

Research Article

Discrete Math Page: Web-Based Learning Material for Discrete Mathematics

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Abstract: The traditional belief toward mathematics such as it is difficult subject, require a lot of memorizations, teacher-based learning, and disconnected from real-world applications need to be restructure because it can lead to resistance in mastering the subject. This could affect the understanding while solving mathematics problem and hence lead to worst performance towards that subject. These beliefs closely related to the traditional approaches of “drill and practice” and “chalk and talk” that commonly used. The use of technology in traditional approaches of teaching and learning mathematics are required to be incorporated to grasp the student attention. Limited engagement becomes the main problem due to the passive learning in which students expected the lecturer to solve the exercises without active participation. Hence, student-centered learning is required to give full access to student for them to promote active engagement and this approach could reduce the fear and anxiety during their learning environment. In this study, a web-based learning material is developed for Discrete Mathematics subject at the undergraduate level to utilize the arise of technology. The pages involved in the web-based are Homepage, Contact Us, Additional Reference and Feedback. By integrating technology in teaching and learning mathematics will gives the impact to the society by increasing the access to resources, improving the student and lecturer engagement, increasing the collaborative learning experiences, and preparing the students for better preparation for the digital era. The material can be commercially available in education industry in which can be further improved for mobile application that able to offer offline access to the content.

Keywords: Traditional Belief; Mathematics; Web-based; Learning Material; Engagement.



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1. INTRODUCTION

Traditional instructional approaches of “drill and practice” and “chalk and talk” are often used in learning mathematics. The “drill and practice” is method involved repetitive exercises on solving problem activities that focusing on mathematical operations and formulas. By practising the activities,

it is expected to develop the formula memorization, speed, and accuracy in calculation. The “chalk and talk” involves traditional delivering information by educators which is more likely to teacher-based learning. The student become passive just listening and taking notes. Most people expect by memorization, bundles of exercises are good mathematics teaching (Rodley & Bailey, 2021). But, by using these methods, student experience limited opportunities for active, independent learning and hence bring challenges in teaching mathematics.

Teaching Mathematics nowadays has become more challenging especially to educators such as teachers or lecturers due to the mathematics anxiety, limited problem-solving skills, technology integration and time constraints. Fear toward mathematics subject block their learning ability and hence it brings misconceptions about mathematics. Limited problem-solving skills related to the lack of critical thinking and analytical skills in solving mathematics problems. Students need to be more creative in solving the given problem independently.

Technology integration in teaching mathematics give new challenges to the educators which require them to balance up between the traditional and digital approaches. There is a study conducted by Jimenez, Campos, Soto & Parejo (2023) on the role of ICT in primary education with the teaching-learning processes of mathematics. It demonstrated that ICT improved the performance, motivation and problem solving of students. Widely available digital sources need to be utilised in a good manner so that sources could benefitted to the others. Landicho (2021) recommended that the intervention activities that involved graphing software and ICT integration gain more interest from students.

Time constraints is the worst challenge as the educators need to balance the conceptual understanding on certain topics while to ensure the students grasp the importance and steps involved in solving problem related the topics. These challenges need to be addressed by collaboration among educators such as collaborative teaching in developing content or in teaching the subject. This is important to create supportive and positive learning environment for students-centred learning.

Collaborative teaching in content development is one of the approaches to support student-centred learning which involved teachers to work together to share ideas in developing content for teaching and learning purposes. The benefits of the collaborative teaching are to enhance content quality, to share expertise, resources, materials, and lesson plan among educators.

In this study, a web-based learning material was developed as a result of collaborative teaching in content development for Discrete Mathematics subject at the undergraduate level. The developed leaning material has been successfully implemented in the classroom to support the use of technology in teaching mathematics subject. Web-based learning material is one of the powerful tools that could enhance the teaching and leaning process. Hadjerrouit (2010) proposed a user-centred approach that supports effective learning in school education. The approach was evaluated from three different perspectives: trainee teachers, school teachers, and school students.

2. METHOD & MATERIAL

The used technology has encouraged the development web-based learning tool where it increases the accessibility and flexibility and offers interactive and engaging learning experiences. Web-based learning material named as Discrete Mathematics Page was successfully developed in this study for Discrete Mathematics subject at the undergraduate level. There are 4 main pages in the web-based learning material that are Homepage, Contact Us, Additional Reference and Feedback as shown in Figure 1. The learning material can be accessed via this link: <https://sites.google.com/view/discrete-mathematics-page/home?authuser=0>.



Figure 1. Main Page of the Discrete Mathematics Page.

2.1 Architecture Design

The design of the web page is shown as in Figure 2. The navigation of the web page is flexible from one page to another.

