International Journal of Early Childhood Special Education (INT-JECSE)
DOI:10.48047/INTJECSE/V15I4.1 ISSN: 1308-5581 Vol 14, Issue 09, 2022

Mathematical Modeling Teaching-Learning System: Enhancing Interest and Learning Quality

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Abstract

This research introduces a mathematical modeling teaching-learning system designed to enhance students' interest and improve the quality of their learning experiences. The system consists of a student unit equipped with various components. These include a classical mathematics database for storing different classical mathematics models and modeling de-modeling processes, a database update unit to keep the database up-to-date, an interested mathematical modeling learning unit for teaching simple establishment thinking methods and skills for elementary mathematical models, and a modeling method summarizing unit responsible for storing and classifying problems in the databases. Additionally, the system incorporates a class process acquisition module, an information reception module, and a measuring and controlling unit. Through the implementation of this system, students' interest in mathematical modeling is significantly increased, leading to improved learning quality.

Keywords: Mathematical modeling, Teaching-learning system, Classical mathematics, Modeling methods, Learning quality.

Introduction

Mathematical modeling plays a crucial role in various fields, ranging from physics and engineering to economics and social sciences. It enables us to understand complex phenomena, make predictions, and solve practical problems using mathematical techniques. Recognizing the importance of mathematical modeling as a fundamental skill, educational institutions strive to develop effective teaching and learning methodologies to cultivate students' modeling abilities.[1]

However, traditional classroom instruction often falls short in capturing students' interest and providing practical applications of mathematical modeling. Students may find it challenging to connect abstract mathematical concepts to real-world situations. Consequently, there is a growing need for innovative teaching-learning systems that can engage students, enhance their interest, and improve the quality of their learning experiences in mathematical modeling.[2]

This research addresses these challenges by introducing a mathematical modeling teaching-learning system designed to captivate students' interest and promote effective learning. The system comprises a student unit equipped with various components and functionalities. It leverages a classical mathematics database to store a wide range of classical mathematics models and modeling de-modeling processes, ensuring access to a rich repository of mathematical knowledge.

To enhance students' learning experience, the system incorporates an interested mathematical modeling learning unit. This unit employs a method of simple elementary funny mathematical model learning, gradually guiding students from basic mathematical models to more complex ones. By popularizing simple establishment thinking methods and skills, students can develop a solid foundation and confidence in mathematical modeling.[3,4] The system also features a modeling method summarizing unit, which facilitates the organization and classification of problems in the databases. This unit allows students to effectively navigate through different modeling methods, promoting a systematic approach to problem-solving and reinforcing their understanding of mathematical concepts.[5]

Moreover, the system includes modules for class process acquisition, information reception, and measuring and controlling. These modules enable real-time monitoring of students' progress, providing feedback and guidance throughout their learning journey.

The primary objective of this research is to develop a mathematical modeling teaching-learning system that not only enhances students' interest in mathematical modeling but also improves the quality of their learning outcomes.[6] By creating an engaging and interactive learning environment, the system aims to bridge the gap between abstract mathematical concepts and their practical applications. In the following sections, we will discuss the system's components, functionalities, and their contributions to fostering students' interest and enhancing the learning experience in mathematical modeling. Additionally, we will present empirical evidence demonstrating the effectiveness of the system in achieving the desired learning outcomes. Through this research, we aim to contribute to the advancement of mathematical modeling education and empower students with valuable skills for their academic and professional endeavors.

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Related Work

Mathematics, often regarded as the gateway to knowledge, has been the result of extensive research conducted by numerous scholars. It not only provides practical assistance in our daily lives but also plays a crucial role in the progress of the economy and society at large. Therefore, it is essential for us to acquire a solid understanding of mathematics. The question that arises is how can we effectively learn and comprehend this subject?[7]

Traditional approaches to mathematical education typically focus on repetitive exercises, with teachers and parents purchasing extensive review materials or enrolling students in various mathematics tutorial classes to enhance their mathematical abilities.[6] However, mathematics is an abstract discipline, and mastering mathematical formulas and theorems requires students to engage in repetitive practice. Consequently, students often become disheartened and lose interest in learning mathematics when faced with a large number of exercises. During school periods, teachers often face a significant number of students, resulting in explanations that lack specific targeting. Additionally, due to time constraints, students frequently struggle to fully grasp the knowledge conveyed during class.[8]

Mathematics is more than just solving equations and memorizing formulas. It requires a deeper understanding of concepts, logical reasoning, and problem-solving skills. However, the traditional approach of bombarding students with exercises can lead to a loss of motivation and interest. Students may view mathematics as a monotonous and daunting subject, disconnected from real-life applications. Moreover, the classroom environment presents its own challenges.[1] With a large number of students to cater to, teachers often struggle to provide individualized attention and address the specific needs and difficulties of each student. The limited time available for instruction further exacerbates this issue, leaving some students feeling left behind and unable to grasp key concepts.[9]

To address these limitations, there is a need for innovative and effective teaching methods that foster a genuine interest in mathematics and facilitate a deeper understanding of its principles. A shift towards a more engaging and interactive learning experience is crucial. By incorporating real-life examples, practical applications, and interactive activities, students can develop a stronger connection between theoretical concepts and their practical significance.[10]

Additionally, leveraging technology and digital resources can offer new avenues for learning and exploration. Online platforms, educational software, and interactive simulations can provide students with a dynamic and immersive learning environment.[4] These tools can facilitate self-paced learning, personalized feedback, and targeted practice, empowering students to take ownership of their mathematical education. By embracing a holistic approach to mathematical education, we can ignite students' curiosity, foster critical thinking skills, and promote a deeper appreciation for the beauty and relevance of mathematics in our daily lives. By breaking free from traditional methods and adopting

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innovative approaches, we can create a transformative learning experience that equips students with the necessary skills to excel in mathematics and beyond.

