J-IAMSTEM
Journal of Innovation, Advancement, and Methodology in STEM Education
Vol. 2, No. 3, pp. 150-158, May-June 2025
https://so13.tci-thaijo.org/index.php/j_iamstem

# Interactive Videos on Typhoon Formation for Grade 8 Learners

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Received: 14 Mar 2025 Revised: 3 Jun 2025 Accepted: 6 Jun 2025

**Abstract**

Conventional science teaching methods often fail to engage students or enhance their understanding of natural phenomena, such as typhoons. Typhoons form over warm ocean waters (26.5 °C or higher) when moist air rises, creating low pressure. The Coriolis effect makes the surrounding air spiral inward, creating a rotating storm. In the Philippines, where typhoons are common, misconceptions about their formation hinder learning and disaster readiness. Question-embedded videos (QEVs) are being tested to address this. This study (1) evaluates existing Grade 8 science materials on typhoon formation and (2) develops an interactive video to enhance learning. A needs assessment involving nine teachers revealed that slide presentations, videos, and animations were commonly used but lacked interactivity, reducing student engagement. While PowerPoint, YouTube, and DepEd modules provided visuals, they missed interactive elements. To bridge this gap, an interactive video was developed using Edpuzzle, featuring embedded quizzes on typhoon formation. This approach improved conceptual understanding and engagement, with students and teachers reporting enhanced learning through immediate feedback. Technology in STEM education is transforming how complex concepts are taught. This study demonstrates that interactive multimedia, like QEVs, can effectively help Grade 8 students grasp typhoon formation. Such tools offer a promising alternative to traditional methods, particularly in disaster-prone regions like the Philippines. The study contributes to SDG 4 (Quality Education) by using interactive scientific education to improve disaster preparedness and community resilience, while also addressing SDG 13 (Climate Action) by raising awareness of typhoons' environmental impacts. It encourages sustainability in vulnerable places.

**Keywords**: Interactive multimedia, Question-embedded videos, Typhoon formation, Conceptual Understanding.

## 1. Introduction

Conventional approaches to teaching science frequently struggle to draw in students and clarify misunderstandings regarding complex natural events, like the formation of typhoons. In the Philippines, where typhoons often occur, understanding their development is not just essential for academic purposes but also for disaster preparedness. Many students have trouble understanding the concepts involved because of outdated teaching strategies that do not offer interactive and dynamic learning experiences (Stylos et al., 2021). This gap emphasizes the necessity for effective educational strategies that improve conceptual understanding through engaging and interactive methods, particularly in the context of disaster preparedness.

Multimedia technologies, particularly those with interactive aspects like videos with embedded quizzes, have shown great promise in improving learning outcomes by actively engaging students in the educational process (Zolkwer et al., 2023). Suarmika et al. (2022) found that question-embedded videos significantly enhance students' understanding of typhoon formation by allowing for guided, self-paced, and feedback-rich learning. Similarly, Sriyani et al. (2023) discovered that interactive learning materials fill in gaps in abstract knowledge, enhancing students' comprehension of scientific facts. According to Wang (2022), interactive multimedia resources can significantly enhance student engagement, knowledge retention, and critical thinking, particularly in complex disciplines like geoscience and typhoon formation. This study evaluates the potential of multimedia resources, particularly interactive videos, to revolutionize the teaching of typhoon formation, emphasizing their effectiveness and areas for improvement.

Additionally, it aims to develop an interactive video on typhoon formation to significantly enhance student comprehension and engagement. The findings of this study are crucial for improving the teaching of natural phenomena by using more interactive multimedia technologies. Furthermore, this study addresses the urgent need for better teaching materials to enhance student understanding and disaster preparedness. The findings of this study are not just about improving the teaching of natural phenomena, but also about enhancing students' conceptual understanding and improving engagement in learning about typhoon formation.

