

# Optimizing Elementary School Reading Comprehension in Malaysia: A Visual Information Approach

Wong Yoke Seng

Computer Science and Digital Technology Department, Faculty Computing and Meta Technology, Sultan Idris Education University

Olowosile Ayokanmi Seun

Computing Department, Faculty Art, Computing and Creative Media, Sultan Idris Education University

To Link this Article: <http://dx.doi.org/10.6007/IJARBS/v13-i11/19697> DOI:10.6007/IJARBS/v13-i11/19697

**Published Date:** 26-11-2023

## Abstract

Utilizing visualization strategies, which involve the creation of images to reinforce students' understanding of reading comprehension, forms the basis of this research. During the reading process, students articulate the meaning extracted from the text through rough sketches, influenced by their existing knowledge, encompassing general information, emotions, and personal opinions. The incorporation of these visualizations aims to enhance focus during reading, facilitating a clearer understanding of the content. This study is designed to explore the impact of information visualization on the learning outcomes of elementary school students, specifically in the context of reading comprehension. Participants will include Standard 4 to Standard 6 students from a selected elementary school in Malaysia. The research objectives encompass examining the effect of information visualization on the reading comprehension levels of elementary students, investigating potential gender-based differences in the effects of visualization techniques, and assessing significant disparities in outcomes between students employing information visualization and those who do not.

**Keyword:** Visualization Technique, Reading Comprehension, Learning Outcome

## Introduction

Language acquisition involves mastering four essential skills: listening, speaking, reading, and writing. Reading, in particular, holds significance as a vital source of knowledge and serves as the cornerstone for self-development in the pursuit of information. As highlighted by Farrell (2019), reading is an interactive process that demands active participation from readers. The primary objective of reading is to comprehend the text and extract meaning from its content. When immersed in a text, readers are tasked with

understanding the material they encounter. Additionally, reading can be defined as the meaningful interpretation of written or printed verbal symbols, with comprehension representing the ultimate goal of the reading process.

Possessing the ability to read is a highly valuable skill that involves a dynamic and interactive process between the reader and the writer. Reading goes beyond mere visual recognition; it encompasses the capacity to connect visual forms with sounds and interpret their meanings based on experience. The comprehension of reading is a multifaceted skill influenced by a combination of language proficiency, cognitive style, and reading experience, as highlighted by (Farrell, 2019). Recognized as a vital language skill, mastering reading comprehension is essential for students. According to Rogde et al (2019), reading comprehension comprises a range of interdependent and interconnected abilities. Students must develop the right set of skills to proficiently understand and engage with the material they read.

Drawing from the guidelines outlined in the General Handbook of the Malaysia Integrated Primary School Curriculum (Ministry of Education [MOE], 2019), it underscores the uniqueness of each student, characterized by differences in experiences, behaviors, practices, talents, and abilities. Consequently, certain students grapple with challenges when attempting to master reading comprehension. These difficulties can pose significant barriers to academic progression, exerting a profound impact on various aspects of students' lives. As noted by Ngui and Nasri (2021), a substantial number of students contend with issues related to reading comprehension. Considering that reading is an indispensable facet of students' academic pursuits, involving the study of books and materials relevant to their lessons, hurdles in reading comprehension become a matter of paramount concern. Indeed, reading is frequently regarded as the most pivotal skill among the four language skills, encompassing listening, speaking, and writing.

### **Research Background**

Visualization technique is said to be great to teach reading comprehension to students. According to Will (2018), information visualization is a powerful method presenting the data to provide insights and make it understandable by the target group. Li (2020) mentioned that visualization is a method of using computer technology to determine the best method in displaying interactive visual data to reinforce observations. Examples of visualization activities include encouraging students to draw, use dramatization, or create music. Students can use the camera to take photos, or they can search for photos, images, and other graphs. They can make their own videos or watch videos produced by others; they can listen to music or use programs to make your own. The variety of tools and software applications available can be stimulating visualize students and support their efforts to draw, make diagrams, and create picture. Kolodii et al (2017) added that visual images are one of the most significant teaching aids used in learning vocabulary. The advantage of this use is being able to associate new information with concepts in memory by means of meaningful visual pictures and will make learning more efficient.