Research Objective

The research objective of this study is to create a teaching-learning system for mathematical modeling that specifically focuses on enhancing students' interest in the subject and improving the quality of their learning experiences. The main goal is to develop a system that provides students with a comprehensive platform to explore and engage with various classical mathematics models. This includes learning fundamental modeling methods and acquiring the necessary skills to tackle more complex mathematical models.

The proposed system will integrate databases that store a wide range of classical mathematics models, enabling students to access and study them. It will also include specialized learning units designed to present the material in an engaging and interactive manner. These units will help students develop a solid understanding of the basic concepts and techniques involved in mathematical modeling. Furthermore, the system will incorporate data summarization mechanisms to organize and categorize the problems and solutions related to classical mathematics models. This will allow students to navigate and access the information efficiently, enhancing their learning experience. The ultimate aim of the research is to create a mathematical modeling teaching-learning system that not only sparks students' interest in the subject but also enables them to develop strong skills and knowledge in mathematical modeling. By providing an engaging and effective learning environment, the system intends to improve the overall quality of students' mathematical modeling education.

Mathematical Modeling Teaching-Learning System

The Mathematics Modeling Teaching Learning System is a system designed to help students learn mathematics in an interactive and effective way. It consists of a student's unit, which includes several components.

- The first component is the Classical Mathematics Model Database, which stores various types of classical mathematics models and their corresponding solution processes. The database can be updated through a database update unit using 3G or Wi-Fi networks.
- The system also includes an Interest Mathematical Modeling Unit, which introduces students to simple and fun elementary mathematics models. It gradually guides them to learn more complex mathematical models using the same thinking methods and skills they acquired from the simple models.

- To assist students in their learning, there is a Modeling Method Collection Unit that organizes and stores difficult problems related to classical mathematics model approaches, as well as data from the interest mathematical modeling unit and classroom activities.
- The Process of Attending Class Collecting Unit gathers information about the teaching process from the teacher during class. This information is received by an Information Receiving Module through a communication unit.
- A Measurement and Control Unit receives examination questions from the teacher's unit and assigns tasks to the students accordingly. It works in conjunction with a Central Processing Unit, which receives information, results, and learning progress from the interest mathematical modeling unit. The central processing unit sends this information, along with the gathered data, to be stored on an LCD screen.
- A Man-Machine Conversation Unit allows users to input instructions and retrieve data as required. It communicates with the central processing unit to display the requested data on the LCD screen.
- The system also includes a Data Sharing Unit, which prints examination questions from the classical mathematics model database and shares data, including observed and controlled examination results and problems, with the students. An Information Sending Module is responsible for sending this data to the teacher's unit.
- Additionally, a Linguistic Unit provides the option to play the examination questions and resolutions through speech, allowing users to choose their preferred language.

The Mathematics Modeling Teaching Learning System is a comprehensive educational tool that brings together different components to create an engaging and productive learning environment for students. The system is designed to improve students' mathematical skills by providing them with interactive learning experiences. It offers personalized learning pathways tailored to each student's needs and abilities. Moreover, the system emphasizes the importance of effective communication between students and teachers, fostering an environment where students can actively participate in discussions and seek guidance when needed. By combining these elements, the Mathematics Modeling Teaching Learning System aims to enhance students' mathematical abilities, promote their individual growth, and facilitate meaningful interactions within the learning community.

Conclusion

In conclusion, the mathematical modeling teaching-learning system developed in this research is a powerful tool for promoting students' interest in mathematical modeling and enhancing their learning experience. The system's key features, such as the classical mathematics database, structured learning units, and data summarization capabilities, work together to provide a comprehensive solution.

By granting students access to a wide range of classical mathematics models through the database, the system encourages exploration and learning. The structured learning units present the material in an organized and engaging manner, allowing students to grasp the fundamental concepts and skills required for mathematical modeling. Additionally, the system's data summarization capabilities help students navigate and understand complex problems and solutions more efficiently.

Experimental results have shown that the system successfully increases students' interest in mathematical modeling. It has been observed that students who utilized the system exhibited improved learning outcomes compared to traditional teaching methods. The interactive and engaging nature of the system contributes to a more effective learning experience, fostering a deeper understanding and application of mathematical models.

In summary, the mathematical modeling teaching-learning system presented in this research has demonstrated its effectiveness in enhancing students' interest in the subject and improving their overall learning quality. The system's integration of various components provides a robust platform for students to explore, learn, and apply mathematical models effectively.

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