i-Kitab: An Interactive Textbooks Platform

[1]Kanupriya Ishu, [2]Gayatri Bangar, [3]Jigar Chawda, [4]Vaishali Khairnar

Department of Information Technology, TEC, University of Mumbai, Mumbai, India

[1] kanupriyaishu@ternaengg.ac.in, [2] gayatribangar@ternaengg.ac.in,
[3] jigarchawda@ternaengg.ac.in, [4] vaishalikhairnar@ternaengg.ac.in

Abstract

Use of digital mode for learning has proliferated significantly in past few years. However, digital learning is not as effective as interactive learning, since it is one way unlike the later which engages user for better experience and improved learning process. Interactive textbooks are one of the most popular tools used for interactive learning, they are easy to use and highly engaging. There are many platforms available on the internet that contain a plethora of interactive textbooks, however there are meagre platforms that let user create and share interactives textbooks. Therefore, the proposed system enables user to create and share interactive textbooks with other users. Users will be able to experience immersive learning by using these interactive textbooks and learning can become interesting experience in and of itself as a result of the interactive aspect.

Keywords. Interactive learning, Interactive textbook, Online learning, Book creator, Online textbook

1. INTRODUCTION

Nowadays, due to the rise in technology, traditional learning methods incorporate some sort of digital learning methods to achieve better understanding of concepts. Digital learning is the type of learning that involves the use of technology which is supposed to make the learning process more personalized and effective. However, to make learning experience more engaging and enriching, interactive elements should be incorporated in the existing digital learning methods. Interactive learning is the type of learning that actively involves the student in the learning process. Interactive textbooks are one of the best ways of incorporating interactive learning into students' curriculum.

An interactive textbook is a digital version of a textbook that includes interactive components. After all, when it comes to online learning, becoming digital isn't enough. It is remarkably convenient because it is equivalent of having both your study materials and visual elements under one roof. Various computer programming courses, and science courses can be made immensely easy to learn using interactive platforms. Many interactive learning platforms available do not provide user the freedom of creating their own textbooks as per their needs. While designing this website, one of the most important factors was to let user create their own textbooks and share them with others. The user can create textbooks without having to pay subscription fee. For the textbook creation purpose, an editor with many interactive functionalities was developed.

2. LITERATURE SURVEY

Smith et al. [1] provided comprehensive research on student's involvement using interactive computer textbooks. They created an interactive textbook based on Jupyter-notebook for the students who have newly enrolled for computer-related courses. There were three levels of engagement, change frequency, reading time, and response frequency. Change frequency refers to the number of times new cells were created by the students apart from solving the given problems. Reading time refers to the time the notebook was kept open in the browser. Response frequency is the number of times the cells consisting of given code were executed. The response frequency and change frequency were the key parameters in determining the active interaction. The major findings of the study were, the reading time spent on the textbook does not completely relate to the active interaction and active interaction was more efficacious than reading time in determining students' progress. The main aim of Weng et al [2] was to scrutinize the interactive online textbooks' impact on the methods of active learning, performance and cognitive load of students of 7th grade. The class was divided into two groups consisting of an equal number of candidates. Each group was handed a static PDF e-textbook and an interactive e-textbook. The interactive e-textbook group outperformed the static PDF e-textbook group in terms of cognitive and affective learning, as well as willingness to use an online textbook. However, the static PDF e-textbook group outperformed the interactive e-textbook group on the final exam. The findings also revealed that neither group's cognitive load differed considerably. D. Bikowski and J. Casal [3] conducted research among 13 students of a large U.S. University to explore their engagement towards interactive digital textbooks. An iBook was used for this study which acted as the digital textbook. The study employed a phased analysis design. All participants took an expected involvement survey during Phase I (Weeks 1–2), and six took part in the first round of TAP. Students' reflective journals and training in Phase II (Weeks 3–10) were informed by this information. The survey of actual participation, the final TAP, and member checking was all part of Phase III (Weeks 11–15). Students were mostly pleased with the interactive textbook and strongly suggested that it should be included in future classes. This interaction helped students stay motivated during training and gave them more time with the digital textbook to learn new techniques and processes, as well as decide which current strategies should be transferred or changed for this setting. A. Edgcomb et al. [4] researched whether incorporating an interactive textbook into preliminary STEM classes would help students increase their grades. The interactive textbook was characterized as having significantly lesser text in comparison to a traditional textbook, as well as various integrated problem, sets built for learning rather than quizzing, as well as multiple illustrations of core ideas and built-in tools. The University of California at Davis, the University of Michigan, and the University of Arizona all offered four preliminary computer programming courses: MATLAB, C++, and C/C++ respectively. Two-course offerings, one with a traditional textbook or static online tools and the other with an interactive textbook, were compared. Final course grades as well as results on individual course pieces were examined. From static to an interactive textbook, course grades increased by 0.28 points on a scale of 0-4 points for all 1,945 students. More notably, students in the course's lowest quartile gained 0.38 points. From static to interactive textbooks, exam scores increased by 13.6 per cent and project scores by 7.4 percent. The interactive textbook was subscribed to by 98 percent of the students, and they completed a few of the activities on it. An average student

