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ผ่านสื่อปฏิสัมพันธ์การพับกระดาษโอริกามิ  
Enhancing Science Learning Achievement of Generation Alpha Students  
through Origami-Based Interactive Media

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## Abstract

This study is a research and development project aimed at enhancing science learning achievement among Generation Alpha students through an interactive web-based learning medium integrated with origami activities. The integration of origami supports learning efficiency, engagement, and learner concentration, aligning with the learning characteristics of Generation Alpha. The objectives of the study were to: (1) develop origami-based interactive media to enhance science learning achievement among Generation Alpha students; (2) evaluate student achievement in a science project course after using the media; and (3) assess student satisfaction with the origami interactive media. The sample consisted of 24 sixth-grade students (Class 6/1) from Wat Amarintraram School in the 2024 academic year, selected through purposive sampling. The research design employed a one-sample t-test model. Research instruments included: (1) the origami-based interactive media, (2) a science achievement test, and (3) a student satisfaction questionnaire. Data was analyzed using descriptive statistics and t-tests. The findings revealed that: (1) the quality of the origami-based interactive media was rated as excellent, with a mean score of 4.62 (SD = 0.59); (2) student achievement in the science project course exceeded 70%, with statistical significance at the 0.05 level; and (3) student satisfaction with the media was rated at the highest level, with a mean score of 4.56 (SD = 0.68).

**Keywords:** Origami, Interactive media, Learning achievement, Generation Alpha

## 1. Introduction

Science plays a critical role in human development and national progress. It contributes to advancements across various sectors, including healthcare, communication, agriculture, industry, and sports. At the individual level, the development of scientific knowledge promotes personal growth, enhances community well-being, and drives societal progress by supporting both physical and mental development. Theoretical and practical applications of science can greatly improve daily life and overall quality of life [1]. However, results from the Program for International Student Assessment (PISA) 2022 indicate that Thai students' performance in science remains relatively low, with Thailand ranking 58th out of 81 participating

countries, marking a decline from 2018 [2]. Previous research by Kongcharoenkitkul et al. [3] and by Supakesorn et al. [4] has identified short attention spans and lack of concentration as major contributing factors to Thai students' low academic performance. This highlights the importance of promoting science education as a critical factor in improving Thailand.

To achieve this goal, it is necessary to implement various strategies that enhance the learning experience in line with the characteristics of current students, particularly those of Generation Alpha, born between 2010 and 2025. This generation has grown up immersed in a digital environment and tends to favor interactive, technology-enhanced learning experiences. Studies have demonstrated that Generation Alpha learners are especially responsive to educational methods that integrate multimedia and interactive content [5-6].

Origami, derived from the Japanese words "ori" (folding) and "kami" (paper), is the traditional art of paper folding to create various forms without cutting or gluing. Incorporating origami into classroom activities not only stimulates students' interest but also fosters cognitive, social, and motor skill development, which supports academic achievement of students in various subjects [7-8].

In this context, the integration of interactive technology with origami-based activities represents a promising approach to enhance student attention and engagement. The effective use of such tools has been shown to improve learning outcomes and promote academic success. Recognizing these benefits, this study aims to investigate the impact of origami-based interactive media on the science learning achievements of Generation Alpha students in Thailand.

## **2. Literature Review**

### **2.1 Interactive Technology in Science Learning of Generation Alpha**

Jukić & Škojo [9] shows that Generation Alpha's educational needs differ from those of earlier cohorts, as they grow up in a highly digital world. Their learning is shaped by constant exposure to digital tools, necessitating a shift in pedagogical strategies toward digitalization, gamification, and the integration of interactive technologies. Supporting this view, Sahronih et al. [10] investigated the impact of interactive learning media and student motivation on science learning outcomes among elementary school students. Their study revealed that students who engaged with interactive, environment-based media achieved significantly higher outcomes in science compared to peers using non-interactive methods. Statistical analysis confirmed the effectiveness of interactive media, showing a notable main effect of media type on performance. Furthermore, the interaction between learning media and motivation was found to have a substantial influence on learning outcomes. These findings underscore the importance of utilizing interactive learning tools that not only engage students but also cater to their cognitive and emotional needs.

### **2.2 Origami-Based Activities in STEM Learning**

Origami is an innovative tool, which has gained attention for its educational benefits across multiple disciplines. Origami, derived from the Japanese words "ori" (folding) and "kami" (paper), is the traditional art of paper folding to create various forms without cutting or gluing. Incorporating origami into classroom activities not only stimulates students' interest but also fosters cognitive, social, and motor skill development, which supports academic achievement of students in various subjects [7-8]. Previous research has demonstrated that origami serves as an effective hands-on tool in STEM education, contributing to cognitive, motor, and emotional development. For instance, Marji et al. [7] reported that the integration of origami into mathematics instruction significantly enhances students' mathematical skills, particularly in geometry. This improvement is attributed to increased spatial reasoning and problem-solving abilities

fostered through origami activities. Additionally, the practice of origami has been shown to improve fine motor skills, reduce stress, and promote creativity and critical thinking, skills that are closely aligned with the objectives of STEM education.

