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INTERACTIVE, INNOVATIVE, AND ADAPTIVE LEARNING BASED ON AUGMENTED REALITY

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Abstract

Interactive, inventive, and adaptive learning based on augmented reality (AR) is an educational approach that uses augmented reality (AR) technology to enhance students' understanding of abstract concepts and enhance their understanding. The purpose of this study is to improve students' understanding of abstract concepts and objects that are difficult to learn in conventional learning, make learning more efficient and adaptable to the needs of learners, and help learners in the learning process without educators. This research method uses augmented reality (AR) technology to visualize abstract concepts and help them understand them. Helping educators and students understand and integrate information from the virtual world to the real world, increasing student creativity. Learning outcomes are more effective and appropriate to the needs of learners by helping them think critically about problems and events. More engaging and challenging learning, more fun and challenging learning, and real-time hands-on and real-time learning

Keywords: Learning, Interactive, Innovative, and Adaptive Based on Augmented Reality

Introduction

According to Achmad Munib (2017), education is a systematic effort and awareness made by those responsible for influencing students to develop traits and habits that are in accordance with educational goals. Therefore, education is expected to be truly geared towards helping students become more mature and become more independent.

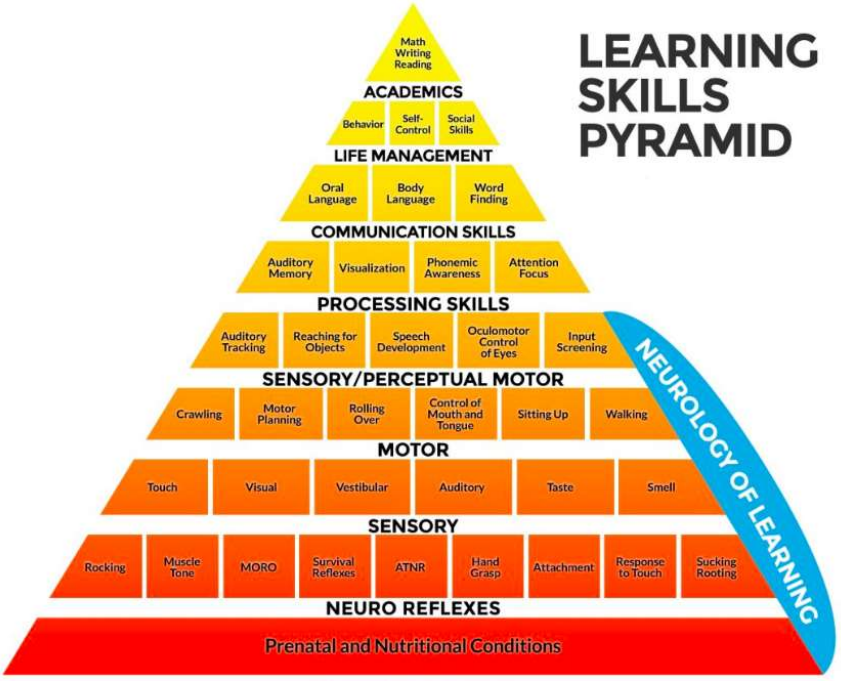
Human life is much influenced by the progress of science and technology. Education is an important part of the process of human maturation. However, education also needs to take advantage of advances in science and technology in order to be able to achieve its goals.

The use of teaching aids has changed due to advances in technology and science. The educational paradigm is changing because learning in schools is starting to be adjusted to AR (Marleni, 2022). This shows that the use of AR in classroom learning has become a necessity and demand in this modern era.

Various innovative and innovative learning models must be developed to improve the efficiency and effectiveness of learning. This must be done so that the learning process does not seem less interesting, monotonous, or boring. As a result, this will hinder the transfer of knowledge. Media will make learning more varied and not boring, so their role is very important in the learning process.

Basically, the learning process is the communication of messages from the introduction to the recipient. The message consists of subject matter that is incorporated into symbols of nonverbal and verbal communication. Learners will perceive this message as knowledge, skills, and principles that can be used in everyday life. It is very important to have adequate resources or media for the message to be conveyed effectively.

In reality, the teacher's model of learning activities greatly affects student retention or student capture. If teachers use lecture activities to teach students, students can only absorb 5% of the subject matter. However, student retention power reaches 90% when learning activities are carried out with peers.



