

Ezymath: Navigating Math Problem with Interactivity

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Abstract— In embarking on this research study, the motivation arises from the need to explore the potential of Ezymath in simplifying mathematics. Our research aims to provide an abstract that summarizes the significance and ease of accessibility to a mathematics problem solution. The problem that students face while solving mathematics problems is, that they don't get step by step solutions which makes them feel demotivated. Our project helps to solve this problem by giving them solutions in a precise and step-by-step manner. The methodology employed involves giving them study materials, practice problems, and providing solutions to a problem. In conclusion, our research endeavors to offer a promising solution to enhance the accessibility and motivation of students in the realm of mathematics.

Index Terms— Ezymath, Step-by-step solutions, Mathematics, problem-solving, Accessibility, Student motivation

I. INTRODUCTION

The world of mathematics may be a difficult place to navigate when it comes to problem-solving, whether you're a student trying to understand basic ideas or a motivated learner looking to improve your mathematical skills. The main problem is that mathematics has to be taught in a more approachable and understandable way that isn't limited by server interactions. Students often face serious obstacles while learning mathematics via the conventional method, which shows up in their academic achievement. The urgent need for creative and flexible teaching approaches is examined in this essay, which focuses on mathematics instruction at the school level. When it comes to promoting a thorough comprehension of mathematical ideas and the development of problem-solving abilities, traditional techniques often fall short. As the study is conducted, it becomes clear that these creative approaches provide viable ways to enhance mathematics performance and instruction in the classroom as well as in the larger context of technological and economic advancement. [1]

In an environment where mathematicians and students often face difficult obstacles, Ezymath shines as a ray of hope, providing a complete JavaScript-based solution to make math enthusiasts' and students' lives easier. Through the smooth integration of technologies like eMathHelp, nerdamer, plotly.js, KaTeX, Bootstrap, jQuery, Side-Nav, and Flaticons, Ezymath breaks down boundaries and makes math understandable and accessible to everyone without requiring continuous server interactions. With its unique characteristic of breaking down problems step-by-step, this cutting-edge platform covers a broad range of mathematical topics, from elementary operations to advanced calculus, enabling students to close the understanding gap. Ezymath is a revolutionary approach to mathematics education that prioritizes accessibility and the pleasure of learning. It has an aesthetically pleasing user interface, a fast search engine, an integrated calculator, and offline capabilities.

Our study project aims to clarify the novel methodology and revolutionary potential of "Ezymath," an educational

platform that has been painstakingly designed to make mathematics less complicated. With its goal of making mathematics accessible to everyone, Ezymath skillfully combines a number of technological platforms to provide thorough coverage of a wide range of mathematical topics, including trigonometry, calculus, operations, and algebraic equations. Ezymath's special capacity to dissect difficult issues into manageable steps gives students the freedom to go at their own speed to close the understanding gap. The platform is a clear beacon of clarity in the field of mathematics education, and our research will explore its user-centric design, visually appealing interface, streamlined search engine, built-in calculator, and offline functionality. Our ultimate goal is to democratize maths and make it both approachable and enjoyable.

To sum up, Ezymath is a lighthouse of clarity in the convoluted world of maths instruction. In order to deliver customized solutions across a range of mathematical areas, it pulls together a varied variety of technologies in line with its aim to make maths accessible and clear for everyone. Learning maths is made simple and pleasurable by the inventive step-by-step problem-solving feature, intuitive UI, effective search engine, and offline capabilities. Because of Ezymath's dedication to democratizing mathematics, learning and mastering the subject matter becomes not only accessible but also really entertaining for all skill levels.