*Objectives of the study*

The primary objective is to enhance the understanding of learners of typhoon development using interactive videos. The study specifically aims to:

1. Assess the multimedia resources utilized by teachers in teaching typhoon formation.
2. Develop an animated video using the Edpuzzle application.

## 2. METHODS

The Modified Luther's Multimedia Development Model is employed to develop and implement interactive videos on typhoon formation. The model has been modified to more closely correlate with the specific objectives of the study in order to guarantee that the phases are suitable for this subject. This modification enables a more precise alignment with the study's specific objectives. The procedure for developing interactive videos is divided into six distinct phases. The subsequent section provides a comprehensive explanation of the data collection and analysis processes that are employed in each of the six distinct stages: Concept, Design, Material Collection, Assembly, Testing, and Dissemination.


Figure 1. Modified Luther's Multimedia Development Model

**Stage 1: Conceptualization**

This stage includes topic selection, needs assessment, setting learning objectives, and preparation of assessment instruments. The topic "Typhoon Formation" was selected for its significance within the Philippine curriculum and its relevance to learners' environmental context. The prevalence of misconceptions in learners' understanding and insufficient interactivity in pedagogical methods prompted implementing this multimedia-focused approach. Data collection involved interviews and surveys with nine Grade 8 science teachers to determine the limitations of current teaching strategies. Data were analyzed using thematic coding to identify common challenges, such as lack of interactivity and difficulty addressing misconceptions.

**Stage 2: Designing**

A learning plan was developed to improve learners' conceptual understanding of typhoon formation through the 7E instructional model. Interactive tools, videos, and collaborative activities were integrated to promote active learning. The researcher developed a storyboard that aligns multimedia design with educational objectives. Feedback from content experts confirmed that the videos were engaging and aligned with instructional standards. Considering the technological limitations in the school where this study was implemented, features were optimized for offline and online use. Learning activities were following the 7E instructional model during this phase. Experts developed and validated the learning plan during the data collection process. The video storyboard and interactive components were refined through qualitative feedback analysis.

Table 1: Learning Plan for the Topic Understanding Typhoon

| Day | Activity | Objective/s | Method/s | Assessment |
|---|---|---|---|---|
| 1 | Elicit and engage | Access prior knowledge and introduce typhoon formation. | - Activity: Sea Breeze and Land Breeze fill-in-the-blank exercise.<br>- Video: Typhoon Julian footage with discussion. | Responses to guide questions and participation. |
| 2 | Explore and explain | Visualize the PAR and understand its role in typhoon tracking. Explain the stages of typhoon formation. | - Activity: Plot typhoon locations within the PAR.<br>- Interactive video: Stages of typhoon formation with embedded questions. | Accuracy of plotted maps and responses to video questions. |
| 3 | Elaborate | Analyze how landmasses and bodies of water affect typhoon intensity and behavior. | - Activity: "The Aftermath" - Analyze visual illustrations to determine the impact of land and water. | Completed tables with detailed explanations. |
| 4 | Elaborate and extend | Create a storyboard to explain the lifecycle of a typhoon and its impact. | - Activity: Storyboard making (4-6 panels) focusing on typhoon lifecycle and safety measures. | Creativity, clarity, and accuracy in storyboards. |
| 5 | Extend and Evaluate (Posttest) | Raise awareness about typhoon preparedness and evaluate overall learning. | - Activity: Design a community typhoon awareness campaign (poster, video, or skit).<br>- Posttest: Identification questions to assess knowledge. | Quality of campaign outputs and posttest scores. |

**Stage 3: Material Collection**

Educational resources were systematically selected, which includes DepEd modules, YouTube videos, and data from PAGASA. Data collection consisted of gathering curriculum-aligned materials, teacher-recommended sources, and relevant online content (e.g., DepEd modules, PAGASA reports, TikTok videos). These were screened based on relevance and accuracy. The analysis involved content mapping against the learning objectives.

