Assessment of Early Childhood Teachers in Mechatronic System-Based Innovative Learning Media in Indonesia

Rita Kurnia
University of Riau
Pekanbaru, Indonesia
rita.kurnia@lecturer.unri.ac.id

Azriyenni Azhari Zakri
University of Riau
Pekanbaru, Indonesia
azriyenni@eng.unri.ac.id

Piki Setri Pernantah
University of Riau
Pekanbaru, Indonesia
piki.setri@lecturer.unri.ac.id

Triana Ramdha
University of Riau
Pekanbaru, Indonesia
trianaramdha@lecturer.unri.ac.id

***Abstract*—Technological advancements must be used to support education to make it more effective and efficient. Creating learning media must be integrated with a technological foundation that could potentially lead to learning media innovations. This study employs descriptive research and qualitative analysis, which may serve as a motivator for early childhood teachers to prepare mechatronic-based learning media and other technology-based learning media. This study was conducted in Indonesia with 558 early childhood teachers serving as informants to assess the need for and use of mechatronic-based learning media in learning activities. The data instrument is made up of three parts: 1) an analysis of media needs; 2) the availability of supporting learning media and facilities, and 3) limitations and difficulties in using learning media. This study's findings indicate that learning media based on mechatronics are most needed, more appealing, affect early childhood development ability, and can be used effectively for early childhood education with no major obstacles.**

Keywords—assessment, early childhood teachers, learning media, innovative, mechatronics, Indonesia

I. INTRODUCTION

The advancement of increasingly sophisticated technology is an important means of more effectively and efficiently achieving educational goals. However, there is a strong demand for teachers to learn how to use technology and learning media [1]. High-quality and attractive learning media can improve the quality of education [2]. State learning media as a source of learning can be used to make learning so effective. It is also expected that the use of media will make the learning process easier and more varied so that learning objectives can be easily achieved. Therefore, consideration must be given to the quality of good learning media [3].

Learning media is developing very rapidly at both the early education, primary, secondary and tertiary levels. In early childhood education, many forms of learning media are designed to stimulate early childhood development, ranging from classical, modern, and a combination of both. One of the learning media that is combined is mechatronic-based learning media, combining classical and modern systems. Integrating learning media based on mechatronic systems is a way of combining machine, electronics, and computer technology to design, produce, operating, and maintaining systems to achieve approved objectives.

These issues are also very relevant to the current conditions of 21st-century learning that encourage a variety of educational creativity and innovations, including the existence of interesting, creative, and innovative learning media. To make it more effective and attractive, it has an impact on improving quality and learning activities. Instructional media, which serve as an auxiliary or intermediary teacher to present the material, can work well and the learning materials are well received by the participating students. Ruth Lautfer in [4] says that learning media is one of the tools for teachers to teach and enhance the creativity of learn-er participants and boost student awareness in the learning process. Supriyono [5] also revealed that the media, as one of the components of the learning system, means that the media should or should be used in every learning process.

For early childhood children to be able to excel in school as well, they must be educated with the right strategies and approaches. As a result, children's curiosity, creativity, independence, cooperation, and persistence can be educated through the learning process using a combination of learning media, namely the use of mechatronic system technology as the basis for the development of learning media. Guernsey in [6], suggests that in preparation for the effective use of technology in early childhood learning environments, early childhood teachers need professional self-development. Teachers must have extensive knowladge to be prepared to make decisions on how to apply technology properly to meet the social, physical, and cognitive needs of early childhood.

Learning media based on a mechatronic system is a combination of classical media such as images with the presence of a tool or a remote device that makes it move (conventional) and is then displayed by the teacher. In addition, the photos can be replaced or exchanged by the teacher on-site according to the learning theme. The requirement in creating learning media for early childhood is that learning media must be suitable and by the needs and interests of students and following the stages of their age [7]. Media that is made must be simple and according to needs and also comprehensive [8]; [9]. The media that are produced must be simple and needs-based and

also comprehensive [10]; [11], and should be able to help students learn [12]; [13]; [14].

