

Redefine Reading Comprehension with Tarsia: An Innovative Approach in Understanding Reading Text

Noorfatin Zakaria, Mohamad Noh Mustafah Hussain,
Norshamshizar Abdul Jalil, Melor Md Yunus, Harwati Hashim &
Karmila Rafiqah M. Rafiq

Faculty of Education, Universiti Kebangsaan Malaysia
Corresponding Author Email: harwati@ukm.edu.my

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Abstract

In the global context, students in Malaysia scored lower than the OECD average in reading, mathematics, and science in PISA conducted in 2018. In the field of English education, reading is perceived as a boring and complex process as well as one of the challenging components where students find it difficult to comprehend and tend to give up easily when they look at complex or longer text. Hence, the purpose of this paper is to describe how Tarsia is used to facilitate students' reading comprehension and to explore the effectiveness of Tarsia in improving students' collaboration and communication in ESL classrooms. By using the ADDIE model as the research model, 34 participants from lower secondary students in Kuala Lumpur were selected based on convenience sampling. The significant impacts on students' reading comprehension were proven through pre and post-tests and a simple survey. TARSIA benefited the students in understanding the reading text easily and inculcating the elements of the 4Cs besides acting as useful teaching aid among teachers. TARSIA could potentially be game-based materials, designed for English reading classrooms for A2-B1 achievers. It is fair to deduce that TARSIA might have high commercialisation potentials.

Keywords: ESL, Tarsia, Reading Comprehension, Collaboration, Communication

Introduction

The process of reading comprehension involves communication between the reader and the text. Through the use of prior knowledge and efficient reading comprehension techniques, the reader derives meaning from the text as they read (Alghonaim, 2020). As a result, using certain signs can improve how poorly readers do while trying to understand what they are reading (Alghonaim, 2020). According to the Malaysian Education Act of 1966, English is taught as a second language in all Malaysian schools. Due to this, Malaysia encourages the concerned parties to improve pupils' English language abilities, particularly reading

comprehension, in accordance with the Malaysian Education Development Plan (PPPM) under the Ministry of Education.

The strategy emphasises once more that, in the Malaysian context, a significant percentage of reading comprehension is covered in the Form Four and Form Five Malaysian English Language Syllabus, which helps pupils develop a variety of reading abilities (PPPM). To put it another way, the Curricular Specifications emphasise that curriculum materials must be modified to account for the various reading demands and skills of ESL students (Alghonaim, 2020). This suggests that, among the three remaining abilities, reading is considered to be the most important skill when it comes to teaching the English language. Despite prior efforts, it seems that more work is still required to close the gap between learners and their mastery of reading abilities, particularly reading comprehension.

PISA results from 2018 show that Malaysian pupils performed below the OECD average in reading, maths, and science (OECD, 2019). Most of the pupils, who came from low-income families, achieved at least Level 2 reading proficiency, representing 54% of them. This implies that, when specifically instructed to do so, they can recognise the main concept in a text of average length, locate information, and remark on the purpose and format of texts. Due to their poor reading comprehension abilities, Malaysian pupils generally struggle to connect with lengthier and more complicated reading texts. This has caused the four language skills to be poorly acquired. In contrast, those who scored Levels 5 or 6 on the PISA reading exam are proficient readers who can follow lengthy texts, understand abstract ideas, and distinguish between facts and opinions based on implicit clues about the information's source or content.

Since students are facing difficulty in understanding complex and longer texts, they tend to give up easily when dealing with one. As a result, students lose their motivation and end up not enjoying reading and become passive learners in the process. This does not bode well since in both the primary and secondary English Language textbooks and *Dokumen Standard Kurikulum dan Pentaksiran (DSKP)*, students are targeted to master the necessary skills to become independent readers throughout their years of schooling. These are vital in assisting students to acquire the necessary insights or pointers on reading comprehension that are related to the various themes and contents introduced in the syllabus. Thus, it is the teacher's responsibility to help the students in understanding their reading materials, cater to the students' needs and make the lesson less dreadful, especially for this group of students by considering students' different learning styles in planning their lessons and preparing lesson materials. Concerning this matter, this paper aims to design, develop and evaluate the use of TARSIA in facilitating students' reading comprehension and in improving students' collaboration and communication in ESL classrooms. The innovation part lies within the fact that previously it was used widely in mathematics Koss (2022), vocabulary Jalok (2019) and grammar Mattheoudakis & Panteliou (2022) whereby in this article TARSIA is utilised for reading comprehension skill.

