A Proposed Concept of Learning Based 3D Hologram to Enhance Attention Among Primary School Learner

Article · July 2019

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A Proposed Concept of Learning Based 3D Hologram to Enhance Attention Among Primary School Learner

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*Abstract***:** *This paper discusses the children attention enhancement in education and presents a conceptual phase of learning via 3D hologram. Attention enhancement is important to keep children engaged and sustained their attention skills of learning in school. It is the very first step in the learning process that occurs in the brain. It is the brain's ability to concentrate on something through careful observing or listening. However, the children's concentration span is very limited and easily distracted. They will quickly shift their attention to something more interesting when they feel the task given is not fun. Therefore, the methodology of meta-analysis is carried out based on three-dimensional hologram (3DH) as digital learning tools, to identify the factors that will influence children's attention, and its effectiveness to develop the content for 3DH. Ten studies from the year 2007 to 2017 were analyzed qualitatively and summarized according to the visual elements and content, based on children's learning style. This study shows the significance of learning style characteristics used for 3DH, such as visually engaging, character animation, duration, colour graphic, audio, and storyline in order to draw children's attention and continuously maintain focus during the learning process. Children are able to grasp the concepts of topics easily when they focus, get fun and understand the illustrations of 3DH. Based on the analysis, the paper presents a heuristic concept generated, lead to integrate 3DH technology as an effective teaching tool in attracting students' attention and enhance their understanding. In fact, young children have the limitation in their thinking abilities as they cannot understand and increase more scientific notions. Hence, 3DH technology as a teaching material is applicable for teaching on the concept of scientific topic, such as the phenomenon of astronomy, the structure and developmental process of human, animals and plants.*

*Index Terms***:** *Attention Enhancement, Children Attention, Digital Learning, Education, Hologram*

I. INTRODUCTION

Many people understand that learning requires the ability to focus and pay attention. Paying attention is a key skill for learning and subsequently for academic achievement [1]. In fact, most children often struggle to sustain attention in their study, as they can easily get distracted by the littlest things, such as background noise, bright lights, hunger, or there is a very interesting idea comes from their mind. Besides, they also find it hard to focus on things that do not interest them and easily get bored.

This always happens in their learning process, and it is part of growing up for the children. Much research has looked at children's attention and concentration. In order to improve it, one of the key findings is children learn better and pay more attention when their individual learning styles are recognized [2]. Gardner also outlined three majors learning styles of auditory, visual, and kinesthetic (VAK), as centered learning models, which have found success helping children learn in the way that is best for them hence focus. Therefore, the usefulness technology based learning is able to incorporate all these three learning styles of auditory, visual, and kinesthetic (VAK) approaches into a class, to catch the children's attention in learning. This is also supported by VAK theorists that, presenting information using all three styles allow all children to become involved, no matter what they preferred. 3DH technology utilizes an effective visualization tool towards generating audio, visual, and haptic contents in three-dimensional space. This technology allows children to learn more on-the-spot experience and integrate with the real environment, hence gaining children's attention skills of learning is a great advantage. Yet, 3DH is a new technology and still in its infancy stage in the field of education as the paper quoted in [3]. In order to develop 3DH technology with effective learning content, a meta-analysis is carried out in this study to identify the learning style characteristics in digital learning, to attract children's attention and enhance their understanding in their study.

II. LITERATURE REVIEW

Written works of past researchers who have done a similar or related research of children's attention in learning and 3D hologram technology were reviewed, to provide brief ideas, findings and summary in which relating to this study.

