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Improving Science Activities through STEAM Approach using Camtasia Studio Multimedia in Early Childhood Education

Pupung Puspa Ardini[1*], Yenti Juniarti[2], Waode Eti Hardiyanti[3], Ni Made Pararatih[4], Riza Dwi Yuliana[5]
[1,2,3,4,5]Universitas Negeri Gorontalo
*pupungpuspa@gmail.com

ABSTRACT

The purpose of this study is to improve science activities through STEAM approach using Camtasia videos that can display various science activities in early childhood education. Ten children aged 5-6 years old were the participants in this research using classroom action research with two cycles as the method. Various videos of scientific activities were played and applied into the learning activities. The results show that the children's prior comprehension on science subject were quite low. Meanwhile, in the cycle I, the average of children science activity score was 58.42% to become 72.89% in the cycle II. Additionally, throughout these science activities children were not only improving their comprehension toward scientific process and results but also internalizing some science attitudes, and importantly, they felt motivated and excited when STEAM approach with the videos shown at the beginning of learning were playing in the learning activities because it can combine science, technology, and arts in one activity.

Keywords
STEAM approach, learning tool, children

Introduction (Times New Roman, bold, 12)

Education is a key milestone for determining the fate of a nation. Education provides a plenty of opportunities and competencies for students to face the challenges of globalization. In order to encounter the future competition, Indonesian government has provided many educational institutions at different stages for preparing students to be global citizens. Therefore, the ideal figure of future education in Indonesia is more equitable and inclusive (Minister of National Education, 2014).

Education has rapidly changed in schools and colleges. The progress of information and communication technology (ICT) is one of the factors of change in the education system in Indonesia and the world. Currently, technology has an essential role for educational process and also provides direction in the development of the world of education. In the history of educational development, information technology is part of the media used to convey massages of knowledge to many people, ranging from printing technology several centuries ago, such as printed books, to telecommunications media such as, sound recorded on cassettes, videos, television, CD and learning through the internet (e-learning) (Arsyad, 2002).

In educational institutions, teaching and learning activities are always presented, where students learn and teachers teach subject in the classroom (Dwiyogo, 2008). In conventional learning, the implementation of learning involves three main components, namely: teachers, students, and materials. The contents that student learn have all been written in the textbook. Teacher's task is to deliver the contents or materials to students. To examine whether students have understood what has been taught and will be taught, students will be assessed through testing and structured assignments given by the lecturer or teacher.

According to Hosnan (2002), active learning is a learning activity using all potentials possessed by students optimally, with the aim that they can achieve satisfying learning outcomes based on their personalities and characteristics. This is in line with Government Regulation No. 58 of 2013 concerning the learning process that changes

passive learning patterns into active-seeking learning where students actively build their knowledge which is reinforced by a scientific approach as the learning models (Mendikbud, 2014).

Literature Review

The use of multimedia is not only for independent learning, but also for solving problems in groups. Multimedia learning can make students practice the ability to think critically and creatively in solving a problem individually or in groups (Winarto et al, 2009) According to Kustiono (2010), the word "multimedia" can be interpreted as a harmonious blend of various media both text (regular and hypertext), images, graphics, audio, video / film, and animation, which are synergistically packaged to achieve certain goals (learning). Whereas Winarto et al (2009), defines learning multimedia as a combination of text, images, graphics, animation, audio and video, as well as interactive delivery methods that can create a learning experience for students like in the real life. Learning multimedia can be interpreted as a multimedia application used in the learning process. Multimedia learning is useful for transforming messages (knowledge, skills, and attitudes) and can stimulate student choice, feeling, attention, and decision so that the learning process is intentional, purposeful, and controlled (Daryanto, 2011).

In other words, multimedia can be used as media that creates teaching materials in the form of anything that can be enjoyed and studied by the learner. In this case, the material is a science activity at an early age that can be created in the form of multimedia. In general, science is everything that is amazing, something that is found and considered interesting and gives knowledge or stimulates people to know and investigate it (Nugraha, 2001).

Surjono (2010) states that learning technology has many benefits or advantages to solve education and learning. One technology that can be used in learning activities is Camtasia Studio. Camtasia Studio (CASI) is a program that can display IT-based learning media in the form of instructional videos that are equipped with material descriptions, learning videos, pictures, animations, diagrams, tables, and voice narration. This CASI multimedia is not only can be accessed using android through the storage of video files on the smartphone memory, but also through YouTube, Google Drive and Screencast.com applications (Grotta & Grotta, 2013).

Science is one of subjects taught in the school often faces challenges in delivering into an innovative way. Teachers need supports to use interesting teaching materials in order to motivate student's science activities (Haug, 2014). Government Regulation Number 19 of 2005 Article 19 paragraph 1 concerning National Education Standards explains that learning process must be conducted to make students feel interactive, inspiring, fun, challenging, and motivating (PP No. 19 of 2005). Therefore, to avoid uninteresting science activities, teachers need to use teaching materials that are interesting and can motivate children.

According to Wijaya, Dina, and Amalia, (2015), the introduction of science to preschool students is more emphasized on the process than the product (facts, concepts, theories, principles, and laws). The scientific process is known as the scientific method, which broadly includes: 1) observation, 2) finding problems, 3) conducting experiments, 4) analyzing data and 5) drawing conclusions. For kindergarten / early childhood students the science process skills should be done simply while playing. Science activities enable children to explore various objects, both living and non-living objects around them. Children can find the characteristics of objects and other things through exploration. According to Leeper (as cited in Nugraha, 2001), the importance of developing science learning is to make children have the ability to solve the problems they face through the use of scientific methods; hence children will have scientific attitudes. Children obtain scientific knowledge and information that can be trusted based on appropriate scientific standards, because the information obtained is the result of findings and formulations which are their objective of scientific principles. Science can make children

become more interested to the things around their environment.

Unfortunately, learning using technology is seldom used and explored in the Early Childhood Education. One of the reasons is because the teachers are still unfamiliar with the use of IT, especially in science activities. Research conducted by Juniarti (2015) regarding the readiness of using IT in kindergarten shows that 70% of teachers do not have the ability to operate computers. Whereas 30% of teachers are able to operate computers but only to just type some school documents and administration. In addition, student assessment in science learning often focuses on cognitive learning outcomes only rather than creating meaningful experience. As explained Haug, (2014) that "student assessment in the mathematics classroom often focuses on cognitive learning outcomes".

Science in Camtasia Studio Multimedia

Science is one of the aspects of development that must be possessed by children aged 4-6 years in other words at the age of preschool. In early childhood education, children's scientific activities are around the topics of the earth and the universe (science), life sciences (biology), and the fields of physics and chemistry studies (Abruscato, 1974).

Figure 1 Camtasia Studio Program

The Camtasia Studio program has a variety of interesting features that can facilitate the creation of multimedia in the form of videos with the addition of animation, images, music, and text that attract attention in short period of time. In addition, this program can record a computer screen or PowerPoint presentation so that it is not only an ordinary video but an instructional video which is highly appropriate to be used in developing children's understanding of a whole and holistic material.

Steps to create multimedia (Camtasia Studio) are as follows:

1) Download and install Camtasia Studio 8 software.
2) Open Camtasia Studio which is already on the desktop.
3) Select the Record the Screen menu.
4) There are five icon parts, namely full screen icon, custom screen, camera, and audio, and record. You can adjust the screen size according to our needs, for example to record the entire desktop select the full screen icon. If you want to add sound (audio) and the camera make sure the microphone and web cam are connected to the computer.
5) Then start recording all activities on the computer by clicking the icon Rec.
6) When you finish recording, then just click the STOP or F10 button on the keyboard to stop.
7) If you are satisfied with the recording results and there is nothing to edit, click Produce and then your recordings are produced directly without editing process, you can also delete the project if it feels unsatisfactory, but if you want to edit first select save and edit.
8) To cut the video against the part that you do not want move the cursor track on the part that you want to throw away right click and select split.
9) To give effect to the cursor select the Cursor Effects menu.
10) When the video has been edited, the next step is to produce the video.
11) Select the produce and share menu. Choose what type of production you want, for example you can choose MP4 with 1080p video quality. Then select Next
12) Name the recording, then select Next and Finish.

The schema of the steps to make CASI (Camtasia Studio) multimedia in general can be seen in Figure 2.

Figure 2. Steps for Using Camtasia Studio Multimedia.

The Camtasia Studio (CASI) program can be used to design teaching materials or in this case science activities as an innovation in the learning process. Permatasari (2016) explained that science and

technology are important keys in facing challenges in the future, with STEAM approach that can support children's scientific learning, which can be taught in the environment, classroom, laboratory, computer, websites, and worksite. In line with this opinion, Grotta & Grotta (2013) explains that multimedia refers to technology that presents material in verbal and visual form. Meanwhile, STEAM is an abbreviation that consists of Science, Technology, Engineering, Arts, and Mathematics. STEAM is a package of learning in preschool that will be the future skills and knowledge needed.

Camtasia media has some benefits in learning. First, software Camtasia media is designed for students that can provide quick and easy access for teachers and educators in learning. Second, when it uses for lecturers, it can be used as a guidance and reference in implement the learning activity, third, the Camtasia can provide references and sources of videos as example of how to implement scientific knowledge using the STEAM approach through videos. Lastly, the result of this study is to examine the use of Camtasia media that is expected to contribute on creating meaningful scientific activities for children.

Based on the preliminary research, it is important to develop STEAM-based multimedia studio in early childhood science activities. Therefore, the research question asked was how to improve science activities through STEAM approach by the use of Camtasia videos that displays various science activities in early childhood education?

Methodology

In this study, the researchers used a class action research, which was conducted in two cycles. The participants were children aged 5-6 years old in a kindergarten in Gorontalo city. The participants were 10 children. The science activities focused on mixing color and experimenting with air, water and fire. The two topics are part of the curriculum program. During these activities, researchers prepared observation sheet based on the rubric that was made to further documenting children's experience in learning science through videos related to the topic and activities.

Videos of science activities, for example mixing color, were played to the children, in some meetings, it played at the beginning of the learning, in other meetings, it can be in the middle or end of learning activities. It depends on the activities and children readiness to watch videos. After children watched the videos, they then did the experiment based on what they have watched on the videos.

The classroom action research has four steps to conduct one cycle with Kemmis and Mc.Taagart's version (as cited from Wiriaatmadja, 2009). Those stages are plan, act, observe, and reflect. Firstly, planning means researchers construct inquiry strategy or learning plan to undertake in this research. Secondly, action is where researchers ask questions that encourage children to say or do what they already experience and understand, next is observation, where researchers observe children by asking some questions, record and document children answers and respond. Lastly, it is reflection, which means that to unpack the result of each stage and find out which part needs to be improved in the possible next cycle.

Instruments used in this research are based on scientific approach that consists of five steps. Those steps are observing, questioning, collecting information, processing information and communicating their experiences.

Results

This research was conducted in two cycles, each cycle had three meetings, and each meeting was done by two researchers and a collaborator which was a teacher helping with playing the scientific videos. The level of completeness of each activity is 81 points which is adjusted based on theories and children's conditions in the field. Each step is discussed in the following.

Pre-Cycle

The initial assessment was done on January 10, 2020 at the Kiddie Care School. In this initial

phase, the researchers collaborated with teachers in terms of conducting instrument assessment. The scores from the two collaborators the would be combined into the average grade for each child. This initial assessment aims to determine the initial conditions of scientific activity and children's comprehension.

Table 1. Initial Assessment Result of Pre-Cycle in Children Science Activity

No.	Child initial name	Score	Average	Info.
1.	ATH	110	55	Less active
2.	MA	85	40.25	Less active
3.	HR	85	40.25	Less active
4.	MG	91	45.5	Less active
5.	ARF	75	37.5	Less active
6.	LN	76	38	Less active
7.	FQ	61	30.5	Less active
8.	HF	90	45	Less active
9.	GR	78	39	Less active
10.	YJ	88	44	Less active
Total		**839**	**41.5**	**Less active**

From the average score pre-cycle children's scientific activity based on the table above, if presented in graphical form, the results are as follows:

Graph 1. Science activity in pre-cycle

From the graph 1, there are a number of things that need to be improved as a recommendation to move to the next meeting in cycle I. When the researchers did an initial assessment or early observation, the researchers noticed that the activities conducted were less varied, such as introducing science to children was presented only in the form of an ordinary illustration, talking about the metamorphose of the butterfly but the child was not shown directly or be able to discover a butterfly, then in terms of knowledge, the teacher still lacked or had minimal references in conducting experiment in scientific activities. Therefore, the process of studying science itself is limited and lacking, although sciences is broad which is everything that is in the earth, whether living or non-living, can be used as scientific activity. These are life science, physics science, biology, geology, and we can stimulate children through a variety of simple activities.

Cycle 1

The results of the observations obtained from researchers and collaborators on the science activities are as follows:

Table 2. Results of children's science activities in cycle 1

No.	Child initial name	Score	Average	Percentage (%)	Info
1.	ATH	515.5	73.77	**68.31**	Quite active
2.	MA	466	66.69	**61.75**	Quite active
3.	HR	428.5	61.34	**56.80**	Quite active
4.	MG	505.5	72.15	**67.05**	Quite active
5.	ARF	415	59.56	**55.05**	Quite active
6.	LN	413	58.05	**54.65**	Quite active
7.	FQ	405	57.91	**53.63**	Quite active
8.	HF	465	66.55	**61.60**	Quite active
9.	GR	419	59.93	**55.48**	Quite active
10.	YJ	376	53.85	**49.86**	Quite active
Total		**4408.5**	**62.98**	**58.418**	**Quite active**

Based on table 2, children's scientific activity scores have increased sufficiently well, where from ten aspects observed and the number of ten children, with the highest score was showed by ATH where he got the average score 73.77 and with the percentage of 63.81. Meanwhile, the lowest score was YJ with the average score was 53.85 with 49.86%.

The graph 2 displayed average score of the scientific activities can be seen as follows:

Graph 2. Average score of scientific activities in cycle 1

Furthermore, it is important to consider that teacher should provide motivation or reward to each child for their hard work and enthusiasm, then teacher should explain all steps and its purpose that would help children to understanding the meaningful learning using the STEAM approach.

Cycle 2

The cycle 2 was conducted in quite similar way with the cycle I, there were four steps involve, it begins with planning, observation, action and reflection. Meanwhile, the average score of children's scientific activities conducted after some changes and recommendation from the previous cycle can be seen in the table 3.

Table 3. Children scientific activity result in cycle II

No.	Child Initial name	Score	Average	Percentage %	Info
1	ATH	697	99,44	**91.06**	Very Active
2	MA	642.5	90.93	**84.10**	Very Active
3	HR	618.5	96.30	**81.80**	Very Active
4	MG	675.5	97.20	**90.05**	Very Active
5	ARF	589.5	84.07	**77.77**	Very Active
6	LN	589.05	85.00	**74.05**	Very Active
7	FQ	569	80.90	**74.85**	Very Active
8	HF	642	91.05	**85.00**	Very Active
9	GR	585	83.05	**77.05**	Very Active
10	YJ	520	74.55	**68.05**	active
Total		**6128.05**	**88.249**	**72.893**	**Very Active**

Based on the table 3, each child score has increased although not all children have a high improvement such as YJ, which is still in the active category. This improvement is mainly caused by the various activities and each activity gives different challenge for children.

Furthermore, children score can be seen in this graph as follows:

Graph 3. Average score of scientific activity in cycle 2

In the graph 3, it can be seen the average differences between score and percentage of each child from each meeting in cycle II.

Discussions

The development of science in children cannot be separated from the science process itself, where there are several aspects of science process skills that must be provided by a teacher to a child, these skills are observing, measuring, classifying, predicting, and communicating (Black et al., 2017; Bustamante, Greenfield & Nayfeld 2018).

As seen in the all tables and graphs mentioned above that scientific activity using the STEAM approach has increased from pre-cycle, first until the third meeting in cycle I then the same first to the third meeting in the cycle II. This shows that using various activities of science planned by teacher encourage children to feel the different nuance in each activity. Therefore, it is pivotal to highlight the essential findings that researchers and teacher saw and what children felt in the following discussion.

As mentioned, children often feel that science is difficult, frightening, even hearing the word science can be stressful for children (Bates, Salsberry, & Ford, 2017). As a result, this fact makes teacher and parent worry, how to increase interest in science as early as possible or how to motivate children to later when they grow up, they will not be afraid to learning science (Oppermann, Brunner, Eccles, & Anders, 2018).

Therefore, it was found that the various type of activities given and done made children capable in communicating what children did that day. This fact is also supported by the results of research on other findings that children are equipped with the ability to imagine by doing various activities that allow children to communicate and even provide comments on issues they encounter like adults do,

for example, by exploring the place where they are active playing and having many meaningful experiences (Caiman & Lundegård, 2018).
Children are not only gaining communication aspect but also their observation skill. For example, when doing practicum, teacher and children watched the scientific activities related with the practicum, then teacher asked children to help and together prepare tools and materials that will be used, after that, teacher asked children to observe one by one the tools and materials on the table and listen to the teacher who mention the name of each tool and material, therefore in the process of color mixing activity, the teacher asked the child to mention the color, how to use the tools and materials provided, so they can experience and learn from their mistakes. As stated by Abruscato, (1974), that the stage in observing is the first important thing that must be passed by children. Through observation, it trains children's concentration on certain things, and with observation children can understand something.

As commonly known that science is a process not only by observing and communicating but by shaping children critical thinking so they can solve problems they face later. The practicum done in the second meeting in cycle II was about children did an experiment with water, air and fire, where the activity is "magic balloon", same as before, a video about the experiment was played but not until the end. This activity aims to introduce to children that they are not only observing and communicating but also predicting (Darling-Hammond, Flook, Cook-Harvey, Barron, & Osher, 2020; Volchik & Maslyukova, 2019) for example, the activity where balloon was filled with water and children would predict whether it would explode when it hangs above the fire. After finishing all activities, the researchers did not forget to ask children to classify some things based on the size, shape and color, this is done to stimulate the child's cognitive and memory (McLeod, 2015).

At the end of each activity, the teacher asks the children to write down their ideas in the form of a picture that would be colored according to the artistic value of each child, this is done in order to make the scientific learning activity become more meaningful and valuable for children and also asking their opinion regarding experiences learning science and also watching scientific videos. They said that colorful videos made them motivated and excited to know about their scientific experiments. Therefore, using the STEAM approach, where science, technology, engineering, art and math in one scientific activity can motivate and engage them learning (DeJarnette, 2018; Wijaya, Dina, & Amalia, 2015).

Based on the above discussion, the researchers focus not only on the skills of the process, but also the improvement of children scientific attitudes, such as children learning culture of queuing and being patient to take turn on using tools and materials, and being responsible for cleaning and tidying their scientific tools and materials. In this study, these are important findings outside the given instrument, where when scientific activities were done, they are not only gain the knowledge but also form a new habit.

Conclusion

Science in early childhood education can be a challenge or an opportunity. To maximize the learning opportunity for science activity, a STEAM approach can be the solution where teachers can provide various activities and integrate science learning to meet with the children needs. This research combines technology, arts, engineering, math and science activities, where children can learn through videos and then do various experiments. It shows that their result scores have increased significantly in the cycle II. Importantly, children are not only comprehending the process but developing scientific attitudes and with the use of videos, it also increases their motivation and excitement in learning science. Therefore, it can be stated that STEAM provides multiple activities in one approach.

Limitations and Future Studies

The study has used some videos that may be improved in terms of qualities and quantities of the videos in order to display high quality of

videos for children. It is hoped that the upcoming studies will provide more active approach to include children in each step of activity.

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REFERENCES

Abruscato, J. (1974). Science for the open and accountable classroom. *Science Education*, *58*(3). https://doi.org/10.1002/sce.3730580317

Arsyad, A. (2002). *Media Pembelajaran*, edisi 1. Jakarta: PT. Raja Grafindo Persada.

Bates, R., Salsberry, P., & Ford, J. (2017). Measuring Stress in Young Children Using Hair Cortisol: The State of the Science. *Biological Research for Nursing*. https://doi.org/10.1177/1099800417711583

Black, M. M., Walker, S. P., Fernald, L. C. H., Andersen, C. T., DiGirolamo, A. M., Lu, C., … Grantham-McGregor, S. (2017). Early childhood development coming of age: science through the life course. *The Lancet*. https://doi.org/10.1016/S0140-6736(16)31389-7

Bustamante asbustam@uci.edu, A. S. ., Greenfield dgreenfield@miami.edu, D. B. ., & Nayfeld nayfeld@etsu.edu, I. (2018). Early Childhood Science and Engineering: Engaging Platforms for Fostering Domain-General Learning Skills. *Education Sciences*.

Caiman, C., & Lundegård, I. (2018). Young children's imagination in science education and education for sustainability. *Cultural Studies of Science Education*. https://doi.org/10.1007/s11422-017-9811-7

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science*. https://doi.org/10.1080/10888691.2018.1537791

Daryanto. (2011). *Media Pembelajaran*. Bandung: Sarana Tutorial Nurani Sejahtera

DeJarnette, N. K. (2018). Implementing STEAM in the Early Childhood Classroom. *European Journal of STEM Education*. https://doi.org/10.20897/ejsteme/3878

Dwiyogo, W. D. (2008). Aplikasi teknologi pembelajaran: Pengembangan media pembelajaran pendidikan jasmani dan olahraga. Malang: FIP UM

Grotta, S. W., & Grotta, D. (2013). Camtasia Studio 8: Easy Interactive Video. *PC World*.

Haug, B. S. (2014). Inquiry-based science: Turning teachable moments into learnable moments. *Elementary Science Teacher Education, 25*, 79-96. doi: 10.1007/s10972-013-9375-7

Hosnan. (2014). Pendekatan saintifik dan kontekstual dalam pembelajaran abad 21. Bogor: Ghalia Indonesia

Juniarti, Y. (2015). Peningkatan kecerdasan naturalis melalui metode kunjungan lapangan (field trip). *Jurnal Pendidikan Usia Dini*, *9*(2), 267–284. Retrieved from http://journal.unj.ac.id/unj/index.php/jpud/article/view/3505

McLeod, S. A. (2015). Jean Piaget: Cognitive Theory. *Developmental Psychology*.

Mendikbud. (2014). *Lampiran I Peraturan Menteri Pendidikan dan Kebudayaan Nomor 58, Tahun 2014, tentang Kurikulum 2013 Sekolah Menengah Pertama/Madrasah Tsanawiyah*

Minister of National Education. (2014). *BUKU PANDUAN PENDIDIK KURIKULUM 2013 PAUD*.

Nugraha, A. (2001). *Pengembangan Pembelajaran Sains Pada Anak Usia Dini*. JILSI Foundation.

Oppermann, E., Brunner, M., Eccles, J. S., & Anders, Y. (2018). Uncovering young children's motivational beliefs about learning science. *Journal of Research in Science Teaching*. https://doi.org/10.1002/tea.21424

Permanasari, A. (2016). STEM Education: Inovasi dalam Pembelajaran Sains. *Prosiding Seminar Nasional Pendidikan Sains*, 2016–2023. Retrieved from https://media.neliti.com/media/publications/1

73124-ID-stem-education-inovasi- dalam-pembelajara.pdf

Surjono, H. D. (2010). Pemanfaatan teknologi informasi dan komunikasi dalam peningkatan kualitas pembelajaran. Malang

Wijaya, A. D., Dina, K., & Amalia. (2015). Implementasi Pembelajaran Berbasis STEAM (Science, Technology, Engineering, Art, Mathematics) Pada Kurikulum Indonesia. *Seminar Nasional Fisika Dan Aplikasinya*.

Winarno, dkk. (2009). *Teknik Evaluasi Multimedia Pembelajaran*. Jakarta: Genius Prima Media

Wiriaatmadja, R. (2009). Metode penelitian tindakan kelas. Banding: PT. Remaja Rosdakarya