In addition, for the learning media to function properly, there needs to be a measuring tool or an assessment process so that it can be seen that the learning media can be said to have been used successfully and effectively in the learning process. In early childhood education, the assessment process is very important to determine the development of early childhood, and also the learning process cannot be separated from the assessment element, because assessment is an important element in learning. In addition, assessment is aimed at providing feedback in the education practice, improving teaching, expressing understanding, and rethinking and re-evaluating learning [15]. This paper is the development of the previous research entitled Development of Learning Media for Early Childhood Based on the Mechatronic System that focuses on assessing the learning media that has been made based on the early childhood teachers' perception.

Therefore, additional research is required to determine the extent of the use of mechatronics in the teaching and learning process in kindergarten, as well as assessing the teachers as practitioners in the field.

II. Review of Related Literature

A. *Innovative Learning Based on Mechatronic System*

To achieve innovative learning, the efforts of teachers in design and develop innovative learning media are also needed. Innovative learning means learning that is assembled by a teacher or an instructor, a form of ideas or techniques that are considered new, to make it easier for students to make progress in the learning process and to achieve results [16]. Innovative Learning is a creative and unique learning model that tends to involve the activity of students in the process of learning [17]. Innovative learning is a learning process designed in such a way that it is different from learning in general which is not only offers many benefits to students but also to educators, such as improving a creative learning environment with new ideas that educators can apply [18].

Innovative 21st-century learning refers to the framework for 21st-century learning with components such as: (1) the learning environment, (2) the development of professional skills, (3) the curriculum and education, and (4) standards and assessments, as the gateway to a globalist era that is able to compete in the world of work [19]. That innovative learning in the 21st century is compiled and developed to measure the learning achievement of students, including the achievement of 21st-century skills. Here, the students are expected to have the skills to determine their learning objectives (self-directed learning), build knowledge (knowledge construction), collaborate (collaboration), communicate (communication), and use ICT, problem-solving, and innovation. These skills can be built by integrating ICT into an innovative learning process [20].

A mechatronic system (mechanics-electronics) means a tool that is assisted by using the basic work of electronics. A mechatronics-based learning system is a learning system that puts instruction in media-electronic mechanics. This mechanics-electronic-based learning media is de-signed to create learning situations that are more interesting, interactive, and fun to improve learning quality.

This approach has been applied by Vlasov et al., [21]. Their report shows that the current state of education in the world challenges educator, scientists, and industrialists with immediate challenge of seeking successful paths of transmitting knowledge for following generations, considering the real limitations of our time.

Mechatronic system has been widely used in vocational and engineering field. For the specific purpose, focused on the use of mechatronic on teaching early childhood which developed a learning media based on mechatronic system [22]. The article entitled Development of Learning Media for Early Childhood Based on the Mechatronic System, it is stated that a mechatronic device in early childhood education can be used as a medium of learning well with no effect on the physical and mental safety of the children.

B. *Early childhood Teachers' Assessment on Learning Media*

Learning media is one of the most significant elements of school learning because the media can help teachers deliver teaching materials to students. To that end, an assessment or evaluation process should be carried out for the sake of appropriate tool aids. Assessment of learning media is an act of assessment that aims to determine whether the learning media used in the teaching and learning process can achieve predetermined goals or not. The learning media assessment process is carried out as an effort to introspect the implementation of the teaching-learning process so that it can be improved in the future if the media used still have shortcomings. Teacher ratings are very important for children of early learning age to be more effective and interesting with appropriate and good quality learning media. The role of the media in teaching children at an early age is very important because it can be used as a message for early childhood teachers to stimulate thought, feelings, interests, and attention to children in learning so that learning takes place effectively. The grading system for assessed media can be described as follows [23]:

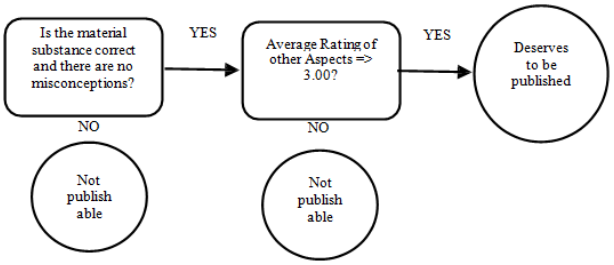

FIG 1. MEDIA ASSESSMENT SYSTEM

Based on the figure, a study media is considered to be appropriate if: (a) the material is substantially correct and/or there is no misconception; and (b) the average assessment of other aspects, the curriculum, and learning design aspects, as well as the learning communication

media, reach an average of more than or equal to 3.00 from a scale of 1–5 scores.

III. METHODOLOGY

The research was conducted in Riau, Indonesia. This study uses research descriptive methods with a qualitative analysis approach, i.e., describing the data collected in the description of the sentence that has a profound meaning, because it describes precisely the phenomenon, the circumstances, the symptoms in the specific group to determine the frequency of the relationship between the phenomenon and other phenomena. The informants for this study were early childhood teachers in Indonesia (N = 558). This research using the theoretical framework, which begins with data collection, performs data analysis and concludes the assessment of early childhood teachers on innovative teaching media-based mechatronic systems in Riau, Indonesia.

The term qualitative research is used to describe a number of approaches that analyze data in the form of natural language (e.g., words a) and expressions of experience (e.g., social interactions and artistic presentations) [24]. Qualitative research is also research which seeks to understand the phenomenon of what is experienced by the research subject, for example: behavior, perception, motivation, action, etc, in a holistic way, and by means of a description in the form of words and language, in a context of a specific nature and using various natural methods [25]. The sources of data in this study were teachers, events, and documents gathered through interviews, qualitative questionnaires, and observation. The instruments used in this study were observation sheets, interview guidelines, and qualitative questionnaires. The instrument (Appendix) consists of three parts, namely 1) media needs analysis; 2) availability of supporting learning media and facilities, and 3) limitations and difficulties in using learning media. The data collected was analyzed with a qualitative approach by describing the results of feedback from teachers as many as 558 people as Riau teachers about innovative instructional system mechatronics based-media in Riau, Indonesia.

The data was analyzed by using an approach found by Miles and Huberman (2009), namely: (1) the collection of data, is to use interviews, observations, and questionnaires; (2) Data reduction is the process of summarizing, selecting the core, and focusing on the important things in such a way that the data offered are a clearer picture; (3) the presentation of the data is presented in the form of narrative text, matrix, diagram, table, and graph; (4) the conclusion is in the form of an interpretative activity, i.e. the search for the meaning of the data that has been presented to produce a new one

IV. RESULT AND DISCUSSION

The primary key to becoming successful teachers can be seen in determining and utilizing their students' learning styles, because the learner will demonstrate or demonstrate the effectiveness of excellence and attitude when methods and teaching resources are adjusted to their [27]. However, the learning process in schools still presents various challenges, one of which is how to assess children's development through mechatronic-based learning media, due to the lack of knowledge of some teachers, media knowledge and procedures for assessing the mechatronic system, and how indicators that can be used to evaluate mechatronic- based learning media. Therefore, early investigators want to know and analyze the Mechatronics-based learning media assessment

The contribution of early childhood teachers in choosing the right learning media will certainly have a significant impact on early childhood learning success. Selection of educational media that is not appropriate for early childhood can have an impact on classroom activities, boring learning, and even lazy student participants. As a result, early childhood teachers need knowledge and understanding to choose the right learning media and the character of the students. Teacher is not enough to have only media knowledge, but must also have the ability to choose and use the right media [28]. Teachers also need to identify a variety of activities that are relevant to educational objectives, develop an effective learning process and support learning [29]; [30]. Because the selection of the right media significantly affects the efficiency and effectiveness of the learning process [31]. Schramn presents a media selection matrix that can be used as a reference for teachers:

TABLE I. MEDIA SELECTION ACCORDING TO LEARNING OBJECTIVES

Learning objectives	Factual info	Visual introduction	Principles & concepts	Procedure	Skills	Attitude
Silent Visual Media	Moderate	High	Moderate	Moderate	Low	Low
Film	Moderate	High	High	High	Moderate	Moderate
Television	Moderate	Moderate	High	Moderate	Low	Moderate
3D objects	Low	High	Low	Low	Low	Low
Audio Recording	Moderate	Low	Low	Moderate	Low	Moderate
Programmed Discussion	Moderate	Moderate	Moderate	High	Low	Moderate
Demonstration	Low	Moderate	Low	High	Moderate	Moderate
Notebooks	Moderate	Low	Moderate	Moderate	Low	Moderate
Imitation	Moderate	Low	Moderate	Moderate	Low	Moderate

Source: Schramn in Abidin [32]

Based on the results of the assessment questionnaire given to early childhood teachers in Riau Province, it can be seen that early childhood teachers have used learning media.

Teachers have used high technology learning media for students, such as LCD projectors, but teachers have not implemented learning media that allow students to use them interactively, so the learning is less interesting and less active. The table above shows that the teacher prioritized visual introduction over the skills that the students should achieve. Because they did not accomplish their objective abilities, early childhood learners become passive because the media is not used interactively, and they establish a teacher learning-centered environment. Points out that the lack of facilities to support learning media can lead to an atmosphere of learning that is less meaningful for learners, while at the same time leading to an inability to develop the skills and potential of learners in a more optimal way [33].

In order to overcome these various problems, we need an innovation in early childhood learning media that is more interactive for students. Huang in Bustanil et al., said technology-based interactive learning media can provide students with the latest educational information [34]. Interactive media are used to stimulate learners to better understand and enhance the interaction of learners [35]. In addition, good quality learning requires a variety of efforts to ensure that this happens and that these efforts are made to fulfill the support facilities such as interactive multimedia learning support [36]. In this regard, a media technology based-learning mechatronics system for children of early school age has been developed and recommended. The need for teachers to apply interactive learning media has been analyzed on the basis of 3 indicators, namely: 1) media needs analysis; 2) availability of support for learning media and facilities; and 3) limitations and difficulties in the use of learning media [37].

For an estimation of the need for early childhood teachers to learn from Riau's early child-hood teacher on media technology, specifically mechatronics systems, here is the results shown in Table 1 below are as follows.

TABLE II. ANALYSIS OF TEACHER NEEDS ASSESSMENT OF MECHATRONIC SYSTEM BASED LEARNING MEDIA TECHNOLOGY

Aspect	Question	Yes	No
The needs of media based on mechatronic.	Have you ever known about mechatronic-based learning media?	31.2%	68.8%
	Have you ever used mechatronic-based learning media?	20.5%	79.5%
	Have you ever made your own mechatronic-based learning media?	10.1%	89.9%
	Is the father/ mother requiring mechatronics-based instructional media to teach early children ages in the school?	82.9%	17.1%
	Do you need a mechatronic-based learning media by integrating local folklore?	83.7%	16.3%
	Are there any mechatronic-based instructional media products in your school?	80.8%	19.2%
The availability of facilities and supporting learning media	If the answer to question number 6 is yes, is the father/ mother use the instructional media in the early childhood learning process?	77.0%	23.0%
	Can this mechatronics-based learning media make a child's early learning age more interesting?	89.2%	10.8%
Limitations and Difficulties in Using Learning Media	Do you have any difficulties/limitations in using mechatronic-based learning media?	14.2%	85.8%
	Do you understand how this mechatronic-based learning media works?	81.5%	18.5%
	Does the availability of this mechatronics-based learning media affect early childhood development capability?	83.1%	16.9%
	Is this mechatronic-based learning media effective for early childhood education?	69.1%	30.9%

Source: Result Research (2020)

Table 2 indicates that the first aspect, the analysis of the needs of mechatronics-based me-dia is very high at 82.9 % of the total respondents' early childhood teachers require mechatronics-based learning media for early childhood learning in school. Even more than 83.7 % of all early childhood teachers require media mechatronics-based learning by integrating the local folklore. In conclusion, the design and application of this mechatronic-based learning media technology are necessary. Therefore, this learning media is very much needed, so this will be a major step towards improving the quality of early childhood learning in Riau Province, Indonesia. As a result, early childhood learning in Riau Province of Indonesia will be more interactive, inspiring, and fun for the students in school.

