]. Nevertheless, they do not always have emotional awareness and solidarity with the tutoring systems, leaving a hole in the support.

On the whole, based on the findings of literature on the topic, AI technologies rank among the most promising in terms of customization and automation, but the existing solutions have drawbacks due to the

inability to integrate with other systems, the deficiency of emotional intelligence, and transparency and ethics issues. Future studies ought to be directed towards the designing of consolidated AI systems incorporating tutoring, emotional support and career to offer a comprehensive support of the student.

3. Research Methodology

The paper adheres to the systematic literature review method in an effort to explore how **Artificial Intelligence (AI)** motivated intelligent tutoring and counselling systems in education evolved. The rationale of the methodology is to single out, assess, and integrate the current studies associated with intelligent tutoring systems, conversational AI, emotional AI, and AI-driven career counselling websites [2]. The keywords that were used to search the literature included the “**Intelligent Tutoring Systems, Artificial Intelligence in Education, Educational Data Mining, Conversational AI in Education, Emotional AI in Learning Systems, and AI Career Counselling Systems**”[5]. The search was based on the **publications published from 2019 to 2025** since this is the time frame during which the analysis will incorporate current developments in AI-based educational technologies [1].

The duplicate and irrelevant articles were eliminated after the initial search procedure. The rest of the **studies were filtered using their applicability to the AI-based tutoring systems, emotional intelligence in the learning environment, and AI-based counselling systems**. Lastly, a list of the topical research articles and academic resources was selected to be **analyzed and synthesized** in detail. The chosen articles were reviewed to **determine the architectures, applications, benefits, issues and technological frameworks applied in the AI-based tutoring and counselling systems**. The review is also directed towards development of research gaps, technological constraints and prospects of research on development of integrated intelligent educational ecosystems.

4. Background and Evolution of AI in Education

4.1. AI Systems in early education.

The history of AI in education started with tutoring systems made of rules which were processed on a set of fixed rules. These were systems that were not flexible and effective in dealing with individual student needs in terms of learning [10]. As the computing technologies have developed and more data has become available, present-day educational systems have turned into machine-learning based system, facilitating the learning systems to learn through the interactions of the users and offer more responsive and individualized learning experience.

4.2. Intelligence Tutoring Systems Evolution.

Intelligent Tutoring Systems (ITS) have also developed to be dynamic and adaptive learning systems as time goes by as opposed to the current instructional models [5]. **Innovative ITS applies learning analytics, cognitive modelling, and predictive methods to streamline learning**. Such systems are capable of individualizing learning paths, offering feedback on a moment-by-moment basis, and replicating the relationship of a one-to-one tutor, which makes them very useful in large-scale learning contexts [2], [9].

4.3. Appearance of AI-Based Counselling Systems.

As the process of academic and career decision-making becomes more complex, AI-based counselling systems have been introduced to help students choose academic paths and achieve skills and career planning. These systems use student information to offer personalized advice, and conversational AI is a major contributor to the interaction counselling services [14]. Although it has developed, both ITS and

counselling systems tend to be non-integrated, interoperable and contextually aware, leading to disjointed support. This is where the necessity of powerful AI-based platforms that are able to combine academic, emotional, and career advice through one platform lies.

5. Artificial Intelligence Frameworks in Education

Intelligent tutoring, counselling, and emotional AI systems are all based on artificial AI frameworks in the current educational context. These frameworks should be understood since they define how learning platforms will gather, process and analyze data to derive forecasts, adjust to individual learners, and offer valuable feedback. **These systems facilitate personalization and automation, as well as smart decision-making within AI-based learning systems.** Learning analytics and educational data mining is one of the essential elements to consider, which is the collection and analysis of big amounts of student data to improve learning outcomes [5], [7]. By using data mining processes, AI systems can determine patterns of learning and predict students performance, enabling teachers to track their progress and implement interventions in the most appropriate time. Data mining in education is also used in the creation of adaptive learning platforms which provide a personalized educational experience [1]. Machine learning is another technology that is very crucial because it allows educational systems to respond dynamically to needs of learners. Machine learning algorithms use the past learning information in predicting future performance and prescribing suitable learning strategies. The methods used include **classification, clustering, and reinforcement** learning which are usually used to enhance the efficiency of the intelligent tutoring systems [2], [7]. Moreover, **natural language processing (NLP)** is an important part of conversational artificial intelligence in the educational sphere. NLP helps chatbots to decode student requests, comprehend natural language input, and produce appropriate replies and support automated academic help, intelligent dialogue and real-time student support [14],[5],[18].

