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Feasibility of Electronic Magazine Learning Media on the Subtopic of Abnormalities and Disorders in the Circulatory System for 11th-Grade High School Students

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ABSTRACT The rapid development of information and communication technology has influenced the field of education, which can be utilized in the learning process through the application of technology in learning media usage. Abnormalities and disorders in the circulatory system are complex subtopics involving interconnected organs in the blood circulation process, occurring inside the body and not directly observable. Therefore, it is necessary to use media to visualize these subtopics. One learning media that can be utilized is electronic magazines. This research aims to assess the suitability of electronic magazines as a learning media for abnormalities and disorders in the circulatory system subtopics. The study employs the Research and Development method with five stages: problem identification, data collection, product design, design validation, and design revision. Data analysis utilizes Aiken's V Content-validity Coefficient. The validation results of the electronic magazine learning media for abnormalities and disorders in the circulatory system subtopics, assessed across four criteria—format, content, language, and presentation—yielded a coefficient value of 0.91, indicating very high validity. Therefore, it can be concluded that electronic magazines are suitable for use as a learning media for abnormalities and disorders in the circulatory system subtopics.

Keywords Abnormalities and disorders in the circulatory system subtopics, Electronic magazine, Learning media

1. INTRODUCTION

Currently, information and communication technology is rapidly developing and influencing various aspects of life, including education (Lestari & Wirasty, 2019; Huda, 2020; Ghory & Ghafory, 2021; Rubiantica, Sutomo, & Suhardi, 2021; Salsabila & Agustian, 2021; Akram, Abdelrady, Al-Adwan, & Ramzan, 2022; Wityastuti, Masrofah, Haqqi, & Salsabila, 2022; Kalyani, 2024). In the field of education, the advancement of information and communication technology can be utilized in the learning process to enhance its quality (Lestari & Wirasty, 2019; Ghory & Ghafory, 2021; Kouser & Majid, 2021; Nurfadillah, Azhar, Aini, Apriansyah, & Setiani, 2021; Salsabila & Agustian, 2021; Akram, Abdelrady, Al-Adwan, & Ramzan, 2022). The use of information and communication technology in the learning process can create effective, efficient, and engaging learning experiences (Huda, 2020; Kouser & Majid, 2021; Nurfadillah, Azhar, Aini, Apriansyah, & Setiani, 2021; Akram, Abdelrady, Al-Adwan, & Ramzan, 2022; Wityastuti, Masrofah, Haqqi, & Salsabila, 2022). One utilization of information and communication technology in the learning process is through the use of learning media (Lestari & Wirasty, 2019; Rubiantica, Sutomo, & Suhardi, 2021; Salsabila & Agustian, 2021; Sulistiani et al., 2023).

Learning media refers to everything used to facilitate the delivery of learning materials in the learning process to achieve learning objectives (Hadzami, Nurdiansih, & Sari, 2023; Wulandari, Salsabila, Cahyani, Nurazizah, & Ulfiah, 2023) . The use of learning media can visualize abstract learning materials into more concrete forms, making them easier to understand (Abdulrahaman et al., 2020; Kustandi, Farhan, Zianadezdha, & Fitri, 2021; Melati et al., 2023). Innovative, engaging, and interactive learning media can stimulate interest, desire, motivation, and stimulation for

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learning (Abdulrahaman et al., 2020; Hadzami, Nurdiansih, & Sari, 2023; Wulandari, Salsabila, Cahyani, Nurazizah, & Ulfiah, 2023). The use of learning media is not restricted by space and time, thus it can be used anywhere and anytime (Kustandi, Farhan, Zianadezdha, & Fitri, 2021; Lestari, Yuhanna, & Lukitasari, 2023; Mdhlalose & Mlambo, 2023; Melati et al., 2023; Wang, Chen, Yu, Liu, & Jing, 2024). Furthermore, the use of learning media can create a pleasant, effective, efficient, and meaningful learning atmosphere, thereby achieving learning objectives and improving the quality of learning (Mdhlalose & Mlambo, 2023; Lestari, Yuhanna, & Lukitasari, 2023; Wulandari, Salsabila, Cahyani, Nurazizah, & Ulfiah, 2023; Wang, Chen, Yu, Liu, & Jing, 2024).