There are many studies that found visualization technique to have significant positive impact of reading comprehension (Kolodii et al., 2017; Sanati, 2020; & Will, 2018). Will (2018) mentioned that students usually struggle with reading comprehension since they have difficulties to visualize words that they read, and hence not able to fully understand the text. Therefore, visualization techniques supposedly help to teach the students to visualize the text they read. Visualizing a text that being read into pictures, images, or diagrams able to help

the students to construct the meaning of the text they read, and hence enhancing their reading comprehension (Addinna et al., 2019).

Thus, this research has the purpose to investigate the effect of information visualization on the learning outcomes of the elementary school students in the context of reading comprehension. The Standard 4 to Standard 6 students from one of the elementary school from Malaysia will be participating in the study. There are three objectives of this study, first objective is to examine the effect of information visualization on reading comprehension level of elementary students. The second objective is to determine the significant differences on the effects of visualization technique on reading comprehension level based on gender. The last objective is to assess whether there are significant differences in students' outcomes between those that use information visualization and those who do not.

### Theoretical Framework

This research aims to investigate the effect of information visualization on the learning outcomes of elementary school students in the context of reading comprehension. Cognitive Theory by Wiley (1990) has been used to aid the study. Through this theory, it is said that students learn better through visual learning. The process of visual learning includes visual cognition process which is the main focus of the study. Visualization techniques mostly used pictures, diagrams, charts, and many other visual stimuli to help the students understanding, remembering, as well as forming and editing visual information, and hence achieve certain level of reading comprehension.

In addition, the Visual, Auditory, and Kinesthetics (VAK) Model of learning also has been used to aid the study. As there are three aspects in the model namely visual, auditory, as well as kinesthetics, the study will mainly focus on the visual learning style. Through this learning style, it is said that the students learn better by looking at visual of text and any other form of visualization to help them remember and understand the text. Padilla (2018) mentioned how the cognitive process of visualization took three stages. The first stage is internalizing. After a person has seen through their eyes an image, they internalize the word, but the word is not meaningful. The second stage is conceptualizing the visual models. A person's short- and long-term memories work with the visual image that was internalized to make sense of the visual. The memories help a person to make sense of what they see. The last step is externalization of visual models. This is when a person can take what they have seen, understand what they have seen and then express using words or pictures to share with others what the person has learned. Hence, the study theorizes that information visualization techniques help the students to master reading comprehension and hence achieved better learning outcome.

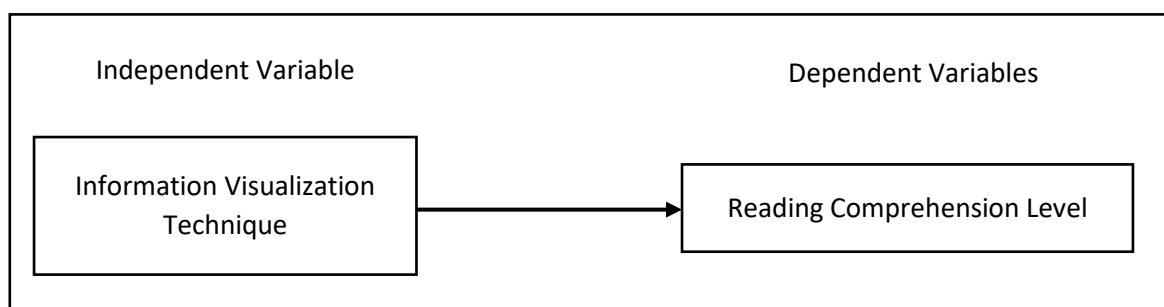


Figure 1.1 Theoretical Framework.

**Concepts of Reading Comprehension**

Comprehension is a part of the cognitive domain that exists in Bloom's taxonomy. Bloom's Taxonomy is a hierarchical model that categorizes learning objectives into varying levels of complexity, from basic knowledge and comprehension to advanced evaluation and creation. Someone is said to have understood an information when he or she is able to re-explain the information in his or her own sentences. Working memory plays an important role during reading, especially due to working memory has limited capacity. The readers who have a relatively large range of working memory can process sentences ambiguous quickly. An individual who can keep many items inside his or her memory will be very fast and accurate in understanding complex sentences. This shows that reading skills are highly dependent on cognitive ability (Ngui & Nurfaradilla, 2021).