Literature Review

ESL instructors in Malaysia will be able to teach reading comprehension to lower secondary students with the use of this invention. In other words, it uses TARSIA to help students overcome their anxiety of treating themselves to a lengthier reading content. Since very little research has been done in the past on the use of games, jigsaw puzzles, or even TARSIA to teach students how to answer literal, reorganisation, and inferential comprehension questions according to the students' reading abilities, Namaziandost et al (2020) claim that

this innovation is significant. This new approach will serve as a guide for ESL instructors in terms of how to teach reading comprehension at beginner, intermediate, and advanced levels. The fact that it is utilising the gamified learning theory, one of the learning theories, is a clear indication that this invention has a lot of promise going forward.

Gamified learning theory implies that gamification design positively contributes to academic participation (Zaric et al., 2021). It has also been implied in the classroom by various educators for a long time. Gamified learning is derived from Piaget's cognitive development theory where the students apprehend new input through assimilation and adaptation. This can also pave the way for schemata activation to long-term memory retention. Moreover, gamified learning is also vital to students since they are more engaged in the learning process based on the findings of previous studies that signified the effectiveness of gamified learning towards students' learning (Cruz & Palaoag, 2019; Raju et al., 2021)

Jigsaw puzzles can be categorised under gamified learning and it is an effective educational tool (Cavalcanti et al., 2021). It is parallel with the twenty-first century learning elements where it seeks to trigger students' creativity, critical thinking, problem-solving and collaborative skills. The teachers play a major role in making the best use of jigsaw puzzles in their lessons for language learning. Since students tend to lose motivation and interest upon facing longer reading texts, incorporating jigsaw puzzles with reading comprehension exercises can be seen as a solution to this endemicity. This is because students will move physically and work cooperatively in groups to solve the jigsaw puzzle. As a result, tension will be lifted, energy will increase and students shall be able to understand the texts thoroughly (Wulandari et al., 2022). Thus, using jigsaw puzzles in teaching can be perceived as a useful and student-centered tool for teaching reading comprehension strategies.

TARSIA is a software package that enables teachers to create and customise engaging mathematical jigsaw puzzles to fit into their instruction. Students need to assemble the puzzle by answering the questions to form a designated shape. In this particular project, TARSIA is used in improving one English language skill in particular which is reading. TARSIA paves the way for teachers to create customised puzzles. It is widely used in Mathematics (Koss, 2022), grammar (Jalok et al., 2019) and vocabulary (Mattheoudakis et al., 2019).

TARSIA is student-generated material which means they are actively involved in their learning. In other words, it is student-centered. TARSIA is not a single-use product as well. In terms of the teaching and learning material, students are exposed to a variety of questions to enhance their understanding of the reading texts. The elements of the 4Cs namely Collaboration, Communication, Creativity, and Critical thinking are promoted as well along with the 21st Century elements. Apart from that, it also enhances group participation and encourages the students to talk and discuss with each other to complete the task given (Ching Hao & Azrina 2019). Every group member who is part of the team is active in the language classroom by collaborating, discussing, agreeing and disagreeing in making final decisions (Qomaria, 2019) Teachers are able to provide support and push students from their actual language limit to successfully complete the joint task at the same time.

TARSIA creates interactive and interesting learning experiences and makes reading comprehension less daunting (Stavy et al., 2019). This will boost their confidence, motivation, creativity, and enhance cognitive development through solving problems and transfer of learning including reading, analysing, understanding text and speaking up (Dwiniasih & Nugraha 2019; Jalok et al., 2019). Also, it triggered a sense of positive competition in the classroom and acts as a differentiation learning tool. Hence, it made answering reading comprehension questions enjoyable and the whole learning session to be less intimidating

for students. Moreover, TARSIA employs the concept of versatility (Omur & Said, 2019), which can be used with all levels of students since the teachers are free to choose any reading texts and generate questions in any way that they perceive as parallel with their students' level.

The usage of the TARSIA puzzle, one of the game-based learning resources that may be utilised in the classroom, may offer fresh approaches to creating flexible and secure learning settings as well as helping to foster an environment that is more conducive to the use of natural language. Additionally, it is essential for the emotional and cognitive development of the brain. Homer, Raffaele and Henderson underlined the fact that adopting game-based learning in the classroom allows for many representations of the same subject matter and concepts in their research, which was published in 2020. This increased the students' understanding of what they were learning and exposed them to multidimensional thinking. As one of the main ideas behind this innovation is a cognitive learning theory, employing the TARSIA puzzle in language schools can help students improve their problem-solving and logical thinking abilities. These abilities include analysing and utilising game possibilities in addition to determining the puzzle component designs while responding to the pertinent questions. Filtering away unnecessary information and being able to adjust to the game's changing requirements are among the abilities required for content sharing.