Abnormalities and disorders in the circulatory system are subtopics of the circulatory system (Porsche, Tulenan, & Sugiarso, 2019; Ardiansyah & Sumarno, 2021). The circulatory system is a subject in biology that covers the organs comprising the circulatory system, the circulation process, as well as abnormalities and disorders in the circulatory system (Porsche, Tulenan, & Sugiarso, 2019; Ardiansyah & Sumarno, 2021). The circulatory system is a complex topic involving interconnected organs participating in the circulation process, which can lead to abnormalities and disorders (Porsche, Tulenan, & Sugiarso, 2019; Balela, Kaspul, & Arsyad, 2021). The circulatory system, which cannot be directly observed as it occurs inside the body, contributes to the difficulty students face in understanding the topic (Porsche, Tulenan, & Sugiarso, 2019; Ardiansyah & Sumarno, 2021; Balela, Kaspul, & Arsyad, 2021). In the learning process, visualizing the circulatory system through media is essential to facilitate comprehension (Hardiyanti, Mustami, & Mu'nisa, 2020; Ardiansyah & Sumarno, 2021).

One of the learning media that utilizes and applies technology for educational purposes is electronic magazines (Fuad, Karim, & Palennari, 2020; Rohmah, Saputra, & Listyarini, 2020; Munawaroh, Ahmadah, & Purbaningrum, 2021; Gultom, Haryati, & Anwar, 2022; Gusnira & Wikarya, 2022; Handika, Syafii, & Mahadi, 2022; Nuraida, Susanti, & Jailani, 2022; Azhari, Tanjung, & Akhyar, 2023; Septiana & Rohmadi, 2023; Sirih, Arifin, & Idris, 2023). Electronic magazines are digital-based magazines packaged in the form of files or applications that can be accessed online via computers, laptops, and smartphones (Rohmah, Saputra, & Listyarini, 2020; Munawaroh, Ahmadah, & Purbaningrum, 2021; Nuraida, Susanti, & Jailani, 2022; Ananda, Yunianika, Hadianti, & Supratmi, 2023). Electronic magazines can contain learning materials by integrating various elements such as text, graphics, images, photos, audio, video, and animations to facilitate understanding of the learning content (Fuad, Karim, & Palennari, 2020; Munawaroh, Ahmadah, & Purbaningrum, 2021; Alfiah, Edwita, & Supriatna, 2022; Handika, Syafii, & Mahadi, 2022; Nuraida, Susanti, & Jailani, 2022; Azhari, Tanjung, & Akhyar, 2023; Septiana & Rohmadi, 2023; Sirih, Arifin, & Idris, 2023). Presented in a digital-based format, electronic magazines are designed with full color, varied text, complemented by images, and use simple language to create an engaging and non-boring impression, making them attractive in the learning process (Alfiah, Edwita, & Supriatna, 2022; Gultom, Haryati, & Anwar, 2022; Nuraida, Susanti, & Jailani, 2022). Moreover, electronic magazine learning media is user-friendly as it can be accessed via students' smartphones, laptops, and school computers (Gusnira & Wikarya, 2022; Ananda, Yunianika, Hadianti, & Supratmi, 2023; Septiana & Rohmadi, 2023).

So far, electronic magazine learning media has been widely used in the learning process. Fuad, Karim, & Palennari (2020) stated that the use of electronic magazines in plant growth and development topics, supplemented with images, animations, learning videos, and crossword puzzles, can capture students' attention and enhance their motivation. Electronic magazine learning media for electrolyte and non-electrolyte solution topics are presented symbolically, microscopically, and macroscopically, thus assisting students in understanding the learning material at three representative levels (Jariati & Yenti, 2020). The use of electronic magazine learning media for the circulatory system topic can enhance critical thinking skills through quizzes and Higher Order Thinking Skills (HOTS)-based exercises in assessments (Nuraida, Susanti, & Jailani, 2022). Alfiah, Edwita, & Supriatna (2022) found that electronic magazine learning media based on a scientific approach can facilitate students in understanding the properties of light in mirrors, thereby improving students' learning outcomes. Furthermore, the use of Android-based electronic magazines can also facilitate students in understanding spatial concepts, thereby enhancing their learning outcomes (Kasriana, Ode, & Magfirah, 2023).

