



Multimedia-based Learning for Early Childhood Education

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Abstract. This study aims to describe the usefulness of multimedia for early childhood education. Multimedia as a medium that facilitates and motivates learners in learning to be more interactive, effective, efficient, and interesting. With that, learners are encouraged to have a positive motivation in learning to achieve autonomy, mastery of knowledge, and the main objectives in learning. Here, educators act as facilitators for learners. Learning is centered on learners. Thus, learners become more active and creative, and engage in the learning process based on their needs and abilities. Authors use the Systematic Literature Review (SLR) method to identify, evaluate, and interpret research relevant to multimedia learning topics for early childhood education. The use of the SLR Method can review and identify journals relevant to multimedia learning and early childhood education systematically while following the protocols that have been established in each process. This method features relevant research questions related to multimedia and early childhood education. The results of the study in this paper show that the use of multimedia makes learning meaningful and contributes positively to the development of learners. Learners can achieve the expected learning goals. Multimedia can be used to stimulate aspects of early childhood development such as religious and moral values, physical-motor, cognitive, language, social emotional, and artistic values.

Keywords: Multimedia · Learning · Early Childhood Education

1 Introduction

Learning media is a way to teach students. Learning with multimedia can increase student motivation. Motivation is a combination of autonomy, mastery and purpose [1]. The use of learning media helps students to learn independently, mastering knowledge, and achieve learning objectives. Learning becomes meaningful for the development of students.

Utilization of learning media functions as one of the domains in educational technology studies. Technology that is integrated into learning can stimulate students to learn in various ways and sources according to their conditions and needs. Because technology aims to innovate, change, modify everything needed to meet individual needs and

facilitate the learning process [2]. Therefore, students must have technological literacy as the ability to understand the functions and works of technology. Technology that literate learners characterized by the following three (3) characteristics: [2], namely (a) Knowledge, namely the knowledge dimension of technological literacy includes factual knowledge and conceptual understanding of technology; (b) Capabilities, namely the dimensions of ability related to one's ability to use technology and carry out the design process to solve problems, (c) Critical Thinking and Decision Making, namely the dimensions of critical thinking and decision making related to one's approach to technological problems. Educational technology has five areas, namely planning, development, utilization, management, evaluation [3]. One of the educational technology domains that can be applied in learning is the use of media to facilitate students to learn more effectively and efficiently. Utilization of media means using media as a learning resource systematically [3]. Utilization of this media is very important to connect students with learning resources. In addition, the use of media is related to the activity of utilizing learning resources, preparing and guiding students so that they can interact with learning materials, solve learning problems and assess student learning outcomes. [4]. Therefore, the use of media should be in accordance with the characteristics of students who are learning.

Teachers can use multimedia as a medium in the learning process. On the other hand, students can easily use multimedia because it is equipped with a control menu to choose what they want in the next process [5]. Multimedia displays material with printed or spoken words and visualized images [6–9]. In addition, multimedia is a combination of several types of media to convey information sequentially and simultaneously in the form of text, images, graphics, movies, video, audio, and animation in order to improve students' understanding and memory [8, 10, 11]. These media are integrated to convey learning messages to students [12]. Multimedia is used as a tool and learning strategy with the help of computers or other digital devices [13] by combining text, audio, video, and animated images [14]. Thus, the learning process can be carried out in accordance with the abilities, needs, interests, time, and increase the interaction of students with learning resources [10].

Teachers are expected to use multimedia as learning resources, tools, and strategies so that students can achieve learning objectives. Multimedia learning as a learning resource can also be used at the level of Early Childhood Education (ECE). Because learning at the early childhood education level has a special character, namely learning by playing [15]. Therefore, the multimedia used in early childhood learning must be in accordance with the stages of child development, so that it will be interesting and meaningful for children. In addition, multimedia used in the form of text, images, video and audio can stimulate children's development aspects. The results of the study indicate that the effective learning multimedia can encourage early childhood to think critically. In addition, early childhood will have a strong sense of self-confidence in the learning process [16]. With that, the learning multimedia used can produce meaningful learning and help early childhood to achieve optimal learning goals [17]. Therefore, the study in this article relates to multimedia learning and ECE, multimedia as a learning resource and learning strategy; multimedia for early childhood learning.

The study in this article relates to multimedia learning and ECE, multimedia as a learning resource and learning strategy; and multimedia for early childhood learning. Therefore, the important question that must be answered and analyzed in this literature review article is what are the benefits of multimedia in learning and the benefits of multimedia learning in ECE?.

2 Methods

The author uses the Systematic Literature Review (SLR) method to review, identify and interpret relevant research results on multimedia learning and ECE systematically in each process with three main stages [18, 19], namely, Stage 1. Planning stage which consists of three steps (a) Identify the need for a systematic review, (b) Develop review protocol, (c) Evaluate review Protocol; Stage 2. Conducting stage consists of five stages (a) Search for primary studies, (b) Select primary studies, (c) Extract data from primary studies, (d) Assess quality of primary studies, (e) Synthesize data; and Stage 3. Reporting stage, namely Disseminate results. Based on these steps, the authors formulate research problems, identify relevant topics, assess the quality of the study, summarize the evidence, and interpret all the findings in accordance with the purpose of this study, which is to describe the concept of multimedia learning for ECE.

3 Result and Discussion Result

This article examines a number of research results on multimedia in learning; multimedia as a learning resource and learning strategy; learning theories that underlie the development and utilization of multimedia learning. Based on this study, the author discusses learning multimedia for ECE.

3.1 Multimedia Learning and Early Childhood Education

Educational technology functions as a study and ethical practice to ease learning and expand students' performance by creating, utilizing and managing appropriate technological processes and resources [20]. By this action, it could be seen as an alternative solution to produce an effective, efficient and fun learning that has a positive impact on student performance. Multimedia, consists of words and pictures, serves as an alternative medium to solve learning problems [9]. Interactive multimedia at first goal, can create a quality learning environment to make students actively involved in learning activities. Multimedia integrates several media to present computer-aided learning materials [21, 22], and present multidimensional information with two or more media such as audio, visual, audio-visual, text, images, graphics, animation, applications and internet media as well [23–26]. These media display learning messages interactively and provide feedback to students. Using multimedia, increases the involvement, understanding and achievement students' abilities in learning [27, 28], because students easily using and determining the topic of learning. In addition, multimedia is useful for offering experiences, and able to encourage students to explore their perceptions [29]. Moreover,

multimedia facilitates students to acquire knowledge, skills, and experiences stored in long-term memory. With displaying messages in the form of audio, animation, video, text and graphics, colors, motion, images, learning becomes more interactive and meaningful [30]. Multimedia learning is more focused on interactivity between users and the media. So, students could learn individually, start and end learning process as they wish, even repeat and master the learning material as a whole.

Early childhood educates and guides children from the age of 0 to 6 years old or under eight years [31, 32]. ECE shapes the early children's lives development. ECE plays as an important stage for the personality, values, and basic attitudes development to support critical thinking, emotional processing, and socialization throughout a child's life [33]. Therefore, ECE needs to be carried out in the form of play activities because playing is considered as one of the most suitable and relevant methods for children. [34]. Because, ECE aims to support child development holistically in various fields of care and related education [16]. Therefore, early childhood education must be seen as high quality to prepare the children entering a higher education stage [35, 36] by stimulating six child development aspects, namely religious and moral values, physical-motor, cognitive, language, socio-emotional, and artistic [25, 37]. These aspects are integral, interrelated, and support each other. Every early childhood learning activity must heed to those development aspects in a balanced way. Early childhood learning process can be achieved completely if assisted by media and learning resources that are relevant to child's development. Multimedia can be used as an alternative media in early childhood learning. Multimedia-assisted learning has a positive effect on children's learning outcomes, actively ask questions, and able to build new knowledge [38].

3.2 Multimedia in the Learning Process

As a tool, multimedia serves to optimize interaction between students, students and teachers, the environment, and other learning resources. Thus, learning means a relatively permanent process of behavioral transformation in learners with experience or training through interaction [39]. Students need to interact because the main activity in the learning process is about students learning themselves. By self-learning, students will experience changes in knowledge, attitudes, behavior, and skills. Multimedia as a main factor, helps children's growth, development of psychological and behavioral changes at all ages [40]. Since, multimedia learning can facilitate student learning activities.

Learning as a system, directs students in learning [41]. The learning system is designed and structured to support the learning process and influence students internally. Therefore, conditions for learning are created by design so that students achieve learning goals optimally. Here, meaningful learning is conditioned as the process by which an individual acquires knowledge, skills, or builds understanding based on experience and practice from various sources [42]. On that basis, the learning process needs to display the following principles: [4], namely: 1) learning as a form of experience and effort to change student behavior; 2) learning outcomes appear in changes of students behavior as a whole; 3) learning as a process; 4) the learning process encourages the goal achievement. Thus, learning means the process of creating a conducive learning environment.

The learning process can be assessed optimally if the teacher succeeds in motivating students to experience changes in cognitive, affective and psychomotor aspects on an ongoing basis. Multimedia learning could be applied as a strategy to help students interact actively, increase creativity, and motivate students to be active in learning [43]. With the help of multimedia, students' learning becomes interactive, productive, efficient, effective, and interesting. Thus, multimedia usage in learning aims to overcome students' learning problems such as lack of enthusiasm, boredom, and lack of motivation. The use of multimedia as well, helps students to receive additional text information (either in written or in oral form) about what is being learned [30]. Multimedia learning combines and synchronizes all types of media with interactivity that is tailored to the students' conditions. With that, various forms of media could be assessed to make more meaningful learning. Learning multimedia is equipped with a controller for users, so they can choose the next activity according to their choice [44]. It combines all media components in developed or designed based on learning theories and principles. With that, multimedia learning is expected to improve the quality of learning, build knowledge and skills [45], motivate and improve student learning outcomes [6, 46], learning will be more productive, teachers are encouraged to make an innovation, help students to achieve learning goals, visualize difficult material into conventional lectures or teaching aids, and teach students to gain knowledge independently [47]. Multimedia works as a way to convey learning messages in the form of knowledge, skills, and attitudes that stimulate the thoughts, feelings, attention, and willingness of students at the end. As an alternative strategy, the use of learning multimedia will guide and facilitate students to learn actively, experimentally, and optimally. It should be noticed; learners are the centers for multimedia-assisted learning. Therefore, with the help of technology, multimedia-based learning should be understood as a learning strategy to produce innovative, effective, efficient learning and understand or serve the needs of students. Multimedia-assisted learning requires high creativity in modifying the delivery of information or learning messages to students both offline and online [16].

3.3 Learning Theory in the Use of Learning Multimedia

On the first basis, multimedia aims to facilitate students in learning. The learning theories that underlie the use of learning multimedia are as follows:

First, Behaviorism. Behaviorism theory was developed by Edward Lee Thorndike, Burrhus F. Skinner, Ivan Petrovich Pavlov and Albert Bandura [39, 42, 48]. Behaviorism theory examines the basic concept of learning as a form of conscious student behavior. If there is a stimulation, then the individual will show certain behavior. Behaviorism emphasizes rewards and punishments as drivers of learning [49]. If the teacher provides the right stimulus, then students can carry out learning activities appropriately and intensively. In these learning activities, environmental conditions act as a stimulus to which individuals must respond with certain consequences, both positive and negative.

Second, Cognitivism. The theory of cognitivism was developed by Jean Piaget with a starting point in cognitive psychology to analyze mental processes and memory structures (cognition) in learning activities scientifically [39, 42, 48]. Cognition means the process of acquiring, organizing, knowing, and using knowledge. Cognitive psychology emphasizes that cognitive structure is related to an individual's knowledge repository that

includes long-term memory. This theory focuses on cognitive structure aspects to understand an individual in seeking, processing, selecting, organizing, and storing knowledge [49]. A person's mental structure develops according to the cognitive development level. The higher the level of person's cognitive development, the higher the ability and skills to process various information accepted from the physical and social environment.

Third, Constructivism. This theory was initiated by John Dewey with the democratic learning concept, Jean Piaget with the idea that knowledge is a construction of one's activities or actions; Lev Vygotsky by giving place to the learning social aspect [39, 42, 48]. This theory emphasizes human activity to produce knowledge by giving meaning according to experience in learning. Therefore, it emphasizes the learning process importances rather than learning outcomes. If it runs well, it will get optimal results. This approach is based on the reality that each individual has the ability to reconstruct previous experiences or knowledge. Students need to build their own knowledge by using the knowledge that already exists within them actively.

Fourth, Humanism. Carl Ransom Rogers originated the learning theory of humanism (1902-1987) [39, 50]. This theory calls learning activities as activities that involve cognitive, affective and conative psychic dimensions. It understands learning as an activity that a person does to fulfill life needs or to facilitate the students' needs. If students have achievement motivation in learning, learning process has met the needs of students.

Fifth, Cybernetic Learning Theory. This learning theory is relatively new which developed in line with the technology and information science development [51]. This theory emphasizes the learning management significance as a teacher's effort to help students achieve their learning goals effectively. Cybernetic theory views learning as an information process. Information systems determines the learning process. Then, it will take place if the information system being studied is managed properly as well.

These learning theories could benefit teachers understand multimedia well. Multimedia- assisted learning can help teachers find good ways of teaching [52]. Based on these learning theories, the development and use of multimedia in learning need to consider such things as (a) the stimulation provided must be bearable and realistic so that students can give a positive response; (b) Learning media must help students to develop through stimulation in the form of learning materials or content that is provided in a complete and systematic way cognitively; (c) Media can encourage students involved in building knowledge based on previously acquired knowledge actively; (d) Media is able to serve students' needs and conditions so that they are motivated to learn independently, gain knowledge and achieve optimal learning goals; (e) The learning media developed must be an effective information system for students.

3.4 Multimedia as Learning Resources and Learning Strategies

Educational technology has three basic principles in the development and utilization of learning multimedia, namely a systems approach, a learner-oriented approach, and the use of varied learning resources [53, 54]. The Association for Educational Communication and Technology (AECT) explains learning resources as all sources in the form of data or people and certain forms that used by students in learning separately or in combination to easy achieving learning goals [3]. Learning resources can be developed by design and by utilization [55] to solve learning problems, facilitate learning, and improve

student performance [56]. These learning resources include messages, people, materials, tools, techniques, and the environment. The combination of software and hardware is called learning media [9].

Multimedia as a learning resource is deliberately designed to help students achieve learning goals, a means to convey information from learning resources (teacher-communicator) to the recipient of the message (student-communicant) [14]. To distribute messages for students, learning multimedia functions as a medium in the form of sound and image media (audio visual), or in the form of moving audio visuals, silent audio visuals, motion visuals, silent visuals, audio and text [9, 57].

As a medium, multimedia facilitates students to carry out learning more meaningfully and optimally [4]. Learner-oriented learning will be implemented only in a progressive education system that refers to the philosophical concept of progressivism proposed by William James, John Dewey, Hans Vaihinger and Ferdinand Shiller [58] by freeing students how to think physically. With it, students are able to develop their talents and abilities without being hampered by external influences. This principle emphasizes that learning subjects in students who are potential to develop, be active, creative, innovative and dynamic, while educators are facilitators, motivators and mentors only for students. The progressive learning process will success if students learn concretely from their environment by doing, observing, touching, smelling and touching real things, feeling emotions from various phenomena, and not memorizing abstract things. This principle is in line with Edgar Dale's classification of learning media based on learning experiences. This level of experience is called Edgar Dale's Cone of Experience [23, 59]. Dale grouped the levels of learning experiences sequentially from the concrete at the base of the cone to the abstract level at the top of the cone as shown in the following figure 1:

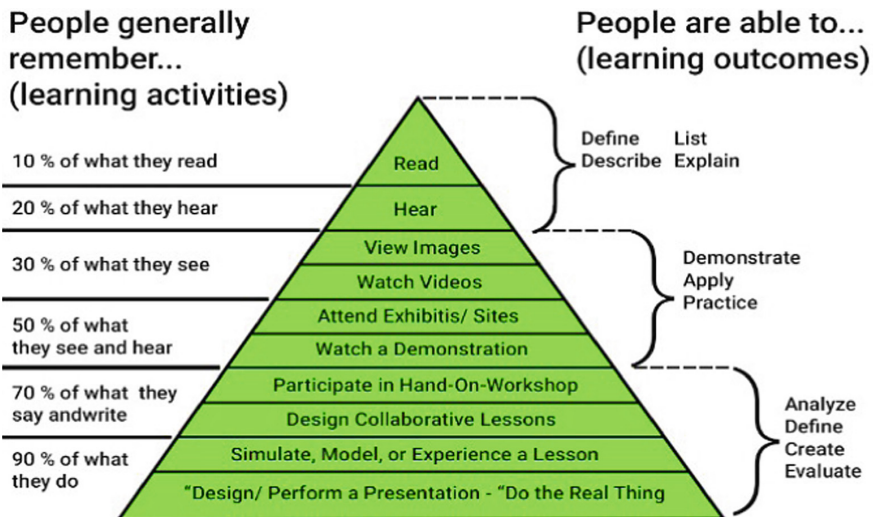


Fig. 1. Edgar Dale's Cone of Experience [23, 59]

Based on the above study, multimedia is useful for learning resource and strategy to optimize the learning process of students.

