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Development of E-module based on Problem-Based Learning Imbued with Character Education Values on Viruses Topics

Shil Viina Rohmaniyah[1], Dina Rahma Fadillah[2], Sujiyo Miranto[3]
Biology Education Departement, Faculty of Education and Teaching Science, UIN Syarif Hidayatullah
Jl. Ir H Djuanda Cempaka Putih, Ciputat Timur, Tangerang Selatan, Banten, Indonesia

Corresponding author
[1]shilviina00@gmail.com

Abstract: One of The Indonesian National Educational Objectives is to develop the potential and build good character within the student. Based on the problem identified at MAN 1 Tangerang Selatan shows that the instructional materials they used lack character educational values and the media also has limited variation. This study aims to produce an e-module based on problem- based learning with educational character content on topic viruses. This research method uses developmental research with the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. Data collection involves the use of validation sheets by experts, readability assessment sheets, and practicality evaluation sheets. The e-module is validated by two expert validators. The validation results indicate that both the content and media aspects of the e-module received scores of 94.55% and 89.3%, respectively, falling within the "highly valid" category. The readability and practicality assessments yielded scores of 95.833% and 77.140%, respectively, demonstrating that the developed e-module is highly suitable for instructional use and for fostering character development in students through biology learning.

Keywords e-module, character education, problem-based learning, viruses, ADDIE

Introduction

Education is an effort undertaken to assist learners in actively developing their intelligence, noble character, and the skills necessary for themselves and society (Syaril & Zen, 2014). This aligns with the national educational goal of enhancing the abilities and character of learners to become individuals with noble character, faith, competence, excellence, and responsibility (Lepiyanto, 2011). Unfortunately, Indonesia is currently experiencing a decline in character quality, evident in the prevalence of bullying, the use of inappropriate language and words, student brawls, increasing underage use of drugs and alcohol, a lack of etiquette and responsibility, and a decrease in work ethic, which is crucial for survival in society (Saripudin et al., 2021).

Therefore, character education must be implemented in teaching. Character education serves to instill positive values in learners so that they can cultivate unique characteristics within themselves (Sukatin & Al-Faruq, 2021), with the aim of becoming outstanding individuals (Hayah, 2017). However, the reality in the field indicates that teaching still focuses on the cognitive domain and lacks attention to the affective domain of learners (Saripudin et al., 2021). It is undeniable that the integration of character education into every subject, including biology, is crucial for instilling character values in learners.

As a subsystem of national education, biology plays a crucial role in shaping the character of learners. Biology education can guide learners to instill positive characteristics such as precision, discipline, honesty, diligence, critical thinking, responsibility, and cooperation (Murianti et al., 2021). The implementation of character education in biology teaching can be achieved through instructional materials. Instructional materials are the core of the learning process, encompassing all

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materials used as sources of information in the teaching and learning process (Kosasih, 2021).

MAN 1 South Tangerang is one of the schools that has already implemented character education, both through habituation and integration into various subjects, including biology. However, some issues persist, such as the infrequent development of instructional materials containing character education and the absence of certain important character values in learners during biology lessons. Furthermore, the lack of variety in teaching aids used during the learning process results in reduced enthusiasm among learners.

To address these issues, a solution is to develop instructional materials that include various teaching aids with character education content, such as e-modules. An e-module is a digital form of a module that learners can use with minimal assistance from teachers, promoting independent attitude (Yaumi, 2018). Its digital nature allows e-modules to incorporate various types of media (Yusuf & Widyaningsih, 2022). The development of e-modules also considers the possibility of using them with teaching models that support student activity, such as problem-based learning. This model emphasizes a real-world problem-solving approach (Israfiddin et al., 2016). Problem-based learning can be used to assess the character values that develop in learners (Suri & Raharjo, 2020). Learning using this model also influences the improvement of critical thinking skills and curiosity among learners (Suhirman et al., 2021).

Based on the above background, the researcher is interested in developing a problem-based learning e- module with character education content on the topic of viruses. The aim of this research is to produce a problem- based learning e-module with character education content on the topic of viruses that is suitable for use as instructional material.

Materials and Methods

Study Area:

This research was conducted at MAN 1 South Tangerang, located on Jalan Raya Serpong, Kademangan, Setu District, South Tangerang Regency, Banten 15313, during the academic year 2022/2023. In that academic year, MAN 1 South Tangerang still implemented the 2013 Curriculum and had a vision, mission, and objectives to enhance the character values and thinking skills of the learners.