Generally, learning media development includes existing learning materials (Panjaitan, Titin, & Wahyuni, 2021). Additionally, learning media development can incorporate relevant research findings related to the learning materials (Panjaitan, Titin, & Wahyuni, 2021; Panjaitan, Maulidya, & Yokhebed, 2022; Kristi, Panjaitan, & Mardiyyaningsih, 2023). Some developments in learning media include research findings integrated into the learning materials, such as the development of booklets as learning media equipped with an inventory of medicinal plants (Panjaitan, Titin, & Wahyuni, 2021), booklet development as learning media incorporating research on the benefits and processing of food from the Zuriat palm fruit (*Hyphaene thebaeca* (L.) Mart.) (Panjaitan, Maulidya, & Yokhebed, 2022), encyclopedia development as learning media for disease and circulatory system disorders supplemented with an inventory of medicinal plants for hypertension (Kristi, Panjaitan, & Mardiyyaningsih, 2023),

pocket book development as learning media for subtopics on breastfeeding and family planning, supplemented with an inventory of lactation-promoting plants (Aprilianti, Panjaitan, Titin, & Lestari, 2024), and booklet development as learning media for subtopics on fertilization, pregnancy, and childbirth, supplemented with an inventory of medicinal plants for postpartum care (Hartika, Panjaitan, & Tenriawaru, 2024).

Based on the discussion regarding the rapid advancement of information and communication technology, the complexity of abnormalities and disorders in the circulatory system subtopic, the numerous advantages of using electronic magazine learning media, and the development of learning media enhanced with research findings, these factors motivated researchers to develop electronic magazine learning media on abnormalities and disorders in the circulatory system subtopics. This development is complemented by testing the anti-hypercholesterolemic activity of noni leaves extract (*Morinda citrifolia* L.).

2. METHOD

This research utilizes the Research and Development (R&D) method as outlined by Sugiyono (2021), albeit not all stages were implemented. The stages conducted in this study up to the fifth stage include potential and problem, data collection, product design, design validation, and design revision (Figure 1). Data collection by doing of testing the anti-hypercholesterolemic properties of noni leaves extract and literature studies on the subtopic of circulatory system disorders, information regarding hypercholesterolemia, and the potential of noni leaves. Based on the results of data collection, product design involves creating electronic magazine learning media on the topic of disorders and disturbances in the circulatory system. The steps for creating electronic magazine learning media refer to Asfuriyah (2014), which include formulating the basic competencies (KD) that must be mastered, gathering materials for electronic magazine learning media, determining evaluation tools, structuring the content of electronic magazine learning media, and organizing the structure of electronic magazine learning media. The creation of electronic magazine learning media on the topic of disorders and disturbances in the circulatory system uses Canva and Fliphtml5 applications. Then, the electronic magazine learning media on disorders and disturbances in the circulatory system was validation by four validators using a validation sheet consisting of 4 evaluation aspects with 10 criteria based on Herman, Tenriawaru, & Candramila (2021) with modifications. The validation sheet for electronic magazine learning media on disorders and disturbances in the circulatory system uses scoring on a Likert scale.