It can be seen from the assessment of the availability of support facilities and learning media that about 80.8% of early childhood schools as Riau provided mechatronics-based learning media products. In addition, around 77.0% of Riau's early childhood school teachers use this learning media in the early childhood learning process, and around 89.2% of Riau's early childhood teachers said that this mechatronic learning media can make early childhood learning more interesting and interactive and stimulate children's thinking. It should be noted that interactive learning media have a very positive impact on students, the ability of students to think critically is higher and learning is not boring [38]; [39]. This study has been explained that the majority of early childhood teachers in Riau Province have

used this mechatronics-based media and have a beneficial impact on the education of children of age early in Riau, Indonesia.

Assessing aspects of limitations and difficulties in the use of learning media limitations and difficulties in the use of educational media, it is known that 85.8 % of early childhood teachers across the Riau can use this media and do not experience difficulties or obstacles, and 81.5% of early childhood teachers across the Riau also understand how to use mechatronic-based learning. There are 83.1% of early childhood teachers in Riau believe that mechatronics-based media can influence early childhood development skills.

The needs of media based on mechatronic

Technology-based interactive learning media can provide students with the latest educational information [40]. Interactive media are used to stimulate learners to better understand and enhance the interaction of learners [41]. In addition, good quality learning requires a variety of efforts to ensure that this happens and that these efforts are made to fulfill the support facilities such as interactive multimedia learning support [42]. The choice of education media not adapted to early childhood can impact classroom activities, boring learning and even lazy students. In this connection, an early school children's media technology-based education mechatronics system has been developed and recommended, with an important impact on early childhood learning success.

The availability of facilities and supporting learning media

This study explained that most early childhood teachers using this mechatronic media found that the education of early childhood teachers in Riau has a beneficial effect. The early childhood educators as well as the parent do agree that interactive learning media have a very positive impact on students, the ability of students to think critically is higher and learning is not boring [43].

Limitations and Difficulties in Using Learning Media

Implementation power and user response (in this case represented by teachers) related to learning media is also an important point in assessing the feasibility of a learning media so that it can be implemented in the learning process. According to McAlpine & Weston [44], one of the aspects of learning media assessment is the feasibility and acceptance of users, which means that the learning media can be seen from the level of ease of use, level of interest, and motivation in using the media, teaching tools for teachers. The rate was likely to enhance the ability of learners to think critically and solve problems, to apply contextually to real-life according to the characteristics of learners, and to provide convenience and speed to master materials, concepts, and skills appropriate to the subject. In addition, mechatronic-based learning media are also very effective and feasible for the early education of children. It is not too difficult for teachers to use because it is intentionally designed with the principle of being easy to use so that it can be used by all teachers without the need for special skills and in-depth training. Besides, it is also relevant to one of the criteria for media selection that teachers must be able to use in the media. The results of this study, therefore, explain that early childhood teachers show a positive assessment of this mechatronic- based learning media. This is relevant to the results of Mahdum et al.'s research in 2019 [45], which shows that teachers also have a positive perception of the use of ICT in learning activities.

V. CONCLUSION

The aim of this study is to describe and analyze the assessment of early childhood education teachers in media mechatronics-based learning in early childhood school learning activities. In addition, this study also discusses the impact and effects on improving the quality of early childhood learning in Riau, Indonesia. The learning media used in learning must be assessed in such a way that it can function properly and in accordance with the needs of early childhood. Using learning media that does not meet the needs of students makes students less motivated by teaching and learning activities. Therefore, it must be an assessment indicator so that it is known that the learning media can be said have been used successfully and effectively in the learning process. In this case, the process of assessing mechatronic-based learning media was carried out by paying attention to 3 assessment indicators, namely:

1. The needs of mechatronic-based media are known to be very much needed in the design and application of mechatronic learning media technology, and early childhood teachers across Riau can be supported in the production of such learning media.
2. The availability of facilities and support for learning media, it is known that this mechatronic learning media has been used for learning and can make early childhood learning more interesting.
3. 3.Limitations and Difficulties in Using Learning Media It is known that there are no major obstacles to the use of mechatronic-based learning media. This learning media can also affect the ability of early childhood development and is used very effectively for early childhood education.