The object of this research is the problem-based learning e-module with character education content on the topic of viruses. The subjects of this research were content experts and media experts for the validation process, as well as the students of class X at MAN 1 South Tangerang in the academic year 2022/2023. The number of students involved was 16 for the small-scale trial and 35 for the large-scale trial. This research follows the developmental research design. The product generated from this research is the problem-based learning e- module with character education content on the topic of viruses. The developmental model employed in this research is the ADDIE model, consisting of five stages: analyze, design, development, implementation, and evaluation

Procedures:

Analysis

The analysis phase is conducted to identify gaps in the learning process. Data collected at this stage involves interviews, documentation, and questionnaires. The researcher conducts interviews with biology teachers and administers questionnaires to students to understand the classroom learning process and the characteristics of the learners. Additionally, an analysis of the curriculum (KI and KD) is performed to determine the content coverage and the character values that need to be instilled in the virus material.

Design

In this phase, the researcher formulates learning objectives, outlines the material, and creates a flowchart as the framework for the e-module to be developed. The design phase results in the blueprint for the e-module, which will be further developed in the next stage.

Development

This phase involves the realization of the e-module design from the previous stage. Several steps are taken in this phase, including the creation of the initial product, validation testing by two expert validators, and a small-scale trial. Data in this phase

are obtained through validation questionnaires and readability questionnaires given to the students. The validation questionnaire employs a Likert scale ranging from 1 to 5 to assess the quality of the e-module according to the validators. Meanwhile, the readability questionnaire uses a Guttmann scale with Yes or No answers to determine whether the language, layout, and presentation of the e- module facilitate students' understanding of the material (Dewi & Arini, 2018).

Implementation

The implementation phase involves a large-scale trial with students to assess their response to the practicality of the e-module. The goal is to determine the feasibility of the developed e-module for use in the learning process. The large-scale trial is conducted with 35 students from class X IPA at MAN 1 South Tangerang in the academic year 2022/2023. Data in this phase are obtained from student response questionnaires regarding the practicality of the e-module. This questionnaire uses a Likert scale with a range of values from 1 to 5 to describe the e-module's feasibility in each indicator.

Evaluation

The evaluation process in this research is conducted both formatively and summatively. Formative evaluation is done before implementation, involving content validation by experts and a small-scale trial to assess the feasibility and readability of the e-module. Summative evaluation is performed by administering questionnaires to students and teachers to understand students' perceptions of the e-module. These results serve as the basis for improving the developed e-module.

Data Analysis

The data obtained in this study consists of both qualitative and quantitative data. Qualitative data include interview results, student needs questionnaires, and suggestions from validators regarding the e-module. Meanwhile, quantitative data consist of assessments by validators and students on the feasibility, readability, and practicality of the e-module. The validation and practicality results of the e-module are assessed using a Likert scale with the following evaluation criteria:

Table 1. Provisions for the likert scale

Score	Categories
1	Strongly Disagree
2	Disagree
3	Enough
4	Agree
5	Strongly Agree

Meanwhile, readability testing employs a Guttmann scale with the following evaluation criteria:

Table 2. Provisions for Guttman scale

Score	Categories
0	No
1	Yes

Next, the results of quantitative data are tabulated and calculated using formulas, and subsequently interpreted qualitatively into several categories. The formula used to calculate quantitative data is as follows:

Table 3. Feasibility Criteria

Range	Categories
0% - 20%	Very Invalid/ Very negative
21% - 40%	Invalid/ Negative
41% - 60%	Enough
61% - 80%	Valid/Positive
81% - 100%	Very Valid / Very Positive