According to Aulia (2017), reading comprehension is a process that simultaneously digging and building meaning through interaction and engagement from a written language. Ngui and Nurfaradilla (2021) added that reading comprehension is the process of connecting written material with what is has been known and the reader wants to know. Meanwhile, Dahle (2017) mentioned reading comprehension as the ability of the reader to recite the content of an argumentative reading, exposition, or descriptive reading about a certain topic. In addition to that, reading comprehension refers to the reading activity that seeks to interpret experience; connecting new information with what is already known; as well as find answers to cognitive questions from written material (Sanati, 2020). Ngui and Nurfaradilla (2021) mentioned that reading comprehension involves associating meaning with word symbols, evaluating that meaning suggested in the context, the selection of the correct meaning, set the ideas of reading, remembering those ideas, and using them in some activities. Reading comprehension is the search for the meaning of a reading by using elements in the reading, such as keywords, organizing ideas, titles, subtitles, and many more. It is directed by the readers' background of general knowledge and their knowledge regarding the topic being learned. Based on the above description, it can be concluded reading comprehension is an activity that digs in and builds the meaning of each word so that it brings up new information for the readers and enable them to answer any questions that arise in the reader's cognition of the written material.

**Elements in Reading Comprehension**

Ngui and Nurfaradilla (2021) in their study had listed three elements of reading comprehension namely the reader, the text, as well as the activity of purpose of reading. The first element of reading comprehension is the reader. The readers must have a variety of capacities and abilities within comprehension, including cognitive abilities, motivation, and different types of knowledge. Cognitive abilities referring to the abilities such as attention, memory, critical analysis skills, visualization skills, as well as creating conclusion. Meanwhile, motivation refers to the purpose of reading, interest in current content readability, as well as self-efficacy. On the other hand, different types of knowledge include vocabulary, knowledge of the topic or field, knowledge of discourse and linguistics, and knowledge of specific comprehension strategies.

The second element of reading comprehension is text. The features of text have a great influence on comprehension. Comprehension is not just about digging into the meaning of a text. Readers will construct different representations of the text that are important for understanding. This representation includes surface code (proper words of the text), the text base (the units of thought that represent meaning), and a representation of mental models

embedded in the text. The level of difficulty of the text depends on the factors involved in the text, such as the relationship between the text and knowledge and ability of the reader, and activities that involve the reader. In addition, load vocabulary of the text and language structure, writing style, as well as the language flow can be the factors too. If too many of these factors do not correspond to the knowledge and experience of the reader, reading comprehension optimization will be lacking because the text is too difficult.

The third element of reading comprehension is the activity of reading or the purpose of reading. A reading activity involves one or more goals. Before reading, the reader has a purpose, both externally and internally. The objectives in performing reading activities are influenced by variables motivation, including prior interest and knowledge. The initial goal the readers have in reading will probably experience a change, when they get information that raises new questions. As the reading activity continues, the readers processed the text according to the purpose. Text processing involves decoding, which is a high level of linguistics and semantics in processing and monitoring. The consequences of reading are part of the activity. Some reading activities cause an increase knowledge of the reader.

### **Concepts of Information Visualization in Education**

Padilla (2018) asserted that visualization techniques not only help picture cognition about thought forms and other communication, it also helps one's thoughts make real out of the mind. The process of visualization can strengthen cognition by improving one's memory and a combination of existing knowledge. Sanati (2020) has proved in his study that visualization can transform students of all ages from readers passive to active visualization can help students' cross boundaries to improve understanding. The use of visual images to learn vocabulary is based on relevance between pictures and words. Through the use of visual images such as pictures and flashcards, they help students relate new information to inner concepts memory. Therefore, the teacher needs to know what the student needs to know then visualization planning can be effective (Kolodii et al., 2017)

Kolodii et al (2017) in their study emphasizes that visual images are one of the most significant teaching aids used in learning vocabulary. The advantage of this use is being able to associate new information with concepts in memory by means of meaningful visual pictures and will make learning more efficient. Not only that, but the researchers also stated a combination of pictorial with verbal can involve parts of the brain providing greater cognitive power. For example, when we see a notice marked no smoking, then we continue to understand a particular place no smoking. A combination of visual and verbal can help students quickly understand and remembering words. Visuals also involve with colour coding to be able to understand the nature of something in depth. Through sketches drawn by the students themselves, especially abstract words can be remembered through the pupil's visual representation.