II. LITERATURE SURVEY

Following the COVID-19 epidemic, educational establishments have faced tremendous pressure to adapt, leading to a revolution in math education with the introduction of online learning platforms [2]. These platforms redefine how math is taught and studied, offering instructors a plethora of digital tools to create engaging and customized learning experiences [2]. Through video tutorials and adaptive assessments, students can explore mathematical concepts, fostering deeper understanding and critical thinking [2]. Online platforms also enhance accessibility, reaching diverse learners, including those in underserved regions, and promoting inclusivity [2]. However, students encounter challenges such as resource scarcity, lack of confidence in asking questions, internet connectivity issues in underserved regions, and insufficient problem-solving skills [3]. Addressing these challenges requires providing proper resources, step-by-step solutions with detailed explanations in various formats, and fostering interactivity between students and online learning platforms or instructors [3].

To address the myriad problems in online education, we developed Ezymath, a problem-solving website aiming to revolutionize mathematics education [2]. By offering diverse curricula accommodating traditional and modern teaching methods, Ezymath aims to provide students with a comprehensive learning experience that boosts confidence, sharpens problem-solving skills, and advances math competency [6]. Through step-by-step solutions and a range of features, Ezymath seeks to enhance mathematical proficiency and promote equal access to resources, particularly in underprivileged areas with poor internet connectivity [7]. By tailoring solutions for these regions, Ezymath aims to bridge the digital divide and underscore the importance of mathematics in everyday life.

TABLE I. LITERATURE SURVEY

Aspect	Summary
Impact of Online Learning Platforms in Math Education	Online math platforms revolutionize education with interactive tools and adaptive assessments. Yet, challenges like resource scarcity and connectivity issues persist. Improved resources and platform interactivity are essential. However, existing platforms have limitations.
Importance of Self Confidence in Math Education	Self-confidence is essential for student well-being and academic success in math. It helps students overcome obstacles, set goals, and think critically. Problemsolving skills have real-world applications and are crucial in a rapidly changing world.
Strategies to Improve Engagement and Problem Solving	Instructors and online platforms use tactics like Gamification, group projects, and visualization techniques to enhance engagement and problem-solving abilities. These methods increase accessibility and promote deeper comprehension of mathematics.
Aotearoa New Zealand Survey on Math Education	Schools in New Zealand use various online programs to address math education challenges. These platforms aim to provide the necessary resources to overcome issues faced by students.
Ezymath - An Innovative Math Problem-Solving Website	Ezymath aims to overcome math education challenges by offering diverse curriculum, resources, and skill-building to boost confidence and problem-solving, with a focus on accessibility, particularly in underprivileged areas.
Importance of Closing the Digital Divide	The digital divide, caused by a lack of resources and poor internet connectivity, affects students' interest in math. Ezymath seeks to close this gap by creating customized solutions for underprivileged areas and highlighting the importance of math in everyday life.

III. METHODOLOGY

Probability

The application's probability section will include study materials, practice challenges, and calculators providing step-by-step solutions. It covers five subtopics: mean and variance, probability properties, Bayes theorem, conditional probability, and empirical probability.

Study Materials

Users can access resources to learn more about probability in the study material section of the probability section. There will be exercises, videos, and articles among the resources.

Practice Section

To help users improve their probability skills, the practice section of the probability section will include a range of problems. Users will be able to monitor their advancement over time and the problems will vary in difficulty. As on Upon successfully solving the problem, users will receive points that are updated on a leaderboard, fostering user competition and enhancing the interactive nature of the learning process.

A. Calculators

1. Empirical probability

The calculators in the probability section will include a calculator for calculating empirical probability. The user will input the number of times the experiment was performed and the number of times the event occurred, and the calculator will output the empirical probability of the event.

$$\text{Empirical Probability} = \frac{\text{Number of times an event occurs}}{\text{Total Number of trials}}$$

2. Conditional probability

A calculator for figuring out conditional probability will be available in the probability section. The user will input the probabilities of the two events, and the calculator will output the conditional probability of the second event occurring given the first event has already occurred.