Results and Discussion

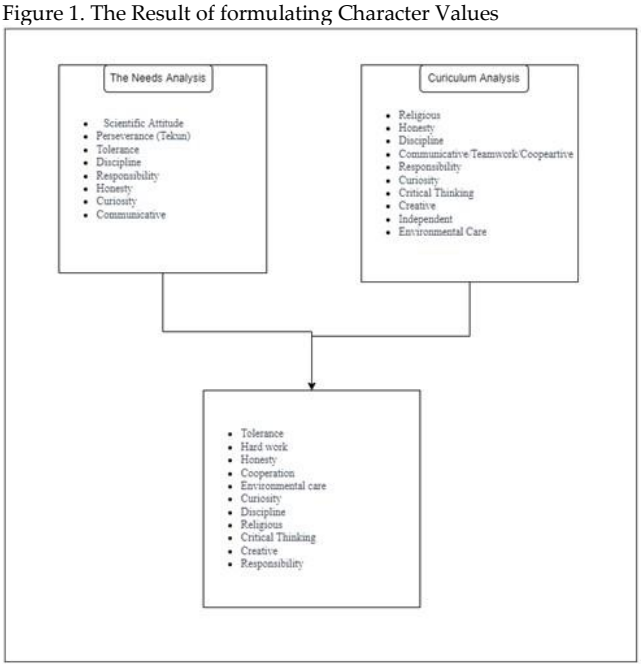
This research comprises five stages, namely analysis, design, development, implementation, and evaluation. Consequently, the findings of this study will be elucidated in accordance with these stages

Analyze

The first stage of the ADDIE model involves the researcher conducting needs analysis and

curriculum analysis. Needs analysis, utilizing interviews and questionnaires with students, revealed that there is currently no instructional material developed with a focus on character education, and there is a lack of variety in instructional media used during classroom teaching and learning activities. Furthermore, survey results from students indicated that they still feel deficient in cultivating attitudes such as scientific attitude, discipline, honesty, diligence, tolerance, and curiosity in their daily activities. Subsequently, the analysis of the instructional objectives (KI and KD) related to the virus material indicated that there are several character values that need to be developed in students, including religiosity, curiosity, discipline, responsibility, honesty, tolerance, critical thinking, creativity, cooperation, precision, diligence, and environmental awareness

Figure 1. The Result of formulating Character Values

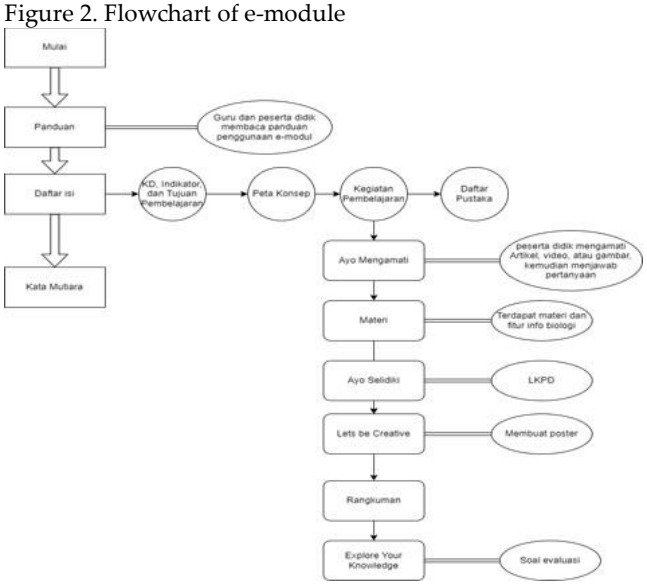


Therefore, based on the findings of this initial analysis, the researcher formulates a solution to address these issues by developing an e-module. This e-module will incorporate varied media and be grounded in problem-based learning principles, with a focus on integrating character education within the context of virus- related content.

Design

The second phase involves designing the content and format of the e-module. Content design begins with the formulation of learning objectives, the creation of a flowchart, and the development of the e-module's content The e-module comprises five learning stages based on the syntax of the problem-based learning model, namely: 1. Let's Observe, 2. Answer Questions, 3. Let's Investigate, 4. Let's Be Creative, and 5. Explore Your Knowledge. Character education values will be integrated into each of these stages.

Figure 2. Flowchart of e-module



Development

In this development phase, the outcomes of the previous design stage are actualized. This stage involves three steps: the creation of the e-module, validation, and pilot testing. The e-module is constructed using WordPress software with the assistance of Elementor and LearnDash plugins to enhance the visual appeal and dynamism of the e-module. Various media elements included in the e-module consist of YouTube videos, images designed using Canva, digital worksheets created using Worksheet, and animated videos.

The visual presentation of the e-module incorporates a blue and white background. The homepage of the e-module includes the title, table of contents, guidelines, and inspirational quotes. In addition to explaining the content material, the e-module is enriched with features such as "Biology

Info" and the integration of character education values

Figure 3. Homepage

Figure 4. Content of E-module

Once the e-module development is complete, the next step involves validation to determine if the media and content of the e-module align with the assessment criteria provided by two expert validators. The aspects assessed for the media include Navigation, visual design, media, and language (M.D, 2016).