A. Children's Attention in Learning

Attention is a critical first step and acts as a gateway to think toward learning. The ability of children to learn to focus effectively and consistently lays the foundation for academic achievement. In the perspective of psychology, [4] explains attention is the cognitive process of taking possession by the mind in clear and vivid form that has limited capacity while ignoring those which are less important. Apart from that, attention span is the total amount of time given by a person to concentrate on any particular activity without getting distracted [5]. As a matter of fact, many children are unable to maintain attention throughout long lessons in

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classrooms, especially primary school students. According to Dr. Becca Harrison, a resident of psychiatry at the Medical College of Wisconsin, a normal attention span should be 3-5 minutes per year of a child's age [6]. For instant, 3-year-old children would have averaged 9 to 15 minute attention span, while 10-year-old children would be around 30-50 minutes of attention span. This is because children are still developing their cognitive abilities, as they are very spontaneous, easily distracted, and their concentration span is very limited. Even so, the children's attention span can be improved. The key is to offer enough extrinsic motivation to keep children engaged and sustained their attention skills of learning in school.

In the classroom, children learn best is motivated by seeing the value and importance of the information presented in the learning environment [7]. As pointed out in the research from Lamba and the team in 2014, there are many factors which can affect attention and concentration of students in the classroom, such as duration and method of teaching, novelty and repetition of topics, surrounding environment, interest, health and emotional status [5]. Besides, Gilakjani also emphasized that visual learners learn best through visual information, auditory learners learn through oral or aural modes, and kinesthetic learners learn through moving, doing and touching [7]. Thus, a combination teaching method of auditory, visual and kinesthetic, allows all children to have the opportunity to become involved, no matter what they preferred. Furthermore, curiosity is an elementary form of interest. It has remained essentially important to gain the child's attention when involved in the learning process [8]. To attract student's curiosity, there are several components must be put into the learning content, such as colourful graphic, animation, and music. It must also contain the objects that introducing the topic to the children.

On the other hand, often it appears that the child has not paid attention when they find the lesson is difficult to understand. As a consequence, it is well suited to convert the complicated information, such as difficult concept, text, charts, and diagrams into a simpler visual form. As claimed by [9], visualization of information is fundamental for the development of attention skills in children to understand the topic. This is because the part of the human brain used to process words is quite small compared to the part that processes visual images. Also, the visuals have been proven to be a learning enhancer if it is connected to the learning styles. As [10] also gives a strong point that a well-written scenario, right audio, visual effects and a descent looking character in learning tools, are all the main factors grabs attention for the children in their study. These are also the main factors that traditional schools lack in delivering the academic content, even sometimes the teacher still needs to use facial expression, acting & vocal effects to explain the scenario for the children to understand the content. In short, the children learning abilities are related to their attention skill in a learning process. Therefore, the learning materials and content must be able to grab children's curiosity, interest, and engagement, in order to draw their attention from the beginning of the learning activities. This is the reason why 3DH received good response among students. Educational based 3D Technology enables to bring the learning content "to life" and allow children to experience and engage with original objects in new ways of visualization.

B. 3D Hologram Technology (3DH)

3DH in the new era of Information Communication Technology (ICT) had been introduced for several decades with proven advantages, to motivate and engage students in their learning skills. Conceptually, 3D hologram is a three-dimensional in the physical structure that diffracts light into an image [11]. A hologram displays products, objects, and animated sequences three-dimensionally, that is not actually "there," but enables seemingly it to appear to float completely freely in space. Unlike a conventional film on a standard screen, a 3D hologram is visible from all sides, which means the observer can walk around the hologram, enabling an absolutely realistic-looking image to form.

Based on [12], the application of 3D holograms in education can be substituted for real objects, for instance of human beings, organs, and animated characters as well as agents like avatars in various learning environments by using the electronic tools. As children can observe the hologram teaching agent and engage in multimodal and multidimensional activities in the demonstration design, their understanding of learning is enhanced. Audio-visual methods in teaching are the key focus on the level of effectiveness, as holographic is a new tool which could support delivering and receiving information and knowledge to engage the learner.