Additionally, they require the ability to draw on knowledge from prior experiences and schemata. This could then be utilised as evaluation tools, efficient learning objectives, learner feedback tools, and individualised learning tools (Stiller & Schworm, 2020). The ability to learn through games and plays encourages the students to compete among themselves and provide the best results from classroom activities in terms of language learning, cognitive growth, and language skills learning (Rogat & Linnenbrink-Garcia, 2019). They are so motivated to succeed in the game and progress in their skill, language, and ability acquisition when game-based learning is implemented in the classroom, whether individually or in groups. Students will be inspired to put forth more effort in terms of their physical, linguistic, and cognitive abilities as a result to accomplish their goals. Without a doubt, this will help create motivating, engaging environments for language learning.

Methodology

The research design used in this study is the ADDIE Model of Instructional Design created by the Centre for Educational Technology at Florida State University for the military in the 1970s. The ADDIE Model is a process used by instructional designers to create effective learning experiences for any audience. The ADDIE Model has also been proven in designing and developing materials in education (Al Ghawail et al., 2021). The name of the model is the acronym for Analysis, Design, Development, Implementation and Evaluation. Figure 1 shows a framework on how the ADDIE Model is applied in innovating TARSIA for reading.

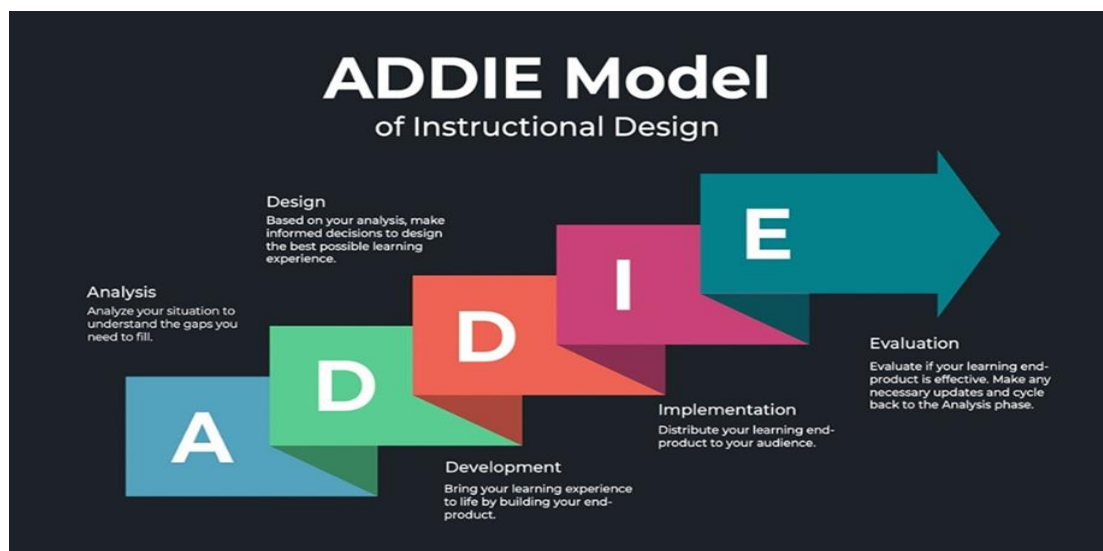


Figure 1: ADDIE Framework

(Source: <https://waterbearlearning.com/addie-model-instructional-design/>)

Analysis Phase

A need analysis was conducted through a questionnaire distributed using Google Forms among the 6 English teachers of SMKTS. Based on the needs analysis, the researchers found that the frequency of teaching reading skills to the students of SMKTS is only 1-2 periods a week among all 6 teachers. The time allocated is not enough for the teachers to teach using all the Reading Strategies often used by the teachers.

Figure 2 is the Reading strategies that are often used by the teachers in class (based on less popular to most popular).