In order to achieve the objectives of national education, it is important that teachers continue to im-prove their skills and enhance their insights into the use of technology-based learning media and other creative-innovative media. This effort can be made by participating in training forums in order to improve their capabilities. The process of developing media based on mechanics and electronics (mechatronics) will continue to be developed and innovated in the future to make it easier for educators and students to carry out the learning process. In the future, school leaders and related parties, such as the Indonesian Ministry of Education, may work with early childhood teachers to develop technology-based learning media. After all, it also needs the full support of the Government as a policymaker to facilitate everything needed for the development of learning media, because learning media is also one of the main factors determining the success of educational objectives.

ACKNOWLEDGMENTS

The research team would like to thank you for the Directorate of Research and Community Service at the Ministry of Research and Technology/National Research and Innovation Agency through LPPM University of Riau as the funder for this research activity through cooperation contract agreement Number: 499/UN.19.5.1.3/PT.01.03/2021, and also to thank you for TK Labor of University of Riau as a partner cooperation that provides a place for research activities in the field, and all parties involved in this research.

REFERENCES

[1] T. Tafonao, "Peranan media pembelajaran dalam meningkatkan minat belajar mahasiswa," *J. Komun. Pendidik.*, vol. 2, no. 2, pp.103–114, 2018.

[2] K. Novitasari, "Penggunaan Teknologi Multimedia PadaPembelajaran Literasi Anak Usia Dini," *J. Golden Age*, vol. 3, no.01, pp. 50–56, 2019.

[3] Hadiansyah, T., Siregar, E. & Widyaningrum, R. "Buku pedoman pelaksanaan evaluasi media pembelajaran berbasis teknologi," *J. Pembelajaran Inovatif*, vol. 1, no. 1, 19-26, 2018.

[4] T. Tafonao, "Peranan media pembelajaran dalam meningkatkan minat belajar mahasiswa," *J. Komun. Pendidik.*, vol. 2, no. 2, pp.103–114, 2018.

[5] Supriyono, "Pentingnya Media Pembelajaran Untuk Meningkatkan Minat Belajar Siswa Sd," *Edustream J. Pendidik. Dasar*, vol. 2, no.1, pp. 43–48, 2019.

[6] S. Ulfa, "Pemanfaatan teknologi bergerak sebagai media pembelajaran bagi anak usia dini," *Edcomtech J. Kaji. Teknol. Pendidik.*, vol. 1, no. 1, pp. 1–8, 2017

[7] V. Fomichov and O. Fomichova, "A new theoretical and practical approach to early positive developing child's consciousness," in *Cybernetics and Systems' 98. Proceedings of the 14th European Meeting on Cybernetics and Systems Research*, 1998, vol. 1, pp. 276–281.

[8] Y. A. Eyadat and A. S. Alodiedat, "The effect of early childhood teachers' perceptions on using computers in the classroom in the Sultanate of Oman," *Int. J. Instr. Media*, vol. 37, no. 4, pp. 403–416, 2010.

[9] Florida State University. "Instructional media: chalkboards to video." *http://condor.tecadfsu.edu*, 2011.

[10] Y. A. Eyadat and A. S. Alodiedat, "The effect of early childhood teachers' perceptions on using computers in the classroom in the Sultanate of Oman," *Int. J. Instr. Media*, vol. 37, no. 4, pp. 403–416, 2010.

[11] Florida State University. "Instructional media: chalkboards to video." *http://condor.tecadfsu.edu*, 2011.