Training Pyramid Image

The media used by teachers affects the effectiveness of learning, according to research by Eyler and Giles (in Sekarningrum, 2023). They found that the highest learning model in the cone—which uses only verbal symbols through text presentation—produced the highest level of abstraction. The most effective learning occurs when directly involved with purposeful learning

experiences. This learning model has a very low level of abstraction, which makes it easier for students to acquire new knowledge and skills.

Definition of Learning Media

The Ministry of National Education (2003) states that the term "media" comes from Latin and is the plural form of the word "medium", which means intermediary or introduction. Everything that has the ability to transmit information from the source to the receiver is called "information". Keeping in mind that learning is a communication process, the medium used for teaching is called the learning medium. Educational media is a component of learning resources, which is a combination of software (learning materials) and hardware (learning tools) that are interactive, innovative, and adaptive.

Media is defined by the Association for Education and Communication Technology (AECT) as all forms and channels used to process information. Media, according to the National Education Association (NEA), is anything that can be manipulated, seen, heard, read, or talked about along with the tools used for the purpose. However, according to Molenda, M. H. (2023, "the term refers to anything that carries information between a source and a receiver."

However, according to Marshall McLuhan (in Yoga, 2023), the media can influence others who are not directly involved. According to this formulation, communication media include telephones, television, movies, and letters, while roads and railways are the media that allow a person to communicate with others.

OemarHamalik also distinguishes media in a narrow and broad sense. In a narrow sense, teaching media only includes media that can be used effectively during the planned teaching process. However, in a broad sense, media also includes simple tools such as slides, photographs, teacher-made diagrams and charts, tangible objects, and visits outside of school. Because both require and use a lot of time to convey information to students, teachers are also considered as presenting media, such as radio and television.

The medium of teaching is described by Romiszowski (in OemarHamalik, 2003: 201) as "the transmission of massage from the source of transmission (which can be a person or an intimate object), to the recipient of the massage (which in our case is a student)." According to Deflin (2023), media is any tool that can be used to disseminate messages or information to achieve learning objectives. With respect to media as a source of learning, media can be broadly defined as people, objects, or events that enable students to acquire knowledge and skills.

Basically, the various limitations mentioned above have the same fundamental meaning. We need tools or media to communicate. Media is anything that can transmit information from a source to a receiver. Educational media is interactive, creative, and adaptive "software" that sends educational messages or information through assistive equipment (hardware) to students. Here it is clear that media and equipment are different, but they work together to convey educational messages and information to students. Therefore, it can be concluded that (a) the media is a container of the message that the source or dealer wants to convey to the target or

recipient of the message, (b) the material to be conveyed is a learning message, and (c) the goal to be achieved is a learning process.

Advantages of Learning Media

Each lesson has a different level of difficulty. Certain learning materials do not require learning media, but others do not. Learning materials with a high level of difficulty must be difficult for students to understand, especially by students who do not like the learning material delivered.

It is undeniable that educational media serve as aids in the learning process because they are interactive, innovative, and flexible. As a speaker, the role of the teacher is very important to facilitate his task in conveying messages—or learning materials—to students. In addition, teachers realize that students will find it difficult to digest and understand learning material without media. If the learning material to be delivered is considered complex and complicated. So, in order for information to reach students effectively, media must be used.

Media generally helps in the learning process as it allows for better interaction between teachers and students. As a result, learning activities become more effective and efficient. However, there are some more detailed media advantages. Kemp and Dayton (in the Ministry of Education, 2003) mentioned several advantages of using media in learning, such as:

1. The subject matter can be uniformized.
2. Learning becomes easier to understand and engaging.
3. Learning is increasingly interactive.
4. Effective in terms of time and effort
5. Improve student learning outcomes
6. Learning can be done anywhere and anytime thanks to media.
7. Students can gain a positive attitude towards lessons and the learning process through media.
8. change the functioning of teachers in a more profitable and productive direction.

There are several obvious advantages of media in addition to the advantages mentioned above. The practical benefits of this interactive, creative, and adaptive learning medium are as follows:

1. Media can make abstract lessons more specific.
2. Media can also overcome the constraints of time and space.
3. Media has the potential to help overcome the limitations of the human senses.
4. In the classroom, the media can present objects of study such as rare and dangerous objects or events.

By using the right media, lesson information will leave a deep impression and be embedded longer on students. By considering the opinions above, it can be concluded that interactive, creative, and adaptive educational media have several practical benefits, including:

Reduce verbalism by concretizing abstract concepts. Using examples such as drawings, schemes, graphs, models, and so on makes the lesson less boring and not monotonous, which can increase the attention of individual students to the entire study group. Functioning of all the senses of the student, so that the weakness of certain senses, such as ears or eyes, can be offset by the strength of other senses.

