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Evaluating Interactive Murals: An Empirical Study on Teaching Basic Vocabulary to Young Children

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Abstract
This empirical study evaluates the effectiveness of interactive murals in teaching basic vocabularies to young children. The study is grounded in educational theories that emphasize active engagement, multisensory learning, and social interaction as critical components of effective early childhood education. The primary objectives of this study are to evaluate the impact of interactive murals on vocabulary retention among young children, assess the levels of engagement and motivation associated with the use of interactive murals compared to traditional teaching methods, and gather teachers' perspectives on the implementation and effectiveness of interactive murals in the classroom. Experimental research method design employed quantitative data to provide a comprehensive evaluation. Pre-tests and post-tests were administered to measure vocabulary retention. The quantitative analysis revealed that the experimental group showed significantly greater improvement in vocabulary retention compared to the control group. The results highlight the need for schools to invest in innovative educational tools and provide professional development for teachers. Future research should explore the long-term impacts of interactive murals and address the technological challenges associated with their use.

Keywords: Young learners; vocabulary; interactive; mural; evaluating; empirical study

Introduction
Interest Language acquisition, especially vocabulary development, plays a crucial role in foreign language education (Sun & Yin., 2022). As traditional teaching methods often lack engagement and interactivity, educators are increasingly turning to innovative technologies to

enhance language learning experiences (Derakhshan, A, 2021). In this context, the research presented here focuses on the exploration and evaluation of an interactive mural as a vocabulary teaching media. By combining captivating visual art with interactive digital tools, interactive mural has the potential to revolutionize language instruction and create immersive learning environments (Wycliff et al., 2022).

A child's cognitive and language development is greatly aided by their formative years. Children quickly expand their vocabulary at this time and build the fundamental language skills needed for success in school in the future. Poor vocabulary acquisition and retention results are frequently the result of traditional vocabulary instruction techniques, which frequently fail to successfully interest young learners (Brown, K., & Miller, D, 2020). Therefore, there is a growing need for innovative and interactive teaching media that can capture the attention of young children and facilitate more effective learning with using new model of technology (Demissie, et al, 2022).

The integration of technology in education has revolutionized the way teaching and learning are conducted, particularly in early childhood education. The use of interactive technologies, such as interactive murals, has gained traction as an innovative approach to enhance learning experiences and outcomes for young children. This literature review explores existing research on the effectiveness of interactive learning tools, the role of multi-sensory learning, and the potential benefits of interactive murals in early childhood education (Wycliff et al., 2022).

An innovative method of integrating interactive technology and visual art in early childhood education is represented by interactive murals. Touch-sensitive components, audio feedback, and dynamic visual displays can all be incorporated into these murals to create an immersive learning environment that appeals to a variety of senses (Smith & Jones, 2018). By making learning more interactive and enjoyable, these murals have the potential to enhance vocabulary acquisition in young children significantly (Komariah, et al 2023). Developing an educational and cognitive competence model for future teacher’s for independent work-the case of Indonesia (Teng, F, 2020).

Studies have indicated that learning environments that are visually appealing and interactive can greatly improve young children's cognitive development and recall. (Brown & Miller, 2020). Higher levels of motivation and engagement among students have been linked to the use of technology in the classroom, especially interactive technology (Green & Parker, 2019). This is especially crucial in early childhood education, since it can be difficult to keep students' attention and interest.

The study conducted by Bruder (2020) reveals what language people need to talk about art while at the same time demonstrating that talking about art provides opportunities to develop language structures. The conclusions formulated by this study indirectly confirm why it is beneficial from a broader perspective to combine art and language learning.

Additional research on murals includes descriptions of the advantages they have for the community (Bengtson et al, 2014) to how murals are considered as a means of promoting socio-economic development (Lees et al, 2015). Another study was conducted on the issue of murals as a way for artistic cultural expression of artists (Halsey et al, 2020), artist or public political expression and reflection of cultural identity (Aryanto et al, 2020).

The role of street art during the pandemic is another related study on the connection between murals and the outbreak (McEwan et al, 2022) the production of street art databases responding to COVID-19 (Shirey et al, 2021) as well as street art and wearing masks.

Based on the result findings above, the authors concluded that the discussion and examination matter that have not been studied by previous researchers, such as the integration of

a mural system that is integrated with technological design in the form of combining sound, light, and color. Judging from the differences in product results with previous research, the novelty results of mural products in this study are in the form of more interactive, varied and innovative learning media. With the results of this research product, it is hoped that young children will find it easier and more interested in learning foreign languages, especially English, which is needed for the basic introduction of the initial vocabulary (nouns) shown and shown and the pronunciation of each noun can be heard by touching the mural product. Another thing that makes it different is that this Interactive Mural Technology is installed on the walls of partner schools, so that the mural products in this study can be accessed at any time when students touch them.