[12] S. Hackbarth, *The educational technology handbook: A comprehensive guide: Process and products for learning*. Educational Technology, 1996.

[13] R. Heinich, *Instructional media and technologies for learning*. Simon & Schuster Books for Young Readers, 1996.

[14] O. S. Olanrewaju, "Production of photo-series self-instructional package in Fine-Arts for junior secondary school students in Ilorin, Nigeria," *Ilorin J. Educ. 25, 154*, vol. 159, 2005.

[15] S. K. Arndt and M. Tesar, "Early childhood assessment in Aotearoa New Zealand: Critical perspectives and fresh openings," 2015.

[16] P. Purwadhi, "Pembelajaran Inovatif dalam Pembentukan Karakter Siswa," *Mimb. Pendidik.*, vol. 4, no. 1, pp. 21–34, 2019.

[17] A. Marzuki, "Model-Model Pembelajaran PAI Inovatif dan Kontekstual," *Al-GHAZWAH*, vol. 1, no. 1, pp. 103–116, 2017.

[18] R. Umamah, H. Shalihatun, S. Purnomo, S. Nur'aini, and R. Ramadhasari, "Strategi Pembelajaran Inovatif dalam Pembelajaran Thaharah," *J. Penelit.*, vol. 13, no. 1, pp. 1–16, 2019.

[19] M. Muhali, "Pembelajaran Inovatif Abad Ke-21," *J. Penelit. Dan Pengkaj. Ilmu Pendidik. e-Saintika*, vol. 3, no. 2, pp. 25–50, 2019.

[20] E. Susilawati, "Penerapan model pembelajaran inovatif yang memanfaatkan portal rumah belajar di SMP Pesat Bogor," *J. Teknodik*, pp. 41–54, 2020.

[21] A. I. Vlasov, A. V Yudin, V. A. Shakhnov, K. A. Usov, and M. A. Salmina, "Design methods of teaching the development of internet of things components with considering predictive maintenance on the basis of mechatronic devices," *Int. J. Appl. Eng. Res.*, vol. 12, no. 20, pp. 9390–9396, 2017.

[22] R. Kurnia, A. Mahdum, and P. S. Pernantah, "Development of Learning Media for Early Childhood Based on the Mechatronics System," in *2nd International Conference Innovation in Education (ICoIE 2020)*, 2020, pp. 211–216.

[23] U. A. Chaeruman, *Instrumen Evaluasi Media Pembelajaran*. Jakarta: Pusat Teknologi Informasi dan Komunikasi Pendidikan Kementrian Pendidikan dan Kebudayaan RI., 2015

[24] H. M. Levitt, M. Bamberg, J. W. Creswell, D. M. Frost, R. Josselson, and C. Suárez-Orozco, "Journal article reporting standards for qualitative primary, qualitative meta-analytic, and mixed methods research in psychology: The APA Publications and Communications Board task force report.," *Am. Psychol.*, vol. 73, no. 1, p. 26, 2018.

[25] Moleong, L.J. *Metodologi penelitian kualitatif*. Bandung: PT Remaja Rosdakarya., 2007

[26] Miles, M. B. & Huberman, A.M, *Analisis data kualitatif*. Jakarta: UI-Press., 2009

[27] Dunn, R., Dunn, K., & Perrin, J, *Teaching young children through their individual learning styles (K-2).* Boston: Allyn and Bacon.,
1994

[28] S. Alwi, "Problematika guru dalam pengembangan media pembelajaran," *ITQAN J. Ilmu-Ilmu Kependidikan*, vol. 8, no. 2, pp. 145–167, 2017.

[29] Y. Rindiantika, "Penerapan Media Dalam Kegiatan Pembelajaran Bahasa Inggris: Kajian Teoritik," *INTELEGENSIA J. Pendidik. dan Pembelajaran*, vol. 3, no. 1, 2018.

[30] R. Angraini, "Karakteristik media yang tepat dalam pembelajaran pendidikan kewarganegaraan sebagai pendidikan nilai," *J. Moral Civ. Educ.*, vol. 1, no. 1, pp. 14–24, 2017.