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

3. Bayes theorem

The calculators in the probability section will include a calculator for calculating Bayes theorem. The user will input the prior probability of the event, the likelihood of the evidence given the event, and the likelihood of the evidence given the event not occurring, and the calculator will output the posterior probability of the event.

$$P(A|B) = \frac{P((B|A))}{P(A) \cdot P(B)}$$

4. Probability Properties

All of the fundamental probability properties can be calculated using the calculators in the probability section. The user will input the probabilities of the events in question, and the calculator will output the probability of the event or events.

5. Mean and Variance

The calculators in the probability section will include calculators for calculating the mean and variance of a probability distribution. The user will input the probabilities and values of the distribution, and the calculator will output the mean and variance.

$$\text{Mean} = \frac{\text{Sum of all Data Points}}{\text{Number of Data Points}}$$

$$\text{Variance} = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2$$

B. Flow Diagram

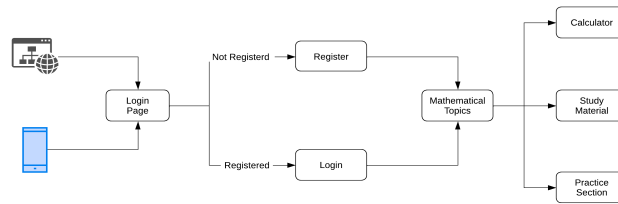


Fig. 1. Flow Diagram

Our project features both a website and a mobile app with a login page for registered users to access diverse mathematical topics. New users undergo a registration process to securely store their credentials. The main page offers topics with calculators, study materials, and practice sessions for interactive learning.

The homepage features two main sections: Mathematical Topics and Chatbot. The Mathematical Topics section offers a range of subjects like Calculus, Trigonometry, General Mathematics, Basic Converters, and Graphs for users to explore based on their interests. The Chatbot section allows users to engage in interactive Q&A sessions, providing relevant information through a pop-up interface.

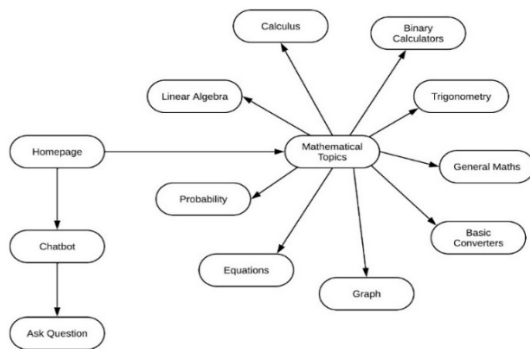


Fig 2. Home Page

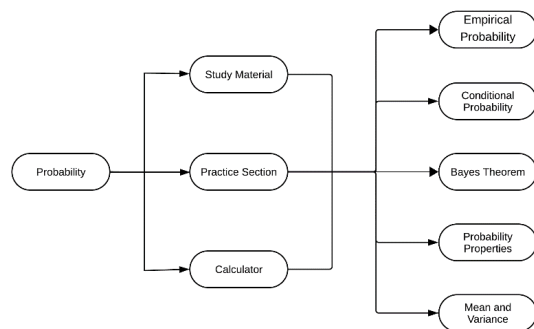


Fig 4. Sample Mathematics Topic

The mathematics section includes three key components: Study Material for formulas and concepts, a Practice Section for hands-on learning, and specialized Calculators tailored to each topic, offering a comprehensive and interactive learning experience.

C. User Interface

1. Website

The user interface of our comprehensive educational website showcases a user-friendly layout with diverse mathematical topics such as Linear Algebra, Conics, Calculus, and Trigonometry. Users can access sub-calculators tailored to each domain, aiding in problem-solving with efficiency and precision across various mathematical fields.