accomplished about 87 percent of the assigned tasks in the specified interactive textbook. Chen [5] briefed about the effects in engagement, implications and features of visual representation in different science textbook formats. He compared conventional, digitized and interactive science textbooks based on the visuals present in them and corroborated that the digitized and interactive textbooks have many more emerging features that can be beneficial in engaging students and expanding their comprehension, investigation and analysis of content-related queries. B. Nansen et al. [6] did a detailed study Mathletics, an online application for learning mathematics interactively. The results are based on an ethnographic study of children's technology usage in Melbourne, Australia. They analysed the governance, commerce, and experience of children using Mathletics, as well as the growing opportunities and difficulties that have emerged as a result of the use of online apps for education and learning. According to the findings, websites provide different modes of learning, including intuitive, enjoyable, and temporary methods of appropriating online applications, for instance modes of play, or counter-play. Such collaborations make use of technology to achieve alternative and collaborative solutions. The study also underscores the importance of using conceptual and theoretical methodologies to evaluate digital education critically, taking into account the software's performance as well as the material's potential and the ways in which children's digital learning, play, and culture are influenced by the relationships they develop with and through software. R. Spencer et al. [7] looked into the effects of Top Hat on student experience, especially belonging, commitment, and self-confidence. To find out how students felt about using Top Hat, a convergent parallel mixed methods system was employed by the researchers. Engagement, and Self-Confidence Scale, Demographic surveys, the Student Belongingness, the Autonomous Learning Scale, and sub-scales associated more directly to the Top Hat’s usage were used to gather quantitative results. The results show that students' experiences with digital media technologies in the classroom are varied. Top Hat was seen as encouraging as well as hampering students' ability to communicate with one another, the professors, and the course content. Top Hat technology brings students closer together through interactivity, simplicity, and connectivity, but by limiting human interaction, it also alienates them from course teachers and peers.

3. RELATED WORK

Table 1. Performance Analysis of Existing and Related Applications

WEBSITE	TECHNOLOGIES USED	ADVANTAGES	DISADVANTAGES
Mathletics [11]	○ Javascipt Libraries: Isotope, Lightbox, jQuery, Modernizr ○ Programming Language: PHP ○ UI frameworks: Bootstrap ○ Databases: MySQL ○ SEO: YoastSEO	○ Students are interested in learning and are encouraged to do so. ○ Mathletics is adaptive, it responds to the child's individual strengths and weaknesses. ○ Students instinctively know whether they are on the correct track and can proceed at their own speed through the program.	○ Students responses aren't adaptive to questions which are rote