In addition to its contributions to spatial reasoning and creativity, origami-based instruction has also demonstrated measurable academic benefits. In a related study, Sochima [11] investigated the impact of an Origami-Based Instructional Model Approach (OBIMA) on secondary school students' academic performance and interest in mensuration in Enugu State, Nigeria. The findings revealed that OBIMA significantly improved students' comprehension of mathematical concepts, especially in the area of mensuration, through interactive and experiential learning methods. Notably, the study found no significant gender differences in the effectiveness of the approach, indicating its broad applicability across diverse student populations. Taken together, these findings underscore the pedagogical value of origami as a multifaceted educational tool. By enhancing engagement and academic performance in STEM subjects, origami-based instruction supports its integration into formal educational curricula as an innovative strategy for improving learning outcomes.

### 3. Objectives

- 1) To assess the quality of the origami-based interactive media to enhance the science learning achievements of Generation Alpha students.
- 2) To assess the learning achievements of students in the science project course after using the origami-based interactive media.
- 3) To evaluate the satisfaction of the sample group with the origami-based interactive media.

### 4. Hypothesis

- 1) The quality of the origami-based interactive media in enhancing the science learning achievements of Generation Alpha students is at a high level.
- 2) The learning achievement of the sample group after using the origami-based interactive media to enhance science learning is equal to or greater than 70%.
- 3) The satisfaction of the sample group with the origami-based interactive media is rated highly.

Conceptual Framework

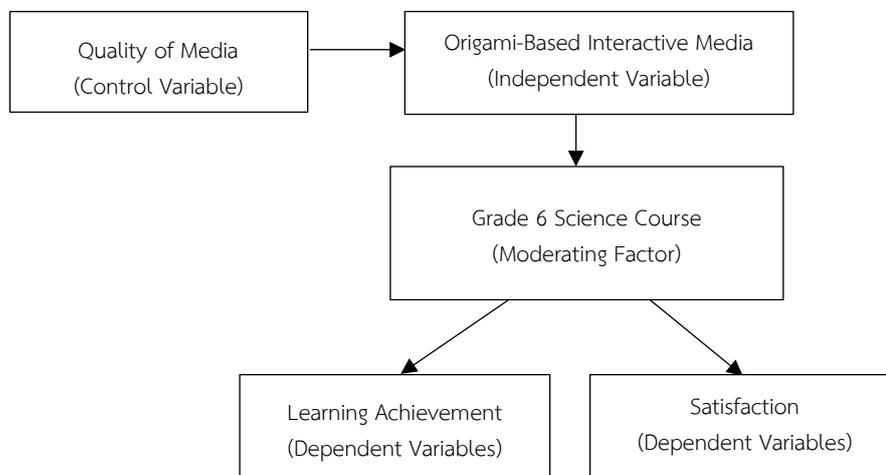


Figure 1 Conceptual framework

## 5. Statistical Methods for Research

- 1) Mean, percentage and standard deviation.
  - Mean represents the central tendency of the data.
  - Percentage indicates the proportion of the data.
  - Standard Deviation reflects the dispersion or variability of the data.
- 2) Hypothesis testing using One-Sample T-test. [12]
  - The test calculates a t-statistic, which is compared against a critical value from the t-distribution table. If the p-value is less than the chosen significance level (e.g., 0.05), the null hypothesis is rejected, indicating a significant difference between the groups.

## 6. Research instruments

- 1) The origami-based interactive media to enhance learning achievement of students in Generation Alpha.
    - The origami folding model delivered through an interactive web-based platform incorporates multimedia elements, including audio, text, graphics, and animations. The content is structured into three levels: Rookie, Beginner, and Advanced.
  - 2) The achievement test in the science project subject.
    - The test consists of 22 multiple-choice items, each presenting four answer options. It was designed to assess students' understanding of the scientific project content. Each item carried a weight of one point, for a total possible score of 22. The test's Item-Objective Congruence (IOC) as evaluated by experts, range from 0.67 to 1.00.
  - 3) The satisfaction questionnaire of the sample group regarding origami-based interactive media
    - This instrument was designed to measure participants' satisfaction with the use of origami-based interactive media.
    - It consisted of 6 items, rated on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).
- The items assessed the following aspects:
1. Aesthetics of the origami-based interactive media
  2. Attractiveness and usability
  3. Ease of use
  4. Speed of system response
  5. Increase in interest after use and
  6. Similarity between folding origami in the media and on paper

