

A study on teacher and student satisfaction with the content design of digital textbooks in junior high school mathematics

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Abstract. Amidst the growing adoption of digital textbooks in educational settings, this study delves into the satisfaction levels of both teachers and students regarding the content design of digital textbooks in junior high school mathematics. Utilizing a quantitative survey approach, data were gathered from 231 mathematics teachers and 100 students in junior high schools. The research findings indicate that a significant majority of both teachers (90%) and students (82%) express satisfaction with the digital textbooks, signaling their effectiveness in enhancing the learning experience. Teachers particularly appreciate the interactivity and content customization capabilities, which they find valuable for tailoring lessons to meet individual student needs. Students, on the other hand, highlight the engaging multimedia features and the flexibility for self-paced learning, which enhance their motivation and comprehension. Nonetheless, some concerns were noted, including technical issues and the need for better integration with traditional teaching methods. Overall, the results underscore the potential benefits of digital textbooks in enriching mathematics education and promoting student engagement, while also pointing to areas for improvement to ensure seamless and effective use in the classroom.

1 Introduction

In the digital era, digital textbooks have emerged as a promising tool in education, offering interactive, multimedia features and customizable content [1, 2]. However, satisfaction levels of teachers and students regarding the content design of digital textbooks in junior high school mathematics remain understudied [3]. Previous research has reported mixed results on their effectiveness [4, 5], with challenges including integration into teaching practices, overwhelming students, and balancing engaging material with clarity [7, 8]. This study investigates teacher and student satisfaction with digital textbook content design in junior high school mathematics, aiming to identify strengths and weaknesses and provide insights for future improvements [9, 10]. Strategies to enhance content design

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include multimedia elements, interactive quizzes, and adaptive learning pathways [11, 12], aligning with trends towards personalized, adaptive, and collaborative learning experiences [13].

2 Method

This section describes the methodology employed in the study to examine teacher and student satisfaction with the content design of digital textbooks in junior high school mathematics. The research utilized a quantitative approach, primarily relying on questionnaires to collect data from both teachers and students.

2.1 Research participants

The research participants in this study comprised junior high school mathematics teachers and students who had experience using digital textbooks. The teachers were selected from various schools in Guangdong Province, China, to ensure a broad representation of teaching practices and educational contexts. A total of 231 teachers completed the questionnaire, providing valuable insights into their experiences and perceptions of the content design of digital textbooks. Additionally, 100 students from the same region participated, allowing for a comparative analysis of teacher and student perspectives.

2.2 Data collection methods and tools

Data collection for this study was conducted primarily through questionnaires, specifically designed to gather information on teacher and student satisfaction with the content design of digital textbooks in junior high school mathematics. The questionnaires were developed based on relevant literature and educational theories, ensuring their validity and reliability.

2.2.1 Teacher Questionnaire:

Content: The teacher questionnaire includes demographic information, opinions on content organization, availability of digital features, and overall satisfaction. **Questionnaire source:** The questionnaire belongs to self compiled literature. In order to ensure its reliability and validity, we went through two rounds of Delphi method before formal distribution. After obtaining expert approval, we conducted pretesting and finally officially distributed it.

Reliability and Validity: The questionnaire was pilot-tested with a sample of 30 teachers to ensure clarity and internal consistency (Cronbach's $\alpha = 0.968$).

2.2.2 Student questionnaire:

Content: The student questionnaire focused on demographic information, understanding of content, engagement with digital features, and satisfaction with the learning experience.

Source: The questionnaire was based on student feedback instruments used in previous educational technology studies [14].

Reliability and Validity: The questionnaire was pilot-tested with a sample of 20 students to ensure clarity and internal consistency (Cronbach's $\alpha = 0.946$).

2.3 Data analysis

Data analysis was conducted using SPSS statistical software to ensure rigorous and systematic evaluation of the collected data. The following steps were taken to analyze the data:

Data Cleaning: Initial data cleaning involved checking for completeness, consistency, and outliers. Incomplete or inconsistently answered questionnaires were excluded from further analysis.

Descriptive Statistics: Descriptive statistics were computed to summarize the basic characteristics of the sample and the responses to the questionnaire items. This included means, standard deviations, frequencies, and percentages.

Inferential Statistics: Inferential statistics were employed to test hypotheses and explore relationships between variables. Specifically, t-tests and ANOVA were used to compare differences in satisfaction levels between teachers and students, as well as across different demographic groups.

Content Analysis: For open-ended questions, content analysis was conducted to identify themes and patterns in the responses. This involved coding the responses, grouping them into themes, and quantifying the frequency of each theme.

3 Results

This section presents the results of the questionnaire survey on teacher and student satisfaction with the content design of digital textbooks in junior high school mathematics.

3.1 Impact of digital textbook content design on students' mathematics learning satisfaction

The study examined how the content design of digital textbooks affects students' satisfaction with their mathematics learning. The results revealed several key findings that shed light on this relationship.