Tophat [12]	○ PaaS: WP Engine, AWS ○ Javascipt Libraries: jQuery, Slick ○ Programming Language: PHP ○ Databases: MySQL ○ SEO: YoastSEO	○ It tracks participation in the classroom ○ Task automation ○ Improved student assessment. ○ Better student engagement	○ The format of the grade book needs to be improved. ○ Website Charges a lot.
PathFinder [8]	○ CMS: Wordpress ○ CDN: Cloudflare ○ Database: MySQL ○ Programming language: PHP ○ Analytics: Facebook Pixel, Google Analytics ○ Tage manager: Google tag manager ○ Video Player: Plyr. Youtube ○ UI framework: animate.css, Bootstrap ○ Front scripts: Google front API, font awesome, Twitter Emoji ○ Security: reCAPTCHA	○ User friendly ○ Platform Independent ○ Job opportunities (as the name of website) ○ Emergency contact	○ The main focus is on academic books and marks. ○ Target audience is exclusively students appearing for entrance exams.
Mathigon [9]	○ Analytics: Cloudflare Browser Insights, Google Analytics ○ Font scripts: Google Font API ○ Video players: Youtube ○ CDN: Google cloud, cloudflare	○ User friendly ○ Platform Independent ○ Paid version is not necessary	○ The lack of a teacher dashboard and a limited course catalogue
Brilliant [10]	○ Analytics: Facebook pixel, Quantcast measure, Profitwell, google analytics ○ Javascripts framework: Vue.js ○ CDN: Cloudflare ○ Cookie: Quantcast choice ○ Miscellaneous: webpack ○ Widgets: Facebook	○ Users can experience endless entertainment while watching, solving interactively. ○ Clean and elegant user interface. ○ Light colours are used in the interface as more focus is on contents on the website.	○ Only STEM subjects are covered. ○ The monthly payment plan is pricey.

After scrutinizing various platforms, it was clear that many applications provided users to browse and use interactive textbooks to a certain limit, after crossing the limit users are compelled to take up subscription by paying a certain fee. Also, there were a handful of free platforms that let user to create their own textbooks. Keeping in mind, all of the above reasons we developed a platform where users can create as well as share interactive textbooks for free.

4. METHODOLOGY

As compared to the existing system, for some websites the process of content creation and teacher approval takes an intensive amount of time, which results in less material availability, and for some websites only textbooks from the author are available to users.

We are proposing a web application where anyone can create an interactive textbook or learning material and share it with others. The block diagram of the system is shown in Figure 1.

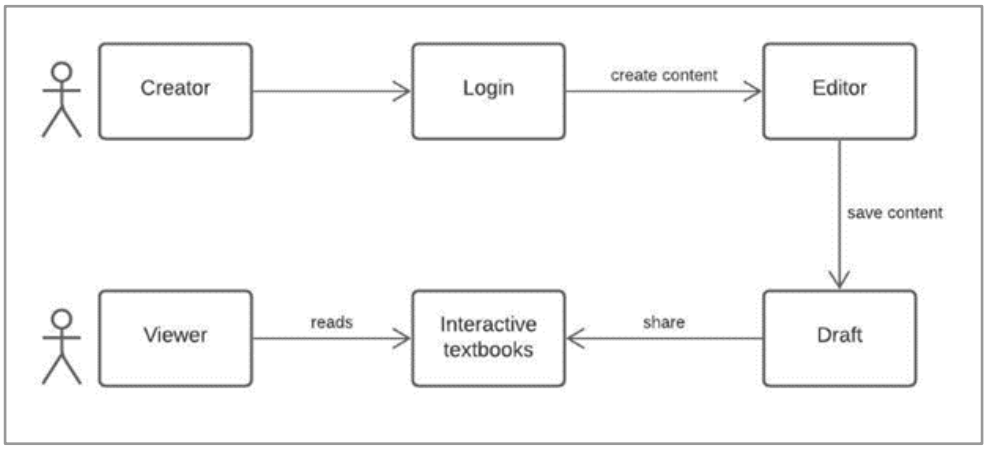

Figure 1. Systems block diagram.