To compare with traditional learning materials, 3DH is far more advanced to represent diverse interactive educational platforms in conceptual context, time and space. As paper quotes, 3DH is an emerging technology and recognized as effective visualization tools in the field of education [13]. It provides superior visual capabilities of information that is either not present or difficult to process in the textbook handouts. The features of 3DH included visual engaging, 3D animation, audio, and images shown in 3D form appear floating in the free air. This exciting learning environment stimulating curiosity, interest and sustaining purposeful attention can increase children's motivation during learning. In spite of engagement, the students allowed to view the object or subject learned from different angles via a 360-degree hologram of 3D images. In a way, this 3DH technology has combined three learning styles of auditory, visual and kinesthetic as mentioned above. However, the visual element and content also play important role in the context of education. In order to develop relevant 3DH for children as learning tools, the further explanation on visual engaging, duration, colour graphic, animation, music, and audio, based 3DH development in children education will be discussed.

III. METHODOLOGY AND ANALYSIS

The aims of the meta-analysis are intended to identify the useful learning visual elements including content, for developing 3DH and enhance the children attention skill in the fields of education. The comprehensive analyses of selected published papers are taken from the years of 2007 until 2017. The

purpose of this review is to recognize how to enhance children's attention in their learning and presents a conceptual phase of learning via 3D hologram. Potentially relevant articles on children attention enhancement based on features extracted from media technology were identified through the literature search in Google Scholar (GS), Life Sciences Education (LSE) and ACM Digital Library electronic databases. Articles were searched using Boolean combinations of the keywords of "attention enhancement" AND "children learning" AND "media OR video OR multimedia OR 3d hologram technology". Moreover, additional papers were identified performing a linear search along the references of relevant review articles previously published. However, papers were considered suitable for this review if they met these criteria: (1) the selected published papers were from 2007 until 2017. (2) the studies must

focusing on application of technology media in learning, not explained deeply on technique, (3) that articles must clearly state the features uses and advantages for children attention enhancement. (4) The features are applicable in the 3D hologram. Through this method, strong evidence in meta-analyses is summarized and the factors are identified, to draw possible implications of 3DH for the future. The important components in the projection of 3D hologram are identified to gain children attention in learning process. Therefore, this section is divided into two elements to fulfil the aim of this study: (a) attention enhancement in children learning process and (b) key features, uses and advantages for 3DH development. All papers were analysed qualitatively as presented in Table 1.

Table 1: Meta-Analysis of Attention Enhancement in Children Learning

Study (Author)	Attention Enhancement in Children Learning Process		
	Key Features	Uses	Advantages
McLanahan et al., (2008)	Audio	Child Voice	Using child rather than adult voices for the characters will make concepts more accessible and help with later recall [14].
Dzulkifli & Mustafar (2013)	Colours Graphic	Warm colours like yellow, red and orange have a greater effect on attention compared to the cool colours like brown and grey	Colours can produce a higher level of attention and is effective to increase memory performance [15].
Guo et al. (2014)	Duration Learning Media	Learning media must show less than 6 minutes	Student engaged and tended to watch the whole video with the time less than six minutes long. Making videos longer than 6-9 minutes is therefore likely to be wasted effort [16].
Hattie & Yates (2014)	Multi-modal	Visually, Auditory, Kinesthetically	Learning become more efficiently for capturing students' attention when information is presented in multiple modes [17].
Sambrani, et al. (2014)	Learning Content Style	Effect of Humour	Nothing wins attention like a good joke. Children listen to teachers who know how to incorporate humour into their material [18].
Briggs (2014)	Sensory Perception	Engage the senses	When children were provided with materials to enhance their sensory perception and teach them, they will appear to revel in the exploration that they offered, concentrating on them for prolonged periods [19].
Habib & Soliman (2015)	Animation	Cartoon Content	Children are attracted to the cartoon content much more than the academic traditional ways of learning, due to the well written scenarios, audio & visual effects and colours. All these factors cause the child to absorb information dozens better than that absorbed from a teacher in a classroom [10].
Brame (2015)	Audio	Use a conversational style	Conversational style encourages students to develop sense of social partnership with the narrator that leads to greater attention and engagement [20].
Hsu (2015)	Storyline	Short stories with adventure plots	Short story to avoid children get bored as their attention is only maintained for 10-15 minutes. Flexible stories with more adventure plots would stimulate children's critical thinking and reinforce children' learning attention [21].