## 7. Data Collection

The data collection process was conducted in a single session with a total duration of two hours. Prior to the session, participants were informed of the study's objectives and procedures, and their voluntary participation was emphasized. At the start of the session, students interacted with the origami-based interactive media for approximately 10–15 minutes. Although this activity was not directly related to the science project content, it was incorporated to investigate whether engaging in the media could positively influence students' concentration and readiness to learn. Following the origami activity, students participated in a regular science project class for the remainder of the session. At the end of the class, they completed a 30-minute achievement test comprising 22 multiple-choice questions, each worth one point. A score of 70% or higher was considered indicative of having met the expected learning outcomes. Finally,

participants completed a satisfaction questionnaire to evaluate their experience and perceptions of the origami-based interactive media used at the beginning of the session.



Figure 2 Origami-based interactive media in science project class

## 8. Data Analysis

This research conducted the following data analysis:

### 1) Quantitative Data:

- Student achievement was analyzed using a one-sample t-test to compare the students' achievement scores against the established criterion of 70%.

- The quality of the origami-based interactive media was assessed by three experts in educational technology and information technology using an Interactive Media Quality Assessment questionnaire. This questionnaire evaluated four key areas: website design, graphic elements, sound quality, and usability/quality of use. Each area was rated on a five-point satisfaction scale, ranging from "strongly unsatisfactory" to "strongly satisfactory".

- Satisfaction with the origami-based interactive media was analyzed using mean scores and standard deviations from a 6-item questionnaire. The results were interpreted based on five levels of satisfaction, ranging from Strongly Disagree to Strongly Agree.

### 2) Qualitative Data:

- Experts provided qualitative feedback on the media's strengths and areas for improvement based on these categories.

## 9. Results

1. The quality assessment of origami-based interactive media to enhance science learning achievement of students in Generation Alpha.

**Table 1** showed the quality assessment of origami-based interactive media to enhance science learning achievement of students in Generation Alpha.

List	Mean	Standard deviation	Qualification Level
Interactive media Aspects			
1. Speed of displaying information on the interactive media	4.67	0.58	Excellent
2. Simple and easy to use symbols on the interactive media	4.33	1.15	Good
3. Accuracy of the content on the interactive media	4.67	0.58	Excellent
Total average	4.56	0.73	Excellent
Graphic elements			
1. Beauty and appropriateness	4.67	0.47	Excellent
2. Appropriateness of color use	4.67	0.58	Excellent
3. Appropriateness of font style	4.33	1.15	Good
4. Balance of the number of elements on the screen	4.33	0.58	Good
Total average	4.50	0.67	Excellent
Sound Elements			
1. Background Sound Suitability	4.67	0.58	Excellent
2. Sound Level Suitability	4.67	0.58	Excellent
Total average	4.67	0.52	Excellent
Quality of use			
1. Support multiple devices	4.67	0.58	Excellent
2. Support multiple web browsers	4.67	0.58	Excellent
3. System stability	4.67	0.58	Excellent

**Table 1** showed the quality assessment of origami-based interactive media to enhance science learning achievement of students in Generation Alpha (continue).

List	Mean	Standard deviation	Qualification Level
4. Functionality is consistent with the intended purpose	5	0	Excellent
Total average	4.75	0.45	Excellent
Overall average	4.62	0.59	Excellent

From Table 1, it can be seen that the overall quality of origami-based interactive media was at an excellent level, with an average score of 4.62 and a standard deviation of 0.59. The quality of the origami-based interactive media was evaluated in 3 aspects, with all aspects being at an excellent level, with an average score of 4.56 and a standard deviation of 0.73. The graphic elements were evaluated in 2 aspects, with an excellent level, with an average score of 4.50 and a standard deviation of 0.67. The sound quality was evaluated in 2 aspects, with an excellent level, with an average score of 4.67 and a standard deviation of 0.52. Finally, the usability quality was evaluated in 4 aspects, with an excellent level, with an average score of 4.75 and a standard deviation of 0.45.

2. The achievement of the sample group in science project course after using the origami-based interactive media.

**Table 2** presents the results of the achievement of the sample group in science project course after using the origami-based interactive media.

List	Number of Students	Full Score	Mean	S.D	t-statistic	Sig. (One-Tailed)
Test	24	22	17.54	4.69	2.237	( $p < 0.05$ )

According to Table 2, the results of the achievement of the sample group in science project course after using the origami-based interactive media indicated that the average test score was 17.54 out of 22, equivalent to 79.73%. In the hypothesis testing using a one-sample one-tailed t-test, the results indicated that the t-statistic (2.237) is greater than the t-critical value (1.714) obtained from the t-distribution table at a .05 significance level.