Another study by Li (2020) discusses that visualization is a method of using computer technology to determine the best method in displaying interactive visual data to reinforce observations. Examples of visualization activities include encouraging students to draw, use dramatization, or create music. Students can use the camera to take photos, or they can search for photos, images, and other graphs. They can make their own videos or watch videos produced by others; they can listen to music or use programs to make your own. The variety of tools and software applications available can be stimulating visualize students and support their efforts to draw, make diagrams, and create picture. The study also found that a

combination of visual and audio can make it easier for students understanding and relationships in content as well as enabling students to develop a love of reading and learning.

The use of information visualization, particularly in education, is not a new concept. It has been used in maps and drawings for many years. Nowadays, the field of visualization is rapidly growing, with much application in various disciplines to enhance knowledge and visual analytics. As such, information visualization mainly aims at enabling learners to understand the abstract data for which there may be no natural physical reality. According to Sanati (2020), information visualization is a powerful method presenting the data to provide insights and make it understandable by the target group. Sanati (2020) further outlines that the discipline is increasingly applied as an essential component in scientific research to assist new readers in becoming aware of its significance in enhancing understanding. Additionally, information visualization is gaining popularity in education due to its ability to take advantage of the broad bandwidth of the human eyes into the mind by allowing the students to see, explore and understand large amounts of data. According to Li (2020), information visualization has a wide variety of uses in learning. For instance, they have led to the increased use of intelligent tutoring systems, which enables students to interact. As such, information visualization in education is being regarded as intelligent because it has the capacity to personalize the teaching technique of the course material based on the past performance of the students. They do so by storing a representation of the student, where they base their teaching decisions on.

### **Information Visualization and Learning Outcomes of Elementary Schools Students**

Kolodii et al (2017) in their study stressed on the importance of visualization to assist reading comprehension among the young learners. In this study, it was mentioned that reading comprehension determines the level of understanding a text among the readers. Young learners usually struggle to construct certain meaning from a text, and hence visualization technique helps as reading comprehension strategies to guide in reading. This is a qualitative study using document analysis as the research instrument. According to this study, there are five functions of visualization based the integration of eight aspects if the reading process in visualization application. The functions of visualization technique to guide young learners with their reading comprehension include helps in meaningful and personalized text connection, decorative and motivational, problem-solving characteristic, continuous learning promoter, as well as difficult and abstract content comprehension. Meanwhile, the eight aspects of reading process in visualization technique are constructive, sensory and perceptual, experiential, affective, learning, thinking, sequential. as well as association.

A study by Sanati (2020) aims to investigate the effects of visualization training techniques on the ability of reading comprehension among the intermediate learners in English language institutes in Iran. Quantitative study through quasi-experimental method was utilized to conduct the study. A total of 40 intermediate learners in English language institutes were chosen to participate in the study and divided into control group and experimental group. A pre-test was given to all the participants to record their initial differences. Both groups were provided with seven teaching sessions. The participants in experimental group were taught using visualization techniques to visualize the words, while the participants in the control group were taught using conventional methods such as reading the text aloud, translating the text, and providing synonyms and antonyms. A post-test was given to all the participants after the teaching sessions. Through ANOVA analysis, it was found

that the participants in the experimental group have higher performance of reading comprehension compared to those in the control group. The study revealed that visualization techniques have significant effect to help the students to enhance their performance in reading comprehension.

Will (2018) in her study mentioned that visualization techniques can improve the students' reading comprehension. According to the study, students usually struggle with reading comprehension since they have difficulties to visualize words that they read, and hence not able to fully understand the text. Thus, this study focuses on the visualization techniques that supposedly help to teach the students to visualize the text they read. However, students visualize differently to understand certain text. This study has been done by doing quasi-experiment with 26 fifth grade students who need intervention method to help their reading comprehension. Lesson plans based on current curriculum standards were made, in which visualization techniques were taught in each lesson. Four strategies to teach reading comprehension from Gregory and Cahill (2010) were used in this study. The strategies are making connections, visualization, asking questions, as well as inferring. Throughout the study, it was found that visualization is helpful to increase the students' reading comprehension. Not only that, but the students also able to remember the text they have read.