Shuja et al. (2016)	Animated Spokes Characters	Physical Appearance, Humour Characteristic, Action & Movement, Children Voices and Music Effect	Young children have limited reading skills, but animated spokes characters serve as a strategy in storing visual content in their minds [22].
Brame & Perez (2016)	Learning Content Style	Use signalling to highlight important information	Key words on screen highlighting important elements can reduce extraneous load and enhance germane load [23].
Orbeta (2017)	Colours Graphic	Colour moving images	Colour moving images first capture children's attention before they understand any message [24].

IV. RESULTS AND DISCUSSION

Throughout the meta-analysis, the result shows the visual elements and learning content, such as colour graphic, duration, animation, character, storyline, multi-modal, sensory perception, music, and audio are essential, leads to greater attention and engagement in children to understand the lessons. These features are suggested to include in developing 3DH technology for the learning purpose, in order to provide children with resulting a deeper thinking and long-term retention of learned. To sum up, 3DH key features to enhance children's attention was presented in Table 2.

Based on the findings, a proposed concept of application 3D hologram in education for children attention enhancement is shown in Figure 1. This summarizes the concept of application 3DH technology, which is intended as a framework for explaining how it works for improves children's attention in learning. According to meta-analysis, a basic overview and assumptions that hold together the whole concept of learning abilities are corresponding to the main focus of auditory, visual, and kinesthetic (AVK) learning styles. At the starting point, the teacher uses 3DH technology as a teaching material to explain the subject's information to students. In this way, children start to grab the information through auditory or visual channels and capture their attention. Information enters sensory memory via the learner's ears, eyes or perception, where relevant learning information will be selected to be sent to working memory, and stored over a period for long-term memory [25].

Table 2: 3DH Key Features to Enhance Children's Attention

3DH Key Features	Significant Findings
Voice	Children voice Conversational style
Colour Graphic	Warm colours Colours moving images Highlight important information
Duration	Show less than 6 minutes
Multi-Modal	Visually, auditory, kinesthetically
Sensory Perception	Engage the senses
Animation	Cartoon content Effect of Humour

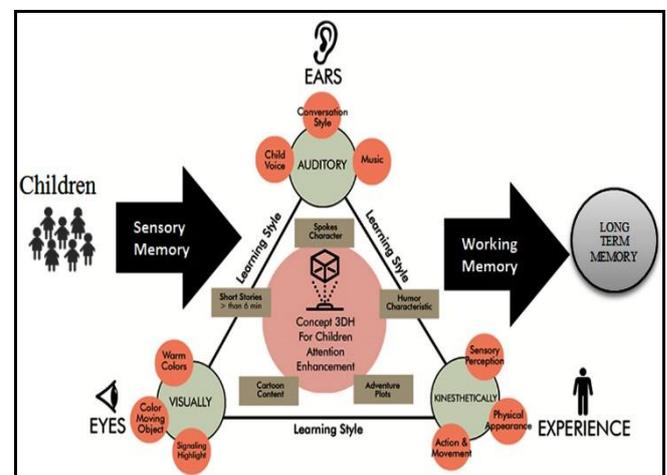| Storyline	Short stories Adventure plots
Character	Spoken and Animated Physical Appearance Humour Characteristic Action & Movement
Audio/Sound	Music and Sound Effect

Fig. 1: Proposed Concept of Application 3D Hologram in Education for Children Attention Enhancement