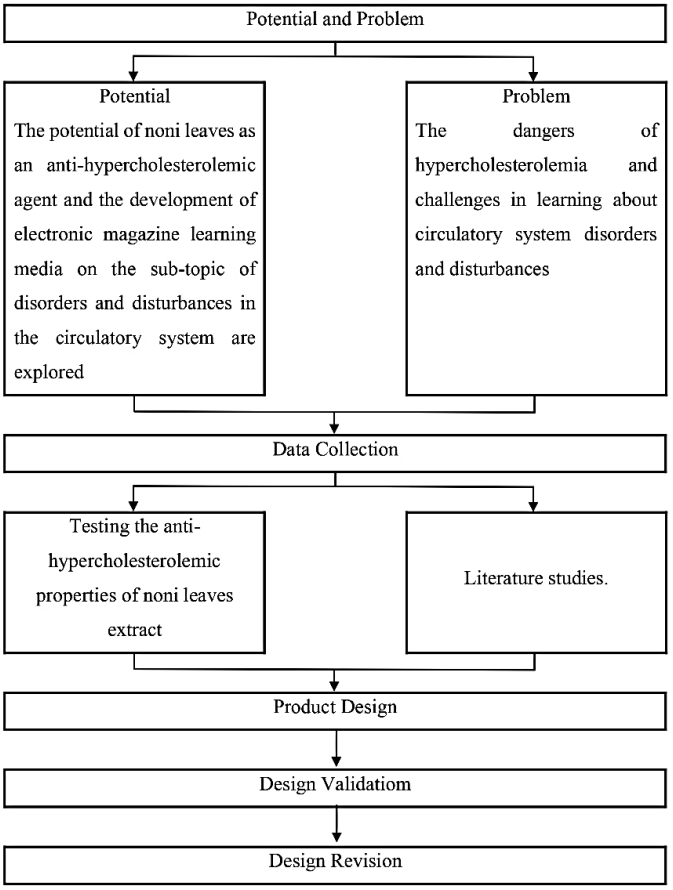

Figure 1 Chart of research methods

The data of validation results of the electronic magazine learning media on disorders and disturbances in the circulatory system will be analyzed utilizes the Content-validity Coefficient method using Aiken's V calculation (referring to Aiken, 1985). The formula for Aiken's V calculation:

$V=\sum S/n(C-1)$

Description:

V = validity score
$\sum S$ = r-Lo
r = scores given by validators
Lo = the lowest rating score
n = the number of validators
C = the highest rating score

The results of Aiken's V calculation will be categorized based on the criteria for learning media validity according to Retnawati (2016) Table 1.

Table 1 Criteria for the validity of learning media

Mean Score	Validity Level
0,8<V<1,0	Very Valid
0,4<V<0,8	Valid
0<V<0,4	Less Valid

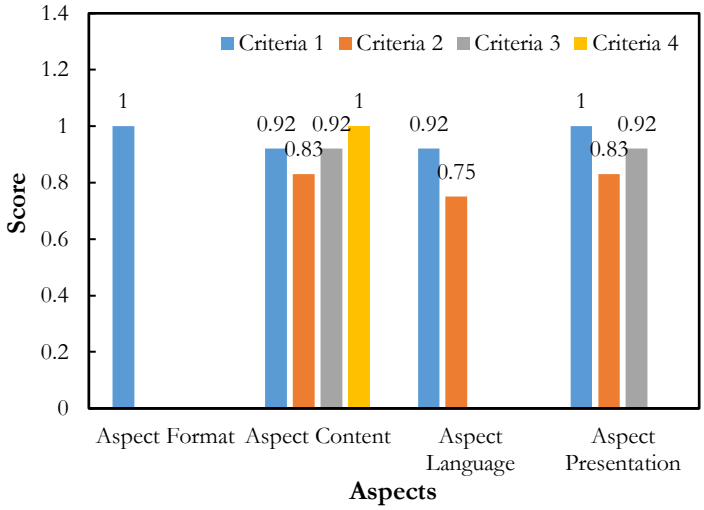

Figure 2 Graph validation results of electronic magazine learning media subtopic of disorders and disorders of the circulatory

3. RESULT AND DISCUSSION

Design validation is a process of assessment aimed at determining the feasibility and validity of a product (Sugiyono, 2021). The product generated in this research is an electronic magazine learning media focusing on disorders and disturbances in the circulatory system. The design validation conducted in this study specifically targets the validation of the electronic magazine learning media on disorders and disturbances in the circulatory system. The validation of this electronic magazine learning media utilizes a validation sheet with four assessment aspects: format, content, language, and presentation. Four validators participated in the validation process. The overall result of the validation for the electronic magazine learning media on disorders and disturbances in the circulatory system yielded a score of 0.91, indicating a very valid category. The detailed validation results can be found in Figure 2 and Table 2.