Another study by Aulia (2017) has the purpose to find the significant effects of using visualization strategy for the students' achievement in reading comprehension. Quantitative through experimental research method has been done in this study, in which a total of 71 second grade students were chosen as the sample population. The students were divided into two classes, namely the Experimental Class and Control Class. The Experimental Class was taught using visualization technique to improve their reading comprehension, while the Control Class was taught using normal 'chalk and talk' method. Based on the findings, the students in Experiment Class scored higher level of reading comprehension compared to the students in Control Class, in which the score was measured using teachers' assessment. Hence, the study concludes that visualization technique has significant effect in improving the students' achievement in reading comprehension.

A study by Addinna et al (2019) has the purpose to find the effect of visualization strategy in reading based on observation from the students' cognitive learning styles. The study hypothesizes that visualizing a text that being read into pictures, images, or diagrams able to help the students to construct the meaning of the text they read, and hence enhancing their reading comprehension. This study conducted quasi-experimental research on 54 students at Universitas Negeri Malang. The students were divided into control group and experimental group, in which visualization strategies were taught to those in experimental group. Through the experiment, the students in experimental group scored slightly higher mean of reading comprehension level compared to the students in the control group. However, the study revealed that visualization strategies have no significant effect in enhancing the students' reading comprehension due to several factors such as short implementation of visualization strategies for the students in experimental group, different knowledge background of the readers, as well as cognitive learning style of the students in control group outnumbered those in experimental group.

### **Research Gap**

Another study by Özkan et al (2018) explored the visualization skills among elementary school students. Özkan et al. argued that information visualization is among the most effective

method that helps students to internalize concepts and to establish an association between them. The study further outlined that visualization is very important, particularly in teaching mathematics, which is perceived as the combination of abstract concepts. Despite the effectiveness and the significance of the information visualization in teaching elementary students, the current study established that most students experience various problems in using visual models and thus consider using calculation methods. As such, to assess the effects of information visualization on the learning outcomes of elementary students, the current study aimed to assess the effects of information visualization on understanding level of elementary students as well as evaluating the significant difference in learning outcomes of the student between those who used the methods and those who did not.

### **Underpinning Theories**

#### **Cognitive Theory by Wiley (1990)**

Wiley (1990) has put forward a visual learning paradigm. This hierarchy of paradigms is almost identical to Bloom's Taxonomy of Learning Objectives and Maslow's Hierarchy of Basic Human Needs. The Wiley Visual Learning Hierarchy consists of three stages and in each stage, there are certain stages that an individual has to go through before reaching the level of visual maturity. However, in this study, only the first stage of the learning hierarchy will be studied. The first stage of the visual learning hierarchy is known as Visual Cognition. Visual cognition is the process of mentally understanding, remembering, forming and editing visual information. There are three levels in this first stage namely Visual Perception, Visual Memory and Visualization. Visual perception is the ability to mentally comprehend visual information; visual memory is the ability to mentally store information and recall; while visualization is the ability to shape and edit visual details.

#### **2VAK Model of Learning**

The VAK style contains three aspects, namely visual, auditory, and kinesthetics learning styles. In this learning style, students learn better by looking at a text in the form of words in a book, on a blackboard or computer display. They better remember and understand the instructions and explanations through the reading of the sentence or text. "Visual" students do not need verbal explanations like "auditory" students, but they can often learn through reading. "Visual" students often write lecture notes and verbal instructions if they want to remember something (Yahya & Abd Razak, 2010).

In this study, visualization strategies through the use of pictures, graphs, flowcharts and many more are used to help the students understand text better. Visualization helps students to think and process what they are learning. Mnguni (2014) mentioned how the cognitive process of visualization took three stages. The first stage is internalizing. After a person has seen through their eyes an image, they internalize the word, but the word is not meaningful. The second stage is conceptualizing the visual models. A person's short- and long-term memories work with the visual image that was internalized to make sense of the visual. The memories help a person to make sense of what they see. The last step is externalization of visual models. This is when a person can take what they have seen, understand what they have seen and then express using words or pictures to share with others what the person has learned. The lesson plans created in this study are based on this cognitive process of visualization. The concept of visualization and reading comprehension which are the main variables of the study had been discussed. Following this, literature associates with the relationship between visualization strategies and reading comprehension level of students,



or their academic performance in a whole has been discussed. Cognitive Theory and VAK Model to aid the study also presented.

### **Methodology**

A research strategy can be defined as a technique as well as the process of gathering and analysing the collected data to make conclusive statements about the proposed research questions (Nardi, 2018). This study will employ a quantitative research strategy through experimental research method.