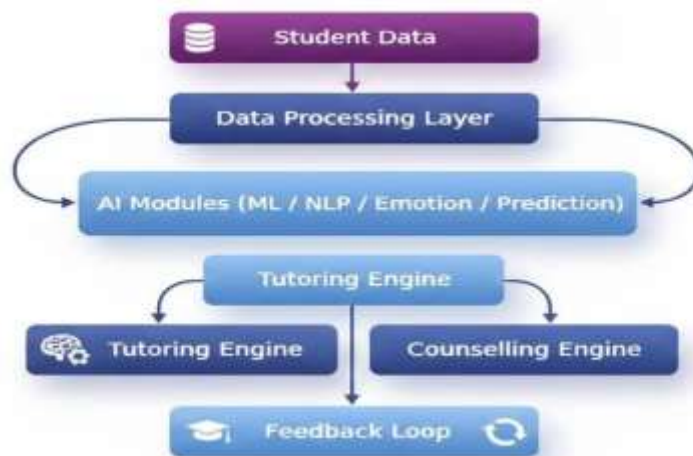


Fig 1: AI framework for intelligent Education System

6. Intelligent Tutoring Systems: A Systematic Surveillance.

Intelligent Tutoring Systems (ITS) is the **highly developed AI-driven systems that are able to mimic human tutoring by changing the instructional strategies in accordance with the performance and behaviour of the individual learners**[2]. Such systems will continuously observe patterns of learning

and provide adaptive feedback, individualized learning trajectories, and real-time performance analysis in order to improve the results of learning [9]. Predictive analytics, learner modelling, and cognitive theories are some examples of technologies that are combined in modern ITS to enhance the accuracy and efficiency of instruction (Dimovski et al., 2017).

ITS architecture often includes four principal elements, namely domain model, student model, pedagogical model, and user interface that assist in creating personalized and interactive learning experiences [5], [10]. ITS has a number of advantages, among which there are enhanced learning effectiveness, instant feedback, and the capability to obtain results that are as good as those of human tutoring [1], [2], [9]. Nevertheless, irrespective of these strengths, ITS has some limitations including the high cost of development, lack of emotional intelligence, and the difficulties in the accurate modelling of complex human learning behaviour [4], [15].



Fig 2: Intelligent Tutoring System Architecture

7. AI in learning or education Conversation AI.

Conversational AI agents, better known as chatbots, were adopted in the education system. These applications of artificial intelligence assistants use dialogue as a channel of providing support services [14], [3].

7.1 Types of Educational Chatbots

Conversational AI agents that should be utilized in the educational sector are of several types, those being:

- Rule-based chatbots
- Chatbot based on machine learning.
- Conversational agents that are hybrids.

The hybrid conversational AI agents are found to be the most appropriate type of chatbots since they combine the rule-based and adaptive learning techniques [3], [14].

7.2 The Uses of Conversational AI.

The assistance of conversational AI systems can offer the following services:

- Academic support
- Administrative support
- Student engagement
- Psychological support

AI finder systems can provide full-time support services. This will ensure that there are support services present and that the workload of the educators is reduced [16], [18].

7.3 Problems of Conversational AI.

The AI systems providing the conversation entail the following problems:

- Emotional ignorance.
- The systems are dependent on good data to train the AIs.

It needs to be conducted in further studies in order to expand the abilities of conversational AI systems to become empathetic [8], [4].

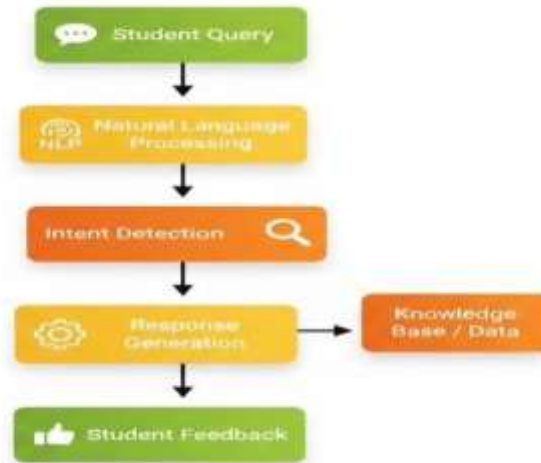


Fig 3: Conventional AI workflow in Education

8. Emotional Artificial Intelligence Learning and Counselling Systems.

Emotional Artificial Intelligence (AI) is essential in the process of improving learning as it allows the systems to recognize and react to the emotional conditions of students. Emotional AI detects levels of engagement, stress, and motivation of learners through facial expression recognition, voice sentiment analysis and behavioural analytics. Contrary to the ancient methods of basis of academic performance only, Emotional AI incorporates emotional intelligence into the learning process that enables adaptive and customized support enhancing the learning efficiency and well-being of students.