3.1 Format Aspects

The validation aspect of electronic magazine learning media begins with the format aspect. In this aspect, the sole assessment criterion is the completeness of magazine components. The validation result for electronic magazine learning media in the format aspect, with the assessment criterion being the completeness of magazine components, obtained a score of 1.00, categorized as very valid. This indicates that the electronic magazine learning media was developed with complete components, including the front cover, editor's note, table of contents, learning objectives and competencies, content pages, evaluation questions, bibliography, and back cover (Figure 3). The content pages of the electronic magazine learning media on the subtopic of abnormalities and disorders of the circulatory system consist of four sections: scientific articles, spotlight section, get learn more section, and bio info section. The *scientific articles* section contains subtopics on abnormalities and disorders of the circulatory system. The *spotlight* section provides information on hypercholesterolemia. The *get learn more* section presents the results of anti-hypercholesterolemia testing of noni leaves extract. The *bio info* section contains information about the potential of noni leaves. This is consistent with Suryani (2015); Herman, Tenriawaru, & Candramila (2021); Gultom, Haryati, & Anwar (2022), who stated that the components of electronic magazine learning media include the front cover, editor's note, table of contents, content pages, and back cover.

Table 2 Validation results of electronic magazine learning media subtopic of disorders and disorders of the circulatory system

Assessment Aspects	No.	Assessment Criteria	Category
Format	1	The completeness of magazine components	Very valid
Content	2	Alignment of presented material with basic competencies and learning objectives	Very valid
	3	Depth of material presented in the magazine	Very valid
	4	The comprehensiveness of material presented in the magazine	Very valid
	5	Availability of references as sources of information in the magazine	Very valid
Language	6	Ease of understanding sentences from the effectiveness, completeness of sentence components, and choice of diction	Very valid
	7	Consistency of grammar in the magazine content with the General Guidelines for Indonesian Spelling (PUEBI)	Valid
Presentation	8	Appeal of displayed images in the magazine	Very valid
	9	Readability of the font used in the magazine	Very valid
	10	Suitability of color combinations on each page of the magazine	Very valid

(a) (b) (c) (d)

(e) (f) (g) (h)

Figure 3 The completeness of magazine components with the following sections: the front cover (a), editorial team (b), table of contents (c), competencies and learning objectives (d), content pages (e), evaluation questions (f), bibliography (g), and back cover (h)

3.2 Content Aspects

The second validation aspect of electronic magazine learning media is the content aspect. This aspect consists of four assessment criteria: alignment of presented material with basic competencies and learning objectives, depth of presented material, comprehensiveness of presented material in the magazine, and availability of references as sources of information in the magazine. The first assessment criterion in the content aspect, which is alignment of presented material with basic competencies and learning objectives, obtained a score of 0.92, categorized as very valid. This indicates that the subtopic on abnormalities and disorders of the circulatory system presented in the magazine aligns with basic competencies (KD) 3.6 and 4.6, as well as the learning objectives achieved in the subtopic on abnormalities and disorders of the circulatory system, thus enabling the creation of effective, efficient, meaningful, and high-quality learning (Figure 4). Consistent with Panjaitan, Maulidya, & Yokhebed (2022); Sarip, Amintarti, & Utami (2022), it is stated that presenting material aligned with basic competencies and learning objectives can maximize the learning process.

The second assessment criterion in the content aspect, which is the depth of presented material, obtained a score of 0.83, categorized as very valid. This indicates that the subtopic on abnormalities and disorders of the circulatory system has been presented in depth, as it not only includes learning materials but also incorporates research findings thus enhancing the knowledge and understanding of the students (Figure 5). In line with Panjaitan, Titin, & Wahyuni (2021); Kristi, Panjaitan, & Mardiyyaningsih (2023), it is noted that the development of learning media involves not only incorporating existing learning materials but also adding relevant research findings to enhance the learning content.

Figure 4 The alignment of the subtopics on abnormalities and disorders of the circulatory system presented with Basic Competency (KD) 3.6, KD 4.6, and learning objectives

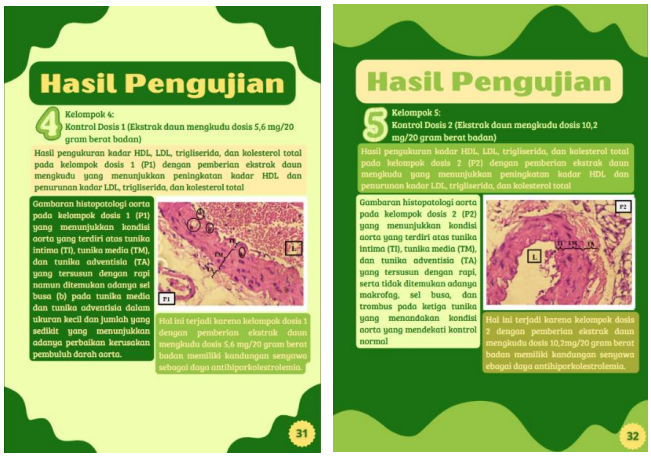

Figure 5 The subtopic on abnormalities and disorders of the circulatory system is presented in-depth, complemented by relevant research findings

