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Digital Learning for Future Science Learning: A Systematic Literature Review

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Abstract: In the 21st Century, technology is increasingly fast, even getting information is considered very easy with the existence of digital media which becomes a facilitator to be able to communicate with each other share and exchange information. Of course, with the development of time, feel left behind if you don't keep up with technological developments. Education in the digital era is mandatory education integrating Information and Communication Technology into all areas of lessons. Students need to have the ability to think to be able to answer the problems they face and education must be able to facilitate developing this thinking ability. The research aims to examine Digital Learning for Future Science Learning. A review is conducted on the state-of-the-art methods using the preferred reporting items for reviews and meta-analyses (PRISMA) guidelines We must know and practice changes in education and learning patterns at all levels of education by describing the characteristics of learning that are currently needed. The results of this research explain that learning and learning have theory and implementation to be applied at every level of education, several learning media are carried out, and currently, digital learning media is increasingly widespread and developing with the times.

Keywords: Digital learning; Learning; Science

Introduction

The education system is defined as a method or strategy applied in a teaching and learning process to develop students' potential and make them more active (Haleem et al., 2022). This change can be seen from changes in the education system which consists of learning, teaching, curriculum, student development, learning methods, learning tools, facilities and infrastructure, and graduate competencies from time to time. According to behaviorist theory, learning is a change in a person's behavior that can be seen and observed directly, which occurs between stimulus and response by mechanistic principles (Anindyarini et al., 2018). Responding to the challenges of education in this digital era, teachers and students in the 21st century must be able to communicate and adapt accordingly to developments over time, in this case, technological developments, apart from that as time continues to develop, it is directly proportional to the development of problems that require resolution with high-level thinking.

The problem faced is globalization, economic growth, international competition, and environmental, cultural, and political issues, these complex issues make it very important to develop abilities and knowledge for success in the 21st century. The development of education in the world cannot be separated from the development of the industrial revolution that occurred in the world (Bose & Sarma, 1975), because indirect changes in the economic order also change the education order in a country. Humans cannot escape from learning. Learning is a human process and is carried out throughout life. Starting from birth, when babies learn to breastfeed, when they grow up and learn to understand their parents' advice, until adulthood when they learn to understand lecture material, learning is part of supporting human life. This learning ability is

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what differentiates humans from other living creatures. The learning process occurs within humans so they can adapt to their environment. Education in the Era of Industrial Revolution 4.0?

Indonesia plans to overhaul the education curriculum with greater emphasis on STEAM (Science, Technology, Engineering, the Arts, and Mathematics), aligning the national education curriculum with future industrial needs. This is related to learning and learning, learning media, and digital learning media. Learning is a process of acquiring knowledge. Learning is an activity that results in a change from not knowing to know, from being unable to being able. Meanwhile, learning refers to two concepts, namely learning and teaching. Learning is a complex process that presents learning activities carried out by students as well as teaching activities carried out by teachers. Studying and learning are two activities that go hand in hand and are interconnected with each other. This means that the learning process will not be successful if learning activities are not present. On the other hand, if the teaching component in the learning process is not carried out well, then learning activities will also be lame and not achieve maximum results.

Learning media has the function of carrying information from the teacher (source) to the students (recipients). The function of the media can be determined based on the media's advantages and obstacles that may arise in the learning process. According to Putri et al. (2019), the general uses of learning media are as follows: clarifying the presentation of the message so that it is not too verbalistic; overcoming limitations of space, time, and sensory power; appropriate and varied media can overcome the passive nature of students; assist students and teachers in teaching and learning activities. Khusniyah (2022) suggested 4 functions of learning media, namely; the attentional function of attracting and directing students' attention; the affective function of visual media can be seen from students' level of enjoyment when learning; the cognitive function; the compensatory function of learning media helps students who are weak in reading to organize information in the text and remember it again. According to the expert opinion above, it can be concluded that learning media must be able to motivate students in the learning process because media is a communication tool for teachers and students in the teaching and learning process to achieve the desired learning goals.