Nardi et al (2018) outline that a quantitative strategy involves the collection of numerical data and generalizing on a particular study. The approach was chosen because it enhances knowledge development using observable variables. The approach was also employed as it enables the researcher to assess various variables to predict, explain, and monitor the overall nature of the research questions.

A quasi-experimental design will be used as the research instrument in this study. The students are divided into 2 groups, namely experimental group, and control group. Each group contains 150 students. The experimental group of students will be taught reading comprehension using information visualization techniques, while the students in control group will be taught in conventional method for reading comprehension. There will be 3 lessons of reading comprehension per week, and the study is conducted in a total of 6 weeks. After the experiment, the level of reading comprehension skills among students in both experimental group and control group will be assessed using teachers' assessment. Besides that, the current study will utilize structured questionnaires as data collection tools. The questionnaires will be structured to include only a close-ended question to enhance the collection of numerical data suitable for quantitative research studies. The purpose of the questionnaire is to assess the students reading comprehension after learning through information visualization techniques through their own viewpoint.

There are a total of 13 questions in the questionnaire. The questionnaire is divided into 2 categories namely Section A (Demographic Profile) and Section B (Impact of Visualization Technique). The measurement items in Section B are adapted and modified from Saeidi and Ahmadi (2016), as well as designed with Likert-scale type ranges from point 1 (strongly disagree), to point 3 (partially agree), and point 5 (strongly agree). Table 3.2 shows the breakdown of the Likert-style scale used in the questionnaire.

### **Validity and Reliability of the Quasi-Experiment**

A manipulation check was used to check for the validity and reliability of the quasi-experiment, Manipulation check is an inclusion to measure if the participants of the experiment give their attention to the factors in the treatment, as well as understood the messages. For this experiment, the participants in the experimental group were explained on the learning of reading comprehension by using visualization technique. The teachers will explain on the information visualization technique, and the research expectation. Hence, the participants of the experiment got a grasp of what they participate in. Besides that, a pre-experiment has been done to a total of 10 teachers to check for the right teaching method of information visualization technique, and to standardize the technique used in the learning sessions.

**Content Validity and Reliability of the Instrument**

A validity test helps in measuring how well a statistical test evaluates the assigned function without significant changes. All the respondents will need to go through face validity to make sure only elementary students from Standard 4 to Standard 6 in Sekolah Kebangsaan Sri Sendayan participated in the research. This act is done to make sure the questionnaire developed to conduct the research is relevant, reasonable, unambiguous, as well as clear so that the data collected is valid for the research.

On the other hand, reliability can be defined as a measure of how well the test score is. This consequently helps in determining the consistency and the stability of the test statistics. In this study, the researcher evaluated the reliability of the research instruments using Cronbach's Alpha. According to the Hair *et al.* (2010), a research instrument is considered reliable when each variable tested with Cronbach Alpha will get a minimum value of 0.7. A pilot study with 100 students who do not involve in the actual study are utilized to conduct the reliability analysis.

**Conclusion**

This research aims to investigate the impact of visualization technique on the learning outcome of elementary school students from Standard 4 to Standard 6 in Sekolah Kebangsaan Bandar Sri Sendayan, Seremban. The study utilized quantitative study through quasi-experimental design and survey design. A total of 300 students are divided into Experimental Group and Control Group. The students in the control group will learn reading comprehension through conventional method, while the students in experimental group will learn reading comprehension through visualization technique. After the experiment, their level of reading comprehension skill will be assessed through the teacher's assessment. Then, a set of questionnaires is distributed to the students. Descriptive analysis of frequency and percentage, as well as inferential analysis of Pearson correlation and Multiple Linear Regression analysis are utilized to meet the objectives of the study, as well as prove the hypotheses.