The third assessment criterion in the content aspect, which is the comprehensiveness of presented material, obtained a score of 0.92, categorized as very valid. This indicates that the electronic magazine learning media includes the subtopic on abnormalities and disorders of the circulatory system across various sections: scientific articles, information on hypercholesterolemia in the *spotlight* section, testing of noni leaves extract for anti-hypercholesterolemia in the *get learn more* section, and the potential of noni leaves in the *bio info* section thus facilitating the students' understanding (Figure 6). Consistent with Beatha, Daningsih, & Titin (2018); Nurhuda, Syamswisna, & Tenriawaru (2023), it is stated that magazine content includes several sections such as scientific articles, spotlight sections, get learn more sections, bio info, and scientist profiles.

The fourth assessment criterion in the content aspect, which is the availability of references as sources of information in the magazine, obtained a score of 1.00, categorized as very valid. This indicates that the electronic magazine learning media on the subtopic of abnormalities and disorders of the circulatory system utilizes references as sources of information presented in the bibliography section (Figure 7). Consistent with Herman, Tenriawaru, & Candramila (2021); Sirih, Arifin, & Idris (2023), it is noted that all information presented in electronic magazine learning media includes clear references.

3.3 Language Aspects

The third validation aspect of electronic magazine learning media is the language aspect. This aspect comprises two assessment criteria: ease of understanding sentences from the effectiveness, completeness of sentence components, and choice of diction; and compliance of grammar in the magazine content with the General Guidelines for Indonesian Spelling (PUEBI). The first assessment criterion in the language aspect, which is the ease of understanding sentences from the effectiveness, completeness of sentence components, and choice of diction, obtained a score of 0.92, categorized as very valid. This indicates that the electronic magazine learning media on the subtopic of abnormalities and disorders of the circulatory system uses effective sentences and appropriate diction, making it easy to understand students. Consistent with Panjaitan, Maulidya, & Yokhebed (2022); Handika, Syafii, & Mahadi (2022); Septiana & Rohmadi (2023), it is noted that the use of precise, concise, and clear sentences can facilitate student comprehension. The second assessment criterion in the language aspect, which is the compliance of grammar in the magazine content with the General Guidelines for Indonesian Spelling (PUEBI), obtained a score of 0.75, categorized as valid.

This indicates that the content of the electronic magazine learning media on the subtopic of abnormalities and disorders of the circulatory system uses grammar in accordance with the General Guidelines for Indonesian Spelling (PUEBI) thereby making it easier for learners to understand. Consistent with Herman, Tenriawaru, & Candramila (2021); Panjaitan, Maulidya, & Yokhebed (2022), it is stated that using appropriate language and adhering to established linguistic rules can enhance student understanding.

(a) (b) (c) (d)

Figure 6 The electronic magazine learning media, covering the subtopic on abnormalities and disorders of the circulatory system, includes comprehensive materials in its scientific articles (a), hypercholesterolemia information in the spotlight section (b), testing of noni leaves extract for anti-hypercholesterolemia in the get learn more section (c), and information about the potential of noni leaves in the info section (d).

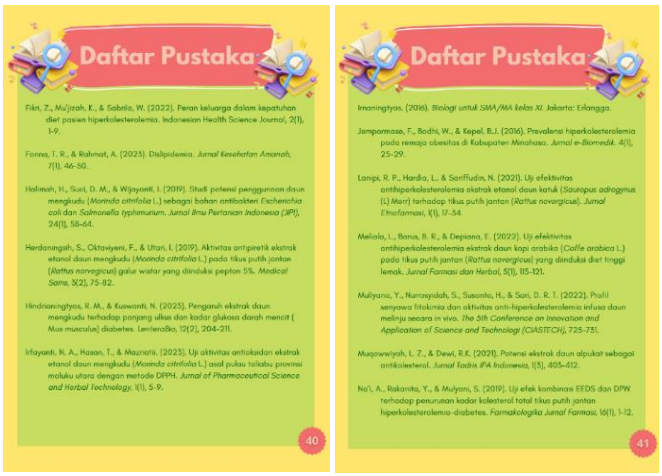

Figure 7 The availability of references in the electronic magazine learning media on the subtopic of abnormalities and disorders of the circulatory system as sources of information included in the bibliography section