There are following parts in our system:

- Creator: The creator is the person who will create the interactive textbook. They will be able to the content of their choice which will be interactive for the viewers.
- Login: Create will have to create an account on the website. They have to login to start editing the interactive textbook.
- Editor: An editor will be provided on the website where the creator will edit the interactive textbook. The editor will contain different functionalities to make the textbook interactive.
- Draft: Creator can save their work and come to edit it later by logging in to the website.
- Interactive Textbooks: After the creator finishes with the editing they will publish the interactive textbook and share it with the public.
- Viewer: Anyone can view the interactive textbooks without logging in after it is being shared by the creator.

Creating a web application that users will find useful and usable is challenging, and to avoid wasting time on flawed ideas, programmers should be involved early in the process. In order to get a glimpse of the final product early in the development process, low fidelity [13] and high fidelity mock-ups [14] are viable strategies.

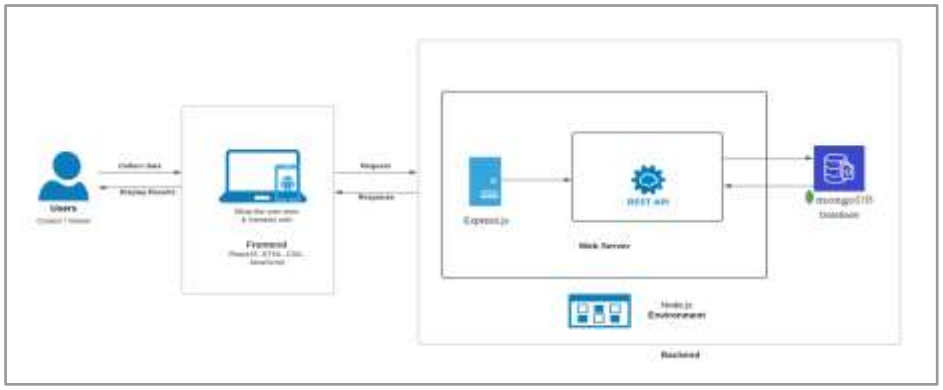

Figure 2. Web Application Architecture.

5. RESULTS

The use of interactive textbooks can bring a revolutionary change in education. This analysis of various systems reveals that interactive textbook significantly improves the performance of the user in the subject. When compared to traditional textbooks, it helps the user learn the contents better and retain them for a longer period.

Figure 3. Home Page: This is the Home page that shows an overview of the website as well as shows how to use the website.

Figure 4. Login Page: This is the login page that lets the user to login the website.

Figure 5. Register Page: This a registration page for the website which lets the user to register as a creator or a viewer.

Figure 6. Account Information page: Account information page displays the information of user like their Username, Email address, Profile Picture and Password.

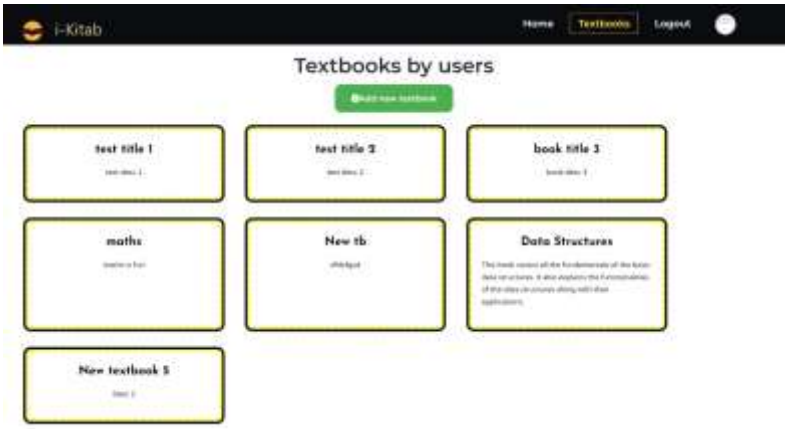

Figure 7. Textbook Page: This page shows the textbooks uploaded by the users.