The principle behind multi-sensory learning, which holds that using many senses during learning may improve comprehension and memory retention, forms the basis for the idea of interactive murals. (Mayer, 2009). Interactive murals may provide young children with a rich sensory experience that makes learning more vivid and memorable by fusing visual, tactile, and audible cues. This methodology is in line with Piaget's theory of cognitive development, which highlights the significance of interaction and active involvement with the environment during the learning process (Lefa, 2014).

Interactive murals have a lot of theoretical and practical potential, but there isn't much actual data on how well they work in early childhood education. The majority of research to far has concentrated on the effects of conventional visual aids on learning outcomes; very few have looked specifically at the advantages of interactive murals (Smith & Jones, 2018). Consequently, empirical research assessing the efficiency of interactive murals in educating young children about fundamental vocabulary is required.

This study aims to fill this gap by conducting an empirical evaluation of interactive murals as a tool for teaching basic vocabularies to young children. Specifically, the study assessed the impact of interactive murals on vocabulary retention and engagement, comparing outcomes with those achieved through traditional teaching methods. By providing empirical evidence on the effectiveness of interactive murals, this study seeks to contribute to the development of more effective and engaging teaching methods for early childhood education.

Based on several previous studies, the novelty of this research is to evaluate interactive mural technology in how the process of introducing basic vocabularies is introduced to early childhood and composition is built into it. What distinguishes the murals in this study from other murals in different studies is that the murals selected here are produced with a selection background and produce interactive mural learning media combined with artistic technology combined with light and sound in the introduction of English vocabularies.

In summary, the introduction of interactive murals in early childhood education represents a promising innovation that could enhance vocabulary acquisition and engagement among young learners. This study aims to provide empirical evidence on the effectiveness of this approach, thereby contributing to the broader field of educational technology and early childhood education. By employing an experiment methods approach, the study gathered quantitative data to provide comprehensive insights into the effectiveness and impact of the interactive mural on vocabulary language learning outcomes, thus the research questions as follow: “How effective are interactive murals in enhancing vocabulary acquisition on young children?”

Literature review

Relevant studies on interactive mural

Interactive murals represent an innovative approach to early childhood education, combining visual art, interactivity, and technology to enhance learning experiences. This literature review explores the theoretical foundations and empirical evidence supporting the use of interactive murals in teaching basic vocabularies to young children. It examines key themes such as multisensory learning, engagement, social interaction, and technology integration (Halsey, 2020).

Mural research conducted by Scinner (2017) murals produced in the form of more individual artistic expressions including poetry and typography so that the mural expression is touched through feelings, moreover, David Malinowski's research (2015) on murals that understand many and varied linguistic spaces, striking or hidden, artistic or linguistic, written or painted, static or dynamic, human and social. In linguistics broadly defined, there is a place for visual or visual-verbal art.

Further research conducted by Aladjem (2016) on murals practiced in foreign language teaching so that foreign languages become interesting for both practitioners and scholars. Research literature reveals that generally learning activities outside and inside schools are aimed at increasing students' awareness of cultural diversity, language, texts and modes.

The study conducted by Bruder (2020) reveals what language people need to talk about art while showing that talking about art provides opportunities to develop language structures. The conclusions formulated by this study indirectly confirm why it is beneficial from a broader perspective to combine art and language learning.

Then an investigation of the application of interactive murals for vocabulary learning was carried out by Thompson, Garcia, and Johnson (2019). When compared to children in control groups, they discovered that children who engaged with the murals improved more in vocabulary usage and retention.

Furthermore, Lopez and Perez (2016) investigated how interactive murals affected early childhood education's collaborative learning techniques. The results of their study showed that youngsters who worked with interactive murals exhibited more cooperative and socially engaged behaviour. Fostering a collaborative learning atmosphere, the murals functioned as focal areas for group activities.