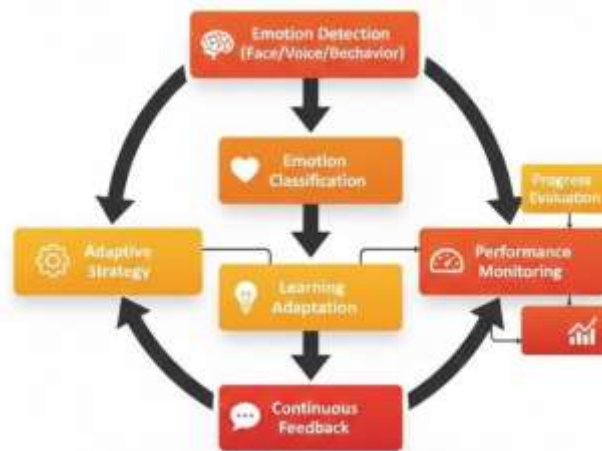


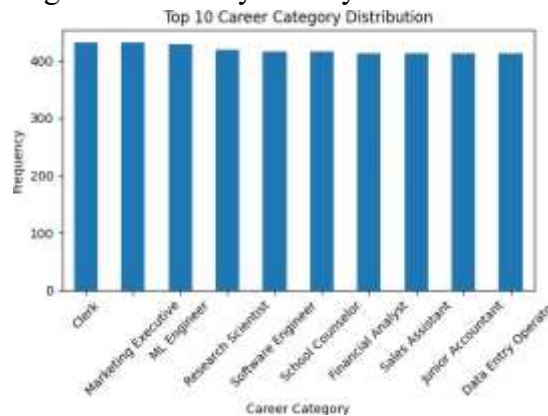
Fig 4: Emotional AI feedback loop

According to Fig. 4, the process starts with emotion detection then emotion classification which assists in knowing the state of the learner. On this, the system engages in learning adaptation and uses adaptive

strategies in order to change content and difficulty. Although Emotional AI has these benefits, data privacy, misuse of sensitive information, and psychological hazards are some of the ethical issues that Emotional AI can create, and it must be implemented safely and responsibly.

9. Artificial Intelligence-based career counselling systems.

Career counselling systems based on AI help students to make informed academic and career choices by information of academic performance, personality traits and labour market tendencies [13], [14]. The systems also make customized suggestions, minimize human influence, and even offer ongoing instructions during the learning process, particularly in institutions with a high-number of students [13]. The distribution of the career categories served by such systems is shown in Fig.



Even with their potential, AI-based counselling systems have drawbacks, including being unreceptive to the needs of a broad range of students and being emotionally insensitive [8], [15]. Most systems are based on fixed data and are not harmonized with intelligent tutoring systems providing inaccurate and partial instructions. Thus, the future systems are supposed to include the dynamic behavioural data, emotional intelligence and integrated learning models to give more precise, personal and comprehensive career guidance.

10. Comparison of Intelligent Tutoring and Counselling Systems.

AI-based counselling systems assist in decision-making in academic, career and emotional fields, whereas Intelligent Tutoring Systems (ITS) improve academic performance via adaptive learning and personalized feedback. Although ITS enhances cognitive learning, it lacks emotional intelligence whereas counselling systems are able to offer emotional and career guidance but fail to offer deep instruction support. ITS is technologically based on cognitive modelling and learning analytics, whereas counselling systems are based on natural language processing and predictive analytics. There are ways of integrating tutoring system and counselling system in order to achieve a holistic approach combining academic performance, emotional well-being and career readiness [13], [8].