Figure 8. Individual Textbook: This page gives a brief overview of the textbook

Figure 9. Create Page: This page is essentially an editor which lets the user create interactive textbooks using different elements provided.

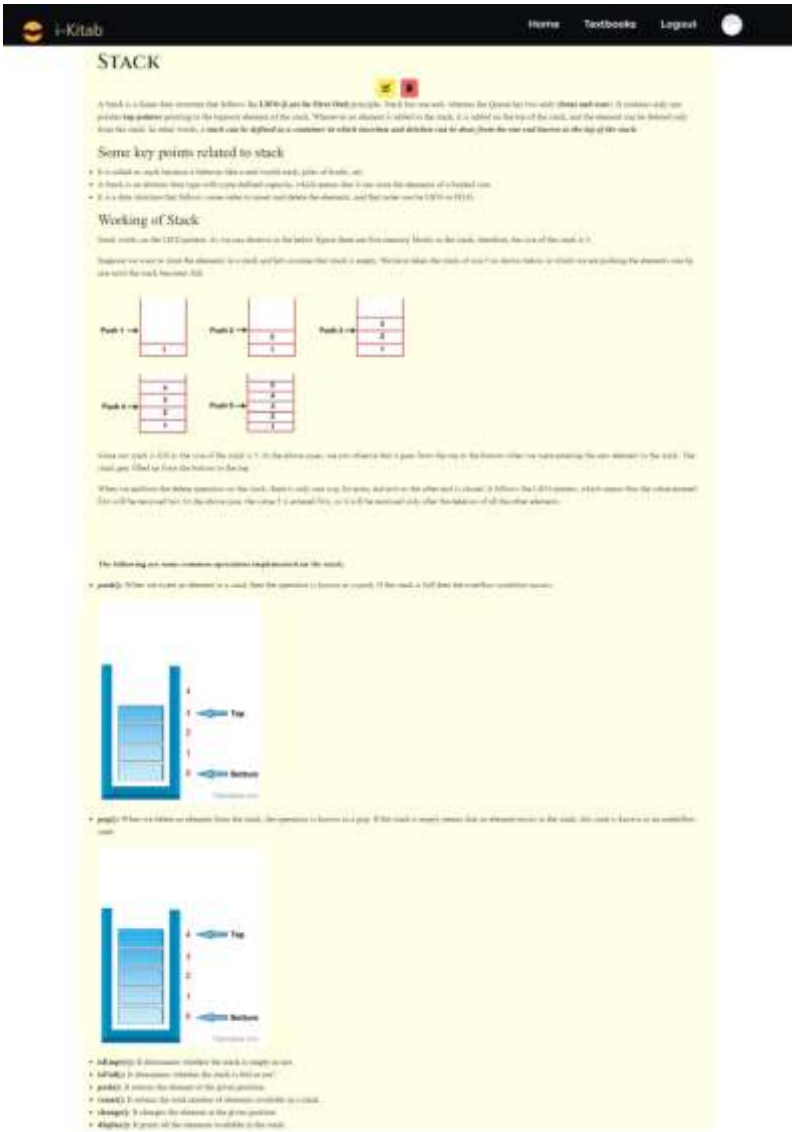

Figure 10. Individual Lesson: This an example of a user textbook.

6. CONCLUSION

Use of interactive textbooks can bring a revolutionary change in education. Through the analysis of various systems, it can be concluded that interactive textbook significantly improves the performance of the user in the subject. When compared to traditional textbooks, it helps the user learn the contents better and retain them for a longer period. The proposed system successfully allows users to not only create interactive textbooks but also share them with other users. Some of the improvements that can be added in future are, quizzes at the end of every lesson, a chatbot can be integrated for better user interaction, and

a few more interactive components can be added to the editor to make the textbooks even more interactive.

REFERENCES

[1] D. Smith, Q. Hao, C. Hundhausen, F. Jagodzinski, J. Myers-Dean and K. Jaeger, "Towards Modeling Student Engagement with Interactive Computing Textbooks", Proceedings of the 52nd ACM Technical Symposium on Computer Science Education, 2021. Available: 10.1145/3408877.3432361.