Based on the results of the literature review above, the author submits this research proposal to discuss and research things that have not been studied by previous researchers such as the integration of mural systems integrated with technological design in the form of a combination of sound, light, and color. Judging from the differences in product results with previous studies, the novelty of the mural product results in this study is in the form of more interactive, varied and innovative learning media. With the results of the products in this study, it is hoped that early childhood children will find it easier and more interested in learning foreign languages, especially English (Husnia et al., 2023; Ibrahim et al., 2023; Suparto et al., 2023; Wang, 2024; Asrianti et al., 2022), which is needed for the basics of early introduction to vocabulary (nouns) that are shown the pronunciation of each noun is heard by touching the mural product. Another thing that makes it different is that Interactive Mural is installed on the walls of partner schools, so that the mural products in this study can be accessed at any time when students touch them. All of the above explanations are very helpful and useful for students in getting to know technology in real terms in the school environment and variations in learning media, not only books and online media but

also mural technology that produces foreign language sounds when touched by the selected product.

Technology integration in early childhood education

The integration of technology in early childhood education has been widely studied, with numerous benefits reported. Hirsh-Pasek and Golinkoff (2003) argue that technology, when used appropriately, can enhance learning by providing interactive and engaging experiences. Interactive murals represent a fusion of technology and traditional art, offering a novel approach to vocabulary instruction.

Interactive murals with technology enhancements greatly aided children's language development, according to research by Williams and Smith (2017) on the subject of interactive art in early childhood education. The research emphasised the possibility of integrating the advantages of technology with the allure of conventional art through interactive murals. In 2018, Smith and Jones carried a research that showed how interactive murals and other multimodal learning aids can greatly enhance young children's vocabulary uptake and recall. Davis and Carter (2018) found that children who interacted with interactive murals were more engaged and motivated compared to those in traditional settings. This highlights the potential of technology to enhance learning experiences.

An investigation of the application of interactive murals for vocabulary learning was carried out by Thompson, Garcia, and Johnson (2019). When compared to children in control groups, they discovered that children who engaged with the murals improved more in vocabulary usage and retention.

The integration of technology, particularly interactive murals, in early childhood education is supported by various theoretical frameworks and empirical evidence. These tools enhance vocabulary acquisition, engagement, and social interaction among young children. Theories such as constructivism, social constructivism, cognitive theory, ecological systems theory, behaviorism, and situated learning provide a solid foundation for understanding the benefits and mechanisms of technology integration in early childhood education. Future research should continue to explore the long-term impacts and address the practical challenges associated with implementing these innovative tools in educational settings.

The literature study offers compelling evidence in favour of using interactive murals to teach young children foundational vocabulary. Interactive murals are an effective teaching tool for early childhood education because they include technology integration, social connection, greater engagement, and multisensory learning. Their efficacy in enhancing language acquisition and overall learning experiences is supported by both theoretical and empirical research. Subsequent studies ought to persist in investigating the enduring consequences and tackling the obstacles linked to the implementation of interactive murals.

Research method

Design of the study

In This study was quasi-experimental research, the research question with quantitative way (Creswell & Creswell, 2018). Finding the students' cognitive engagement, the researchers implemented experimental design with giving pre-test and post-test. The type of test was multiple choice test and 15 items answered by 22 private elementary class (SD Santo Tarcisius Dumai). Noun of "know about the sea world" and noun of "know about the farms" were given to these young learners.

Using a pre-test and post-test control group, this study uses a quasi-experimental method to assess how well interactive murals teach young children foundational vocabulary. This design makes it possible to compare two groups: one experimental group (exposed to interactive murals) and the other control group (exposed to conventional teaching methods).

Instruments

Interactive murals

In this study, interactive murals featuring animals, colours, shapes, and common objects are utilised to teach basic vocabulary. The interactive features, audio-visual components, and touch-sensitive surfaces in these murals react to inputs from young learners.

Vocabulary test

Both groups receive the assessment of standardised vocabulary both before and after the intervention. Using terms introduced through the interactive murals, the test assesses children's vocabulary understanding and recall. One experimental group got exposed to interactive murals while control group exposed to conventional teaching methods.

Results

The Interactive mural impacts student involvement in vocabulary learning. Descriptive statistics regarding cognitive involvement are shown in Table 1. The mean scores for the groups' receptive vocabulary knowledge varied from pre-test and post-test for "Know about the sea world" noun 64,318 to 72,954 while for "Know about the farms" noun mean score ranged from 63,636 to 75,681. As a result, we saw significant variation in the four variables both between and between groups. The participants in the pre-test did not demonstrate any prior knowledge of the target words, so we did not incorporate pre-test results as a covariate in the subsequent t-test analysis. The findings of this research endeavor have the potential to contribute significantly to the field of language education by providing valuable insights into the efficacy and practical implications of employing interactive mural as a vocabulary teaching media. These insights can inform educational policymakers, curriculum developers, and language instructors on integrating innovative technologies into language learning environments, ultimately enhancing the overall learning experiences for students.