Using learning media is the only way to bring the world of theories and concepts closer to the real world. For example, children are unlikely to gain direct experience of learning earth patterns. As a model for the globe, made globe. By using learning media, symptoms that are too big or too small, movements that are too fast or too slow, objects or symptoms that are dangerous or difficult to obtain, things that are too complex, and so on can be clarified.

Increase students' chances of having direct interaction with their environment. For example, by using recordings, experiments, field trips, and others.

Give uniformity or uniformity in observation because the comprehension of each student will vary depending on their own experience and intelligence. For example, if elephants are observed directly or if examples are brought to the front of the class, perceptions of elephants can be consistent.
There is the ability to repeat and retain learning information at any time. For example, it can be recordings, movies, slides, images, photos, modules, and others.

Media Type
Janah (2023) states that there are six categories of media based on type: projected media, unprojected media, audio media, film and video media, communication-based media, and communication-based media. However, Schramm categorizes media based on two factors: complexity, cost, and coverage. According to Briggs, there are thirteen types of educational media that are interactive, creative, and adaptive. These include objects, models, live sound, sound recording, print media, programmatic learning, whiteboards, transparency media, string films, frame films, television films, and picture films. Gagane enumerates seven categories of media: objects to demonstrate, oral communication, print media, still images, motion pictures, sound films, and machine learning. There are six types of learning media, according to Edling: interactive, creative, and adaptive; visual and audio subjective codification; visual and audio subjective codification; and hands-on experience with people and things. Soeparno (1988) stated that media classification was carried out using three categories based on their attributes, dimensions of presentation, and usage.

According to Bretz (in Hujair, 2009), the three main components of media are sound, visual, and motion. Every visual form consists of images, lines, and symbols. In addition, Bretz distinguishes between broadcast media (telecommunications) and recording media (recording). As a result, there are eight categories of media: first is motion audio-visual media; second is the silent audio-visual medium; third is semi-motion audio-visual media; fourth is the visual medium of motion; the fifth is semi-mobile media; the sixth is audio media; and eighth is print media.

It is possible to overcome learners' passive attitudes in learning by using interactive, creative, and adaptive learning media that are appropriate and varied with sound (audio), visual, and movement experiences. Table 1 shows examples of each of the media mentioned above.

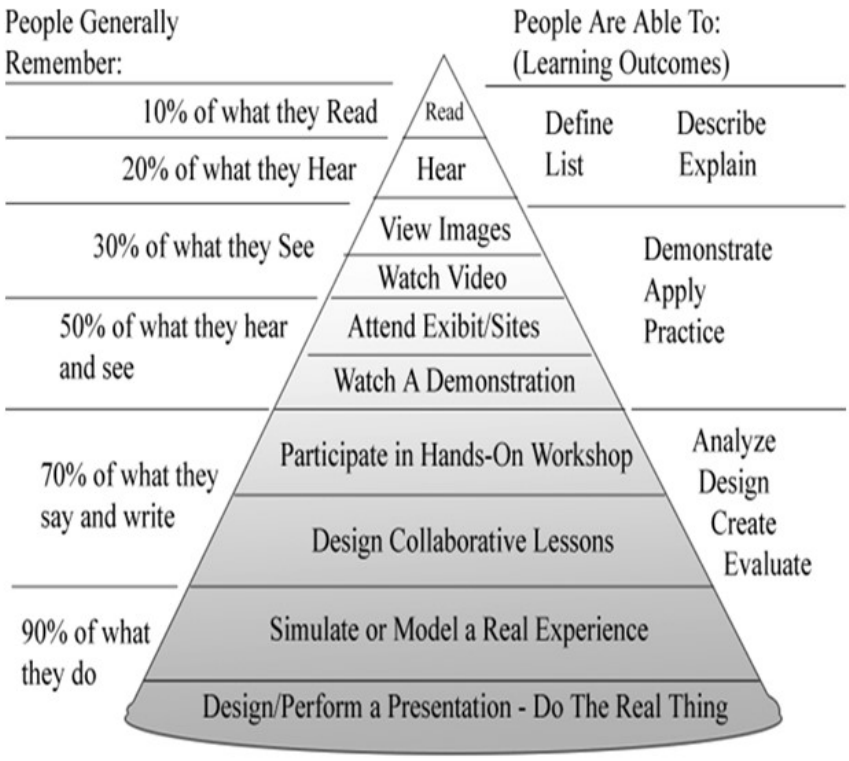


Image of Edgar Dale Learning Media Classification

The grouping of economic media and learning resources can also be reviewed by type: audio, visual, audio-visual, and all-round. This is due to the wide variety and forms of teaching media.

