Development 0f Fliphtml5 Learning Media To Improve Students' Learning Outcomes On The Human Nervous System

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Abstract.
This study aimed to determine the feasibility of FlipHTML5 learning media, examine students' responses, and analyze its effect on learning outcomes on the human nervous system material for Grade XI students at SMA Negeri 6 Pematangsiantar. The study employed Research and Development (R&D) using the ADDIE (Analyze, Design, Development, Implementation, and Evaluation) model and a pretest-posttest control group design. The participants were Grade XI M2 as the control group and Grade XI M6 as the experimental group. Data were collected through media validation questionnaires, student response questionnaires, and learning outcome tests. The validation results were 90.0% for material, 76.6% for presentation, 63.3% for design, and 86.6% for language. The mean student response was 67.67%. Learning outcomes also increased in the experimental group, with the mean score increasing from 29.17 on the pretest to 78.83 on the posttest, whereas the control group increased from 29.00 to 58.73. Because the data did not meet the normality and homogeneity requirements, the hypothesis was tested using the Mann-Whitney U test. The test produced an Asymp. Sig. (2-tailed) value of 0.000, which was lower than 0.05. Therefore, the developed FlipHTML5 learning media was considered feasible and its use was associated with significantly different learning outcomes between the experimental and control groups.
Keywords: *FlipHTML5, learning media, learning outcomes, human nervous system and digital learning.*

I. INTRODUCTION

Digital technology has increasingly influenced educational practices and has encouraged teachers to use learning media that are more varied, interactive, and relevant to students' learning needs. Digital learning media can support the learning process while also strengthening students' digital literacy [1]. Learning media are useful for delivering information, stimulating attention and motivation, and helping students understand learning content more effectively [2].

Biology topics that contain abstract structures and processes require media that can provide clear visual representations. The human nervous system is one such topic because students need to understand neuron structures, impulse transmission, the central and peripheral nervous systems, and the coordination of body functions. When the topic is presented mainly through textbooks and conventional presentations, students may have difficulty connecting textual explanations with the biological structures and processes being discussed.

An observation conducted at SMA Negeri 6 Pematangsiantar on 13 March 2026 showed that Biology learning was still dominated by government-provided textbooks and PowerPoint presentations. The existing media had not optimally supported student motivation because the presentation of the material tended to be monotonous and provided limited visual interaction. The midterm examination data for the 2025/2026 academic year showed that only 67 of 198 students (33.84%) reached the minimum mastery criterion, while 131 students (66.16%) did not reach it. This condition indicates the need for learning media that can provide more engaging and accessible learning experiences.

FlipHTML5 can convert learning materials into digital books and integrate multimedia elements such as images, animation, video, audio, and interactive links. Previous studies have reported positive results from the use of FlipHTML5-based materials, including high validity and practicality [3–6]. Digital flipbook media have also been reported to support students' cognitive learning outcomes [7]. These characteristics make FlipHTML5 potentially appropriate for presenting the human nervous system, particularly when students need visual support for structures and mechanisms that are difficult to observe directly.

Based on this background, this study developed FlipHTML5 learning media for the human nervous system and examined its feasibility, students' responses, and its effect on learning outcomes among Grade XI students at SMA Negeri 6 Pematangsiantar.

II. METHODS

The study used a quantitative Research and Development (R&D) approach with the ADDIE development model, consisting of Analyze, Design, Development, Implementation, and Evaluation. The development approach was selected because it provides a systematic sequence for analyzing learning needs, designing the product, developing and validating the media, implementing it, and evaluating the results [8,9]. The study was conducted at SMA Negeri 6 Pematangsiantar, Bah Kapul, Siantar Sitalasari District, Pematangsiantar City, North Sumatra, Indonesia, from 24 August to 4 September 2026 during the 2026/2027 academic year. The population consisted of Grade XI students. Purposive sampling was used to select XI M2 as the control group and XI M6 as the experimental group. The two classes received the same Biology material and were taught by the same teacher; each class had 33 students in the sampling description in the thesis, while the analyzed experimental data contained 30 students. The manuscript retains the analyzed sample sizes used in the reported statistical results.

The learning design was a pretest-posttest control group design. The control group received conventional learning, whereas the experimental group received learning supported by the developed FlipHTML5 media. Before the treatment, both groups completed a pretest, and after the learning activities they completed a posttest. The instruments consisted of media validation questionnaires, student response questionnaires, and multiple-choice learning outcome tests covering cognitive levels C1–C4.

Media feasibility was assessed through expert validation covering material, presentation, design, and language. Student responses were collected using a five-point Likert scale. The learning outcome instrument was tested for validity, reliability, discrimination, and difficulty using SPSS 25. The thesis reports 20 valid items out of 30 tested items, with a Cronbach's Alpha of 0.824. Data normality was assessed using the Shapiro-Wilk test and homogeneity using Levene's test. Because the data did not satisfy the required assumptions, the difference between the experimental and control groups was analyzed using the Mann-Whitney U test. A significance level of 0.05 was used.

III. RESULT AND DISCUSSION

The development process produced a digital FlipHTML5 learning medium containing the human nervous system material. The media presented textual explanations together with visual materials and multimedia elements intended to make abstract biological concepts easier to understand. The development followed the ADDIE stages, beginning with analysis of the learning condition and student needs, followed by media design, product development and validation, classroom implementation, and evaluation.