Discussions

Advances in technology have simplified the process of designing and presenting learning materials. Past research shown that technology has become an integral part of the classroom and everyday life. Therefore, integrated technology in learning can facilitate students to communicate, understand the concepts being taught, and implement knowledge in real life [60]. That is, technology as a learning aid because it has the potential to support the learning process of early childhood [61]. Multimedia as an alternative media can be used in ECE to motivate students with a control tool that students use to choose what is needed during the learning process [10, 62].

The use of multimedia in the right context can help psychomotor development and strengthen the visual process of its users [63]. As a combination of media elements, multimedia can accommodate the students' learning needs who have different cognitive abilities [64]. Here students can use computer-assisted learning multimedia to access information or messages in the form of audio, visual, video, animation, or other features. Multimedia that meets pedagogical and learning aspects can facilitate and improve student performance [20], make students happy, attract attention to receive new knowledge quickly, clarify the presentation of learning material, overcome the limitations of time or space as well as the senses, make learning more interactive [52, 65, 66]. In addition, multimedia-based learning increases curiosity, help learning activities and increase interest of early childhood [65, 67], creating a positive classroom environment and increasing early childhood participation [68], motivate and improve early childhood learning outcomes [40], learning outcomes are more permanent or steady, and helping children who miss learning materials [52, 65]. Multimedia usage in learning makes learning more interesting and interactive because it integrates several media, efficient teaching time, improves teaching quality, and takes place flexibly [40, 69]. Multimedia also present complex objects or events that may occur sooner or later [70, 71]. In addition, multimedia used in learning can develop early childhood critical thinking skills through imagination, creation, and communication and improve children's social development and children's preparation to enter the next level of education [65, 72].

Multimedia learning for ECE needs to be developed and utilized [73, 74] in accordance with the stages of early childhood development, supports learning objectives, is useful and has a double impact for both teachers and students as well as, from the interests of the institution, must be based on pedagogical aspects and educational studies, childhood characteristics, quality and relevant to the objectives, physical requirements, strong and durable, in accordance with the child's world, simple, attractive and colorful, related to children's play activities, the duration is not too long, pays attention to the balance between basic learning media and supporting materials in accordance with the curriculum, and provides guidelines for information retrieval.

Multimedia used for ECE should be in accordance with the child's needs and conditions, so that it will be useful for optimizing growth and development. Developed or utilized multimedia is expected to be able to prepare students to enter the next stage of education [36]. Minister of Education and Culture Regulation 137 Number 14 concerning National

Standards for ECE underlines that every ECE teacher needs to develop and utilize learning media for early childhood [75]. The use of media aims to overcome the limitations of children's experiences in the learning process [76], channeling messages from the sender to the recipient of the message, stimulating the thoughts, feelings, concerns, interests, and concerns of students so that learning runs optimally [14].

Multimedia learning can be an effective strategy in ECE if it involves teachers as facilitators to support learning objectives [77]. Therefore, the selection of learning media [73, 74] need to consider the characteristics of early childhood who have high spirits, have not been able to distinguish between fantasy and reality, talk to themselves in a loud voice, short concentration power, feel unable to be defeated and ready to accept new challenges in any form, show empathy for others and can talk about their own feelings or those of others, feels safe lying, but gets angry when adults break promises, lacks concentration, focuses on things that are interesting and close to their experience.

Based on the characteristics of this early childhood, multimedia learning for early childhood can be classified into three [73, 74] namely visual media such as still images (pictures of humans, animals and so on), audio media containing messages in auditive form (can only be heard), and audiovisual media that can be seen and heard. These media are integrated into multimedia so that they can present learning materials completely and optimally, helping teachers to facilitate early childhood in the learning process [78]. The media used plays a role in creating interaction between early childhood and the material being studied; increase learning motivation, increase children's attention and retention of learning materials. Therefore, the development and utilization of learning multimedia must be in accordance with the developmental aspects and the level of achievement of early childhood development [79]. Thus, multimedia-assisted learning can serve the needs and conditions of early childhood and improve aspects of early childhood development.

4 Conclusion

Multimedia is a medium that functions as a strategy and tool for teachers and students in the learning process. With it, the learning process becomes more productive and interactive. Students can understand the learning material well because it is presented systematically and accompanied by contextual examples. Students can learn according to their needs, abilities, and desires. Students become the center of learning, while the teacher is the learning process facilitator. Meanwhile, multimedia can be used also in the learning process at the level of ECE. The use of multimedia in learning aims to stimulate the development of early childhood fundamental aspects. Because, learning using multimedia allows for reciprocal interactions between teachers and students, with fellow students, students with the environment and with learning media.

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