**Stage 4: Assembly**

Interactive videos were developed using Canva for motion graphics, Microsoft PowerPoint for additional animations, and Edpuzzle to integrate assessment questions. Data collection during this phase includes recording and editing scripts, integrating questions in Edpuzzle, and developing motion graphics. The analysis involved an expert validating prototype videos for technical quality, clarity, and content alignment. The video materials were enhanced through the iterative use of feedback.

**Stage 5: Testing**

*Face Validation*

In the face validation phase, the panel shared several suggestions to enhance the interactive videos. A panel member suggested developing three short videos that break down the two learning objectives, each lasting one to three minutes. These videos would specifically concentrate on the term "typhoon" rather than the more general "tropical cyclones." They suggested focusing on the development of typhoons instead of talking about tropical cyclones as a whole. They also suggested adding a short comparison between Jupiter's Great Red Spot and Earth's typhoons to show how Earth's storms differ from other planets.

*Pilot Testing*

The interactive videos were tested in a private school in Marawi City. Ethical standards were followed, ensuring voluntary participation through assent and consent forms. Pretests were administered one week before the intervention to evaluate learners' foundational knowledge of typhoon formation. The videos served as the primary instructional resource, integrating embedded assessments. Quantitative data were collected through pretest and posttest scores. Descriptive statistics (mean, percentage improvement) were used to assess learning gains. Qualitative data from student observations and teacher feedback were analyzed thematically to evaluate engagement and usability.

**Stage 6: Dissemination**

*Actual Implementation*

The study was conducted in a public school, adhering to ethical guidelines and ensuring voluntary participation. Pretests and posttests assessed improvements in learners' conceptual understanding of typhoon formation. Feedback from learners and teachers was gathered through perception questionnaires, showing the multimedia intervention's effectiveness in improving engagement and conceptual learning. Quantitative data from posttests were compared with pretests to measure conceptual improvement. Qualitative data from open-ended student responses and teacher interviews were coded and analyzed for recurring themes on effectiveness and student motivation. The dissemination included sharing results with stakeholders and reflecting on scalability.

## 3. Results and Discussion

### 3.1 Assessment Result

The study included nine science in-service teachers who provided valuable insights through a needs assessment regarding their instructional methods in teaching natural phenomena, particularly typhoon formation. The responses collected are used as a basis for the development of interactive videos that are designed to enhance the teaching of typhoon formation. Various instructional tools and strategies, such as multimedia such as videos, animations, and hands-on experiments, are emphasized in the feedback as essential for improving students' comprehension. Furthermore, teachers stated their anticipation for the potential advantages of interactive videos in simplifying complex concepts. These results are consistent with the current body of literature on effective science teaching strategies, with a particular emphasis on the significance of multimedia and interactive learning in enhancing student engagement and understanding.

Table 2 summarizes the responses from the needs assessment, emphasizing the most effective teaching methodologies that the teachers identified. The teachers observed that the use of multimedia tools, including PowerPoint presentations, animations, and videos, was effective in describing the formation of typhoons. One teacher emphasized the effectiveness of "animations and videos" in teaching students on typhoons, while others emphasized the significance of multimedia in answering misconceptions regarding the subject matter.

Hands-on experiments were frequently identified as effective strategies in addition to multimedia. Teachers emphasized that "hands-on experiments help explain typhoon formation effectively," and others observed that participating in such activities enhances student engagement and understanding. This is consistent with the findings of Bonwell and Eison (1991), who discovered that active learning methods, such as hands-on experiments, are essential for promoting improved understanding and addressing misconceptions in science education.

