

Design and Development of Visual Novel-Based Educational Game to Enhance Computer Basics Understanding for High School Students

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Abstract

This study was intended to design and determine the effectiveness of a visual novel-based educational game in enhancing the understanding of basic computer subjects for high school students. The research used the ADDIE model as its development framework, which stands for Analysis, Design, Development, Implementation, and Evaluation. The analysis phase revealed that students were having difficulty understanding concepts about computers because conventional lecture-based teaching methods were being used. The visual novel game was designed by combining narrative storylines with illustrations, interactive quizzes, and decision-making elements to engage students in learning activities. Media and material experts validated the product with feasibility scores of 90% and 88%, both categorized as highly feasible. Implementation involved 26 tenth-grade students who completed pretest and posttest assessments; results indicated significant learning improvement with average scores increasing from 5.81 (41.5%) to 10.77 (76.9%), producing an N-Gain value of 0.61 (medium category). Student response questionnaires indicated high acceptance with an overall score of 87.58%—particularly in game usefulness at 94.23% and learning experience at 91.35%. This proves that visual novel-based educational games can improve student understanding, motivation, and engagement in learning basic computers as an alternative to conventional teaching methods in ICT education.

Keywords: Educational Games; Visual Novels; Interactive Learning; Computer Basics; ICT; ADDIE Model.

Abstrak

Penelitian ini bertujuan untuk merancang dan menentukan efektivitas permainan edukatif berbasis novel visual dalam meningkatkan pemahaman mata pelajaran komputer dasar bagi siswa SMA. Penelitian ini menggunakan model ADDIE sebagai kerangka pengembangannya, yang merupakan singkatan dari Analisis, Desain, Pengembangan, Implementasi, dan Evaluasi. Fase analisis mengungkapkan bahwa siswa mengalami kesulitan memahami konsep tentang komputer karena metode pengajaran berbasis ceramah konvensional yang digunakan. Permainan novel visual dirancang dengan menggabungkan alur cerita naratif dengan ilustrasi, kuis interaktif, dan elemen pengambilan keputusan untuk melibatkan siswa dalam kegiatan pembelajaran. Pakar media dan materi memvalidasi produk dengan skor kelayakan 90% dan 88%, keduanya dikategorikan sangat layak. Implementasi melibatkan 26 siswa kelas sepuluh yang menyelesaikan penilaian pretest dan posttest; hasilnya menunjukkan peningkatan pembelajaran signifikan dengan skor rata-rata meningkat dari 5,81 (41,5%) menjadi 10,77 (76,9%), menghasilkan nilai N-Gain sebesar 0,61 (kategori sedang). Kuesioner tanggapan siswa menunjukkan penerimaan tinggi dengan skor keseluruhan 87,58%—terutama pada kegunaan permainan sebesar 94,23% dan pengalaman belajar sebesar 91,35%. Hal ini membuktikan bahwa permainan edukatif berbasis novel visual dapat meningkatkan pemahaman, motivasi, dan keterlibatan siswa dalam mempelajari komputer dasar sebagai alternatif metode pengajaran konvensional dalam pendidikan TIK.

Kata Kunci: Game Edukasi; Visual Novel; Pembelajaran Interaktif; Dasar-Dasar Komputer; TIK; Model ADDIE.



1. Introduction

Educational game design has become an innovative solution supporting learning in the modern era. These games combine educational and entertainment aspects, creating engaging and enjoyable learning experiences. Research by Suryana (2020) demonstrates that educational games increase student interest by presenting applicable simulations, visualizing abstract concepts, and encouraging active student participation. Particularly in Information and Communication Technology (ICT) education, educational game development can help students understand computer fundamentals—hardware, software, and networks—more effectively (Nugroho & P. H., 2019). However, many high school students still struggle to understand basic computer material. Conventional teaching methods—such as one-way lectures and textbook-based instruction—remain dominant and tend to be unattractive to digital-native generations (Dewi, 2018). These approaches make it difficult for students to visualize abstract concepts like hardware relationships, software logic, or computer network operations.