In order to attract children attention, the general content of 3DH needs to meet with the learning characteristic, such as the explanation used with speaking character, humour characteristic, cartoon style, adventure plots and overall not longer than 6 minutes. Besides, 3DH in education shows its potential as a visualization tool for teaching and allows the object to appear hanging up in the air. This interesting learning environment has to accompany with the child's learning characteristic, to make learning more effective. For visualization information, 3DH shown in better result with warm colours, highlighting an important keyword, and using coloured moving images to gain children's attention in the lesson. Apart from that, kid's voices are used for the characters' speaking, to make the concepts more accessible to children and help with better recall compare to adult voices. Likewise, conversational style of explanation has shown to be an effective learning form to convey the message to the learner. Music as an additional way may calm and focus children with special education needs, thereby enhancing learning ability. Moreover, the integration of

kinesthetic learning in 3DH technology takes place by the students by carrying out physical activities, sensory perception, action and movement. In order to achieve a long-term memory, different techniques have to be used to allow all children to have the opportunity to become involved, no matter they are visual, auditory or kinesthetic learners. The children can activate prior knowledge to be integrated with the verbal, pictorial and tactile models in a 3DH instructional message in working memory, which can store and resulting knowledge in long-term memory.
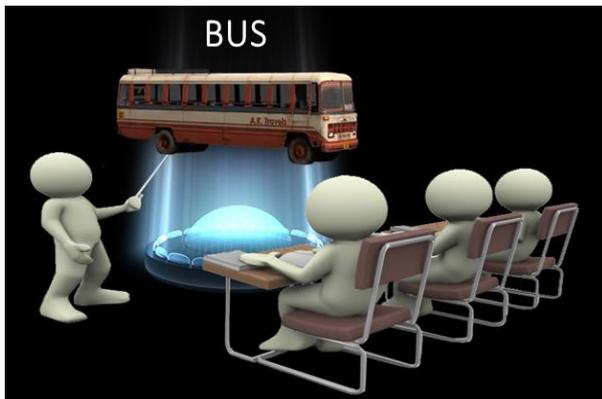

Fig. 2: Symbolic View of the Application 3DH in Education As shown in Figure 2, 3DH also provides a 360-degree view from different perspectives via 3D image hologram. These visual tools enhance the students' understanding from various angles. Hence, 3DH technology is an effective learning for explaining a complicated topic in an easier format, where this provides the children to think logically to process and remember the content of information. Besides, this will lead children into attention, excitement, curiosity, and knowledge transfer. However, 3DH technology as a learning tool should be designed not simply to present information, but also to guide the learner's cognitive processing during learning.

V. CONCLUSION

Overall, this research proposes the concept and identifies the useful learning visual elements including content, for developing 3D hologram that enhance the children attention skill in the fields of education. According to the findings, the comprehensive analyses of the meta-analysis show the essential of education characteristic for media tools to apply as learning material for children. The results of all articles reviewed have proved the significant visual elements and content for developing 3DH as an effective tool to improve children' learning outcomes and attention. Based on the review study, the learning characteristic such as the explanation used with speaking character, humour characteristic, cartoon style, adventure plots and overall duration of media show is no longer than 6 minutes, are able to make learning more effective for children. Moreover, the results also implied that warm colours, highlighting an important keyword, and using coloured moving images provides better result for visualization tool in 3DH to gain children's attention in the lesson. Theoretically, the whole concept of application 3D hologram in education, explained the role of auditory, visual, and kinesthetic learning styles in

3DH technology, to process the learning information for long-term memory and retain children focus. The 3DH technology able enhances the student's real-time visual experiences through its interesting displays, and sustaining purposeful encourages children to engage in learning for themselves. This point of view does significantly enhance children' academic performances, comparing to 2D images of traditional teaching tools. 3DH technology addresses a key challenge to getting children engaged in a lesson. In fact, young children have the limitation in their thinking abilities as they cannot understand and increase more scientific notions. Therefore, 3DH technology as a teaching material is applicable for teaching on the concept of scientific subject, such as the phenomenon of astronomy, the structure and developmental process of human, animals and plants.

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