Sound media such as radios, vinyl records, audio tapes, record players, and visual resource telephones

Still visual media include photographs, drawings, illustrations, clippings, frame films, frame films, string films, transparencies, microphys, overhead projectors, graphics, charts, sketches, posters, cartoon drawings, maps, and globes, as well as other printed goods.

1. Motion Visual Media: Film That Does Not Talk
2. Music and visual media
3. Silent audiovisual media include still television, slides and sound, series films and sound, and books and sound.
4. Audio-visual motion media include motion picture and sound, video, CDs, television, images, and sound.
5. Unscrupulous media
6. boards and displays: whiteboards, whiteboards, magnetic boards, showboards, wall magazines, and multiplier machines
7. Reality, samples, artifacts, models, dioramas, and displays are examples of three-dimensional media.
8. Dramatization techniques in media include drama, mime, role-playing, demonstrations, marches, carnivals, puppet decks, and simulations.
9. Social Learning Resources: Field Work, Travel, Camp
10. Study Program
11. computer machine

Development of Interactive, Creative, and Adaptive Learning Media Based on Augmented Reality (IT)

The use of interactive, innovative, and adaptive learning media based on Augmented Reality (IT) is becoming a need and demand in today's era of globalization and information. However, doing so is not always easy. In order to optimally use the substrate and not deviate from the goal, it is important to consider several techniques.

Arief Media is divided into two types based on how ready they are made. According to Sadiman et al. (2006), media are divided into two categories: first is media specifically designed for specific learning goals and objectives; The second is media as a trading commodity available in the broad market in a ready-to-use state (media by utilization).

From the statement above, it can be concluded that computer media and LCD projectors are design media that are indispensable for use properly. The hardware, or hardware, used to inspire the media is to use a complete computer unit connected to the LCD Projector. So, this medium should attract the attention of students during learning.

With computer network technology or the internet, users can communicate directly with others. A device called a modem was made to make this possible. With the help of computer networks or the internet, participants have the opportunity to communicate in writing and exchange ideas

about the learning activities they are doing. It is possible to design computer networks so that students and teachers can communicate with each other and have learning interactions with other students. Computer networks allow students to interact with each other and in groups. Computer conferencing system (CCF) is another term for a distance education system that uses computer networks. Systems are usually sent by electronic mail or email. Some of the advantages of using computer networks in distance education systems are as follows: it can improve tutorial models, can solve student learning problems in less time, and can overcome time and space problems in obtaining information. CCF allows students and educators to interact directly in learning both between individuals and groups (Mason, 1994 in Benny A. Individual and Tita Rosita, 2002: 13-14)

According to KetutGedeDarma Putra (2009), there are a number of media that can be used in IT-based learning, such as:

Online

With the advent of the internet, e-learning models, distance learning, web-based learning, and other IT-based education terms emerged. The Internet is a global computer network that facilitates, accelerates, and disseminates information.Information and knowledge (learning material) so that the material can always be updated during the teaching and learning process. To implement IT-based education, internet access must be available.

As a result of the rapid development of telecommunication networks, areas in Indonesia that have access to the internet network are increasing. To access the internet, you can use a variety of technologies, including home and office telephone networks, Speedy Telkom networks, ISP leased lines, and GPRS, 3G, and HSDPA communications through GSM and CDMA modems from cellular providers. In other words, today there are many technology options available to connect you to a global network.

Internet

Intranets can be used as an IT-based educational medium as an alternative if internet infrastructure is not available. Intranets are similar to the internet but are intended for local areas such as classrooms, schools, buildings, or between buildings. Synchronous and asynchronous learning models can be run on intranets more easily and cheaper. Intranets can be the right choice to implement IT-based education, according to the authors, in certain situations.

Car

The rapid advancement of cellular phone technology allows the use of cellular phone media for IT-based learning. Using their mobile phones, students can follow lessons easily. The development of this technology is so advanced that a new term for IT-based learning has emerged called M-learning.