Visual novels, as a game development genre, hold significant potential for educational applications. Their emphasis on narrative, illustration, and interactivity makes them unique media for delivering educational material through storytelling. Visual novels create emotional engagement through compelling storylines, helping students connect more deeply with the material (Suryadi & K. R., 2022). Several previous studies have utilized visual novels as learning media. Handayani *et al.* (2021) developed visual novel media for Indonesian history education, while Prasetyo and Mufidah (2020) used visual novels for junior high school science material. These studies show that such approaches can increase student interest and comprehension. However, few studies have specifically developed visual novel-based educational games for high school computer basics education. Therefore, our research focuses on developing visual novel-based educational media that not only delivers material but also enhances student understanding of basic computer concepts through contextual and engaging narrative approaches.

One primary goal of developing visual novel-based educational games is to improve student understanding of computer fundamentals. In an era where digital literacy grows increasingly vital, understanding computer technology has become an essential need that cannot be overlooked. Through interactive and narrative-based learning experiences, students are expected to build stronger conceptual foundations while developing critical thinking skills necessary for navigating the digital world.

2. Methodology

This study employs Research and Development (R&D) methodology, aiming to design and build a visual novel-based educational game as interactive learning media to enhance high school students' understanding of computer fundamentals. The primary focus is producing feasible and attractive learning media while measuring its effectiveness in the learning process. We adopted the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) as the development framework (Branch, 2009). To determine media effectiveness, we used a single group pretest-posttest experimental design, where students took tests before and after using the media (Campbell & Stanley, 1963). Data analysis employs both qualitative descriptive and quantitative approaches to provide a complete picture of visual novel educational game effectiveness in improving student understanding of computer basics material.

2.1 Expert Validation Analysis

Validation instruments use 4-point Likert scale assessment sheets with the following criteria:

Table 1. Feasibility Assessment Criteria

Score	Category
4	Highly Feasible
3	Feasible
2	Moderately Feasible
1	Not Feasible

Expert assessments are calculated using the feasibility percentage formula:

$$\text{Feasibility Percentage} = \frac{\text{Score Obtained}}{\text{Maximum Score}} \times 100\%$$

Where Score Obtained represents the total score from all validator items, Maximum Score equals the number of items multiplied by the highest score (4), and the resulting percentage is converted to a feasibility category. For example, if Validator 1 (Material Expert) assesses 18 instrument items with a total score of 64 out of maximum 72 (18 × 4), the Material Feasibility Percentage would be $64/72 \times 100\% = 88.9\%$, categorized as Highly Feasible. Similarly, if Validator 2 (Media Expert) assesses 15 items with a total score of 54 out of 60 (15 × 4), the Media Feasibility Percentage would be $54/60 \times 100\% = 90\%$, also categorized as Highly Feasible. The Average Feasibility is then calculated as $(88.9 + 90)/2 = 89.45\%$.

2.2 Pretest and Posttest Analysis

The analysis follows systematic steps: answer scores are calculated (1 for correct, 0 for incorrect), average pretest and posttest scores are calculated for each group, N-Gain scores are computed using Meltzer (2002) formula, and improvement results are compared between groups. The N-Gain formula is expressed as:

$$N\text{-Gain} = \frac{X_{\text{post}} - X_{\text{pre}}}{X_{\text{max}} - X_{\text{pre}}}$$

Where X_{post} represents the average posttest score, X_{pre} represents the average pretest score, and X_{max} represents the maximum ideal score.

Table 2. N-Gain (Normalized Gain) Interpretation

N-Gain Range	Category
> 0.7	High
0.3 – 0.7	Medium
< 0.3	Low

Table 3. Calculation Example

Group	Average Pretest	Average Posttest	N-Gain	Category
A (without game)	55	68	0.29	Low
B (with game)	54	83	0.64	Medium

2.3 Student Questionnaire Analysis (Quantitative Descriptive)

Student responses are measured using a 4-point Likert scale questionnaire with the following assessment criteria:

Table 4. Assessment Scale

Score	Category
4	Strongly Agree / Very Good
3	Agree / Good
2	Disagree / Poor
1	Strongly Disagree / Very Poor

The percentage for each aspect is calculated using the formula:

$$p = \frac{\text{Score Obtained}}{\text{Maximum Score}} \times 100\%$$

Where Score Obtained represents the total score from all students for a specific aspect, Maximum Score equals the number of items multiplied by the number of respondents and the highest score (4), and p represents the assessment result percentage.