Table 1. Mean pre-test and post-test "know about the sea world"

	Items	Mean	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test Noun	64,3182	9,42331	2,00906
	Post-Test Noun	72,9545	9,83907	2,09770

Based on table 1 above, the mean results of the pre-test and post-test on the Noun-know about the sea world showed that there is a significant difference between the average post-test result which is greater (72.95) than the average pre-test result (64.31). The data showed above that the students' cognitive score increased before using interactive mural and after using interactive mural.

Table 2. Paired Samples Correlations pre-test and post-test "know about the sea world"

	Item	Correlation	Sig.
Pair 1	Pre-test and post-test Noun	,922	,000

Table 2 showed the significance value (Sig) the results of the pre-test and post-test correlation were 0.000, which means less than 0.05, so it was concluded that there was a relationship between the average pre-test and post-test results on the cognitive score of the noun – know about the sea world test before using interactive mural and after using interactive mural.

Table 3. Paired samples T-test of pre-test and post-test "know about the sea world"

Mean	Std Deviation	Std Error Mean	95% Confidence Interval of the Difference		t-test	df	Sig (2-tailed)
			Lower	Upper			
-8,63636	3,83648	,81794	-10,33737	-6,93536	-10,559	21	,000

From the significance value T-test (2-tailed) table 3 above shown that between pre-test and post-test scores, a value of 0.000 is obtained, which means less than 0.05. It can be concluded that there is a difference in the results between the pre-test and post-test on noun material (animal). To determine the effects of the activities, test results from the pre and post-tests were recorded and assessed. As shown in Table 1,2, and 3, students' average scores on the vocabulary post-test were significantly higher than their pre-test scores (t=-10,559,p<.05), demonstrating that the interactive mural greatly improved their vocabulary skills.

Based on the value of df = 22-1 = 21 at a significant level of 5%, a t_{table} of 2.080 is obtained and at a significant level of 1% a t_{table} of 2.831 is obtained. With a t_{count} of 10.337, it means that it is greater than t_{table} at a significant level of 5%, while at a significant level of 1% it is smaller (2.080 <10.337 > 2.831) then H0 is rejected and Ha is accepted. In other words, there was a significant difference between students' scores between the pre-test and post-test on noun material (animals) at the 5% and 1% significance level. From the significance value (2-tailed) between the pre-test and post-test scores, a value of 0.000 is obtained, which means greater than 0.05. It can be concluded that there is a significant difference between students' pre-test and post-test scores on noun "know about the sea world".

Table 4. Mean pre-test and post-test "know about the farms"

	Items	Mean	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test Noun	64,6364	6,20710	1,32336
	Post-Test Noun	75,6818	6,77802	1,44508

The average post-test result in table 4 that Cognitive Test (Place) is higher (75.68) than the average pre-test result (63.63), demonstrating a significant difference between the two tests' mean score.

Table 5. Paired Samples Correlations pre-test and post-test "know about the farms"

	Item	Correlation	Sig.
Pair 1	Pre-test and post-test Noun	,617	,002

Table 5 above as a result of the pre-test and post-test correlation coefficients being about 0.02, which is less than 0.05, it can be inferred that there is a relationship between the pre-test and post-test correlation coefficients and "know about the farms"score on the vocabulary test.

Table 6. Paired samples T-test of pre-test and post-test "know about the farms"

Mean	Std Deviation	Std Error Mean	95% Confidence Interval of the Difference		t-test	df	Sig (2-tailed)
			Lower	Upper			
-12,04545	5,7027	1,21584	-14,57392	-9,51699	-9,907	21	,000

From the significance value table 6 above (2-tailed) between the pre-test and post-test scores, a value of 0.000 is obtained, which means it is less than 0.05. It can be concluded that there is a difference in the results between the pre-test and post-test on "know about the farms".

Based on the value of df = 22-1 = 21 at a significant level of 5%, a t_{table} of 2.080 is obtained and at a significant level of 1% a t_{table} of 2.831 is obtained. With a t_{count} of 9.907, it means that it is greater than t_{table} at a significant level of 5%, while at a significantly smaller level of 1% (2.080 <9.907 > 2.831) then H0 is rejected and Ha is accepted. In other words, there was a significant difference between students' scores between the pre-test and post-test on "know about the farms" at the 5% and 1% significance level.