The development of science and technology influences learning and learning activities, so the learning media used must follow the needs of the learning process (Susilo & Sofiarini, 2021) states that learning media can be grouped into four groups, namely; media resulting from print technology; media resulting from audio-visual technology; computer-based technological media; d) media resulting from a combination of print and computer technology. Ghofur (2022) states that the various types of learning media are audio media (radio, recording equipment, and audio tape), visual media (magazines, newspapers, modules, comics, posters, atlases), audiovisual media (film, video, television), and multimedia. Based on the opinion above, it can be concluded that learning media can be categorized into four parts, namely visual media, audio media, audiovisual media, and interactive media. Based on the background above, research was conducted that aimed to examine Digital Learning for Future Science Learning.

Method

We conducted this research as a systematic review by following the PRISMA guidelines. The PRISMA guidelines provide several items that need to be considered in preparing a systematic review. In this study, we will mainly focus on several key items: Digital Learning, Science, and Learning. This helps form the basis of our assessment. Initially, we collected the latest studies Digital Learning, Learning, and Science, based on a few selected keywords. Then, we apply eligibility criteria to the collection. We only selected literature published in 2017 or later to provide an overview of recent trends. In addition, we limit the types of literature, namely only literature in the form of journals and proceedings.

Result and Discussion

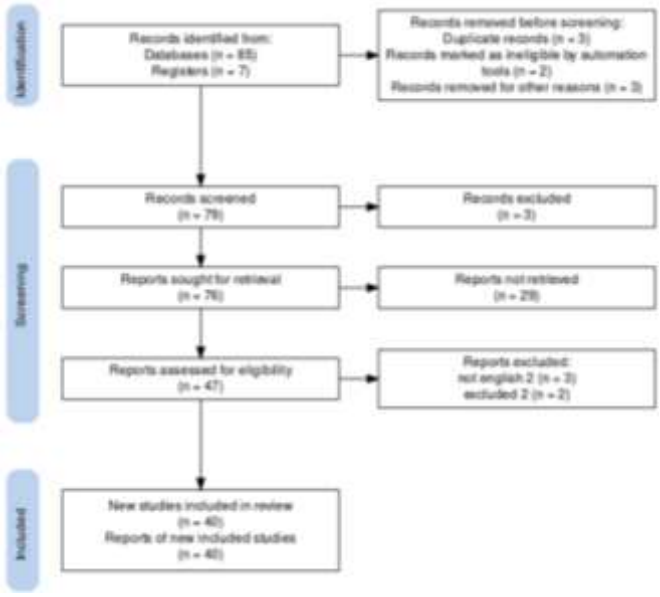

Figure 1. Study and learning

Preferred Reporting Items for Systematic Review (PRISMA) is the preferred reporting technique used in this study. The research was conducted methodically throughout the necessary research stages. The information offered is thorough, and impartial, and attempts to combine pertinent study findings. The steps of a systematic review of the literature involve developing research questions, searching the literature, Completing articles published in international journals from 2017-2023, indexed in databases, and themed Digital Learning for Future Science Learning.

Table 1. Learning Theory and Its Implementation in Learning

Source	Learning Theory and Its Implementation in Learning
(Salamah et al., 2021); (Yulianti, 2023); (Arisnaini, 2022)	Behavioristic Learning Theory
(Wisman, 2020)	Cognitive Learning Theory
(Asfar et al., 2019); (Pr et al., 2023); (Muali et al., 2019.)	Humanistic Learning Theory

Behavioristic Learning Theory

Learning according to behavioristic learning theory is a process of changing behavior as a result of the interaction between stimulus and response, while as a result of the interaction between responses, students have new experiences that cause them to behave in new ways. The characteristics of behavioristic learning theory are: Prioritize the influence of the environment (environmentalistic), Prioritize the parts (elementaristic), Emphasize the role of reaction (response), Prioritize the mechanism for forming learning outcomes, focus on cause and effect relationships in the past, Place importance on habit formation, Special characteristics of problem-solving by "trying and failing" or trial and error. Learning with this theory is Teacher-Centered Learning. Incorrect applications cause unpleasant learning for students. A teacher's astuteness and sensitivity to the reading situation and learning conditions are very important before deciding whether to use this method. Not all subjects can use this method. Material that is suitable for this method includes material that requires practice and familiarization, such as B. Foreign language conversation material, computer handling, etc.