Table 2 Responses of the Need Assessment

| Questions | Responses |
|---|---|
| In your experience, what are the most effective methods for teaching natural phenomena like typhoon formation? | “Showing presentations using videos, animations, slide shows that explain typhoon formation." (NA1)<br>"Videos, animations, slide shows." (NA5)<br>"Multimedia such as animation and videos." (NA7)<br>"Videos and animations are effective tools for teaching typhoons." (NA9)<br>"Hands-on experiments help explain typhoon formation effectively." (NA2, NA6)<br>"Engaging in hands-on tasks improves student understanding." (NA8)<br>"Using hands-on experiments makes learning more engaging." (NA4) |
| How do you currently address misconceptions that students have about typhoon formation? | "Interactive activities such as Think-Pair-Share help clarify misconceptions." (NA4)<br>"Hands-on experiments and manipulatives work effectively to address misunderstandings." (NA2, NA6)<br>"Interactive learning promotes conceptual clarity and addresses misconceptions effectively." (NA3, NA8) |
| What strategies do you find most successful? | “Videos and animations are helpful in clearing misconceptions." (NA9)<br>"Online resources like YouTube videos are useful in addressing student errors." (NA7)<br>"Using DepEd materials supports accurate understanding." (NA5)<br>“Providing clear definition prevent misunderstanding of typhoon formation.” (NA5) |
| What are your expectations regarding the use of Interactive Videos in teaching typhoon formation? | “Interactive videos help students actively participate and stay focused." (NA1, NA5)<br>"They encourage student engagement and motivation to learn." (NA4, NA7)<br>"Using interactive videos enhances conceptual understanding and retention." (NA1, NA7)<br>"Interactive videos allow students to visualize complex concepts more easily." (NA6, NA8)<br>"Interactive videos simplify teaching and make typhoon concepts easier to explain." (NA1)<br>"They help connect theory with practical examples through simulations and real-world applications." (NA3, NA7) |

Additionally, teachers expressed high expectations for the utilization of interactive videos in their teaching of typhoon formation. A teacher asserted that interactive videos "enhance conceptual understanding and retention" and "simplify teaching," while others observed that they "help students actively participate and stay focused." This is consistent with the results of Mayer (2009), who stressed the effectiveness of multimedia in enhancing the retention and understanding of complex scientific concepts. Furthermore, Zhang et al. (2016) conducted research that substantiates the teacher's perspective by illustrating that interactive videos considerably improve student engagement and motivation, thereby enhancing learning outcomes.

Overall, the teachers' responses emphasize the significance of incorporating multimedia and interactive strategies into the teaching of natural phenomena, as they have the potential to improve both student engagement and conceptual understanding. The information obtained from this study is essential for the development of interactive videos that are consistent with the learning requirements of students and the preferences of teachers.

### 3.2 Evaluation of Interactive Videos

The evaluation of the developed interactive videos focused on four essential factors: content, cognitive load, engagement, and technical design. The evaluation aimed to assess how effectively the videos expressed information, engaged Grade 8 learners, and met the technical standards appropriate for educational use. The assessment evaluated if the videos successfully balanced content and simplicity to prevent overwhelming learners, incorporated interactive elements to encourage engagement, and complied with technical standards that improve the overall viewing and learning experience. The analysis of these criteria was conducted in accordance with established principles of multimedia learning, ensuring that the videos address the needs of their intended audience effectively.

Table 3: Evaluators' Rating of the Developed Interactive Videos

| Factor | Mean | Description |
|---|---|---|
| Content | 3.96 | Excellent |
| Cognitive Load | 3.85 | Excellent |
| Engagement | 3.90 | Excellent |
| Technical Design | 3.88 | Excellent |
| ***Overall Average*** | **3.90** | **Excellent** |

Note. *1.00-1.74-Poor 1.75-2.49-Satisfactory 2.50-3.24-Very Satisfactory 3.25-4.00-Excellent*

Table 3 displays the summary results of the evaluation assessed by the panel of evaluators. The interactive videos attained an overall mean score of 3.90, classified as excellent. All factors—Content, Cognitive Load, Engagement, and Technical Design—achieved excellent evaluations, indicating significant enhancements.