Table 4. Result of media validation.

No.	Aspect	Presentase (%)	Interpretation
1.	Navigation	85,71	Very Valid
2.	Visual Design	96	Very Valid
3.	Media	93.3	Very Valid
4.	Language	82.5	Very Valid
	Average	89.38	Very Valid

The table above indicates that the total average score from media validation is 89.38%, demonstrating a highly valid category for the e-module. Each aspect in the assessment also received a score above 80, signifying a very high level of suitability for each aspect.

Next, the results of the content material validation of the e-module can be seen in the table below. The aspects assessed include the components of the e-module, content suitability, construction suitability, alignment of material with character education, alignment of learning activities within the e-module with character education, and alignment with everyday.

Table 5. Result of content validation.

No.	Aspect	Presentase (%)	Interpretation
1.	Component of E-module	77.1	Valid
2.	Feasibility of Contents	93.3	Very Valid
3.	Feasibility of Construction	96.7	Very Valid
4.	Alignment of material with character education	83.3	Very Valid
5.	Alignment of learning activities in e-module with character education	100	Very Valid
6.	Relevance of daily activities	100	Very Valid
	Average	94.5	Very Valid

The data above indicates that the e-module content is categorized as highly valid with a total score of 94.5%. Each aspect also received a score above 80%, except for the "component of e-module" aspect, which obtained a score of 77%. From the validation results of both media and content, it can be concluded that the e- module is deemed suitable for instructional use based on the validators' assessments. However, there are suggestions from the validators to improve the e-module, such as enhancing unclear images, adding additional content, and improving grammar. The e-module will be revised accordingly based on the critics and suggestions from the validators before conducting the pilot test.

The pilot test is conducted with the aim of refining certain aspects of the e-module before implementation. The pilot test involves 16 students as research subjects, and these students will assess the readability of the e-module to determine its ability to provide understanding and ease of learning for users. The aspects evaluated include readability, ease of use, attractiveness, and comprehensibility. The results of the pilot test can be seen in the following table:

Table 6. The result of pilot test

No.	Aspect	Result (%)	Interpretation
1.	Readability	93.75	Very Positive
2.	Easiness	96.25	Very Positive
3.	Attractiveness	96.875	Very Positive
4.	Understandable	95.83	Very Positive
	Average	95.833	Very Positive

The results from the table indicate a positive response from students toward the e-module with a total average score of 95.833%. Consequently, it can be stated that all aspects of the e-module's readability are easily comprehensible to students as users of the e-module. Students provided feedback suggesting the complexity of the "Ayo Mengamati" stage, which will be promptly addressed. Subsequently, a large-scale trial will be conducted during the implementation phase.

Implementation

A large-scale trial was conducted by assessing the practicality of the e-module with 35 students. The results of the large-scale trial can be seen in the following table:

Table 7. The result of the Bic Scale Test

No.	Aspect	Result (%)	Interpretation
1	The Ease of Understanding the E-module	77.55	Positive
2.	Clarity in the Use of Illustrations and Examples	78.057	Positive
3.	The ability of the E-module to Enhance Student Motivation	72.571	Positive
4.	The Usefulness of the E-module as a Teaching Material	80.38	Very Positive
	Average (%)	77.140	Positive

Based on the above data, it can be said that students have a positive response to the e-module, meaning the e-module is easy to use and understand. Additionally, it captivates students, fostering an engaging learning experience. Furthermore, the content within the e-module appears to assist students in enhancing their character values, contributing positively to their overall development.

Discussion

The analysis results show that the limited variety of instructional media used opens up opportunities for the development of teaching materials that integrate various media elements by harnessing current technological advancements(Kimianti & Prasetyo, 2019). Students' inclination to use websites as a learning resource makes the development of e-modules in the form of a website necessary. E-modules in website form enable the integration of various media elements, such as images, text, videos, and animations, making it convenient for students to access learning materials anytime and anywhere (Nana, 2019). One of the advantages of e-modules is their flexibility in being tailored to the needs of students to enhance their learning motivation (Lasmiyati & Harta, 2014). In the development of this e-module, the researcher used problem-based learning as the basis for structuring learning activities with character education components. This is based on the needs analysis indicating that students need to develop certain character values. Problem-based learning is a learning model that inherently reflects character education values, such as curiosity, hard work, love for reading, care, creativity, cooperation, friendliness, communication, and responsibility (Malikha, 2018).