Cognitive Learning Theory

Learning according to cognitive learning theory is always based on cognition, the act of perceiving or thinking about the circumstances in which the behavior occurs. According to this theory, the learning process runs well if new material (continuously) adapts appropriately and follows the student's existing cognitive structure. Therefore, science is built through a process of continuous interaction with the environment. This process does not occur individually or piecemeal, but rather through a fluid, continuous, and comprehensive process. For example, when someone reads text, instead of reading letters one by one, the words, sentences, or paragraphs all appear to be one, and the whole flows and flows at the same time. According to cognitive theory, this is how learning should be. In learning with cognitive learning theory, learning is more student-centered, analytical in nature, and more focused on the process of forming knowledge and reasoning.

The characteristics of learning in a cognitive view are as follows: Providing learning experiences by connecting students' existing knowledge when students learn through the knowledge creation process; and offering a variety of alternative learning experiences. Not all do the same work. For example, problems can be solved in different ways. Integrate lessons with situations that are realistic and relevant to experience; Integrate teaching to enable social communication, namely individual interaction and collaboration with other people or their environment; Use various media, including oral and written communication, to make learning more effective.

Humanistic Learning Theory

Important figures in theoretical humanistic learning theory are Arthur W. Combs, Abraham Maslow, and Carl Rogers. According to humanist theory, the goal of learning is humanization. The learning process is considered successful if students understand the environment and themselves. This learning theory tries to understand learning behavior from the perspective of the perpetrator, not from the perspective of the observer.

The main goal of educators here is to help students develop themselves. It's about recognizing ourselves as unique human beings and helping them realize the potential that lies within them. Humanities experts believe there are two parts to the learning process. The process of obtaining new information and the process of personalizing information about individuals. In humanistic theory studies, teachers act as facilitators and students act as protagonists who interpret the process of their own learning experiences.

The purpose of learning is the learning process, not the learning outcome; Set clear learning objectives; Ensure active participation of students through honest, clear, and positive learning contracts; Encourage the development of students' self-motivated learning

abilities; Encourage students to be sensitive, think critically and independently interpret the learning process; Students are encouraged to speak freely, make their own decisions, do what they want and risk their actions; Teachers accept students as they are, try to understand what they think, do not judge prescriptively, and encourage students to be responsible for their behavior and risks in the learning process; Let students progress at their own pace; Evaluation is carried out individually according to academic achievement. Learning based on humanistic theory is suitable for application to teaching materials related to character formation, conscience, attitude change, and analysis of social phenomena.

Table 2. Instructional Media

Source	Various Learning Media
(Sengkey et al., 2021); (Marpanaji et al., 2018); (Maula, 2019)	Media resulting from print technology
(Pertiwi et al., 2023); (Indrayanti et al., 2023); (Permana, 2019); (Budhyani et al., 2020)	Media resulting from audio-visual technology
(Damarwan & Khairudin, 2017); (Mayefis, 2022)	Computer-based technological media
(Anita Winandari et al., 2022); (Kampa, 2023)	Media resulting from a combination of print and computer technology

Based on technological developments, teaching media are grouped into four parts, namely:

Media Resulting from Print Technology

Print technology is a means of producing or conveying materials, such as books and static visual materials primarily through mechanical or photographic printing processes. The media group resulting from print technology includes text, graphics, photos, or photographic representations and reproductions. Printed and visual materials are the basis for the development and use of other materials and teaching. This technology produces material in the form of printed copies.

Media Resulting from Audio-Visual Technology

Audio-visual technology is a way of producing or delivering material using mechanical and electronic machines to present audio and visual messages. Presentation via audio-visual is characterized by the use of hardware during the learning process, such as film projectors, tape recorders, and visual projectors.