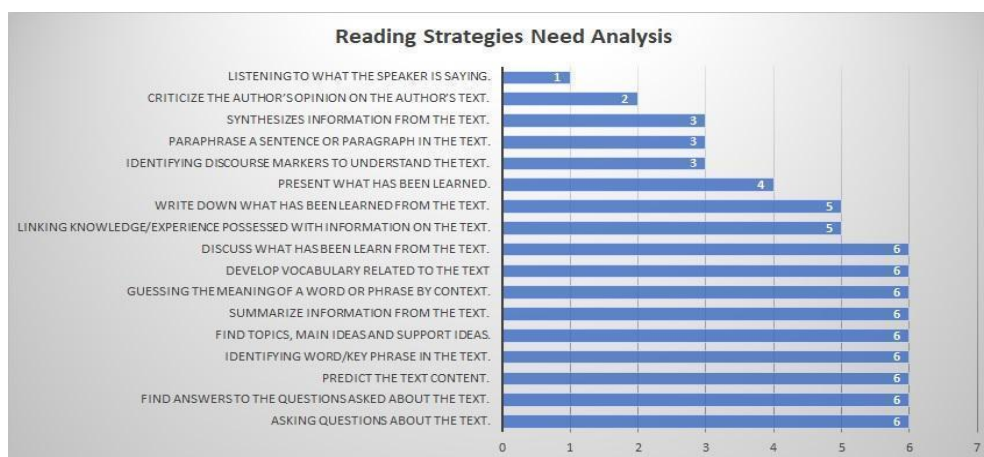


Figure 2: Reading strategies

A need analysis was also conducted to identify the areas of students' reading difficulties through a questionnaire (Hutchinson & Waters, 1987). Through the questionnaire (Figure 3), we identified the students facing difficulty understanding the complex and longer texts. They tend to give up easily; students lose their motivation and end up not enjoying reading and they become passive learners.

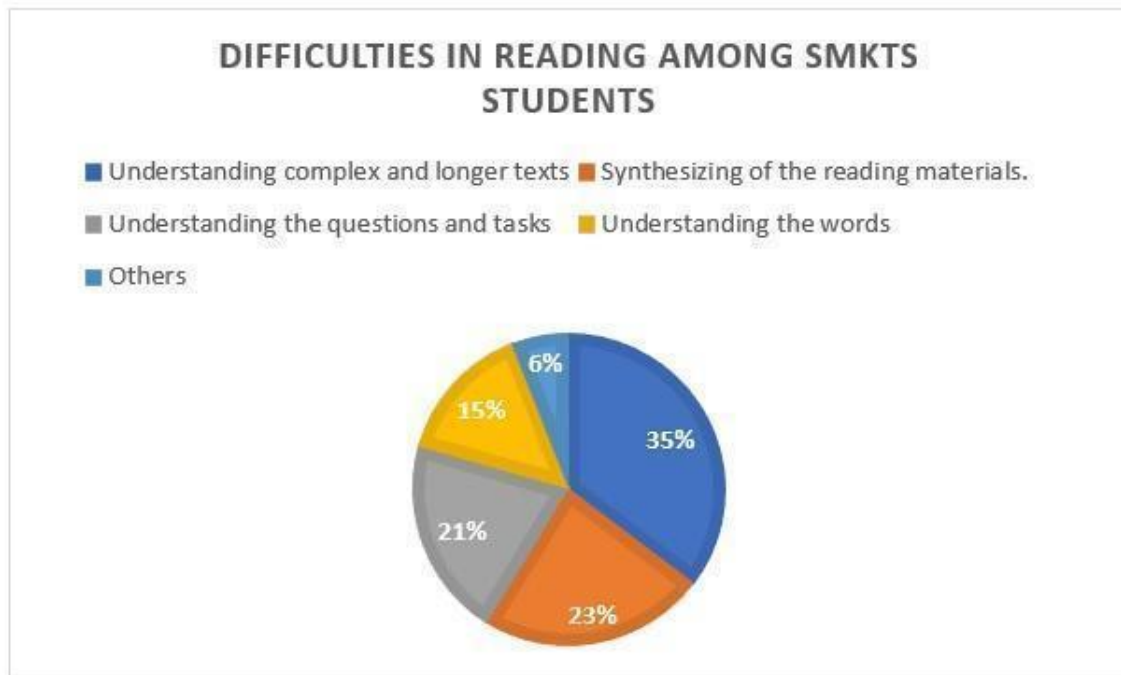


Figure 3: The need analysis of difficulties faced in reading among SMKTS student

Design Phase

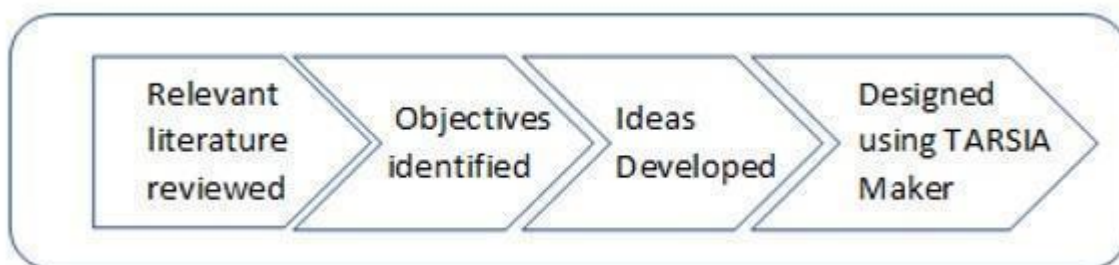


Figure 4: The process in the research design phase

In this phase, researchers outlined and determined the best strategy and approach to teaching the reading skill. Researchers decided on TARSIA as a tool in this collaborative learning approach. The researchers adapted the TARSIA based on the literature review of the relevant pedagogical theories and approaches as well as on the data collected from the need analysis. The main objectives of TARSIA are to facilitate students' reading comprehension and to explore the effectiveness of TARSIA in improving students' collaboration and communication in ESL classrooms.