After the initial product was developed, a validation process was carried out to determine the suitability of the e-module according to the opinions of media and subject matter experts. Based on the validation results, media suitability received an interpretation of "very valid" in every aspect evaluated. The highest score was obtained in the visual design aspect with a percentage score of 96%. This indicates that the e-module has a comfortable and user-friendly appearance for learning. An e-module in website form should have an attractive, creative, and easily readable design (M.D, 2016). The media aspect received a score of 93%, which is in line with to use of media for visualizing content in the e-module, which helps students absorb information more easily (Kustandi & Darmawan, 2021). As a website, the developed e-module should reflect a user-friendly site, with a navigation aspect scoring 85.7%, indicating that the e-module adheres to user-friendly principles (Kustandi & Darmawan, 2021). The lowest score was obtained in the language aspect, with a score of 82.5%. Language in the e-module should be communicative and age-appropriate (Kosasih, 2021). In its development, the e-module must pay attention to simplicity, appropriate sentence structure, and proper language usage (Kurniawan & Kuswandi, 2021). Despite the media suitability receiving a "very valid" category, there were still some revisions suggested by the expert validators for further improvement.

Similarly, material suitability received an average total score of 94.5% with a "very valid"

category. The lowest score was in the e-module component aspect, which scored 77.1%. This aspect is crucial in the assessment process because it includes evaluation indicators that assess whether the e-module structure aligns with the basic competencies and objectives. Nevertheless, this aspect is still deemed "Suitable." E-module suitability scored 93.3%, indicating that the content presented in the e-module aligns with the competencies to be achieved and contextual content. Construction suitability refers to the presentation of the e-module, which is structured based on problem-based learning syntax. This aspect scored 96.7%, demonstrating that the developed e-module has a presentation format that aligns with the learning model advocated in the e-module (Putri & Yohandri, 2020). To assess the alignment of character education content in the e-module, three aspects represent it: the alignment of learning activities with character education, the alignment of content with character education, and the relevance of e-module content to daily life. These three aspects are critical and need to be considered in the development of character education materials, including the integration of content, integration into learning activities, and empowerment of daily culture (Yaumi, 2014).

The results of the validation served as the basis for improving the e-module before conducting small-scale and large-scale pilot tests. The small-scale and large-scale pilot tests showed significant differences in their outcomes. The small-scale pilot test scored 95.833%, while the large-scale pilot test scored 77.01%. This difference is because the two pilot tests assess different aspects. The small-scale pilot test aims to assess students' responses to the readability of the e-module. Readability is assessed to determine whether the language, content, and layout of the e-module are usable for students to understand the material (Dewi & Arini, 2018). In contrast, the large-scale pilot test aims to evaluate the practicality of the e-module based on students' perceptions or responses.

The strengths of this developed e-module include its attractive appearance, accessibility without the need for additional downloads, adherence to problem-based learning syntax, and the integration of character values within, which can help improve students' attitudes such as curiosity, responsibility, discipline, critical thinking, creativity, honesty, objectivity, diligence, precision, cooperation, and tolerance—attributes that are highly important in biology education. However, the drawback of this e-module is the extended loading time due to the use of free hosting and domains, resulting in limitations in its development (Kustandi & Darmawan

Conclusions

In conclusion, the research conducted on the problem-based learning e-module with character education content on the topic of viruses has resulted in a highly suitable teaching resource. The e-module has been found to have a media suitability score of 88.33%, categorizing it as "very valid," and a content suitability score of 94.55%, also in the "very valid" category. Similarly, the readability test in the small-scale pilot test yielded very positive results with a percentage of 95.833%. The students' responses to the e-module in the large-scale pilot test received a "suitable" category with a percentage of 78.4%. The enhancement of the e-module can be achieved by modifying the hosting infrastructure to improve the website's performance and by revamping the visual presentation of the e-module to make it more vibrant and user-friendly. Therefore, the development of the problem-based learning e-module with character education content on the topic of viruses has produced a teaching resource suitable for use in the learning process.