Media Results from Computer-Based Technology

Computer-based technology is a way of producing or delivering material using microprocessor-based sources. The difference between media produced by computer-based technology and the other two technologies is that the information is stored in digital form, not in printed or visual form. Various types of computer-based technology applications in teaching are generally known as Computer Assisted Instruction. These applications include drills and practice (exercises to help student's master previously studied material), tutorials (gradual presentation of lesson material), games, and simulations (exercises in applying newly learned knowledge and skills).

Media resulting from a combination of print and computer technology

Composite technology is a way to produce and deliver material that combines the use of several forms of computer-controlled media. *The learning media that will be created in this paper is computer-based*. Meanwhile, the types of digital technology learning media that can be utilized by teachers include:

Interactive Multimedia

In terms of terminology, multimedia is defined as a combination of various media such as text, images, sound, animation, video, and others in an integrated and synergistic manner using tools such as computers or other electronic equipment to achieve certain goals. This definition means that each multimedia component must be processed, manipulated, and combined digitally using a computer or similar device.

Digital Video and Animation

Technological developments encourage many changes in students. The habit of using textbooks and notebooks is slowly decreasing. Technological sophistication has given rise to a variety of learning methods that are more effective and interesting for students. Video-based learning is an example of an effective learning method and has become a trend in e-learning for the past decade.

Podcasts

Podcasts are program episodes available on the Internet. Podcasts are usually original audio or video recordings and are also recordings of television broadcasts or radio programs, lectures, performances, or other events. Podcasts often offer each episode in the same file format, such as audio or video, so subscribers can enjoy the program in the same way.

Augmented Reality (AR)

Augmented Reality (AR) is a technology that can combine two-dimensional or three-dimensional virtual objects into a real environment and then display or project them in real-time. AR can be used to help visualize abstract concepts to provide understanding and structure of an object model. Several AR applications are designed to provide users with more detailed information from real objects.

Virtual Reality (VR)

Virtual Reality is a combination of digital image processing, computer graphics, multimedia technology, sensor and measurement technology, virtual and artificial intelligence, and other disciplines, building a realistic virtual interactive three-dimensional space environment for humans, and responding to real-time activities or operations for people, which makes people feel like they are in the real world. This will have a great impact on traditional multimedia teaching bringing virtual reality technology into the teaching process, multimedia teaching from 2D to 3D interaction, and building a high virtual simulation teaching environment.

Game-Based Learning

Game-based learning is playing and learning that can occur when classrooms use games as a learning medium. Usually, game technology can make difficult lessons more interesting and interactive. Technological advances are increasingly being used to improve educational games in every discipline. Games can involve solving real-life problems.

Table 3. Digital learning media

Source	Types of Digital Technology Learning Media
(Rizkasari et al., 2021); (Jiang et al., 2022); (Buckingham, 2007)	Interactive Multimedia
(Abdulrahaman et al., 2020)	Digital Video and Animation
(Aditya Nalendra et al., 2020); (Hasibuan & Male, 2022)	Podcasts
(Arzak & Prahani, 2023); (Wahyudi & Arwansyah, 2019);	Augmented Reality (AR)
(Sholihin et al., 2020); (Saputro & Setyawan, 2020); (Mills & Brown, 2022);	Virtual Reality (VR)
(Anggrawan et al., 2023); (Li et al., 2022); (Bistaman et al., 2018)	
(Fujiati & Rahayu, 2019); (Chen & Tu, 2021); (Kadarwati et al., 2023.)	Game-Based Learning

Conclusion

Studying and learning are activities carried out in a planned and patterned manner to create an atmosphere and provide services so that students learn effectively. This is an effort carried out by individuals intentionally or not. There are many benefits obtained from digital media in the context of education. The use of digital media for learning has experienced significant development. The presence of digital media provides various educational innovations.

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Conceptualization, Z. A., A. W. P., A. A.; methodology, A. W. P.; validation, A. A. and Z. A.; formal analysis, A. W. P.; investigation, A. A., and Z. A., A. W. P.; resources, Z. A. and A. W. P.; data curation, A. A.: writing—original draft preparation, Z. A., A. W. P and A. A.; writing—review and editing, Z. A.: visualization, and A. W. P. and A. A. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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