CD-ROM and Flash Drive

If an internet/intranet network is not available, CD-ROM or flash disk media can be a better choice. Media is used to store learning materials, which are then opened on a computer. Using CD-ROM or flash disk media is the easiest and least expensive IT-based learning method. In addition, according to I Ketut Gede Darma Putra (2009), learning management systems (LMS) and learning materials (LC) are the two main components of IT-based learning.

Learning Management System

"If learning content is king, then infrastructure (LMS) is god," the saying goes. This phrase shows how important the LMS component is in technology-based learning. LMS is a computer system that functions as administrative staff to organize the teaching and learning process. LMS has the following functions:

Supervise learning materials

Each subject will have different study materials. Each learning material will be grouped by class and semester. The material taught each semester will be arranged according to the first, second, third, and so on meetings. After that, each learning material can be changed according to curriculum changes.

The above situation will become more complicated when we try to answer the following questions:

What if there are hundreds of learning materials in dozens of subjects?

How can students avoid going into class the wrong way?

What if the teacher wants to improve or improve learning materials for a semester?

How can teachers compare subject matter from different curricula or from previous year's material during the learning process?

In addition, there are many other issues that can complicate the IT-based teaching and learning process.

If the learning process had an LMS, the complicated questions above would be so easy. This is the first function of the LMS that has the ability to manage learning materials and assist teachers and participants in the teaching and learning process.

Registration and Agreement

If there are learning conditions that require approval, the LMS can perform participant registration and other actions. In addition, this function is advantageous because it limits the right of entitled people to study with unauthorized people.

Document teaching and learning activities.

Recording teaching and learning activities is the third task of the LMS. This role can answer questions such as how long it takes, when does learning start, when does it end, and who is present, how the discussion (question and answer) occurs, and provide warnings to participants.

Perform an inspection

The fourth function of LMS is to assess the teaching and learning process. This includes evaluating participants' progress between before and after learning, evaluating how far participants understand the material, and using the evaluation results to advise participants to repeat some material that is considered lacking. Measuring participants' level of satisfaction or their perception of the learning material, especially in terms of material presentation, is an additional evaluation component that can be used. However, there is a significant correlation between the way learning material is presented and participants' ability to absorb it.

Communication using media

LMS can be used to communicate, disseminate announcements, and improve interaction between teachers, participants, and administrators.

Report

The end of the above functions is the creation of automatic and clear reporting on teaching and learning outcomes. Reports can be generated based on the access rights of each member of the school. For example, reporting can be given to leaders, teachers, participants, maybe even parents for various facilities.

Content Education

The learning material that will be presented to students is called content learning. The material should be created by people who are experienced in the field, no matter whether they have extensive knowledge of information technology or not. The content developers (content developers) create electronic versions of the material after it is created so that it can be entered into the LMS.

Resources should be interesting so that the audience is interested in reading (learning). This can include animation, sound, video, interactive, and simulation. However, you still have to pay attention to internet or intranet bandwidth so that content is not too slow to display when learned. During the study of the material, participants must have control over the presentation of the material and have the ability to jump from one material to another. topic to another topic. To maintain interactivity, forums, chat, and video conferencing can be used.

Interactive, innovative, and adaptive learning theory based on augmented reality (AR) according to (Hartono, 2023) is a theory that combines technology with interactive and adaptive learning.

The purpose of this theory is to help students better understand and understand abstract concepts. Interactive, creative, and adaptive learning theory based on augmented reality includes technologies that can integrate three-dimensional objects into three-dimensional environments.
The use of augmented reality (AR) according to (Hartono, 2024) in learning can improve student learning outcomes, such as in broad-based network technology (WAN) learning. The ease of AR learning allows users to develop new perceptions that allow them to interact with the real world. In addition, AR can increase student learning motivation.
AR Special Needs can help make learning environments more inclusive, such as in schools for students with special needs.
Better Visualization (AR) allows students to see concepts or objects in a better way through better visualization. This applies to science learning.
Problem-solving Skills: With AR, students are often faced with problems or challenges that they must solve in a virtual environment, which can improve their problem-solving skills. Interactive learning theory helps students prepare for work in the digital age.

Result

Educational media can be a tool for disseminating interactive, innovative, and adaptive learning messages and information. Well-designed, interactive, innovative, and adaptive learning media will greatly help students understand and understand the subject matter. Media in education serves as a messenger and not just a teacher's props. Each type of learning media, be it interactive, creative, or adaptive, has its features and weaknesses. Therefore, the use of learning media must be well planned.