**References**

- Addinna, A., Ovilia, R., & Asfina, R. (2019). The Effect of Visualization Strategy in Reading Observed from Students' Cognitive Learning Styles. *Lingua Didaktika*, 13(1), 26-34.
- Bonett, D. G., & Wright, T. A. (2015). Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *Journal of Organizational Behavior*, 36(1), 3-15.
- Chai, M. T., Hafeez, U. A., Saad, M. N. M., and Aamir, S. M. (2017). The influences of emotion on learning and memory. *Frontier in Psychology*, 8(1454), 1-22.
- Chua, Y. P. (2014). *Ujian Regresi, Analisis Faktor dan Analisis SEM*. Published by McGraw-Hill Education (Malaysia).
- Dahle, C. (2017). The Effect of Visualization Intervention on Sixth-Grade Special Education Student' Reading Comprehension. *Dissertation for the Degree of Master of Education*, Goucher College.
- Farrell, T. S. C., and Yang, D. (2019). Exploring and EAP Teacher's Beliefs and Practices in Teaching L2 Speaking: A Case Study. *RELCS Journal*, 50(1), 104-117.
- Fleming, J. (2018). Methodologies, Methods and Ethical Considerations for Conducting Research in Work-Integrated Learning. *International Journal of Work-Integrated Learning*, 19, 3, 205 – 213.

- Hair, J. F., Black, W. C., Babin, B. J., and Anderson, R. E. (2010) *Multivariate Data Analysis*. 7th Edition, Pearson, New York.
- Harvey, S., dan Goudvis, A. (2017). *Strategies that work: Teaching Comprehension for Understanding, Engagement, and Building Knowledge, Grades K-8*. Third Edition, Stenhouse.
- Kolodii, O., Kovalchuk, I., & Syvak, O. (2017). The impact of visualization techniques of students learning vocabulary. *International Journal of New Economics and Social Sciences*, 2(6), 359-367.
- Kotchoubey, B. (2018). Human Consciousness: Where is it from and What is it for? *Frontiers in psychology*, 9(567), 1-17.
- Li, Q. (2020). Overview of data visualization. In *Embodying Data*, 17-47. Published by *Springer Link*.
- Daud, M., & Sulaiman, N. A. (2021). The Functions of Visualization in Assisting Reading Comprehension among Young Learners. *International Journal of Academic Research in Business and Social Sciences*, 11(10), 68–79.
- Ministry of Education Malaysia (2019). *English Language Management Guidebook*.
- Nardi, P. M. (2018) *Doing Survey Research: A Guide to Quantitative Methods*. 4th Edition, Routledge, New York.
- Ngui, C. C., & Nasri, N. M. (2021). Penggunaan Kaedah Visualisasi dalam Pengajaran dan Pembelajaran Perbendaharaan Kata Bahasa Inggeris. *Jurnal Dunia Pendidikan*, 3(3), 444-449.
- Ogundele, M. O. (2018). Behavioural and emotional disorders in childhood: A brief overview for paediatricians. *World Journal of Clinical Pediatrics*, 7(1), 9-26.
- Padilla, L. M. (2018). A case for cognitive models in visualization research. *Position Paper*, 1-9.
- Parveen, H., & Showkat, N. (2017). *Research Ethics*. Published by e-PG Pathshala.
- Aulia, R. (2017). The Effect of Using Visualization Strategy on the Students' Achievement in Reading Comprehension. *English Education Program of FKIP UMSU*, Medan, Indonesia.
- Rogde, K., Hagen, A.M., Melby-Lervag, M., and Lervag, A. (2019). The effect of linguistic comprehension instruction on generalized language and reading comprehension skills: A systematic review. *Campbell Systematic Review*, 15(e1029), 1-37.
- Roldan, S. M. (2017). Object Recognition in Mental Representations: Directions for exploring diagnostic features through visual mental imagery. *Frontier in Psychology*, 8(833), 1-15.
- Sanati, Z. (2020). The Effects of Visualization Training Techniques on Reading Comprehension Ability of Iranian Intermediate EFL Learners. *Journal of Language Teaching and Research*, 11(1), 73-85.
- Schoonenboom, J., and Johnson, R.B. (2017). How to construct a mixed method research design. *Kolner Z Soz Sozpsychol*, 69(2), 107-131.
- Taherdoost, H. (2017). Determine Sample Size: How to Calculate Survey Sample Size. *International Journal of Economics and Management Systems*, 2, 237 – 239.
- Terrell, S. R. (2012). Mixed-methods research methodologies. *Qualitative report*, 17(1), 254-280.
- Wiley, S. E. (1990). An Hierarchy of Visual Learning. *Engineering Design Graphics Journal*. 54, 30-35.
- Will, J. (2018). Visualization Techniques to Support Students' Reading Comprehension. *School of Education Student Capstone Project*, 269