Table 5. Result Interpretation

Percentage Range	Category
≥ 80%	Very Good
60–79%	Good
< 60%	Poor

3. Results and Discussion

3.1 Results

3.1.1 Interface Display

The game interface was designed to be simple and user-friendly for students. Each menu has clear functions supporting the learning process. The main page serves as the first screen appearing when the game launches, featuring the game title and several main menus including Start, Load, Save, and Settings, with a simple design and background images supporting the learning theme. The Start Menu initiates a new game, immediately displaying the storyline or learning material according to the designed scenario when students select it. The Load Menu continues previously saved games, allowing students to resume without restarting from the beginning, while the Save Menu enables students to save their game progress for later continuation. The choice options feature appears as dialog boxes with several answer options, allowing students to select specific options to continue the storyline, access material, or answer quiz questions, making the game more interactive and aligned with learning objectives. The Settings Menu contains additional configurations such as music volume or text speed, giving students flexibility in adjusting their learning comfort. Additionally, a Help Menu is provided for users who need guidance while playing the game.

3.1.2 Expert Validation Results

Expert validation was conducted to determine educational game media feasibility before student trials, involving two expert types: material experts and media experts. Validator 1 (Media Expert) assessed 18 aspect items with the highest score of 4, resulting in a maximum score of $18 \times 4 = 72$, achieving a percentage of $72/72 \times 100\% = 100\%$. Validator 2 (Material Expert) also assessed 18 aspect items with the highest score of 4, resulting in a maximum score of $18 \times 4 = 72$, achieving a percentage of $70/72 \times 100\% = 97.22\%$.

Table 6. Expert Validation Results

No	Validator	Score Obtained	Calculated Score	Note
1	Taufiq Hidayat, S.Kom (Media Expert)	72	100%	Valid (Feasible for trial)
2	Novi Ratna Sari, S.Kom (Material Expert)	70	97.22%	Valid (Feasible for trial)

From these results, we conclude that the developed visual novel-based educational game is valid and usable as learning media, though some suggestions are needed for quality improvement. The media expert gave a score of 72 out of maximum 72 or equivalent to 100%, placing it in the Highly Feasible category. Meanwhile, the material expert gave a score of 70 out of maximum 72 or equivalent to 97.22%, also in the Highly Feasible category. Overall, validation results from both experts conclude that the visual novel-based educational game is highly feasible for student trials.

3.1.3 Media Trial Results

Student response calculations used a 4-point Likert scale, where each statement has scores: 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree. With 26 student respondents, the maximum score per item is $26 \times 4 = 104$. The overall calculation shows that the total score for all statements is 1,276, while the maximum score for all statements is $14 \times 104 = 1,456$, resulting in an overall percentage of $1,276/1,456 \times 100\% = 87.58\%$, categorized as Very Good. The category scale ranges from $\geq 80\%$ (Very Good), 60–79% (Good), 40–59% (Fair), to $\leq 39\%$ (Poor).

Table 7. Student Response Score Results for Media

No	Item	Score Obtained	Maximum Score	Percentage	Category
1	T1	83	104	79.81%	Good
2	T2	92	104	88.46%	Very Good
3	T3	91	104	87.50%	Very Good
4	T4	93	104	89.42%	Very Good
5	P1	84	104	80.77%	Very Good
6	P2	87	104	83.65%	Very Good
7	P3	91	104	87.50%	Very Good
8	E1	89	104	85.58%	Very Good
9	E2	91	104	87.50%	Very Good
10	E3	95	104	91.35%	Very Good

11	E4	89	104	85.58%	Very Good
12	K1	98	104	94.23%	Very Good
13	K2	82	104	78.85%	Good
14	K3	91	104	87.50%	Very Good
Total		1,276	1,456	87.58%	Very Good

Based on the table above, student responses to educational game media overall obtained a score of 1,276 out of maximum 1,456 with a percentage of 87.58%, falling into the Very Good category. Generally, trial results show that students received the educational game media very well and assessed it as capable of increasing motivation and enthusiasm for learning computer basics material.