The content factor obtained a mean score of 3.96, which is indicative of the material's appropriateness and clarity. This rating suggests that the videos effectively and easily conveyed complex concepts, including the formation of typhoons. These concepts were simplified and clarified through the use of interactive multimedia elements. Paivio's Dual Coding Theory (Clark & Paivio, 1991) suggests that learners process information more efficiently when both verbal and visual elements are utilized, which is consistent with this. The videos enhanced understanding and reduced cognitive fatigue by integrating visual and verbal cues.

The cognitive load was rated with a mean score of 3.85, indicating that the revisions improved the accessibility and clarity of the interactive videos. Modifications involved the addition of subtitles, which enhanced understanding, especially for students who benefit from visual support. This is consistent with Paivio's Dual Coding Theory (Clark & Paivio, 1991), which states that learners process information more efficiently when it is delivered through both verbal and visual methods. The revision enhanced the use of visuals by incorporating realistic representations of typhoons to clarify complex concepts. The enhancements are supported by Baddeley's Working Memory Model (Baddeley, 1992), which emphasizes the importance of visual and auditory channels in the effective processing and retention of information, which minimizes cognitive strain.

The engagement factor received the highest rating, with a mean score of 3.90, emphasizing the effectiveness of the revisions in sustaining learner interest. The addition of open-ended questions, along with multiple-choice formats, supported critical thinking and participation. The revisions correspond with Vygotsky's Social Constructivism, emphasizing the significance of interactive dialogue and collaborative learning in student engagement. Improvements to the pacing and clarity of the voiceover were implemented, responding to concerns identified in the initial evaluation. The modifications ensured that

the interactive videos were comprehensible and engaging, with a conversational tone that aligned with the Personalization Principle from Mayer's framework.

The technical design attained a mean score of 3.88, suggesting the developed production quality of the revised interactive videos. Adjustments in volume levels and the synchronization of audio with visuals contributed to this rating. The refinements correspond with Moreno and Mayer's Multimedia Principle, which claims that integrating words and visuals improves comprehension. The precise arrangement of text and visuals in close proximity conforms to the Contiguity Principle, facilitating learners' ability to associate textual explanations with relevant images. The incorporation of audio-visual effects and precisely timed animations enhanced the overall technical quality. Ramsden (1992) supports this assertion, stating the importance of well-designed technical elements in instructional materials for sustaining learner engagement and comprehension

In summary, the evaluation results show that the interactive videos successfully achieve a balance between content complexity, engagement, thus technical quality, thus providing a comprehensive learning experience for Grade 8 students. The findings emphasize the significance of considering interactive video design that incorporates multimedia principles to enhance both educational effectiveness and learner involvement.

## 4. Conclusion

This study emphasizes the effectiveness of interactive videos, specifically those developed with Edpuzzle, to improve Grade 8 students' understanding of typhoon formation concepts. The interactive videos engaged students and improved their understanding of complex natural processes by incorporating embedded quizzes and interactive features. Luther's Multimedia Development Model provided a systematic approach to content development, resulting in videos that are both academically sound and technically robust. The findings show that well-designed interactive multimedia tools can significantly enhance student engagement, knowledge retention, and critical thinking skills, particularly in subjects like Earth Science.

The study emphasizes the importance of continuous improvement and modification of educational resources. Feedback from evaluators led to revisions that improved the content, cognitive load, engagement, and technical design of the videos, leading to an excellent overall rating. The enhancements align with established educational theories, such as Mayer's Multimedia Principles and Vygotsky's Social Constructivism, demonstrating the significance of interactive and visually supported learning. The integration of these tools into the science curriculum enhances academic performance and is essential for disaster preparedness, particularly in typhoon-prone regions like the Philippines. This study advocates for a greater use of interactive multimedia in science education to improve understanding and engagement among learners.

## 5. Acknowledgement

I extend my heartfelt appreciation to those who played a significant role in the completion of this thesis:

To my advisers, