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Science Education Through Malaysian Animation Series

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Abstract

Animation is one of the multimedia elements that are able to express children's fantasies into reality. Animation is seen to be able to motivate and stimulate children's thinking to reduce the cognitive load during the learning process. Animation in science education has been utilized as an educational resource to support science learning for decades. However, most members of society consider animation to be merely a form of entertainment. Contrary to popular belief, animation is not just focused on entertainment alone, but also plays a huge role in the world of education. This study was conducted through a data analysis process from Miles et al. (2014) on three popular animation series published by local animation companies. An analysis was conducted to identify the elements of science education delivered through the published animated series. The results of the survey found that 33 episodes of the Upin & Ipin animated, 26 episodes of the Didie and Friends animated series and 14 episodes of the Alif and Sofia animated series contain elements of science education that can be utilized in primary school science education. This study was implemented to ensure that community members make use of the screened animated series used to educate children through non-formal education as basic knowledge of science in children's daily lives. This study is also expected to give ideas to local animation companies to produce more animated series

that have elements of Science education. This study is also able to help teachers to make use of the serial animations that have been published as the latest approach in the development of the primary science curriculum.

Keywords: Science animation, Science education, Primary students, Educational technology, Curriculum development

1. Introduction

Animation is a technological product that allows learning to be delivered using visual and audial elements (Mayer & Moreno, 2003). Animation helps illustrate difficult concepts that cannot be easily explained utilizing text alone (Thomas & Israel, 2013). The use of visual materials in learning also greatly influences the understanding of abstract concepts; explaining facts to mental perception is clearer than through words. Studies show that the amount of human vision absorbed by sight is 40% of the total displayed (Abu Hawar, 2017).

Animation plays an important role in capturing children's interests. Animation is not just entertainment but also able to provide knowledge in an informal form on the basic concepts of Science to be applied in daily life. Children are encouraged to watch a local animated series that contains many elements of Science education in addition to the background of Malaysian culture and environmental education.

1.1 Animation in Education

Animation is one of the educational visual materials that make students effectively involved in the educational process and makes learning outcomes more meaningful. Animation is one of the latest technological approaches to teaching, learning and assessment. Nowadays, the internet, social media and information dissemination function well as an important part of human life (Kayimbaşioğlu et al., 2016). Emerging technologies have a huge impact on the way we live, learn and interact. Technology is among the main human needs in improving and facilitating the efficiency of human activities (Bagatarhan & Siyez, 2017).

The position of children is the center of learning in the modern paradigm of animation-assisted learning. Animation serves to engage children's interests, develop motivation and satisfy children's satisfaction through learning in the classroom (Yakovleva & Goltsova, 2016). Furthermore, in the outdated paradigm, teachers' responsibilities disregard students' involvement in learning activities (Adilah, 2017). Hence, knowledge is trained, constructed and transferred through animated materials that children view through active learning. Children are in the acquisition phase, so these animated learning situations should be planned with interest, interaction and meaningful activities. The learning environment should be designed based on motivation to learn, team learning activities and learning content based on children's basic knowledge (Ucus, 2015).

Through the modern learning paradigm, the selection of activities and animation-assisted teaching media determines the success of learning in primary schools. In addition, children naturally have access to a lot of knowledge as they get older in the world today (Huda et al., 2017). Therefore, teachers must change their role as facilitators compared to just being

communicators of information. This means the use of information and communication technology (ICT) has a probability of improving teaching and learning (Gellerstedt et al., 2018). The production of various genres in animated works by local publishers helps to strengthen the diversity of implementation in the context of learning. Educational practitioners need to have the ability to use modern media and adopt ICT with suitable pedagogical selection (Gellerstedt et al., 2018).

1.2 Science Education Through Animation

Animation in science education has been utilized as an educational resource to support science teaching and learning for decades (Smetana & Bell, 2012). Science education is a process of learning about oneself and one's environment. Science not only discusses a collection of concepts and facts with regard to natural phenomena. It also explains the process of thinking scientifically. Teaching science at the elementary level is something that is challenging. In order to convey complex conceptual knowledge of real natural phenomena into the classroom, teachers are required to establish students' capability to think abstractly and logically (Syawaludin et al., 2019). The employment of animation-based learning media can be provide a workaround for visualization problems and serve as a basic for students' abstract thinking.

The application of animation in the context of the science classroom is a well-established method of learning science. The enjoyment of science learning among primary school students is due to the use of animated visuals (Huong Giang Bui, 2020). Animation and science are promoters of the imagination. The combination of these two elements provides many benefits, especially during science learning sessions. The use of animation in scientific subjects helps teachers brush aside students' perceptions of considering science boring.

Animation sources, such as videos, photos and slides, used to convey scientific information are known as science animations. Geoff Lawton's Permaculture Design has produced more than 700 videos containing recordings of science learning sessions. However, the complex and abstract permaculture process cannot be fully conveyed and explained through such video recordings. So, Geoff sought to combine recording and animated videos totalling 330 learning videos. Science animation plays an essential role in assisting students understanding the complex effects climates and landscapes that take hours if described orally.

A study by Eryanto D.R.D and Prestiliano J. (2017) also proved that 80% of students consider that applications which are a combination of animation and virtual reality, are constructive in understanding lessons related to the solar system. This means that teaching media utilizing animation and virtual reality managed to attract students to understand more deeply about the solar system. A study by Sanda Veres and Ioana Magdas (2020) also proved that students who watched animated films about the Solar System and engaged in active learning activities under the guidance of their teachers could explain the positive outcomes obtained by treatment group students. This shows that learning using animated films with teacher guidance has higher efficiency in forming representations concerning the structure of the Solar System and its functions. Through support for active learning, student-centered learning will potentially improve learning outcomes (Hapsari et al., 2019).

1.3 Animation and Cognitive Theory of Multimedia Learning

The cognitive theory of multimedia learning becomes the main reference in the selection and formation of animation-based learning activities. Richard E. Mayer is a cognitive scientist who developed the Cognitive Theory of Multimedia Learning. Multimedia learning is learning using graphics (including graphics, photographs, animations, maps, as well as videos) and printed or via oral text (Mayer, 2008). This principle emphasizes that deeper learning will occur through the use of graphics and words as opposed to just using words alone. Children's existing knowledge is influenced by graphics or cue support to process information because it determines the resources available for more in-depth approaches (Richter et al., 2018).

Principles of Multimedia Mayer (2001) explains that learning through multimedia includes words and graphics. The dialogues found in the animation are words in the form of speech. Graphics are moving pictures in the form of animation. An entertaining animated presentation will move the verbal and visual channels in the memory effectively (Basri & Lakulu, 2018), in addition to being able to form active learning between users with multimedia elements (Zaibon, 2015).

The framework for the animation-assisted learning module and the way the mind works is derived from three assumptions. As per Austin (2009), the assumption of two-channel processing depends on the original work established by Paivio. Pupils have various channels in their brains to process verbal and visual material distinctly (Mayer & Moreno, 2003). Pupils will choose appropriate words to be processed in verbal working memory as well as suitable pictures to be processed in visual working memory (Toh et al., 2010). According to the limited capacity assumption, each channel can only process a certain quantity of information (visual and verbal). The active processing assumption explains that meaningful and in-depth learning relies on students' cognitive processing to select, organize and integrate information (verbal and visual) presented with prior knowledge (Mayer, 2008). Therefore, the selection of animated material is material that has been watched by students to facilitate the visual and verbal selection process to take place in a relevant way.

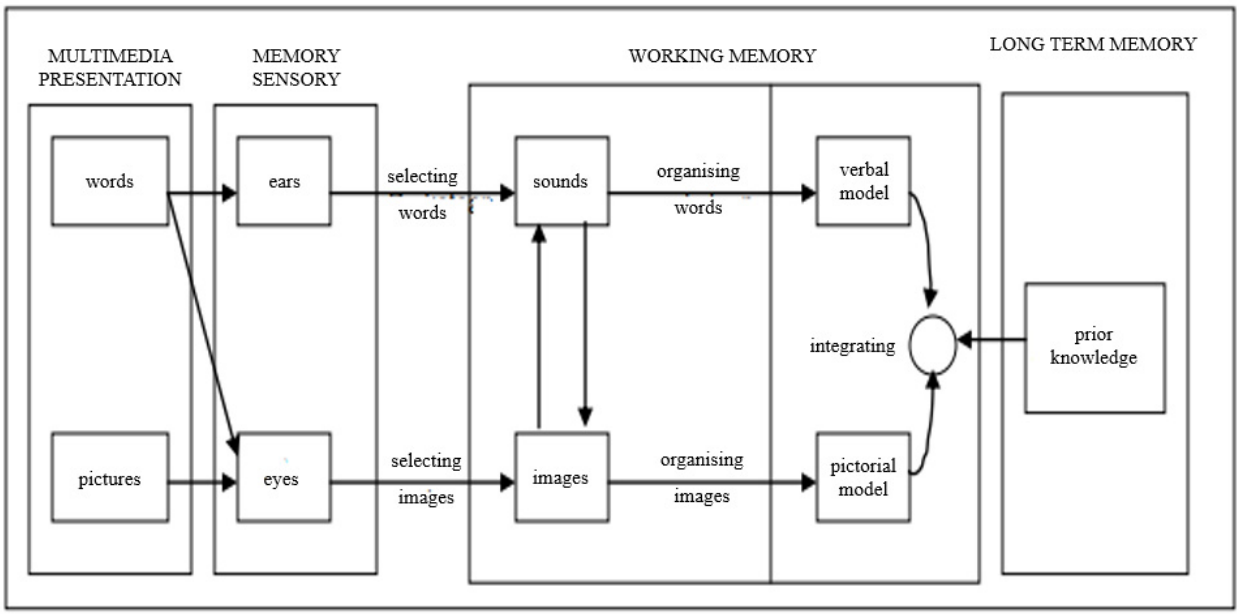

Figure 1. Combination of two-channel assumptions, limited capacity and active processing. Source: Cognitive Theory of Multimedia Learning (Mayer, 2008)

The figure demonstrates how memory works in multimedia principles. Based on Mayer and Moreno (2003), there are two lines containing information processing channels (visual and auditory channel). There exist five columns in this model representing the means of knowledge delivery. Based on the diagram, multimedia learning applications are parallel to animation-assisted learning that uses animation as a multimedia learning resource.

2. Method

Upin and Ipin, Didi and Friend as well as Alif and Sofia are samples of the animation series involved in the analysis of this study. Analysis was made on all series of episodes published and screened from the beginning of publication to now through the main website of the animation company. This study uses a qualitative approach by generating descriptive data from the observed animations. The stages of data analysis in qualitative research are as follows:

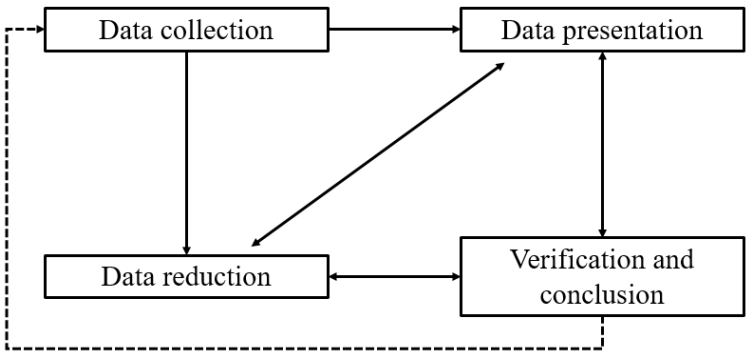

Figure 2. Data analysis process from Miles et al., 2014

The first stage in qualitative data analysis is carried out by collecting data obtained from the main websites of the animation company. Descriptive notes are made based on storylines, content and animated scripts watched over and over again. Then, data reduction is made to ensure that only relevant data is focused on the study made. Data reduction is made to facilitate research for the process of making validations and conclusions. Next, the data that have been analyzed are presented in tabular form to facilitate the mastery of the data. Validation and conclusion occur throughout the research process, that is, during data collection, data reduction and data presentation. After all the processes related to data analysis are completed, then the final conclusion is made.

3. Results

3.1 Three Optional Animation Series

The animation selected in this article is the most popular animation in Malaysia. The animation of this choice has its own strength through the created characters that are able to attract thousands of viewers for each episode aired. In fact, it is also something to be proud of that this selected animation has won various achievements and awards at the international level.

3.1.1 Upin and Ipin

Upin and Ipin is the title of a popular animated series produced by animation company Les' Copaque Production. The animation gets an average of around 800,000 views per episode. The series tells the story of a pair of 5-year-old male twins, Upin and Ipin, who tell the story of their daily lives through fun and funny action with their friends who often learn new things during their daily activities. However, Upin and Ipin are very naughty and often anger their sister, Ros.

Upin and Ipin, which debuted in 2007 on TV9 in Malaysia during Ramadan with the intention of teaching kids about the month of Ramadan, currently has 15 seasons and is not just restricted to television; it is available even in the form of online video streaming. Additionally, Upin and Ipin have been effectively promoted internationally, particularly in Indonesia. The storyline that can be understood by the Indonesian community who have the same cultural background as Malaysia, is one of the success factors of this animated film in successfully penetrating the international market.

Upin and Ipin were recognized as the Most Successful Animation in 2011 by the Malaysia Book of Records due to their success in winning over local fans. In fact, some success has also been enjoyed by this animation series from the beginning of its publication until today. Among the successes of Upin and Ipin include the Mom and Kids Award 2020 for Favorite Animation Series, YouTube Diamond Play Button for 10 Million YouTube Subscribers, Malaysia Book of Records for being the First YouTube Channel to receive the YouTube Diamond Play Button and Child-Friendly Broadcasting Award 2021 for Foreign Animation category from the Indonesian Broadcasting Commission. In addition, this popular animated series made history when it also aired on the Netflix streaming television service in the United Kingdom and Australia on 7 April 2021 (Fatin Farhana Ariffin, 2021).

3.1.2 Didi and Friends

Didi and Friends is an entertaining, educational musical animation that combines entertainment and education in the learning process for children. Didi and Friends is Malaysia's most popular preschool animation series, with more than 1 billion views on YouTube, millions of viewers on Astro Ceria, 3.9 million YouTube subscribers and nearly 200,000 Facebook fans. This animated series is published by Measat Broadcast Network System Sdn Bhd and DD Animation Studio Sdn Bhd. Didi is the main character in this series inspired by the *serama* chicken, a unique type of chicken. Its body is small, its chest is forward, and its tail is fluffy. Didi is cheerful, brave, and energetic and really appreciates friendship. Didi's character is also enlivened by other side characters, Jojo and Nana as well as anthropomorphic animal friends.

Didi and Friends were introduced for the first time in the form of a YouTube channel that broadcasts animated videos of children's songs starting on 15 May 2014. The video is not only themed on Malaysian folk songs but also foreign language children's songs translated into Malay, performed in the video series. Apart from distribution efforts locally and in Indonesia, Didi and Friends are also available in five other languages such as English, Thai, Spanish, Portuguese and Hindi (Wawann Mohd., 2020). In 2018, history was made when the franchise's first cinema film, the musical film Konsert Hora Horey Didi and Friends, was released on 10 March in conjunction with the school holidays in cinemas throughout Malaysia with a special appearance by Datuk Seri Siti Nurhaliza. Among other successes embraced by the Didi and Friends animated series include the Best Preschool Program award at the Asian Television Awards 2020 in Manila and collaboration with WWF-Malaysia to educate children on saving the orang utans through their latest songs entitled "What Would You Do" in conjunction with the International Orang-utan Day 19 August 2021 (WWF Malaysia, 2021).

3.1.3 Alif and Sofia

A short animation series titled Alif and Sofia was introduced by Blindspot Studios and Primeworks Studios with the support of Malaysia Digital Economy Corporation. Alif and Sofia are a pair of siblings who always love knowledge, new knowledge and love adventure. Alif was a cheerful boy and always had a curious nature. Sofia, on the other hand, is a girl who shows a mature, skilled, cheerful and assertive nature. This animated series contains elements such as storytelling, music, songs, dances and imaginative games inspired by the learning of Islamic life.

An early version of Alif and Sofia was published in 2016 and uploaded to the YouTube platform. The Alif and Sofia animated series is also included in the DidikTV screening slot as a platform for relaxing entertainment for the viewers. Even fans and viewers can watch Alif and Sofia animations by subscribing to Disney+ Hotstar's streaming service based on packages offered, starting 9 July 2021. Alif and Sofia was awarded as National Best Preschool Program at the Asian Academy Creative Awards 2020.

3.2 Analysis: Animation Series and the Primary School Science Curriculum and Assessment

Standards Document

The analysis that has been made is adapted to the Primary School Science Curriculum and Assessment Standards Document. Each animated series is presented in tabular form by recording the title, first broadcast, episode list, science topic and class. The use of tables is to facilitate understanding and mastery of the data before a final conclusion is made.

3.2.1 Upin and Ipin

The Upin and Ipin series was first introduced to the audience as one of the special filling programs during the month of Ramadan and Hari Raya Aidilfitri. The first series of this animation has six episodes aimed at educating children about the importance of the holy month for Muslims. The second series of animations published in 2008 also still contains a storyline themed on the month of Ramadhan and Hari Raya Aidilfitri. Therefore, the first and second series of Upin and Ipin animations do not contain science topics in their storyline content.

After two years, the Upin and Ipin animated series were introduced to children. The third animated series was published with more challenging themes and tested children's knowledge and intelligence, including science concepts. Starting the third series, Upin and Ipin will be shown not only during the month of Ramadhan and Hari Raya but also as a filling program for the school holidays. Upin and Ipin animation is the first Malaysian animation series that has succeeded in attracting children to watch and appreciate the stories presented in each of its series. Therefore, a more challenging series was produced to make children more interested in the more challenging science activities in this animated series.

One of the episodes of the Upin and Ipin animation series containing science topics is the episode 'Ecosystem', aired in the tenth season of 2016. In the series, a teacher explains to Upin, Ipin and friends how they can learn about ecosystem life in school garden. Flowers, plants, sunlight, ponds and others can be spotted in their school garden. The teacher gave Upin, Ipin, and their companions an explanation of what an ecosystem is. The teacher in the course discusses how sunlight and water allow flowering plants to live healthy lives.

Upin and Ipin discussed the assignment they received from school with their sister, Kak Ros when they got home. The assignment concerns living ecosystems. Kak Ros is given an explanation of the ecosystem by Upin and Ipin, who also mention that plants and animals are living things that require air, water and sunlight to thrive. The ecosystem develops from there. In this series, there is also a scene of Kak Ros, Upin and Ipin looking for worms for an assignment given by the teacher. Upin and Ipin listen as Kak Ros explains that worms use their entire skin surface for breathing in the soil. In order for the wet skin surface to absorb oxygen, worms must reside in the soil. Upin and Ipin take worms, soil, grasshoppers and plants to bring to school.

The teacher gives students an explaination of the ecosystem results that Upin and Ipin had brought about. Since there are living and non-living things that depend on one another, the ecosystem that Upin and Ipin brought is an example of a complete ecosystem, the teacher added. In an ecosystem, the existence of worms helps to maintain healthy soil so that plants

can thrive. Whereas for grasshoppers to live and breathe inside buildings, oxygen must be produced by trees. In this series as well, Upin and Ipin's friend, Mei-mei describes the results of the rose tree ecosystem that she brought. According to Mei-mei, rose trees thrive in soil that has received water, animal manure, and sunlight as the planting medium.

Based on the storyline, content and script presented in this episode, teachers can apply this animated series to children who can facilitate the learning process about the ecosystem. In fact, many more Upin and Ipin animated series that contain storylines, content and scripts with elements of science topics. The results of the survey found that 33 episodes of the Upin and Ipin animated series out of 197 total episodes screened (16.75%) from 2007 to 2021 contain elements of science education that can be utilized in primary school science education. The following is a list of episodes featuring elements of science education:

Table 1. Results of the survey Upin & Ipin animated series contain elements of science education

Title	First broadcast	Episode list	Science Topic	Year/ Class
Upin & Ipin: Season 3	2009	1. Brush It 2. Clean Self Healthy body	1. Dental Care 2. Healthy Daily Routines	3 6
Upin & Ipin: Season 5	2011	3. It's Too Dark	3. Light Travels	4
Upin & Ipin: Season 6	2012	4. Catch It! 5. Ready To Rescue	4. Parts of Animals 5. Obeying the Science Room Rules	1 1 - 3
Upin & Ipin: Season 7	2013	6. Milk Teeth 7. The Green Leaf 8. The Danger of Haze	6. Milk Teeth and Permanent Teeth 7. Classes of Food 8. Air	3 3 2
Upin & Ipin: Season 8	2014	9. Take Care and Appreciate the Eyes 10. Upin, Ipin and The Storm Ultraman 11. Upin & Ipin: Space 12. The Tree with Thousand Uses	9. Human Senses 10. Activities That Threaten Animals and Plants 11. Members of the Solar System 12. The Importance of Parts of Plants	1 6 3 1

Upin & Ipin: Season 9	2015	13. Dengue Free Squad	13. Life Cycle of Animals	2
Upin & Ipin: Season 10	2016	14. Uuuu…What is The Stange Egg? 15. On School Holidays 16. Ecosystem 17. Journey Through 6 Seasons 18. Behind The Scene 19. A Big Mistake	14. Survival of Animal Species 15. Classification of Animals 16. Interactions Among Animals 17. Protection from Extreme Weather 18. Light Travels 19. Ways of Reproduction in Plants	5 3 6 5 4 3
Upin & Ipin: Season 11	2017	20. Let's Be Healthy 21. Kill the Virus 22. Dino Nature's Adventure 23. Explore the Ocean	20. Classes of Food 21. Tiny Living Things 22. Animal Extinction 23. Classification of Animals	3 6 6 3
Upin & Ipin: Season 12	2018	24. For Achievement 25. Ask the Tree 26. Our dearest Zoo 27. What is that?	24. Classes of Food & Knowing Waste Materials 25. Factors of Competition Among Plants 26. Parts of Animals 27. Waste Management Practices	3 & 6 6 1 6
Upin & Ipin: Season 13	2019	28. Rearing Tadpoles 29. Ehsan's Stomach	28. Life Cycle of Animals 29. The Digestion Process	2 3
Upin & Ipin: Season 14	2020	30. Movement Control Order 31. Mosquito War	30. Life Processes of Microorganisms 31. Live Healthily, Live Well	6 6
Upin & Ipin: Season 15	2021	32. Wind 33. Red Eagle	32. Moving Air 33. Food Web	2 5

3.2.2 Didi and Friends

Didi and Friends is famous for its very cheerful and uplifting songs. For example, the song titled '*Mengantuknya Mumia*' which aired in 2019, was once contagious and got 70 million views on the YouTube channel. Recently, the children's animation came with a new song titled *'Takkan Tak Tahu'*, a duet with the first season's Big Stage champion, Sarah Suhairi. The song *'Takkan Tak Tahu'*, tells the story of environmental pollution, which aims to give awareness to all parties about the importance of caring for the environment. More interestingly, the song was contagious and got almost 3 million views on YouTube in a week, in which Sarah Suhairi also became an animated character who is a foal in the music video.

Digital Durian, also known as the production company for the Didi and Friends animated series, has partnered with UNICEF Malaysia and MERCY Malaysia to promote hygiene practices such as hand washing for young children throughout Malaysia. UNICEF Malaysia and MERCY Malaysia have teamed up to provide essential hygiene and health education kits to Malaysia's most vulnerable population, thanks to generous funding from the Government of Japan since the start of the Covid-19 outbreak in Malaysia. Moreover, the collaboration aims to reach up to 70,000 children and their families having essential hygiene and health education kits in the peninsula and East Malaysia.

The popular animated series Didi and Friends also produced a music video to help remind children to stay clean to fight coronavirus. The video titled Fight Coronavirus is produced in English and Malay versions. In the two-minute video, Didi, Nana and Jojo show three simple steps to keep the Covid-19 outbreak away. The song was composed by the Digital Durian series production company, with music composer Omar K.

The survey found that 26 episodes of the Didi and Friends animated series out of 117 total episodes screened (22.22%) from 2014 to 2021 contained elements of science education that could be utilized in primary school science education. The following is a list of episodes featuring elements of science education;

Table 2. Results of the survey Didi and Friends animated series contain elements of science education

Title	First broadcast	Episode list	Science Topic	Year/ Class
Didi & Friends: Season 1	2014/ 2015	1. Jump Frog Jump	1. Characteristics of Living Things	1
		2. Pak Atan has a farm	2. Classification of Animals	3
		3. Butterflies	3. Parts of Animals	1
		4. Animal Sounds	4. Characteristics of Living Things	1
		5. The Stars	5. Members of the Solar	3

			System	
Didi & Friends: Season 2	2016/ 2017	6. Didie's Ducklings 7. Parts of Body 8. Play in the Circle 9. Bamban The Great Elephant	6. Characteristics of Living Things 7. Living or Non-Living 8. Parts of Animals 9. Parts of Animals	1 1 1 1
Didi & Friends: Season 3	2018	10. Rainbow 11. Stork Oh Stork 12. Bird's Body 13. The baby Turtle 14. The Story of a Caterpillar 15. Tong Tong Tong 16. Pom Pom Pom 17. Bone Shaking 18. Rocket Balloons	10. Formation of a Rainbow 11. Animal Reproduction 12. Parts of Animals 13. Lay a few eggs, Lay many eggs 14. Life Cycle of Animals 15. Basic Shapes 16. Small and Big 17. The Human Skeletal System and Its Function 18. Designing a Wind Rocket	4 2 1 2 2 1 1 5 2
Didi & Friends: Season 4	2019	19. Who is the Champion? 20. Blue Whale 21. Oh Shark 22. Boo and Roon 23. Aum! Tiger 24. Winter	19. Basic Shapes 20. Parts of Animals 21. Parts of Animals 22. Characteristics of Living Things 23. Characteristics of Living Things 24. Protection from Extreme Weather	1 1 1 1 1 5
Didi & Friends: Season 5	2020/ 2021	25. Triangle girl 26. Our Responsibilities	25. Basic Shape Blocks 26. Obeying the Science Room Rules	1 1 - 3

3.2.3 Alif and Sofia

The Alif and Sofia animated series introduced on YouTube in 2017 has reached over 60 million views to date. The success of this original YouTube series proves the ability to

process and revamp more contemporary ideas on the appearance of the characters not only because of the cuteness of the characters but also because the informative content can attract children and parents to watch the series.

Unlike other animated series, the Alif and Sofia animated series will introduce learning objectives before being screened through their Facebook page. The statement of learning objectives through the 'What is learned' segment makes it easier for the audience to understand the content presented in the animated series. For example, in the series entitled 'Science Experiments', there are three learning objectives stated in the series, namely to provide exposure to science learning, conduct fun science experiments and foster development in terms of knowledge and skills. Their Facebook page also informs the date, time and television network involved in the airing of the episode.

The series entitled 'Breathing' features the story of Alif and Sofia who want to learn and understand the importance of oxygen and why humans can breathe. There are simple exercises that children can participate in together while watching this episode. The activities featured in this series make it fun for children to do the activities they are watching together. Although the activities shown are simple, they are able to ward off the boredom of children while watching the series.

The results of the survey found that 14 episodes of the Alif and Sofia animated series out of 105 total episodes screened (13.33%) from 2014 to 2021 contain elements of science education that can be utilized in primary school science education. The following is a list of episodes featuring elements of science education;

Table 3. Results of the survey Alif dan Sofia animated series contain elements of science education

Title	First broadcast	Episode list	Science Education	Year/ Class
Alif & Sofia: Season 1	2019/ 2020	1. (Breathe)	1. Human Breathing Process	4
		2. Take care of the Earth	2. Waste Management Practices	6
		3. National Zoo	3. Preservation and Conservation of Animals and Plants	6
		4. Take Care of The Eyes	4. Human Senses	1
		5. Listen to the Teacher's Advice	5. Obeying the Science Room Rules	1 – 3
		6. Nose's Function	6. Human Senses	1
		7. Give Help	7. Obeying the Science Room	1 – 3

		8. Healthy food	Rules 8. A Balanced Diet	3
Alif & Sofia: Season 2	2020/ 2021	9. Brush the teeth 10. What is 3R? 11. Science Experiments 12. Frog Oh Frog 13. Get to know Parts of the Body 14. Star Oh Star	9. Dental Care 10. Knowing Waste Materials 11. Science Process Skills 12. Life Cycle of Animals 13. Human Senses 14. Rotation and Revolution of Earth	3 6 1 2 1 4

4. Discussion

Based on the findings of the analysis conducted on these three popular Malaysian animation series, it was found that several episodes that have science topics that can be adapted to the Primary School Science Curriculum and Assessment Standard Document. In general, this standard document contains six themes namely inquiry in science, life sciences, physical sciences, materials science, earth and space, and technology and sustainable living. The theme-based analysis in this Document Standard for Curriculum and Assessment (DSKP) shows that the three animation series produced focus more on life science themes. Life sciences focus learning on about living and non-living things, humans: basic needs of living things, senses, reproduction and growth, teeth, food classes, and digestion, animals: body parts, reproduction and growth and eating habits and plants: plant parts, growth and reproduction (DSKP Science Year 3, 2021). The scope of life science learning is also extended to learning about humans: respiration, excretion and defecation, response to stimuli, skeletal system, circulatory system, interrelationships between systems in the body, reproductive system and nervous system, animals: respiratory organs, vertebrates, species survival and interactions between animals, plants: responding to stimuli, photosynthesis, species survival, seed dispersal, interactions between plants as well as preservation and conservation as well as microorganisms (DSKP Science Year 5, 2021). In general, life sciences encompass the field of science that involves the study of living organisms such as humans, animals, plants and microorganisms.