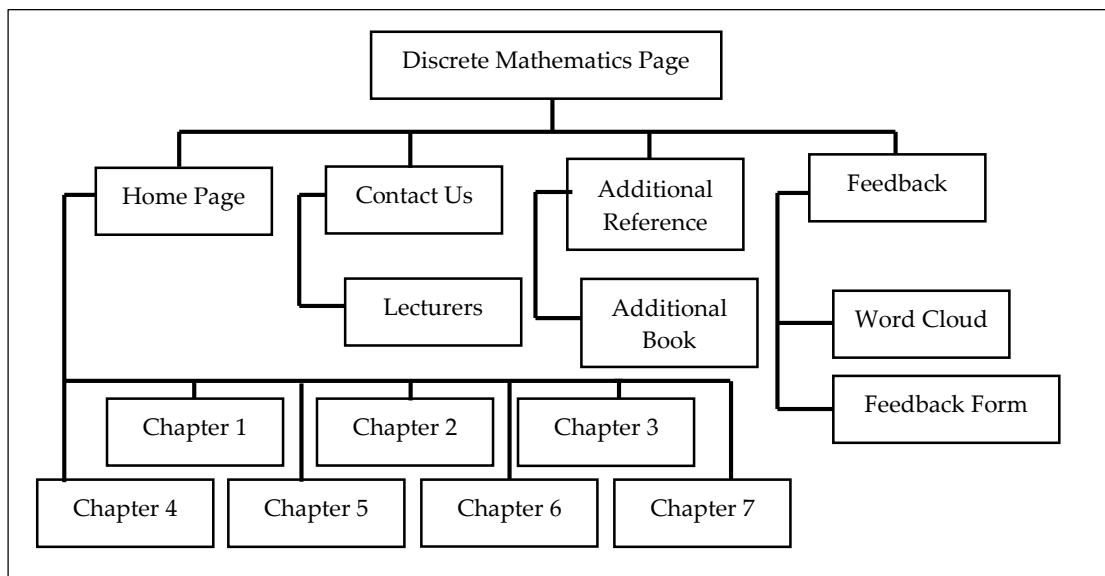


Figure 2. Architecture Design of Discrete Mathematics Page.

There are seven chapters provided in the Homepage that are Chapter 1: Fundamental Principles of counting, Chapter 2: Fundamentals of Logic, Chapter 3: Set Theory, Chapter 4: Properties of Integers: Mathematical Induction, Chapter 5: Relations and Functions, Chapter 6: An Introduction to Graph Theory and Chapter 7: Trees.

In every chapter, videos explanation on tutorial activities are served in the webpage to provide better demonstration to student as it involved text, visuals, and interaction elements. More tutorial activities are also provided at the end of the page. Student feedbacks and comments on the tutorial are also collected to value the students or users works. The findings of each design are elaborated in the next sections.

3. FINDINGS

The design of the Homepage that consists of seven chapters are shown in Figure 3. The links related to all chapters are provided in this page where users able to navigate from one chapter to another chapter in flexible way.



Figure 3. Home page with seven chapters.

The second page is Contact Us as shown in Figure 4. This page presents the lecturers involved in developing the content via collaborative teaching activity.

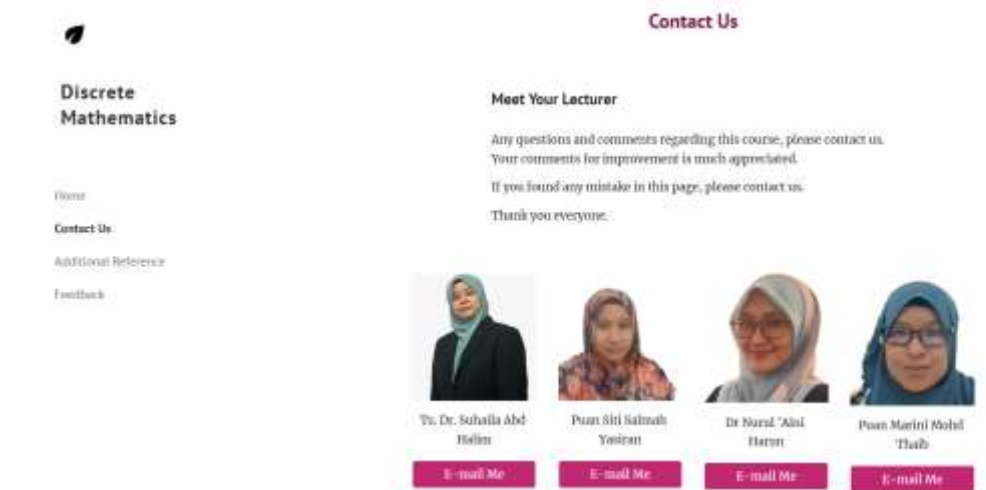


Figure 4. Contact Us page.

The third page is Additional Reference as shown in Figure 5. This page shares the additional book that offers to students as their additional activities.



Figure 5. Additional Reference Page.

The last page shows the feedback in the form of word cloud by students. Word cloud provides data visualization that allows others to identify the results related. The result of word cloud related student feedback on the development of the Discrete Mathematics page is as in Figure 6.



Figure 6. Word Cloud on Student Feedback.

According to Kalmukov (2021), word cloud presented information that could support the decision making.

4. DISCUSSION

The student perception is measure through the results of word cloud. It shows that most of the students agreed that the usability of the web page is useful and helpful for their learning Discrete Mathematics subject. In addition, the page is also interactive that benefitted them in learning that subject too. But, there is also negative comments of hard and complicated while finding information in the web page.

5. CONCLUSION

This study proposed a student-centred learning material named as Discrete Mathematics Page was successfully developed for Discrete Mathematics subject at the undergraduate level. Based on student feedback on the development of the web-based material, it shows positive feedback and be further improved by adding more videos and tutorials related to the chapters. Besides that, more interactive games can be embedded in order to engage student attentions and motivates them with the web page in longer time.

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