First, the students' survey responses indicated that the clarity and organization of content within the digital textbooks significantly influenced their learning satisfaction. As reported in Table 20, 62% of the students agreed or strongly agreed that the chapter divisions in the digital textbooks were clear and helped them understand and master the knowledge. This finding aligns with prior research suggesting that well-structured and logically organized content enhances students' learning experience and outcomes [15].

Table 1. Partial descriptive analysis of teachers.

Descriptive Statistics							
	N	Minimum	Maximum	Mean	Standard Error	Standard Deviation	Variance
Q3	102	3	5	4.29	068	683	467
Q4	102	2	5	4.14	076	771	595
Q5	102	2	5	4.17	085	857	734
Q6	102	2	5	4.15	079	801	642
Q7	102	1	5	2.19	115	1.158	1.341
Q8	102	1	5	4.08	087	875	766
Q9	102	2	5	4.15	084	849	721
Q10	102	2	5	4.05	083	837	701
Q11	102	2	5	4.11	080	807	652
Q12	102	2	5	4.15	081	813	661
Q13	102	2	5	4.08	088	886	786

Q14	102	1	5	4.05	091	916	839
Q15	102	2	5	4.22	081	816	666
Number of Valid Cases (in Row)	102						

Second, the inclusion of multimedia elements and interactive features in the digital textbooks was also positively associated with students' satisfaction. Students commented that the use of images, videos, and animations made the mathematical concepts more engaging and easier to comprehend. This observation is consistent with studies emphasizing the importance of interactive and multimedia-rich learning materials in enhancing students' motivation and learning effectiveness [16].

Third, the difficulty level of the content played a crucial role in students' satisfaction. Many students felt that the digital textbook content was not appropriately challenging, with only 14% agreeing that the content reduced their learning pressure. This indicates that there is a need to balance the difficulty level to ensure it is neither too easy nor too challenging, thereby promoting students' satisfaction and learning achievements.

3.2 Teachers' satisfaction with digital textbook content design and its impact on teaching practice

The study also investigated how teachers' satisfaction with the content design of digital textbooks influences their teaching practice. The results demonstrate a strong correlation between teachers' satisfaction and their teaching effectiveness.

Teachers' satisfaction with the content design of digital textbooks was found to influence their teaching practices in multiple ways. A total of 91% (n=210) of teachers surveyed indicated that the user-friendly interface and ease of navigation in digital textbooks saved them considerable time in lesson preparation. This finding is consistent with the research who noted that digital resources that are easy to use can reduce teachers' workload and allow them to focus more on teaching.

Moreover, 85% (n=196) of teachers reported that the integration of multimedia resources in digital textbooks enabled them to adopt more diverse teaching methods, such as blended learning and flipped classroom models. These innovative teaching approaches were perceived to enhance student engagement and learning outcomes. These results echo the findings, who emphasized the importance of digital resources in facilitating innovative teaching practices.

Lastly, 79% (n=182) of teachers expressed that the real-time feedback and assessment tools in digital textbooks helped them monitor student progress and provide timely support. This feature was particularly valued by teachers who taught larger classes or had limited one-on-one interaction time with students.

Table 2. Partial descriptive analysis of students.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Standard Deviation
Q6	231	2	5	4.51	703
Q7	231	1	5	4.34	775
Q8	231	1	5	4.19	860
Q9	231	1	5	4.21	825

Q10	231	1	5	4.21	855
Q11	231	1	5	4.25	843
Q12	231	1	5	4.29	806
Q13	231	1	5	4.23	858
Q14	231	1	5	4.32	781
Q15	231	1	5	4.37	774
Q16	231	1	5	4.32	830
Q17	231	1	5	4.39	799
Number of Valid Cases (in Row)	231				

4 Discussion

The results of this study indicate that the digital textbook content design significantly influences students' satisfaction with their mathematics learning experiences. Specifically, the use of interactive elements, such as visualizations and simulations, enhanced students' engagement and understanding of complex mathematical concepts. This finding is consistent with previous research highlighting the importance of interactive digital materials in fostering student interest and motivation [17, 18].

One possible explanation for this finding is that interactive digital textbooks provide a more dynamic and personalized learning environment, catering to different learning styles and paces. By allowing students to actively explore and manipulate mathematical concepts, these textbooks transform passive learning into an engaging and interactive process. Additionally, the immediate feedback provided by digital interactions helps students to self-correct and deepen their understanding, thereby increasing their satisfaction with the learning experience.

The study found teachers' satisfaction with digital textbook content design positively influences their teaching practices, facilitating effective integration into lesson plans and classroom activities. Enhanced resources and support reduced workload, enabling student-centered teaching, underscoring the importance of teacher buy-in for successful implementation.

5 Conclusion

This study highlights the impact of digital textbook content design on math learning satisfaction and teaching practices, suggesting potential for engagement and personalization. Limitations include small, single-institution sample. Future research should expand samples and investigate long-term impacts. User-centered design and educator support are crucial for enhancing math education quality.

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