This puzzle (Figure: 5) was created using the TARSIA maker from the free website. The researchers decided to choose the "Turtle Shape" from the online templates. The final draft then was printed on different coloured paper (Figure 6). There was no cost incurred in creating this puzzle.

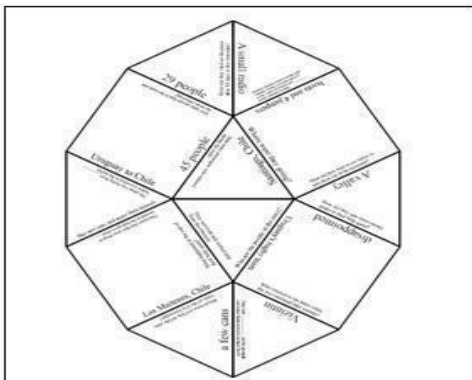


Figure 5: "Turtle Shape" TARSIA

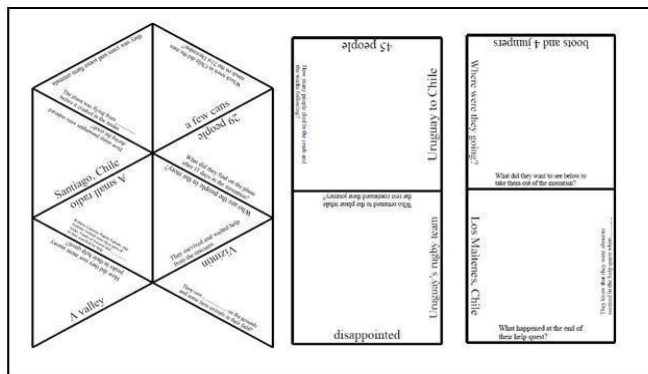


Figure 6: The cut-outs for the "Turtle Shape" TARSIA

The plane was flying from before it crashed in the Andes	Uruguay to Chile
How many people died in the crash and the weeks following?	29 people
What did they find on the plane after 11 days in the mountain?	A small radio
Roberto Canessa, Nando Parrado, and Antonia Vizintin wore three pairs of socks, 4 pairs of trousers and _____ as they searched for help.	boots and 4 jumpers
What did they want to see below to take them out of the mountain?	A valley
How did they saw more snowy peaks in their help quest?	disappointed
Who returned to the plane while the rest continued their journey?	Vizintin
They saw _____ on the grounds and some farm animals in their field?	a few cans
Which town in Chile did the men reach on the 21st December?	Los Maitenes, Chile
They knew that they were about to succeed in the help quest when _____	they saw cans and some farm animals

Figure 7. Sample of comprehension questions Development Phase

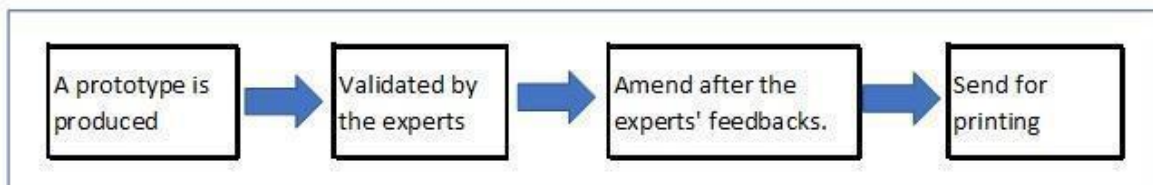


Figure 8: The process in the Development phase

In this development phase, the TARSIA is developed based on the reading text "Survival in the Andes" (page 84) of Unit 6, from the textbook, Pulse 2. The researchers developed questions based on the text to further enhance students' understanding. A total of 12 questions were developed for the students using the free online TARSIA maker. The cut-outs were then put in 5 different envelopes and labelled as Group 1, Group 2, Group 3, Group 4 and group 5.

The draft of the TARSIA and the set of questions were shown to the head of the English panel, the Head of the Language Department and to the English teachers from the SMKTS to get

their expert opinions and recommendations. Their comments were then recorded and analyzed. Changes we made accordingly. Final drafts of the material were sent for printing.

Implementation Phase

As for this phase, an all-boys school in Kuala Lumpur was selected. Two classes of Form 3 of SMKTS, Kuala Lumpur were selected for the innovation based on the convenience of the teachers. A total of 34 students, with levels of CEFR ranging from A2 to B2, were the participants in testing this innovation. A pre-test was given to the students to measure the amount of learning a student has acquired in a specific subject (Kuehn, 2022). As a pre-test, the students read the text “*Survival in the Andes*” (page 84) of Unit 6, Pulse 2 and answered the existing 11 questions in the textbook within 15 minutes. Scores were taken and recorded. Then, the teacher introduced the TARSIA and explained the rules and instructions on how to play the TARSIA. The teacher demonstrated and explained the steps.