3.1.4 Test Results

The basic data shows that 26 students participated, with a maximum score per test of 14, total pretest score of 151, and total posttest score of 280. For the pretest average, the calculation shows $\bar{X}_{pre} = 151/26 = 5.81$, with a pretest percentage of $5.81/14 \times 100\% = 41.5\%$. For the posttest average, $\bar{X}_{post} = 280/26 = 10.77$, with a posttest percentage of $10.77/14 \times 100\% = 76.9\%$. Before learning, students on average answered only 41.5% of questions correctly, while after learning with educational game media, the understanding level increased to 76.9%. The N-Gain calculation using the formula $g = (X_{post} - X_{pre}) / (X_{max} - X_{pre})$ results in $(10.77 - 5.81) / (14 - 5.81) = 4.96/8.19 = 0.61$. The average N-Gain value of 0.61 falls into the Medium category ($0.3 \leq g < 0.7$), indicating that the media is quite effective in improving student understanding.

3.2 Discussion

Pretest and posttest data processing reveals several important findings that warrant detailed examination. The average score improvement from 5.81 (41.5%) on the pretest to 10.77 (76.9%) on the posttest demonstrates significant enhancement in student understanding after using visual novel-based educational game media. This substantial increase indicates that the media successfully helped students understand basic computer concepts in a more attractive and comprehensible manner. The narrative-driven approach combined with interactive elements appears to have facilitated better knowledge retention and conceptual understanding compared to traditional teaching methods. This finding aligns with Satrio and Gafur (2017), who found significant differences in gain scores between control and experimental classes ($t = 8.252, p < 0.05$) when implementing visual novel games in social studies education, demonstrating the effectiveness of narrative-based learning media. Similarly, Adyani *et al.* (2015) reported that interactive animation-based educational games significantly improved student learning outcomes with an N-Gain of 0.77, supporting the notion that game-based media enhances comprehension through engaging and interactive presentation of material.

The N-Gain value of 0.61, categorized as medium, suggests that the media is quite effective in improving student learning outcomes. Notably, some students achieved N-Gain values above 0.7, indicating high category improvement. This variation in individual performance suggests that while the media is generally effective, certain students may benefit more from this learning approach than others, possibly due to differences in learning styles, prior knowledge, or engagement levels. The medium category N-Gain, while not reaching the high category threshold, still represents meaningful learning gains and demonstrates the potential of visual novel-based educational games as alternative learning media. This result is consistent with Harianja *et al.* (2024), who obtained an average N-Gain score of 0.64 in the experimental group using game-based learning with SGQ strategy, classified as medium to high improvement, indicating that educational games effectively enhance student computational thinking in energy literacy. Furthermore, Amalia *et al.* (2024) reported an N-Gain of 0.67 for physics educational games, demonstrating medium-category effectiveness in increasing student learning motivation, while Irnawati and Setiawan (2024) achieved similar results with an N-Gain of 0.67 in disaster risk reduction education, showing knowledge scores increased from 28% to 82% post-intervention. Prayogi and Prihatin (2024) even achieved higher effectiveness with an N-Gain of 0.73 using visual novel games to improve students' self-directed learning, demonstrating that well-designed visual novel media can reach high-category effectiveness.