[31] Z. Abidin, "Penerapan pemilihan media pembelajaran," *Edcomtech J. Kaji. Teknol. Pendidik.*, vol. 1, no. 1, pp. 9–20, 2017.

[32] Z. Abidin, "Penerapan pemilihan media pembelajaran," *Edcomtech J. Kaji. Teknol. Pendidik.*, vol. 1, no. 1, pp. 9–20, 2017.

[33] Z. Mustika, "Urgenitas media dalam mendukung proses pembelajaran yang kondusif," *CIRCUIT J. Ilm. Pendidik. Tek. Elektro*, vol. 1, no. 1, 2015.

[34] M. Bustanil, "Asrowi, & Ardianto, DT (2019). Pengembangan Media Pembelajaran Interaktif Berbasis Video Tutorial Di Sekolah Menengah Kejuruan," *JTP-Jurnal Teknol. Pendidik.*, vol. 21, no. 2, pp. 119–134.

[35] A. Sumarsono, A. Anisah, and I. Iswahyuni, "Media interaktif sebagai optimalisasi pemahaman materi permainan bola tangan," *J. Pendidik. Jasm. Indones.*, vol. 15, no. 1, pp. 1–11, 2019.

[36] M. I. Shofa, I. W. Redhana, and P. P. Juniartina, "Analisis Kebutuhan Pengembangan Media Pembelajaran IPA Berbasis Argument Mapping," *J. Pendidik. dan Pembelajaran Sains Indones.*, vol. 3, no. 1, pp. 31–40, 2020.

[37] D. Y. Saputri, R. Rukayah, and M. Indriayu, "Need assessment of interactive multimedia based on game in elementary school: A challenge into learning in 21st century," *Int. J. Educ. Res. Rev.*, vol.
3, no. 3, pp. 1–8, 2018.

[38] T. Gayatri, H. Soegiyanto, and P. Rintayati, "Development of Contextual Teaching Learning-Based Audio-Visual Adobe Flash Media to Improve Critical Thinking Ability of Geography Learning at Senior High School," in *IOP Conference Series: Earth and Environmental Science*, 2018, vol. 145, no. 1, p. 12004

[39] M. M. Abidin, B. E. Purnama, and G. K. Nugroho, "Pembangunan Media Pembelajaran Teknik Komputer Jaringan Kelas X Semster Ganjil Pada Sekolah Menengah Kejuruan Taruna Bangsa Pati Berbasis Multimedia Interaktif," *IJNS-Indonesian J. Netw. Secur.*, vol. 4, no. 3, 2013.

[40] V. Arkorful and N. Abaidoo, "The role of e-learning, advantages and disadvantages of its adoption in higher education," *Int. J. Instr. Technol. Distance Learn.*, vol. 12, no. 1, pp. 29–42, 2015.

[41] Y. D. Puspitarini and M. Hanif, "Using Learning Media to Increase Learning Motivation in Elementary School.," *Anatol. J. Educ.*, vol. 4, no. 2, pp. 53–60, 2019.

[42] F.-T. Leow and M. Neo, "Interactive multimedia learning: Innovating classroom education in a Malaysian university.," *Turkish Online J. Educ. Technol.*, vol. 13, no. 2, pp. 99–110, 2014.

[43] T. Gayatri, H. Soegiyanto, and P. Rintayati, "Development of Contextual Teaching Learning-Based Audio Visual Adobe Flash Media to Improve Critical Thinking Ability of Geography Learning at Senior High School," in *IOP Conference Series: Earth and Environmental Science*, 2018, vol. 145, no. 1, p. 12004.

[44] L. McAlpine and C. Weston, "The attributes of instructional materials," *Perform. Improv. Q.*, vol. 7, no. 1, pp. 19–30, 1994.

[45] M. Mahdum, H. Hadriana, and M. Safriyanti, "Exploring Teacher Perceptions And Motivations To Ict Use In Learning Activities In Indonesia.," *J. Inf. Technol. Educ.*, vol. 18, 2019.