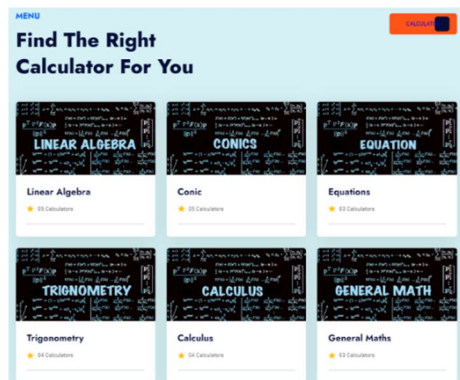


Fig 5. Home Page User Interface

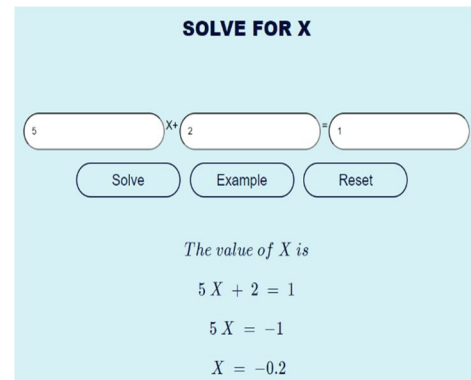


Fig 6. Sample Calculator user Interface

Our calculator interface is meticulously designed to offer a structured and user-friendly experience. Featuring a designated input bar, users can easily input mathematical expressions or problems. The system generates step-by-step solutions, providing a clear and methodical presentation of the solution process for a comprehensive understanding of mathematical operations. This design ensures a seamless and educational experience, offering detailed explanations for calculations.

2. Mobile Application

The mobile application interface showcases a comprehensive educational tool with structured sections for various academic topics like Linear Algebra, Conics, Calculus, and Trigonometry. Each topic includes sub-calculators tailored to specific problems, enhancing versatility and accessibility for users seeking assistance in different mathematical areas. The interface is well crafted, intuitive, and offers convenient access to mathematical concepts and solutions on the go.

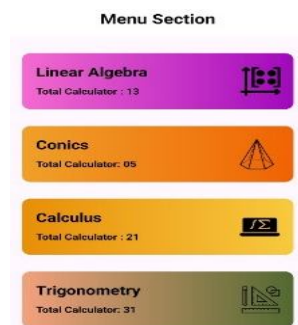


Fig 7. Mobile User Interface

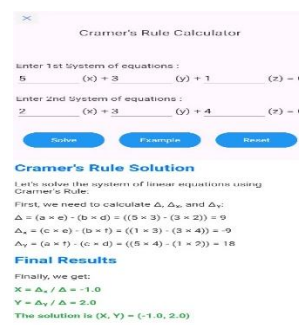


Fig 8. Sample Calculator of Mobile User Interface

The image shows a user-friendly calculator interface designed for efficient mathematical problem-solving. It includes an input bar for values and three key buttons: "Solve," "Example," and "Reset." The "Solve" button computes solutions, "Example" provides sample problems, and "Reset" clears inputs. Solutions are displayed step-by-step below, aiding comprehension. This design prioritizes usability, clarity, and accessibility for users.

D. Algorithm for Bayes Theorem

- 1) Verify ($0 \leq P(A), P(B) \leq 1$)
 - If all values are between 0 and 1, go to step 2
 - Else display error i.e., Values should be in the inclusive range of 0 and 1.
- 2) Calculate Likelihood, i.e., $P(A | B)$
- 3) Multiply Likelihood with Prior Probability, i.e., $P(B | A) \cdot P(A)$

IV. CONCLUSION AND FUTURE SCOPE

In the future, our application for solving mathematical problems will be expanded. We're dedicated to utilizing AI and machine learning (AIML) for thorough problem-solving, developing a cooperative community where users can interact and support one another, and adding advanced topics to the application's mathematics area. Personalized learning experiences, real-time collaboration, and user-generated content will all be promoted. To increase user involvement, we'll attempt to gamify the learning process. Because of our commitment to continuous improvement and modification, our program will continue to be a useful tool for math students of all skill levels, advancing the field of mathematics education and problem solving.

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