3. The satisfaction of the sample group towards the origami-based interactive media

**Table 3** shows the satisfaction of the sample group towards the origami-based interactive media.

List	Mean	Standard deviation	Satisfaction level
1. interactive media aesthetics.	4.58	0.60	highest
2. interactive media attractiveness and usability.	4.56	0.61	highest

**Table 3** shows the satisfaction of the sample group towards the origami-based interactive media (continue).

List	Mean	Standard deviation	Satisfaction level
3. interactive media ease of use.	4.85	0.36	highest
4. interactive media speed.	4.61	0.66	highest
5. increased interest after using the interactive media.	4.33	0.78	high
6. similarity between origami folding on the interactive media and on paper.	4.42	0.87	high
<b>Overall average</b>	<b>4.56</b>	<b>0.68</b>	<b>highest</b>

According to Table 3, that found the assessment of satisfaction of the sample group towards origami-based interactive media. The Sample Group (N = 24) indicates that the overall satisfaction level was at a highest level, with a mean score of 4.56 and a standard deviation of 0.68.

## 10. Discussion

**10.1** The quality of the origami-based interactive media to enhance science learning achievement of generation alpha students.

The quality of the origami-based interactive media for students in generation alpha found that it achieved an overall high-quality rating across all aspects that revealed with hypothesis. Experts noted that the design was engaging, easy to use, and efficient. This aligns with Boonmaphan [13] stated well-designed of interactive media enhance user engagement and improve learning outcomes. Regarding graphic elements, the illustrations, colors, and typography were appropriate. This is consistent with Kimmons' [14] theory, which highlights the impact of color on emotions and learning, aiding in better retention and comprehension of content. In terms of audio, experts agreed that the use of sound effectively enriched the learning environment and helped children maintain focus, aligning with the concept that music can stimulate cognitive processing and increase learners' attention. Additionally, regarding usability, experts indicated that the interactive media supports a variety of devices and functions well across different web browsers. This aligns with the theory of Barendregt & Bekker [15], which emphasized that responsive interactive multi media design enhances accessibility for diverse user groups. Finally, the interactive media's fast processing speed directly impacted user experience.

As a result, the origami-based interactive media to enhance science learning achievement of Generation Alpha students demonstrates practical applicability and potential for further development in future learning contexts. This aligns with Jukić & Škojo [9], who noted that Alpha generation, Technology follows them, shapes and marks them, they are growing up to be the most technologically "skilled" and most educated generation ever.

**10.2** The achievement of the sample group after using the origami-based interactive media to enhance science learning.

The learning achievement of the sample group was significantly higher than the specified criterion at the .05 statistical significance level that revealed with hypothesis, suggesting that origami enhances students'

intellectual learning skills and improves academic performance. This finding aligns with Phanthong [16] who explored the development of students' mathematics achievement through origami folding. The results showed a significant improvement in mathematics knowledge at the .05 level. Additionally, Naksut [17] emphasized that integrating technology in education supports modern learning approaches and enhancing learning outcomes. This is also consistent with Boonmapan [13] who found that interactive media in education promotes engagement and interaction between students and content, leading to more effective learning.

These findings highlight the potential of origami and interactive media to enhance learners' attention and concentration, resulting in effective and efficient learning.

**10.3** The satisfaction of the sample group towards the origami-based interactive media to enhance science learning.

The analysis of the evaluation results from a sample group of 24 participants revealed that overall satisfaction was at the highest level that revealed with hypothesis, encompassing aspects such as aesthetic appeal, engagement, ease of use, interactive multimedia speed, impact on concentration, and the similarity between folding origami on the interactive multimedia and paper. These findings align with Tuma's [18] theory, reflecting UX/UI principles that prioritize intuitive design, ensuring ease of use even for individuals with no prior experience. Regarding the aesthetic appeal, the results also align with Kimmons' [14] stated that the selection of colors and graphical elements significantly influences positive users' emotions perceptions and attitudes, thereby enhancing user engagement and contributing to a more immersive and effective learning experience. As for the similarity between origami folding on interactive multimedia and paper, it was found that while the physical experience could not be fully replicated, the interactive elements allowed users to effectively connect concepts and develop skills.

## 11. Recommendations

1) Origami-based interactive media can serve as a fundamental educational resource for teaching and learning origami, covering both theoretical concepts and practical applications. It is particularly suitable for individuals who wish to begin learning origami.

2) The system should be developed to support multiple forms of user interaction, such as enabling voice-based communication with learners.

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