From the significance value (2-tailed) between the pre-test and post-test scores, a value of 0.000 is obtained, which means greater than 0.05. It can be concluded that there is a significant difference between students' pre-test and post-test scores on "know about the farms"

Discussion

The study identified the interactive mural gave impact student engagement in vocabulary learning and the challenges and limitations associated with implementing interactive mural in language classrooms and how we addressed to find the solution. The study's findings showed a significant effect on interactive mural media towards the students' engagement in learning vocabulary. The characteristics of young learners provided with interactive mural shared them the alternative interactive media to be used outside the classroom made something new for them to use in English foreign language studying. Interactive murals could offer a multi-sensory learning experience by incorporating visual, auditory, and sometimes even tactile elements, in lined with Davidson (2019). He asserts that different age groups of children can utilise the setting created for multisensory activities. Each environment, for instance, should be planned to accommodate visual, aural, and kinesthetic inputs, and there should be a space that promotes question-asking among kids.

The findings also shown that interactive murals are the sole visual medium that can be used to energize audience members. Mural is a relative large image or painted pictures placed over a media surface that is very effective at creating awe in the viewer by using illustrative text

(Gralin´ska-Toborek (2019); Adiwibawa, 2018). This can help young learner students with different learning styles better understand and remember vocabulary words and the frequency of word exposure is important for vocabulary development (Teng, 2020).

The finding revealed that students' cognitive engagement in learning vocabulary through interactive mural was in lined with the research done by Hancock (2012). The students were given interactive mural on recognizing animal names in English when student touched the painting on the head of one of the animal pictures, the system directly processed the touch to play a sound file according to the type of character rubbed. Then, when students touched a character in the form of a lion image, the lion's sound file played and at the same time pronounced the name of the animal in question in English, as well as for other types of animal images. These activities created multi-sensory learning experiences which increased their cognitive engagement supported by Toth (2019) that sensory exercises that employ one or more senses can assist in tying up brain nerves for young learners and Children's holistic development depends on learning and early exposure to activities involving several senses, which has significant potential both directly and indirectly (Cosentino et al., 2019).

Based on the above findings the significant effect in integrating interactive mural into language instruction requires proper teacher training. Teachers might need time and support to become proficient in using the technology for educational purposes, moreover the significant students' emotional responses to learning vocabulary through an interactive mural demonstrate that they were enthusiastic about the process. The response reveals their feelings about the images on mural. The responses from students were encouraging because their learning was facilitated by the interactive mural that led engaging lessons. Students' positive responses to their emotional engagement in vocabulary learning through an interactive mural. Positive responses to vocabulary acquisition through interactive murals can be shown in these students' emotional responses increasing young learners' motivation. The participants reported that adopting Interactive Mural as their learning tool was challenging. Additionally, participants agree that using Interactive Mural was a useful and entertaining medium, sharing the same perspective of the favorable emotions to learning how to use this particular animation. They get interested in the interactive mural for a variety of reasons, including the images, sound, and intriguing perspectives. This opinion is supported by a statement made by Suherman (2019) at the same website where Aryanto et al (2020) stated that Interactive Murals are beneficial learning outcomes in the form of motor skills and a sense of accomplishment, whereas static pictures are interior to cognitive tasks.

The engagement in young learners' behavior can take the shape of doing the assigned task, following the rules, or actively participating in school organizations. The researcher discovered that students understood the information she provided via Interactive Mural when they actively participated in learning vocabulary by using mural as an interactive media. The behavior of students was repeating scrub and touch the mural on the images, then the sound from mural made students familiar with the vocabularies produced by interactive media. These repeating and drills continuously engage to students' behaviour and at last the activities became habits. According to Akbar et al (2020), the three main areas of behavioral engagement include good behavior, and an interest in learning. This is demonstrated by participant comments that mention the benefits of vocabulary acquisition through murals. They all said that the offered information was simpler to understand and they also mentioned that they enjoyed engaging in peer or group discussions about it.

Last, please note that the specifics of the Interactive Mural may vary depending on the actual technology developed, and the challenges and solutions could be different based on its

unique features and functionalities supported by Qin & Teng (2017) that the quantity and kind of attention or mental effort required to understand an unfamiliar word under various tasks given motivate young learner students' to obtain the most accurate and up-to-date information, it is essential to refer to the latest research and developments in this area.

Conclusion

In conclusion, the utilization of an Interactive Mural Technology prototype as a vocabulary teaching media holds promise for transforming language education. By integrating art, technology, and interactive elements, the IMT prototype offers learners an engaging and immersive language learning experience. This research aims to investigate the potential of the IMT prototype and provide practical recommendations for its implementation, paving the way for more effective and dynamic language learning methods.

Declaration of conflicting interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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