Life sciences are important in a child's early learning process. Life sciences allow an understanding of the environment and other living species that share the earth with humans. This knowledge guides conservation and preservation efforts as well as helps to save the shared earth. Furthermore, life science learning helps the understand of disease processes and enables the development of new therapeutics and innovative medical devices, thus indirectly improving the standard of human health (Sujata K. Bhatia, 2015). This shows the animated series produced fulfils the importance of providing early education to children on life sciences as an early effort to help improve a perfect standard of living.

The analysis also shows that serial animations are more suitable for learning Level 1 primary school children. Level 1 is for children in Years 1, 2 and 3, aged 7 to 9 years. In fact, in the learning process, children are more receptive to instructions and information when the transfer of the material is presented in a more creative way and contains interesting and colourful elements. In fact, the information will be stored in the memory of the mind longer than the information presented in a formal form. This is in line with the animated series, which is considered one of the ways of presenting information in the form of a more interesting story in order to more easily steal the attention of the audience, especially children (Hamdan Daniel, 2018). Animations produced with beautiful images, backgrounds or props, as well as an interesting storyline, will easily impress the hearts of the audience. This factor is why the production of animated series is more focused on children between the ages of 7 to 9 years. Most children are easily influenced by hearing and observing the movements of those around them. Apart from practising positive and active communication when with children, they can also be helped by showing a series of animated stories that are appropriate and clear the details of the conversation so that it is easy to understand. In this way, they are able to learn new words and this definitely helps them in understanding the basic concepts of science. A child's brain is still 'fresh', and surely every new word they learn~~s~~ will remain in their memory ~~if~~ constantly recalled by helping them use it daily.

The characters in the animated cartoon series produced in Malaysia are more natural, logical and much based on the realities of real life as Asian people who practice customs or culture as well as a good and admirable way of life. For example, the character Ros in the story of Upin and Ipin always wears *baju kurung* even when they are at home. Ros is also described as a sister who is firm towards her siblings~~,~~ and often scolds Upin and Ipin occasionally when she finds them naughty. Sometimes, the stern attitude towards her siblings was reprimanded by Opah, who was more gentle with the twin siblings. Even so, Ros still loves Upin and Ipin by helping them complete the school Science project. These are instances of characteristics that should be shown to children so that a positive attitude can be nurtured in them from an early age as well as acquire knowledge in science.

Most animated stories from foreign countries have been translated into either Malay or standard English. The same goes for the animation series produced in Malaysia. This means that the order of the sentences spoken and the grammar used are more structured according to the concept of science. Futhermore, as mentioned earlier, children learn to speak by listening and observing. Thus, stories that use clear and correct and age-appropriate scientific terms to watch can train them to adapt well to the social living environment. Overall, the use of scientific terms, storytelling and good language style will have a positive impact on children because generally, at this age, children easily imitate things that can be seen and heard.

Based on the survey findings conducted through previous studies, the animation produced has elements of science that benefit the audience, especially children, and help improve personality development and moral values in children's lives. The success of Malaysian animation on the international stage~~,~~ further expands the production of animation in various languages. Animations of Upin and Ipin, Didi and Friends as well as Alif and Sofia are not only produced in Malay but also in English. They are suitable for viewing by children around

the country. The use of serial animation is one of the informal educational approaches and can even happen anywhere. Although the percentage of episodes is still small, it can still be used as one of the approaches in an effort to attract students to the basic concepts of Science at the primary level. The survey is also expected to provide guidance to educators and the community on the benefits of published serial animations. Animation company publishers are also encouraged to produce more animated series that have science elements to help children get the basic concepts of science through informal education and can even be used as formal learning materials in the classroom.

Watching an appropriate animated series can actually help stimulate the development of children's minds. It can also help them make a brief analysis of the shows they are watching. However, the role of mothers and fathers lies in ensuring the best-animated series for their children in order to provide formal or non-formal education. Moreover, parents need to educate, help and support them when they do good and beneficial things since they are little.

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