The score improvement distribution provides further evidence of the media's positive impact. Nearly all students experienced score increases between pretest and posttest, with approximately 73% falling into the medium category and 27% in the high category. Significantly, no students experienced score decreases, demonstrating that media use had uniformly positive impacts on student learning outcomes. This consistent improvement across all participants suggests that the visual novel format successfully engaged diverse learners and provided accessible pathways to understanding computer fundamentals. The absence of any negative

outcomes indicates that the media does not disadvantage any particular student group and maintains a baseline level of effectiveness across different ability levels. Kurniawan and Hidayah (2021) support this finding, reporting that 85% of students experienced learning outcome increases in medium and high categories when using Android-based adventure games with environmental narrative design, achieving 93.94% classical completeness criteria. The universal positive impact observed in this study reflects the inclusive nature of game-based learning, which accommodates various learning preferences and abilities through multiple engagement pathways.

The high student response scores (87.58% overall) further validate the media's acceptance and perceived usefulness. Aspects receiving the highest scores—game usefulness (94.23%) and learning experience (91.35%)—indicate that students recognized the educational value of the game while enjoying the learning process. The relatively lower scores for display (79.81%) and retention (78.85%) suggest areas for future improvement, particularly in enhancing visual design elements and incorporating stronger reinforcement strategies to improve long-term material retention. These findings align with previous research on visual novel-based learning media, confirming that narrative-driven, interactive approaches can effectively increase student motivation and engagement while delivering educational content in meaningful ways. Satrio and Gafur (2017) reported that more than 50% of students showed positive responses toward visual novel game media, while Sukma and Kholiq (2021) achieved an 85.80% user response rate classified as "very good" for their physics visual novel (SI VINO), demonstrating high student engagement with the learning tool. Adyani *et al.* (2015) found that 91.67% of students achieved learning completeness with good motivation levels, establishing a significant positive correlation ($r = 0.554$) between motivation and learning outcomes when using educational game media. Naratama *et al.* (2023) reported that 100% of high school students (80% strongly agree, 20% agree) felt they better understood social media ethics after playing their visual novel game "Freshmen," demonstrating the effectiveness of interactive narrative design with branching storylines. Puatri (2023) also confirmed that Android-based educational games for ICT material received "very feasible" ratings from experts and "very good" responses from students, indicating high engagement and positive reception. These consistent findings across multiple studies reinforce that visual novel and game-based learning media not only improve academic outcomes but also enhance student motivation, engagement, and overall learning experience, making them valuable alternatives to conventional teaching methods in secondary education.

4. Conclusion

Based on research results and discussion regarding the Design and Development of Visual Novel-Based Educational Game to Enhance Computer Basics Understanding for High School Students, several important conclusions can be drawn. The development of visual novel-based educational game learning media using the ADDIE model proceeded systematically through analysis, design, development, implementation, and evaluation stages. The analysis stage revealed that students struggled to understand basic computer concepts because conventional learning tends to be lecture- and text-based. Visual novel media was then designed by combining storylines, illustrations, and interactive quizzes to increase student interest and understanding. Validation results from media and material experts show that the educational game falls into the highly feasible category for use. The media validator gave a 90% score with notes for improvement including adding visual variety and audio features, while the material validator gave an 88% score with notes to vary examples and adjust them to high school student contexts. Overall, the product was declared valid for implementation in learning. Questionnaires administered to 26 tenth-grade students showed positive responses with an average percentage of 87.58% (very good category). Aspects receiving the highest scores were game usefulness (94.23%) and learning experience (91.35%), while relatively lower aspects were display (79.81%) and retention (78.85%). This confirms that visual novel games can increase student motivation and engagement, though improvements are needed in visual display and material reinforcement strategies. Student learning outcome improvements are evident from pretest and posttest score differences. Analysis shows an average N-Gain value of 0.61, falling into the medium category, indicating that the learning media is quite effective in improving student understanding of computer basics material. These findings demonstrate that visual novel-based educational games represent a viable alternative to traditional teaching methods, offering interactive and engaging learning experiences that can enhance both student motivation and conceptual understanding in ICT education. The combination of narrative-driven content, visual elements, and interactive features successfully addresses the limitations of conventional teaching approaches while providing students with meaningful and enjoyable learning experiences that facilitate better comprehension of fundamental computer

concepts.

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