Figure 8 The attractiveness of the images displayed in the electronic magazine learning media on the subtopic of abnormalities and disorders of the circulatory system

3.4 Presentation Aspects

The fourth validation aspect of electronic magazine learning media is the presentation aspect. This aspect consists of three assessment criteria: attractiveness of displayed images in the magazine, readability of the font used in the magazine, and appropriateness of color combinations on each page of the magazine. The first assessment criterion in the presentation aspect, which is the attractiveness of displayed images in the magazine, obtained a score of 1.00, categorized as very valid. This indicates that the electronic magazine learning media on the subtopic of abnormalities and disorders of the circulatory system displays visually appealing images thereby increasing the desire, motivation, and interest in learning among students (Figure 8). In line with Sirih, Arifin, & Idris (2023), it is stated that using images in learning media can enhance interest and reduce boredom during the learning process. Additionally, the appropriate use of images to visualize learning materials can facilitate understanding (Handika, Syafii, & Mahadi, 2022).

The second assessment criterion in the presentation aspect, which is the readability of the font used in the electronic magazine learning media on the subtopic of abnormalities and disorders of the circulatory system, obtained a score of 0.83, categorized as very valid. This indicates that the magazine uses fonts that are clear and easy to read thereby enhancing the desire, motivation, and interest in learning among students, as well as facilitating their understanding (Figure 9). Consistent with Panjaitan, Maulidya, & Yokhebed (2022); Sundari, Suryani, & Kurniasih (2022); Sirih, Arifin, & Idris (2023), appropriate font type and size in learning media ensure clear readability. Additionally, using simple fonts creates a relaxed and engaging reading experience, capturing attention to

Figure 9 The readability of the font in the electronic magazine learning media on the subtopic of abnormalities and disorders of the circulatory system

Figure 10 The suitability of color combinations on each page of the electronic magazine learning media on the subtopic of abnormalities and disorders of the circulatory system

continue reading (Herman, Tenriawaru, & Candramila, 2021).

The third assessment criterion in the presentation aspect, which is the appropriateness of color combinations on each page of the electronic magazine learning media on the subtopic of abnormalities and disorders of the circulatory system, obtained a score of 0.92, categorized as very valid. This indicates that there are appropriate color combinations on every page of the electronic magazine learning media on the subtopic of abnormalities and disorders of the circulatory system making it more engaging and less tedious, thereby enhancing the interest, desire, and motivation to learn among students (Figure 10). Consistent with Herman, Tenriawaru, & Candramila (2021); Sirih, Arifin, & Idris (2023), it is noted that contrasting color combinations can enhance reader interest.

4. CONCLUSION

The development of electronic magazine learning media for the subtopic of abnormalities and disorders of the circulatory system proceeds through five stages: problem identification, data collection, product design, design validation, and design revision. Validation of the electronic magazine learning media covers four assessment aspects: format, content, language, and presentation. The validation results yield a score of 0.91, classified as very valid, indicating that the electronic magazine is suitable for use as a learning media for the subtopic of abnormalities and disorders of the circulatory system. The electronic magazine as a learning medium on the subtopic of abnormalities and disorders of the circulatory system contains complete components, including the front cover, editorial team, table of contents, competency standards and learning objectives, content pages, evaluation questions, bibliography, and back cover. The learning media in the electronic magazine features subtopics related to abnormalities and disorders of the circulatory system that align with the basic competencies and learning objectives, supplemented by information on hypercholesterolemia, research findings regarding the antihypercholesterolemic effects of noni leaf extract, and the potential of noni leaves. The learning media of the electronic magazine for the subtopic of abnormalities and disorders of the circulatory system utilizes accessible language for better comprehension and is presented with an appealing layout.

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