The validation results are summarized in Table 1. The material aspect received the highest score at 90.0%, followed by language at 86.6%, presentation at 76.6%, and design at 63.3%. These results indicate that the media met the expected criteria for use, although the design aspect received a comparatively lower score and therefore remains an area that can be improved in future development.

Table 1. Validation Results of FlipHTML5 Learning Media

Aspect	Validation Score (%)	Interpretation
Material	90.0	Feasible
Presentation	76.6	Feasible
Design	63.3	Feasible
Language	86.6	Feasible

The results are consistent with earlier studies reporting that FlipHTML5-based learning materials can obtain high feasibility ratings. Halang et al. reported a validity score of 93.09% for a FlipHTML5-based handout, while other studies have reported positive validity, practicality, and student-response results [4,5]. The present findings therefore support the use of FlipHTML5 as a digital learning medium, particularly when the content requires visual presentation.

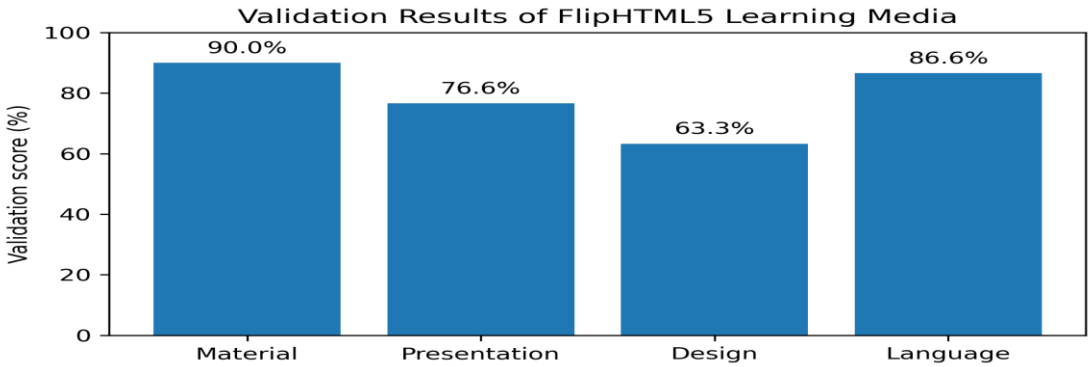


Fig. 1. Validation results of the developed FlipHTML5 learning media

Student responses were also positive. The questionnaire contained nine statements related to visual clarity, organization, readability, and usefulness of the digital material. The reported mean response was 67.67%, with the proportion of students selecting "strongly agree" across the statements ranging from 53% to 83%. This response suggests that students generally accepted the digital presentation and found the media useful during learning. The finding is in line with previous research showing that interactive and digital learning media can increase students' engagement and provide more flexible access to learning materials [3,6].

The learning outcome data showed a clearer difference between the two groups. The control group had a mean pretest score of 29.00 and a mean posttest score of 58.73. The experimental group had a mean pretest score of 29.17 and a mean posttest score of 78.83. Thus, the increase in the experimental group was greater than that in the control group. The thesis also reports that 26 of 30 analyzed students in the experimental group reached the minimum mastery criterion after the intervention.

Table 2. Mean Learning Outcome Scores

Group	n	Pretest Mean	Posttest Mean
Control (XI M2)	33	29.00	58.73
Experimental (XI M6)	30	29.17	78.83

The normality analysis indicated that not all datasets were normally distributed. The Shapiro-Wilk significance values reported in the thesis were 0.193 for the control pretest, 0.017 for the control posttest, 0.098 for the experimental pretest, and 0.055 for the experimental posttest. The homogeneity test also produced a Levene significance value of 0.001 based on the mean. Because the assumptions were not fully satisfied, the Mann-Whitney U test was used for the hypothesis test.

Table 3. Mann-Whitney U Test

Statistic	Value
Mann-Whitney U	35.000
Wilcoxon W	596.000
Z	-6.554
Asymp. Sig. (2-tailed)	0.000

The Mann-Whitney U test produced U = 35.000, Z = -6.554, and an Asymp. Sig. (2-tailed) value of 0.000. Since 0.000 < 0.05, the null hypothesis was rejected and the alternative hypothesis was accepted. This result indicates a statistically significant difference in learning outcomes between the experimental and control groups. The larger posttest mean in the experimental group suggests that the use of FlipHTML5 contributed to better learning outcomes in this study. The result is also compatible with previous research reporting positive learning outcomes from FlipHTML5-based electronic learning materials [7].

The findings should nevertheless be interpreted within the scope of the study. The research was conducted in one school and involved selected Grade XI classes. In addition, the design aspect of the media received the lowest validation percentage among the assessed components. Future development can therefore improve visual layout, interactive features, video integration, and practice activities while testing the product with broader samples.

IV. CONCLUSION

The FlipHTML5 learning media developed for the human nervous system material was considered feasible based on expert validation, with scores of 90.0% for material, 76.6% for presentation, 63.3% for design, and 86.6% for language. Students showed a positive response, with a reported mean response of 67.67%. The experimental group also obtained a higher posttest mean (78.83) than the control group (58.73). The Mann-Whitney U test yielded an Asymp. Sig. (2-tailed) value of 0.000 < 0.05, indicating a significant difference in learning outcomes between the two groups. Thus, the developed FlipHTML5 media can be used as an alternative digital learning medium for teaching the human nervous system.

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