Interactive, creative, and adaptive educational media are increasingly developing in today's era of globalization and information. It has become a necessity to use Augmented Reality (IT) as an interactive, creative, and adaptive learning medium. IT-based media designing requires specific skills, but this doesn't mean media should be avoided or abandoned. Interactive, creative, and adaptive IT-based learning media can be in the form of internet, intranet, mobile phones, and CD/Flash Disk space. Learning Management System (LMS) and Learning Content (LC) are its main components.

Educators must be able to choose and develop the right media for a more effective and efficient learning process because the use of interactive, innovative, and adaptive economic learning media can facilitate the learning process and optimize learning outcomes.

Bibliography

Munib, A. (2017). The concept of nature and its implications in education. *Journal of PROGRESS: Vehicles for Creativity and Intellectuality*, *5*(2), 223-241.

Marleni, T. IMPROVING NATURAL SCIENCE LEARNING OUTCOMES THROUGH VIDEO MEDIA IN GRADE V STUDENTS. In *Social, Humanities, and Educational Studies (SHES): Conference Series* (Vol. 5, No. 6, pp. 1025-1032).

Sekarningrum, H., Setyaningsih, Y., &; Widharyanto, B. (2023). Development of the IngınTahu character instrument in reading and reading learning in grade 1 elementary school. *Journal of Elementaria Education*, *6*(2), 575-587.

Aulya, R., Wardani, S. A., Fahma, M. A., Rahmatika, M. S., Nuristantia, L., &; Wanabuliandari, S. (2023). ASSISTANCE IN NUMBER OPERATION SCALE FOR DEAF BASED ON LOCAL EXCELLENCE THROUGH THE SMART COMMUNITY PROGRAM AT THE DISABILITY COMMUNICATION FORUM. *Mathematic Education Journal,6*(3), 1-7.

Molenda, M. H. (2023). Robert Heinich: Leader Spotlight. In *AECT at 100* (pp. 287-290). Brill.

YOGA, A. (2023). *DEVELOPMENT OF INTERACTIVE VIDEO-BASED LEARNING MEDIA FOR DIGESTIVE SYSTEM MATERIAL IN HUMANS CLASS XI SMAN 1 PUTUSSIBAU* (Doctoral dissertation, IKIP PGRI PONTIANAK).

Sari, S. (2023). *The influence of the mnemonic model accompanied by audio-visual media on students' conceptual understanding of the excretory system material of class XI MIPA SMA N 2 Kudus* (doctoral dissertation, IAIN KUDUS).

Devlin, L. A., Hu, Z., Ounpraseuth, S., Simon, A. E., Annett, R. D., Das, A., ... & Young, L. W. (2023). The influence of mediators on the relationship between antenatal opioid agonist exposure and the severity of neonatal opioid withdrawal syndrome. *Maternal and child health journal*, *27*(6), 1030-1042.

Setiawan, A. D., &; Jufri, M. (2023). THE DEVELOPMENT OF LEARNING MEDIA WITH INFORMATION TECHNOLOGY SYSTEMS. *SITEBA JOURNAL*, *1*(2).

Setiawan, A. D., &; Jufri, M. (2023). THE DEVELOPMENT OF LEARNING MEDIA WITH INFORMATION TECHNOLOGY SYSTEMS. *SITEBA JOURNAL*, *1*(2).

Jannah, M., Arifrabbani, L. M., &; Aziz, A. (2023). Media and Technology Development in Learning. *BLAZE: Journal of Language and Literature in Linguistic Education and Development*, *1*(4), 156-168.

Setiawan, A. D., &; Jufri, M. (2023). THE DEVELOPMENT OF LEARNING MEDIA WITH INFORMATION TECHNOLOGY SYSTEMS. *SITEBA JOURNAL*, *1*(2).

Yusup, A. H., Azizah, A., Rejeki, E. S., Silviani, M., Mujahidin, E., &; Hartono, R. (2023). LITERATURE REVIEW: THE ROLE OF AUGMENTED REALITY-BASED LEARNING MEDIA IN SOCIAL MEDIA. *Indonesian Journal of Education: Theory, Research, and Innovation*, *3*(5).

Hartono, R., Riyana, A., Dewi, I. A. C., Fatonah, U., &; Pangesty, D. A. R. (2024). Education planning analysis using augmented reality, virtual reality, and blockchain.