The students were divided into groups of 4. Each group was given a puzzle with different colours. They try to solve the problem and get the correct shape. The teacher did not tell the students what shape she is looking for. She just told them, if they answered all the questions correctly, they will get the ‘right’ shape. They can solve the puzzle by reading and referring to the text. In solving the puzzle, the students discuss, collaborate and apply problem-solving skills. Time was allocated (20 minutes) to promote a sense of competition among the students.

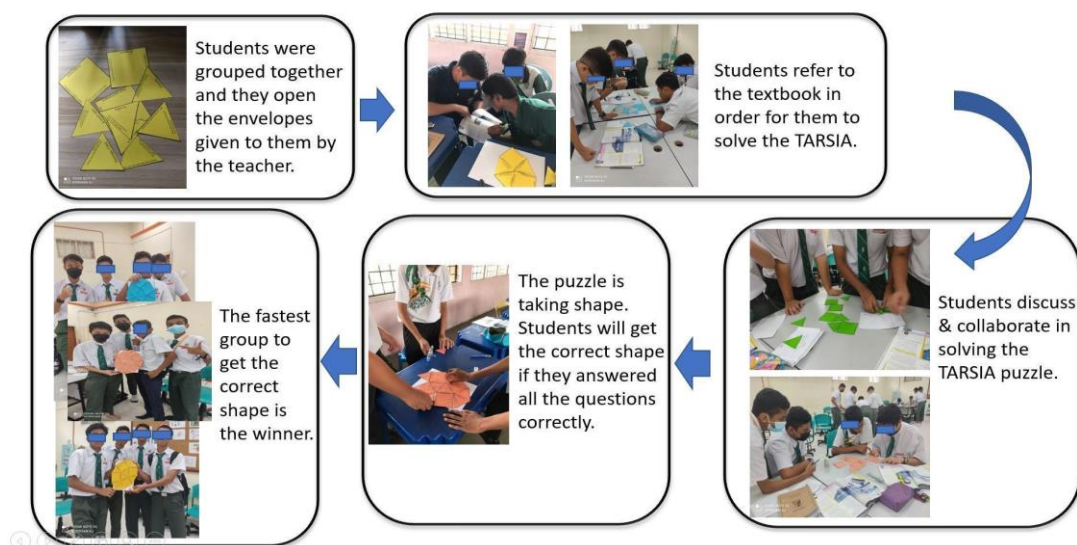


Figure 9: How TARSIA was utilised in the classroom

Evaluation Phase

In this phase, the students retried to answer the questions in the textbook as a post-test. The tests were conducted to determine the effectiveness of TARSIA among the students from the two classes of SMKTS students. The scores of the post-test were then recorded and compared by the researchers in the Findings and Discussion sections. The result was then analysed using SPSS version 26. A survey was also given to the students to find out their responses to utilising TARSIA in the reading lesson.

Findings

Figure 10 and Figure 11 reflect the students' scores from the implementation of TARSIA in 2 Form 3 classes.

