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Elementary school teachers' perceptions of the potential of metaverse technology as a transformation of interactive learning media in Indonesia

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Abstract

Currently, there are many technology-based learning methods that can be used in the teaching and learning process for effective learning situations. The metaverse is a topic that is being widely discussed around the world. Metaverse technology is the concept of combining the virtual world with the real world through the internet. However, the development of metaverse technology in Indonesia's education field is still rarely carried out. Therefore, this research aims to determine how elementary school teachers in Indonesia perceive the potential of metaverse technology as a learning media transformation. The research method used by researchers is descriptive with a qualitative approach. Descriptive research is research that describes the actual situation regarding the importance of the metaverse for teachers in elementary schools. The participants in this study were twenty elementary school teachers who had good technological skills. The data was collected through observation and interviews. The results of this study show that elementary school teachers are interested in using the metaverse as a learning medium. For teachers, one of the options for improving learning performance is to use the metaverse as a tool or as a new learning and teaching style. The use of the metaverse does not mean that the teacher has to change conventional teaching methods but rather assists the teacher in conveying material to students effectively.

Keywords: Elementary School, Learning media, Metaverse.

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1. Introduction

The development of digital technology in education is not only about the physical contribution of technology as a learning tool but also a multidimensional concept such as one definition of learning technology according to the association for educational communications and technology that is "educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources [1, 2]". Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technology processes and resources [3-5].

In fact, learning technology will advance with the times. We often come across the use of technological developments in the educational field even in the implementation of daily learning frequently combining technological tools in the learning process [6-8]. However, the technology will not only bring positive benefits but will also have a negative impact. The development of science and technology has a positive impact by increasing the openness and dissemination of information and knowledge from and to all over the world through the boundaries of space and time [9-11].

There are various problems while using technology-based learning resources among them the teachers themselves. The availability of media (especially modern media) does not ensure that teachers in elementary schools are motivated to use them. On the other hand, teachers' mental burden from being unable to use them is much greater and they do not search for a solution [7, 12, 13]. A number of other problems were found namely the use of learning media technology that was less than optimal due to a lack of components, poor quality and students' disinterest in media technology. In fact, there are many platforms and a variety of learning technologies that can be used by students and teachers according to their learning needs. Teachers can use pre-existing or readily available digital technology-based learning resources or develop their own. One of the new technologies in the educational world especially in Indonesia is the metaverse.

Metaverse technology has great potential for development as a transformation of learning media for elementary schools in Indonesia especially at this time, other developed countries are also still in the development stage and continuing to research this advanced metaverse technology. By allowing more direct interaction between students and the environment and reality through the virtual world, metaverse technology as a learning media transformation it overcomes the limitations of space, time and sensory. It overcome students' passive attitude which can create a passion for learning [14-16].

With the use of metaverse technology, almost all physical activities and learning interactions can be done in a virtual world. Metaverse is likely to transform all activities in a virtual world in the future [17, 18]. Learning is usually done in the classroom while learning uses metaverse technology, namely learning activities carried out in a 3D virtual world [19, 20]. metaverse provides support for online learning without compromising the learning experience at school or college. The method of learning anywhere and anytime is an interesting concept that is liked by many people. The use of technology may reduce time, space and cost [21, 22].

The researcher took the initiative to conduct a needs analysis by exploring elementary school teachers' perception of the potential of metaverse technology as a transformation of learning media in Indonesia. This research is expected to contribute to the development of educational technology. The application of metaverse technology in the educational world will be a solution for educators to help them convey knowledge to students. Metaverse technology as a transformation of interactive learning media in elementary schools, namely the implementation of virtual world learning that allows users to be connected, can communicate, work, play and transact like in the real world. In simple terms, metaverse is a virtual world concept that can be owned and filled with various objects and activities like the real world. This concept is a combination of several technological elements including virtual reality (VR) and augmented reality (AR).

2. Literature Review

Metaverse technology is the topic that is being discussed around the world. Metaverse is a digital technology that is able to create a 3D virtual world by utilizing Augmented Reality (AR) and Virtual Reality (VR) technology, where users can seem to interact in real time in a virtual world [23, 24]. Metaverse as a new medium certainly has a very broad potential for the future, although this medium has not yet been fully used. The concept of metaverse technology can produce a virtual teaching and learning process simulation environment in educational media allowing students and educators to interact and simulate subject matter in the virtual environment [7, 25].

The metaverse is a virtual world created by the convergence of digital technology and the physical world. It is a 3D representation of the Internet where users can interact with each other and with digital objects in a realistic way [22, 26]. Metaverse is still in its early stages of development but has the potential to become a major new platform for social interaction, commerce and entertainment. The metaverse is a virtual world that exists independently of one particular game or program. It is a shared online environment where people can interact with each other and with digital content. The concept of the metaverse has existed for many years but recently it became a reality with the advent of virtual reality technology [9, 27]. The Metaverse is a space where one can be involved in it by using media assistance or you could say something like the digital universe. Because in its users can socialize, shop, plays games or even interact with colleagues in a virtual space. Media needed such as Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR) and so on. The space was created aiming for users to be able to connect with each other where there is no difference in hardware and software. You could say it's like the World Wide Web but created in the form of perfect elements so that the results become more realistic. Metaverse itself provides an Extended Reality (XR) experience that still needs to be developed specifically for all operating systems and devices. Technically, the Metaverse is a virtual world that transcends or acts as an extension of the physical world of humans. It consists of interoperable technologies, such as virtual reality (VR) and augmented reality (AR). The term metaverse itself comes from the author Neal Stephenson who coined the term in his 1992 science fiction novel Snow Crash. In the novel, he imagines lifelike avatars who meet in realistic 3D buildings and other virtual

reality environments. Since then, various developments have made milestones on the way to a real metaverse, an online virtual world that combines augmented reality, virtual reality, 3D holographic avatars, video and other means of communication.

The potential of metaverse technology is as an interactive learning medium in elementary schools. Conversations usually start and end with artificial intelligence through metaverse technology [28, 29]. However, there is another aspect to this discussion that involves both digital and our real worlds. This world is known as the metaverse and it has the potential to change everything about the way we live, work and interact with one another [30, 31].

Metamesta, metaverse or metaversum is the internet part of shared virtual reality that is made as similar as possible to the real world in the technological world. The metaverse as a virtual world known as MUVE (Multi User Virtual Environments), has a format derived from MMORPG (Massive Multiplayer Online Role-Playing Games) which allows everyone to meet avatars in 3D video games by combining virtual reality, augmented reality (AR), virtual reality (VR) and the internet. The application of metaverse technology requires various preparations. In addition to security and the legal basis for cyber and data, Indonesia is obliged to build a level of digital literacy and a quality of infrastructure that is adequate for or supportive of welcoming the metaverse era. With digital literacy and various careful preparations, all levels of society or metaverse users will not be left behind by existing technological developments [32]. Online or remote learning in the metaverse will push the boundaries of social connection and informal learning. Physical presence in class will no longer be a privileged educational experience. Telepresence, avatar body language and facial expressions will allow virtual meetings to be as effective as face-to-face meetings [33].

Metaverse is popular all over the world with many definitions representing diverse opinions. To quickly define the meaning of the metaverse, we must think of a three-dimensional web powered by virtual reality (VR) and augmented reality (AR). The metaverse is persistent, self-contained, infinite, interoperable and real-time and these are its main characteristics. Persistence means it exists regardless of the user's physical presence. Infinite supports countless contemporary users and VR worlds. Sustainable means that users can earn in the metaverse and pay for their utilities. Interoperability helps users move their virtual items, including avatars, from one metaverse project to another. Real-time allows users to enjoy a live experience [34]. Figure 1 illustrates how metaverse technology works.

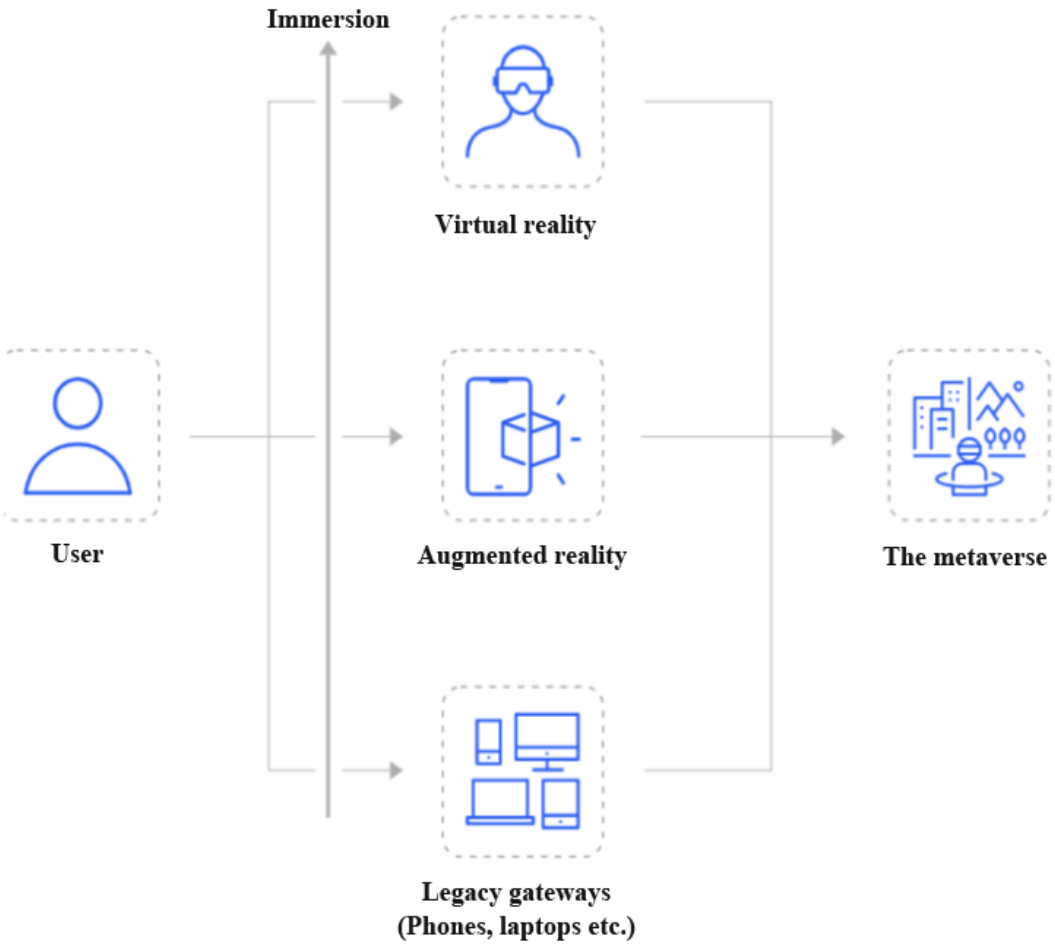

Figure 1.
Metaverse technology [34].

3. Method

The aim of this study is to determine how elementary school teachers in Indonesia perceive the potential of metaverse technology as a transformation of learning media. The research method used by the researcher is descriptive with a

qualitative approach. Descriptive research is research that describes the actual situation of the object under study, according to the actual situation at the time of the direct research. The data collected is not in the form of numbers but comes from manuscripts, interviews, field notes, personal documents, memo notes and other documents. This study uses a descriptive method to compare the actual data with the applicable theory. The formulation of the problem to be studied determines in-depth observations and in-depth research [35] gain an understanding of its nature and a general understanding of social reality from the participant's perspective. This understanding is not predetermined but obtained after analyzing the social reality that is the focus of the research. Based on this analysis, conclusions are drawn in the form of a general understanding that is abstract in nature about facts. Qualitative descriptive research falls under the category qualitative research. The purpose of this research is to reveal the facts, circumstances, phenomena, variables and conditions that occur when the research is conducted and present them as they are. Qualitative descriptive research interprets and tells data related to the current situation, attitudes and views that occur.

3.1. Participants

The participants in this study include twenty teachers of elementary school students spread across the provinces of Indonesia, namely, East Java, Central Java, West Java and Jakarta. These participants were chosen based on the findings of a field analysis conducted by researchers to assess the teacher's ability to use technology.

3.2. Data Source

In this study, primary data and secondary data are used namely primary data which are data sources that directly provide data to data collectors. The data were collected by the researcher directly from the first source or the place where the research was carried out. Researchers use the results of interviews obtained from informants on the research topic as primary data while secondary data are data sources that do not directly provide data to data collectors for example through other people or through documents such as research results from scientific journals.

3.3. Data Collection

Data collection is the most vital step in a study. Data collection in this study used primary and secondary sources. Furthermore, in terms of data collection methods or techniques, data collection can be carried out through observation and interviews. Observation activity is a data collection technique that includes focusing on an object by using systematic recording of the reality being investigated while interviewing is a process of communication interaction carried out by at least two people, on the basis of availability in a natural setting where the direction of the conversation refers to the goals that have been set by prioritizing trust as the main foundation in the process of understanding. The researcher uses a semi-structured interview type where the researcher conducts interviews based on a list of questions that have been prepared and the list of questions can be developed during the interview. Interviews are conversations with a specific purpose. The conversation was conducted by two parties, namely the interviewer (interviewer) who asked questions and the interviewed (interview) who provide an answer to whose questions. The main feature of the interview is direct face-to-face contact between the information seeker and the information source. During the interview, various questions were prepared. It is through these interviews that the researcher collects data, information and descriptions of the research subjects. The interview technique in this study was aimed at exploring teachers' perceptions of metaverse technology as a learning medium. The researchers interviewed respondents according to the interview guidelines that they had developed.

3.4. Data Analysis

Data analysis in research is essentially a process of processing data that has been obtained in the field so that it becomes information. The final result of the study besides depending on the data obtained in the field will also depend on how the data are analyzed. The data analysis technique used is descriptive analysis technique through qualitative research using data and information obtained directly from informants and then analyzed using a theoretical basis and described systematically based on the facts from the field. This data analysis is closely related to the research design and problem formulation that have been determined before. It can be stated that data analysis techniques can only be used after research points have been met for example by collecting the appropriate data that is adapted to the problems in specific research. Thus, the purpose of the data analysis is to determine or get the overall conclusion that comes from the research data that has been collected by the researcher. In addition, data analysis techniques aim to describe and explain the research data, so that it can be understood. Researchers used NVivo software to conduct data analysis and draw conclusions. NVivo has the advantage that it can connect the results of coding, perform queries and create analytical maps based on research data. Furthermore, data analysis in this study also uses Bibliometric analysis with VOS Viewer software. This analysis aims to find and utilize secondary data or data sources as research references.

4. Results and Discussion

4.1. Results

There is a main focus of discussion from the data obtained from this research, namely (a) how the readiness of teachers to face the development of Metaverse Technology as a transformation of learning media in elementary schools (b) Analysis of the advantages of applying Metaverse Technology as a transformation of learning media in elementary schools.

How is the readiness of teachers to face the development of Metaverse Technology as a transformation of learning media in elementary schools. Teachers' perceptions of readiness to face the development of Metaverse Technology as a transformation of learning media in elementary school "Project Map" on NVivo 12 software can be seen in Figure 2.

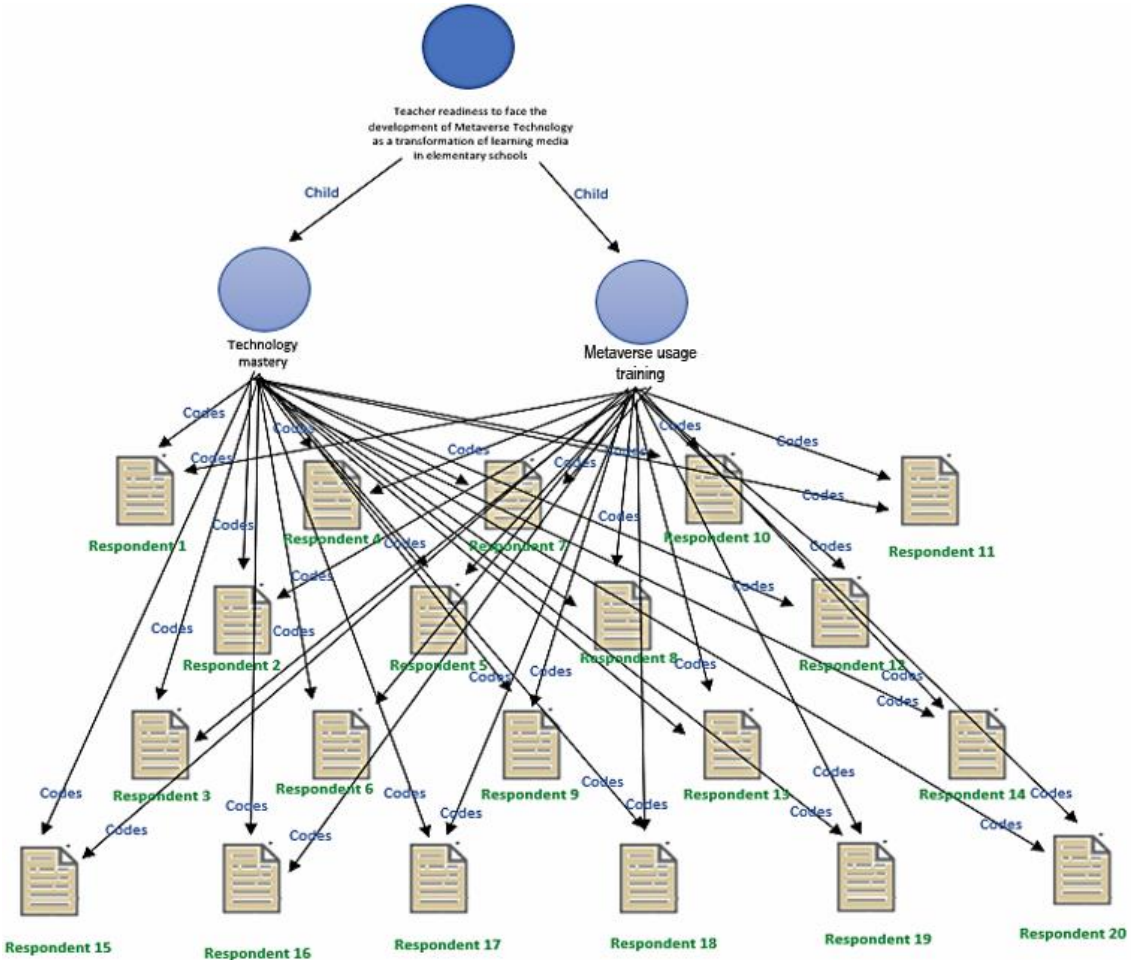

Figure 2.
Metaverse technology as a transformation of learning media in elementary schools project map.

The metaverse creates many opportunities as well as challenges in many industrial fields. One of which is in the field of education. The application of the metaverse itself has been widely used in the education industry. In this era, almost all physical activities and social interactions occur. In simple terms, we can understand the metaverse as an online environment that becomes another real place for users to carry out various activities. Recently, metaverse technology has become an important topic of discussion around the world. According to the results of the statistics survey conducted on February 4, 2022, 52% of respondents want to enter the metaverse in order to gain experience working in a virtual workspace. A person can have a 3D avatar in the metaverse that can be used for various purposes such as virtual office meetings. Interestingly, these avatars can interact with other avatars. Teachers and students can use avatars to meet other people in a virtual room that can describe the feeling of being in the room with other people.

The emergence of the metaverse concept as a new medium of communication may also create new habits that affect human communication styles in the real world. There will also be people who will be more comfortable talking in the virtual world. The application of immersion technology such as Virtual Reality (VR) and Augmented Reality (AR) encourages students to have a high curiosity. Students can also experience things that are difficult to do in the real world. Metaverse technology combined with the concept of pedagogy will make technology not only a medium but also a stimulant. Students become more engaged in their studies and more curious. Metaverse technology systems in learning are virtualized and presented under computer control for reviewers who not only see and hear images and sounds but also make active responses. Metaverse technology is used in the learning process, in other words to channel messages (knowledge, skills and attitudes) and stimulate the thoughts, feelings, concerns and willingness of learners so that the learning process takes place, is purposeful and is controlled.

Teachers' readiness to face the development of metaverse technology as a transformation of learning media in elementary schools is marked by teachers' high motivation about the use of technology such as computers. The use of technology (especially information and communication technology) can be carried out optimally, so teachers must be empowered. Various types of training must be provided to teachers in order to equip them with the ability and skills to use metaverse technology as a transformation of learning media. Teachers who master metaverse technology as a transformation of learning media will look authoritative in front of their students because they give the impression of being updated and not out of date. Moreover, if the teacher is able to make technology part of the material and learning tools, the students will be prouder of it and satisfied with it.

Teachers must be ready and serious to learn Metaverse Technology as a transformation of learning media, how to use it, how to use it to enrich learning materials, and how to make it a source of motivation for students. If there is technology in

the classroom (especially metaverse technology as a transformation of learning media) but the teacher cannot use it, then students' trust in the teacher will decrease and learning will be less interesting. Students will say that the teacher is old-fashioned, out-dated and learning is not effective. This should not happen, so teachers must be willing to study seriously in order to master technology and use it a source of material enrichment and motivation in providing their students with enthusiasm for learning. The results of the needs analysis questionnaire regarding the readiness of teachers to face the development of metaverse technology as a transformation of learning media in elementary schools are as follows:

Figure 3 shows the results of the questionnaire analysis of the needs of teachers' readiness to face the development of metaverse technology as a transformation of learning media in elementary schools.

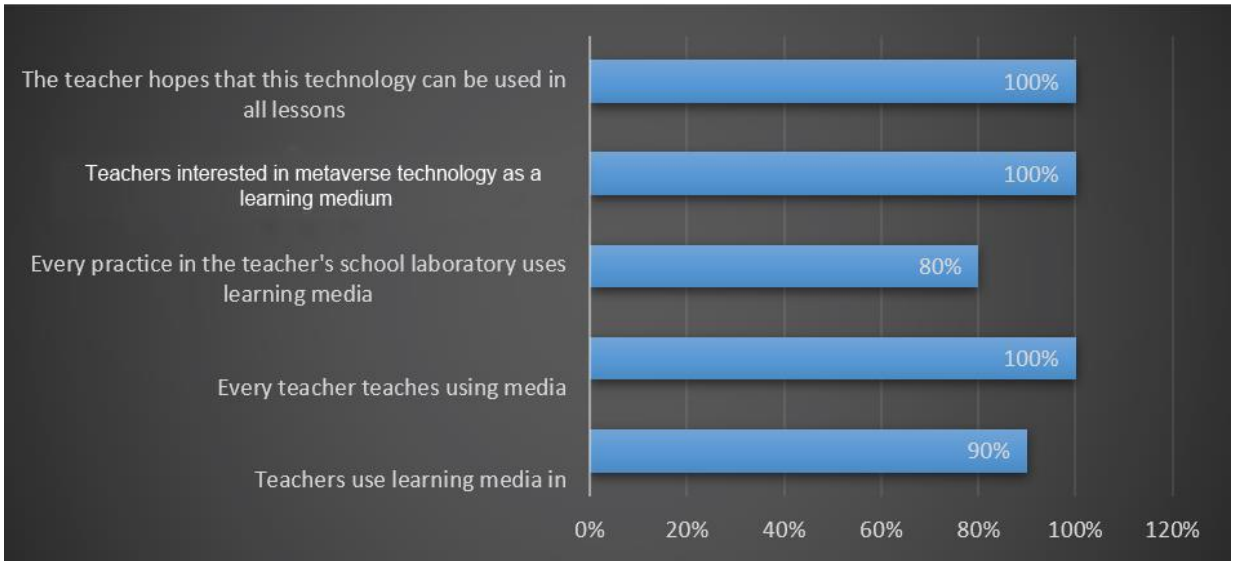

Figure 3. The results of the questionnaire analysis of the needs of teachers' readiness to face the development of Metaverse Technology as a transformation of learning media in elementary schools.

The advantages of using metaverse technology to transform learning media in elementary schools are analyzed using Bibliometrics with VOSViewer software. This analysis aims to find and use secondary data or data sources so that the advantages and updates of metaverse technology will be known as a transformation of learning media in elementary schools. The results of the Bibliometric output with the VOSViewer software can be seen in Figure 4.

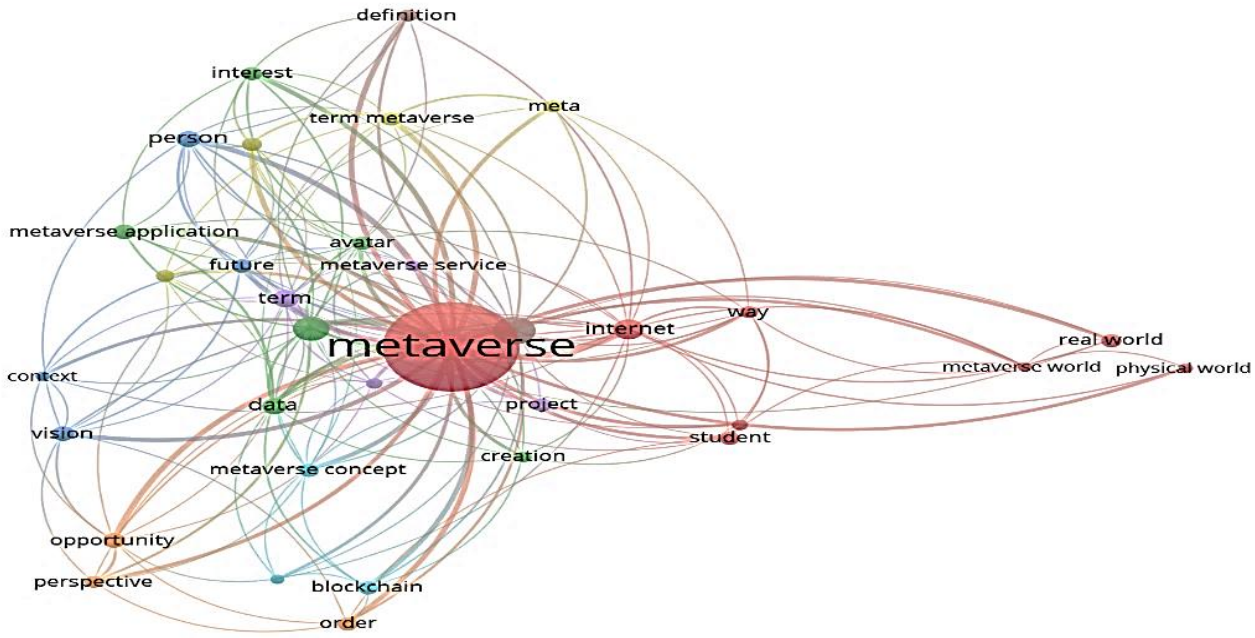

Figure 4.
Metaverse technology research trends based on Bibliometric output with VOS viewer software.

Figure 4 regarding metaverse technology research trends based on Bibliometric output with VOS viewer software obtained 34 research items in the world that discuss the metaverse as many as 763 studies but in Indonesia studies on metaverse technology as a learning medium are still rarely carried out. Metaverse is the latest digital technology trend. According to Les Giblin Skills with People, 83% of people learn through sight, through hearing 11%, through smell by

3.5%, through touch through 1.5% and through taste 1% [36]. By using this theory, it is the dual senses of sight and hearing that determine effective learning and teaching and learning activities require effective visual and auditory learning media. Thus, metaverse technology is a transformation of learning media believed to be a very effective medium for learning.

Metaverse is a new technology that is widely discussed and will continue to develop in the future. Even metaverse technology has a great potential for supporting the world of education because it is a new technology in the future [37]. The function of metaverse technology is the transformation of learning media making it easier for teachers to teach and refine students' minds [38]. Metaverse technology is a transformation of learning media has the function of overcoming the limitations of the experience possessed by students, the experience of each student is different depending on the factors that determine the richness of the child's experience, the number of benefits obtained from learning media and the teacher as a source of information carriers for students. Students should be aware of the importance of metaverse technology as a transformation of learning media [39]. With the existence of metaverse technology as a learning medium, the potential for student learning outcomes and motivation will be maximized. This technology is feasible to be applied to schools in Indonesia and in the future, it will become a future for better education. Metaverse technology as a learning medium not only has the ability to pull us into a new world but also has the capacity to improve the quality of education by unlocking more learning potential than before.

The metaverse relates to experiences in the realm of education. This includes teaching which is the act of conveying of content and providing learning experiences for those being taught. "The learning experience from what we teach is also important for us to see. The experience is a matter of lowering the formula whether we use slides or use the blackboard," he explained. Around 1,000 metaverse projects have been completed by the company in 20 countries. This will continue to grow and reach wider areas in other countries. According to him, the Indonesian metaverse will cooperate with the functions carried out by the government, businessmen and the general public for the sake of developing the quality of life together. He explains the history of the metaverse that has gone viral since 1992 in Neal Stephenson's novel Snow Crash which inspired the development of the metaverse [40].

The use of metaverse technology as a transformation of educational learning media increases the learning effect in the learning process. Learning media is very significant to support the process of learning activities. Learning media are tool that facilitates the process of obtaining the learning materials delivered and facilitates the achievement of learning objectives because participants become more motivated to engage with the learning materials [41] increase learning effect. Metaverse technology is a virtual, visual and audio transformation of learning media that contains good learning messages, including principles, concepts, theories, and knowledge implementation procedures to support understanding the learning material [42]. Metaverse technology as a transformation of learning media is able to make the learning process more interesting and motivate young children to learn. Metaverse technology is a transformation of learning media able to make the learning process more interesting and motivate early childhood to learn.

Metaverse technology has the concept of theory and practice in the design, development, utilization, management and evaluation of processes and resources for learning. The use of the metaverse as a learning medium has the potential to create interesting learning experiences. By presenting different experiences using the metaverse to students, they get a better picture of what the teacher explains do not need to provide detailed instructions because students will understand what is explained. The use of the metaverse is an important element in supporting the learning process. The limitations of educational facilities and infrastructure can result in the ineffectiveness of the learning process.

5. Discussion

The application of elementary school teachers' perceptions of the potential of metaverse technology as a transformation of learning media in Indonesia has the advantage of being an educational medium where students who study wave material will be easier to understand compared to those who do not use metaverse technology as seen from the results of comparison and analysis of the learning of the two types of students. Metaverse technology in education has not been implemented and applied as a supporting medium for interactive education in schools because there is no educational institution that implements it as a mandatory medium that functions as a learning tool [22, 43].

Metaverse technology is a technology that can bring the virtual world into the real world can turn objects into 3D (three-dimensional) objects in order to make learning methods more engaging and inspire users or students to learn more [43, 44]. Metaverse technology is a combination of virtual objects. There are three principles of metaverse technology. The first is a combination of real and virtual environments, the second is running in real-time and the third is the integration of objects in three dimensions. To build an interesting and communicative learning medium with a multi-sensory nature the researchers made metaverse technology an appropriate learning medium. Metaverse technology that combines two-dimensional or three-dimensional virtual objects into a real environment becomes an object [45, 46]. Metaverse offers the magical effect of mixing the physical world with the virtual world and bringing the application from the user's screen to their hands. The use of metaverse technology for learning has grown significantly. The existence of the metaverse provides a number of educational innovations that replace traditional, rigid and monotonous learning. Learning from digital media is considered more practical, flexible and not limited by space or time [47].

The learning process with the use of metaverse technology is a tool that can enable students to improve skills according to the times and is designed to provide opportunities for students to develop critical reasoning and problem solving skills, through collaboration and communication [48, 49]. Learning development through metaverse technology is information that has the potential to change the way a person learns, to obtain information, adjust information and so on. Metaverse technology also provides opportunities for educators to develop learning techniques so as to produce

maximum results. The metaverse opportunity as a transformation of interactive learning media in elementary schools is a positive thing because current technological developments make the process of learning and learning activities easier to carry out.

6. Conclusion

Metaverse technology is a new development and has the potential to change the way we interact with the internet and the digital world. This technology provides a more immersive and interactive experience that can be used as a tool for learning activities, especially in elementary schools. Metaverse has great potential to change the future of education with its wide access to knowledge and the possibility to meet people from all over the world with this innovation.

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