Feature	Intelligent Tutoring System (ITS)	AI Counselling System
Main Purpose	Helps students improve their studies and learning	Helps students with career decisions and emotional support

Technologies Used	Learning analytics, cognitive modelling	Natural Language Processing (NLP), predictive analytics
Key Strength	Provides personalized teaching (adaptive learning)	Gives personalized career and life recommendations
Support Type	Provides instant feedback while learning	Provides continuous guidance and support
Limitation	Cannot understand emotions well	Cannot teach deeply like a tutor
Data Used	Student academic performance	Student profile + job market data

Table 1: AI counselling System Vs Intelligent Tutoring System (ITS)

11. Difficulties and Discovered Research Gaps.

Although AI-based tutoring systems and counselling systems have seen a huge improvement, there are still a number of challenges that limit the effectiveness of these systems. Among the most important issues are the privacy and security of the data, since such systems require working with great amounts of sensitive student information, which can be susceptible to abuse or unauthorized access [14]. Moreover, algorithmic bias is a serious concern, as biased datasets will result in unjust results, and explainable and transparent AI models are required [15].

The other weakness is that the available systems lack advanced emotional intelligence, and this limits their functionality in deciphering the complicated human emotions [4], [15]. The digital divide also impacts the use of AI-based educational technologies, especially in the areas with low infrastructure access [16], [17]. There are several critical issues surrounding AI-based education systems, with regard to their performance, dependability, and usability. Such difficulties are based on technical, ethical, and accessibility-related issues that should be solved to provide equitable and effective learning environments. The areas of key challenges are shown in Fig 5.



Fig.5. Major issues with AI-Based Educational Systems.

As illustrated in Fig. 5, the greatest threats are the risk of privacy of data, biased and unbiased algorithms, absence of emotional intelligence, and digital divide as well as challenges in governance. The above points demonstrate the necessity of safe data handling, open algorithms, enhanced emotional intelligence, equal availability of technology, and adequate regulatory measures [14], [16].

In **research terms**, some of the most significant gaps may be detected in the current AI-based educational systems. One of the most prominent gaps is the inability to combine tutoring and counselling system and provide fragmented support to students [1], [13]. Besides, existing systems have poor emotional flexibility and use unchanging data, which lowers precision of career forecasting. There are no explainable AI models, which is another limitation hindering transparency and user confidence [14].



Fig 6: The main gaps in the research in AI-Based Educational Systems.

In Fig. 6, we can see that the key areas of research gaps are the unimplemented systems, the absence of emotional adaptability, the inability to predict careers, and the unintelligible AI [1], [14]. These weak points underscore the importance of creating more dynamic, open, and connected AI solutions that have the potential to offer more holistic assistance to learners. To resolve these issues and research gaps, creating more reliable and ethical and integrated AI- based educational systems that can be effective in helping students academically, emotionally, and professionally is crucial.

12. Future Research Directions

12.1 Future Research Directions

Future studies in AI-based educational systems must concentrate on incorporating integrated systems into the architecture of intelligent tutoring, emotional intelligence, and career counselling to furnish comprehensive support to the students [11]. The current technologies in multi-mode emotional AI such as facial recognition, speech analysis, and behavioural data may be used to enhance emotional reasoning and adaptive learning [15], [4]. Moreover, explainable AI should be developed to make AI-driven systems more transparent, trustful, and accountable [14]. The next opportunity is real-time career analytics, in which AI applications will use dynamic labour market data and student performance to provide more precise and personal advice.

12.2 Limitations of the Study

Although this review was conducted exhaustively, there are some limitations. The research mostly relies on recent scholarly resources and might not be able to reflect industry-rooted developments in AI education. Some of the findings may become obsolete as time goes by due to the rapid development of AI technologies. Also, the study is founded on secondary data and lacks empirical support and

implementation of the system. The limitations can be mitigated in future research by designing and experimenting integrated AI-based tutoring and counselling systems in the real educational setting.

13. Conclusion

The intelligent tutoring and counselling systems are the new dawn in the education industry. Such artificial intelligence-powered systems have the potential to transform the learning process through the assistance of increased personalization, data-driven instructions, and constant support to the welfare of learners. Even though the significant improvement has been made, challenges remain significant to keep addressing, particularly in the areas of data privacy, emotional intelligence, interoperability, and the seamless collaboration of various AI components. These challenges will require collaboration between researchers, educators, policymakers, and technologists. In turn, this forces the education sector of the future to consider the development of one AI ecosystem that will assist learners of every level of their educational progress [11], [14]. All in all, this review shows the urgency of the situation concerning the need of the explanation and emotionally aware integrated AI infrastructure in the education sector. The future systems are to fill the existing gaps between the cognitive tutoring and psychological support and career planning by being fuelled by multimodal emotional analytics, clear machine learning models, and real-time student behaviour data. It is with these advancements that AI can be built out beyond the isolated application and potentially offer a collaborative support system- one that will positively impact student performance, reduce possible dropout rates, raise equity and promote student success over time.

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