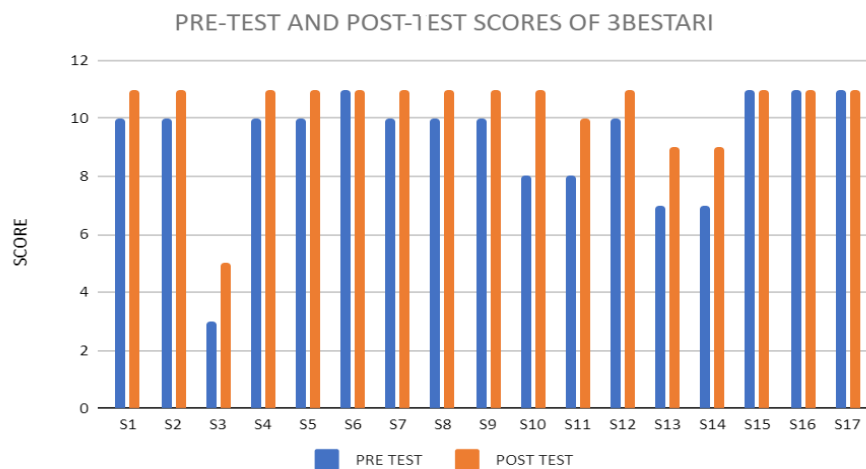


Figure 10: Pre-test and post-test scores of 3 Bestari

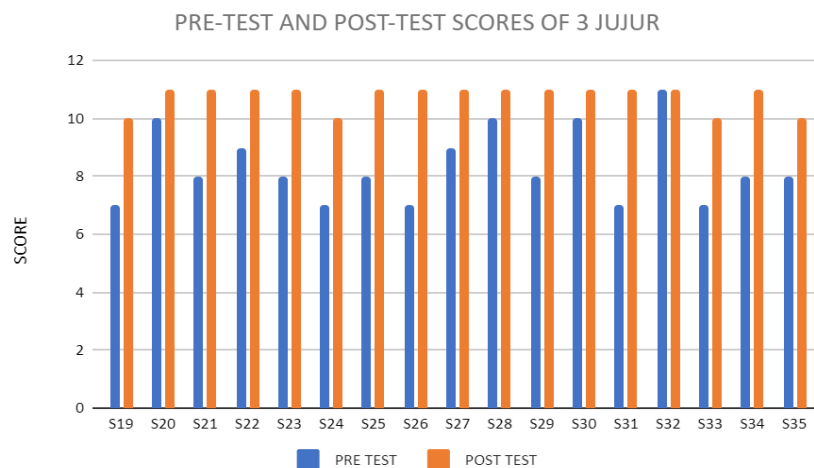


Figure 11: Pre-test and post-test scores of 3 Jujur

Data from class 3 Bestari and 3 Jujur are shown in Figure 10 and Figure 11, respectively. According to the data from both figures, it can be shown that 14 students from 3 Bestari and 16 students from 3 Jujur have significantly improved their post-test scores following the use of TARSIA in their reading class. Through the use of TARSIA, students were able to communicate and collaborate while also improving their grasp of the material. These two components, which aided each other during the activities, improved students' understanding of the material.

Table 1

Overall information from the implementation

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRETEST	8.79	34	1.754	.301
	POSTTEST	10.56	34	1.133	.194

According to Table 1, the mean score of the pre-test of the 2 classes is 8.79, whereas the mean score for the post-test after the implementation of the TARSIA was conducted is 10.56.

Table 2

The paired samples correlations

		N	Correlation	Sig.
Pair 1	PRETEST & POSTTEST	34	.746	.000

Table 3

The paired samples t-test of the pre-and-post-test mean scores

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PRETEST - POSTTEST	-1.765	1.182	.203	-2.177	-1.352	-8.704	33	.000

*p <0.05

Table 2 and Table 3 provide clear evidence of the effectiveness of TARSIA in improving reading comprehension. Results of the paired sample t-test show that mean scores differ before treatment (M = 8.79, SD = 1.754) and after taking treatment (M = 10.56, SD = 1.133) at the 0.05 level of significance, $t(33) = -8.704$, $n=34$, $p<0.05$, 95% CI for mean difference: -2.177 to -1.352, $r= 0.746$. On average, the score was about -1.765 points greater than before the treatment.

We can therefore conclude that there is a statistically significant difference between the pre-test and post-test scores, or between the scores before TARSIA is introduced and the scores after Tarsia is utilised in the class because the innovation administered was effective as students showed improvement in their comprehension.

Table 4

Descriptive statistics on the implementation of TARSIA

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
I like this lesson	34	4	5	4.85	.359
The use of Tarsia/Jigsaw Puzzle made the lesson interesting	34	4	5	4.79	.410
This lesson improved my reading skills	34	3	5	4.65	.597
I paid full attention throughout the lesson	34	3	5	4.59	.557
This lesson helped me to understand the reading passage better	34	4	5	4.56	.504
Valid N (listwise)	34				

The survey findings that were presented to the students after the implementation session are shown in Table 6. Likert scale was used in this survey, with 5 as "Strongly Agree" and 1 marked "Strongly Disagree". Though these descriptive statistics statements were arranged from highest mean scores to lowest mean scores, we can see that the mean scores ranged from 4.56 to 4.85, which is still high. Hence, it can be claimed that respondents strongly agreed with all of the statements. Most of the students liked this lesson as the statement got the highest mean score (M=4.85). This data also supported students' responses in 1 open-ended question, when they claimed that "This activity is very good. I like it. Make me excited and happy" and "Do more fun activities like this so we can play with our friends. mingle more". Some respondents claimed "I need more activities like this to improve my skills" and "I like the game. Easy for me to find the answer". These two statements are relatable with the 3rd and 5th survey statements, which are "This lesson improved my reading skills" (M=4.65) and "This lesson helped me to understand the reading passage better" (M = 4.56)

In addition to these findings, there are also recommendations made by the students on how TARSIA may be more effectively used in ESL classes. Firstly, respondent, S6, proposed that TARSIA should also be done individually. As the students must solve the puzzle based only on their comprehension of the topic, this will undoubtedly increase the challenges they face. As a result, this will undoubtedly link to a different suggestion made by the majority of students, who said that they required more time in finishing the task. In addition, respondent S16 said that it would make the puzzle more engaging if the students had access to videos or other visual aids while completing it. Another significant suggestion made by them that might be taken into account for future classes is the implementation of TARSIA in grammar lessons as well to make the lessons more engaging and interactive.