[2] C. Weng, S. Otanga, A. Weng and J. Cox, "Effects of interactivity in E-textbooks on 7th graders science learning and cognitive load", Computers & Education, vol. 120, pp. 172-184, 2018. Available: 10.1016/j.compedu.2018.02.008.

[3] D. Bikowski and E. Casal, "Interactive digital textbooks and engagement: A learning strategies framework", Dx.doi.org, 2021. [Online]. Available: http://dx.doi.org/10125/44584.

[4] A. Edgcomb, F. Vahid, R. Lysecky, A. Knoesen, R. Amirtharajah and M. Dorf, "Student Performance Improvement using Interactive Textbooks: A Three-University Cross-Semester Analysis", Static.cs.ucr.edu, 2021. [Online]. Available: http://static.cs.ucr.edu/store/techreports/UCR-CSE-2014-10030.pdf.

[5] X. Chen, "A comparative study of visual representations in conventional, digitized and interactive high school science textbooks", Journal of Visual Literacy, vol. 36, no. 2, pp. 104-122, 2017. Available: 10.1080/1051144x.2017.1386388.

[6] B. Nansen, K. Chakraborty, L. Gibbs, F. Vetere and C. MacDougall, "'You do the math': Mathletics and the play of online learning", New Media & Society, vol. 14, no. 7, pp. 1216-1235, 2012. Available: 10.1177/1461444812442926.

[7] R. Spencer, J. Sinno, K. Hatfield, M. Biderman, N. Doria and M. Numer, "Exploring Top Hat's Impact on Undergraduate Students' Belongingness, Engagement, and Self-Confidence: A Mixed Methods Study", Journal of Research on Technology in Education, vol. 52, no. 2, pp. 197-215, 2020. Available: 10.1080/15391523.2020.1722977.

[8] "Pathfinder – JEE, NEET-UG, WBJEE, KVPY Exam Training Institute", Pathfinder.edu.in, 2021. [Online]. Available: https://pathfinder.edu.in/.

[9] "Mathigon – Textbook of the Future", Mathigon, 2021. [Online]. Available: https://mathigon.org/.

[10] "Brilliant | Learn to think", Brilliant.org, 2021. [Online]. Available: https://brilliant.org/.

[11] "Mathletics India | Empowering Mathematics Learning Online", Mathletics India, 2021. [Online]. Available: https://www.mathletics.com/in/.

[12] "The Active Learning Platform for Online, In-Person and Blended Courses | Top Hat", Top Hat, 2021. [Online]. Available: https://tophat.com/

[13] Ishu, K., Bangar, G. & Chawda, J., Lo-fi Mockup. Google Docs. Available at: https://bit.ly/3pMpoMx.

[14] Ishu, K., Bangar, G. & Chawda, J., Hi-fi Mockup. Google Docs. Available at: https://bit.ly/3tuM8kY.

Biographies

Kanupriya Ishu is a final year student of Terna Engineering College pursuing bachelor's degree in information technology. Her research area includes interactive systems and Internet of Things. She has been serving as an author for many highly-respected journals.

Gayatri Bangar is a final year student of Terna Engineering College pursuing bachelor's degree in information technology. Her research area includes interactive systems, machine learning, deep learning and Internet of Things. She has been serving as an author for many highly-respected journals.

Jigar Chawda is a final year student of Terna Engineering College pursuing bachelor's degree in information technology. His research area includes interactive systems.

Vaishali Khairnar received the bachelor's degree in computer engineering from North Maharashtra University in 1997, the master's degree in information technology from Mumbai University in 2006, and the philosophy of doctorate degree in Vehicular ad hoc networks from Nirma Institue of Technology in 2015, respectively. She is currently working as Head of Department at the Department of Information Technology, Terna Engineeing College. Her research areas include interactive systems, machine learning, deep learning and Internet of Things. She has been serving as an author for many highly-respected journals.