References

Darmayasa, I Kadek, Nyoman Jampel, Alexander Hamonangan S. 2018. Pengembangan E-Modul IPA Berorientasi Pendidikan Karakter di SMP Negeri 1 Singaraja. Jurnal Edutech, 6: 53-65

Dewi, Nuriana Rachmani, Florentina Yuni Arini. 2018. Uji Keterbacaan pada Pengembangan Buku Ajar Kalkulus Berbantuan Geogebra untuk Meningkatkan Kemampuan Pemecahan Masalah dan Representasi Matematis. Prisma, 1: 299-303

Hayah, R.K. 2017. Character Education in Islamic Boarding School and The Implication to Students Attitude and

Critical Thinking Skills on Biodiversity Learning. Journal of Physics: Conf. Series, 812: 1-7

Israfiddin, Abdul Gani, Saminan. 2016. Penerapan Model Problem Based Learning untuk Meningkatkan Sikap Ilmiah dan Hasil Belajar Peserta Didik pada Materi Gerak di SMP Negeri 2 Delima. Jurnal Pendidikan Sains Indonesia, 4: 36-44

Kimianti, Febyarni, Zuhdan Kun Prasetyo. 2019. Pengembangan E-Modul Ipa Berbasis Problem Based Learning untuk Meningkatkan Literasi Sains Siswa. Jurnal Teknologi Pendidikan, 7: 91-103

Kosasih. 2021. Pengembangan Bahan Ajar. Bumi Aksara, Jakarta

Kustandi, Cecep, Daddy Darmawan. 2021. Pengembangan Media Pembelajaran. Kencana, Jakarta

Lasmiyati, Harta Idris. 2014. Pengembangan Modul Pembelajaran untuk Meningkatkan Pemahaman Konsep dan Minat SMP. Pythagoras, 9: 161-174

Lepiyanto, Agil. 2011. Membangun Karakter Siswa dalam Pembelajaran Biologi. Bioedukasi, 2: 1-7

M.D, Roblyer. 2016. Integrating Educational Technology Into Teaching. Pearson, United States

Malikha, Dyan Rifiana. Strategi Pembelajaran Pbl (Problem Based Learning) Sebagai Salah Satu Metode Pembelajaran Berkarakter Dan Berwawasan Global. Seminar Nasional Pendidikan dan Kewarganegaraan. Universitas Muhammadiyah Ponorogo. Ponorogo 2018. [Indonesia]

Murianti, Tri Lestari Agus, Afmi Randi Maltika, Rahmadhani Fitri. Implementasi Pendidikan Karakter dalam Pembelajaran Biologi. Prosiding Semnas BIO. Universitas Negeri Padang. Padang 2021. [Indonesia]

Nana. 2019. Pengembangan Bahan Ajar. Lakeisha, Klaten

Putri, Yosa Aulya, Yohandri. 2020. Validity of Teaching Materials Based on Problem Based Learning Using Contextual Teaching and Learning Approach to Improve Critical Thinking. International Journal of Progressive Sciences and Technologies (IJPSAT), 23: 63-70

Saripudin, Didin, Kokom Komalasari, Diana Noor Angraini. 2021. Value-Based Digital Storytelling Learning Media to Foster Student Character. International Journal of Instructional, 14: 369-384

Suhirman, Saiful Prayogi, Muhammad Asy'ari. 2021. Problem-Based Learning with Character-Emphasis and Naturalist Intelligence: Examining Students Critical Thinking and Curiosity. Intenational Journal of Instruction, 14: 217-232

Sukatin, M. Shoffa Saifillah al-Faruq. 2021. Pendidikan Karakter. Deepublish, Sleman

Suri, Mega Dheta, Elisabeth Parwati Raharjo. Pendidikan Karakter dalam Pembelajaran Barisan dan Deret Tak Hingga dengan Model Problem Based Learning (PBL). Prosiding Seminar Nasional Pendidikan Matematika. Universitas Pekalongan.Pekalongan January 2020. [Indonesia]

Syaril, Zelhendri Zen. 2014. Dasar-Dasar Ilmu Pendidikan. Kencana, Jakarta

Yaumi, Muhammad. 2014. Pendidikan Karakter: Landasan, Pilar, dan Implementasi. Kencana, Jakarta

Yaumi, Muhammad. 2018. Media dan Teknologi Pembelajaran. Prenadamedia, Jakarta

Yusuf, Irfan, Sri Rahayu Widyaningsih. 2022. Pengembangan dan Pemanfaatan Teknologi Informasi dan

Komunikasi dalam Pembelajaran. Media Sains Indonesia, Bandung