Discussion

The overall result shows that incorporating TARSIA in ESL reading lessons has the capability to change students' perspectives on L2 reading skills in some ways. The enjoyment retrieved from this puzzle-solving activity, TARSIA, has become an eye-opener to the participants that learning language skills, in this context is reading, is not going to lead them to boredom (Stavy et al., 2019). Instead, as they must cooperate in solving the TARSIA puzzle, some benefits were also noticed, including an increase in students' excitement and their degree of cooperation and teamwork. Classroom observations and survey responses show these changes, and it is clear that students are more eager to include TARSIA in their reading sessions once it was implemented in ESL lessons. Additionally, they possess the capacity to justify their thoughts and provide explanations for concepts that they have no trouble understanding. Using TARSIA changed the dynamic in the classroom as the interaction was more student-centered and the teacher was more of a facilitator for them. Students were actively engaged in their discussion until they were able to complete the puzzle, which proved their understanding of the article used. This was unquestionably consistent with Ching and Azrina's claim from 2019 that jigsaw puzzles also promote group engagement and inspire students to converse and collaborate to finish the assigned task.

These findings also answered the research question of whether or not TARSIA improves students' reading comprehension. Based on the results, they showed that TARSIA has made significant improvements in changing students' attitudes toward reading lessons in ESL classrooms. From the research data, Students showed greater interest and were more motivated to learn when TARSIA was used in reading courses. This resulted in the improvement of students' participation in the lesson itself, which has been proven when

students were actively engaged in activities throughout the lesson. This finding has been in agreement with Dwiniasih and Nugraha's research in 2019, where they found that integrating game-like lessons in ESL classrooms has been a way to promote a better learning environment and improve students' overall learning attitude toward learning the language. With regard to the topic's unfamiliar setting, TARSIA was able to lower their fear and language anxiety. It comes as a result of the lesson's inclusion of communication and collaboration, which was carried out in many levels of interactions, which improved motivation and participation (Qomaria, 2019). Since TARSIA can help students learn more, feel more confident, and develop their critical thinking skills, it is crucial for teachers to design other lessons that incorporate TARSIA that encourage participation from their students.

Since teachers can select any reading materials and create questions in whatever way they feel is parallel to their students' level, TARSIA uses the concept of versatility and flexibility (Idris, 2020). This allows it to be utilised with students of all grade levels with various learning components embedded with it. Hence it is worth considering the respondents' suggestions. Integrating other visual aids like online Youtube videos would be another improvement that can be made in making sure that TARSIA is able to give both teachers and students an impactful learning experience. Supplementing students with videos of related topics would help students, especially visual learners to comprehend the unfamiliar text better. Hence, other than incorporating 21st century learning, they can maximise their understanding when they work on completing their TARSIA puzzle together (Ching & Azlina, 2019; Jalok, et al., 2019; Omur & Said, 2019; Stavy et al., 2019). This is because the kids will move about physically and collaborate in groups to complete the jigsaw puzzle. As a result, the pupils' stress levels will decrease, their energy levels will rise, and they will be better able to comprehend the readings. As a result, employing jigsaw puzzles in the classroom can be seen as a practical and student-centered method of introducing reading comprehension.

Conclusion

The design and development of TARSIA as the foundation of the study produced a positive effect on the teaching and learning of reading comprehension to secondary school students of lower to intermediate proficiency. Results of both the pre and post-tests indicated vital outcomes as the learners experienced gradual progress in inculcating their reading comprehension skills. Learners' physical attachment to learning the reading comprehension skills in accordance with their syllabus and applying the knowledge in the process of playing TARSIA boost their confidence in facilitating reading comprehensibility. This game aided collaborative and cooperative learning among the learners, which is parallel to novelty learning. TARSIA is a great teaching tool that may assist ESL educators enhance their students' reading comprehension since it is versatile, adjustable, and user-friendly, despite a few limitations that can be improved. It also has a great deal of potential for usage in language classrooms to assist Malaysia in achieving the goals set forth in its English Language Syllabus. For future study, the effectiveness of TARSIA may be explored in writing, speaking as well as in grammar lessons. Secondly, since data from this research is limited to only one school, it is recommended that in the future, TARSIA is experimented on specific populations such as Orang Asli or children in vulnerable situations.

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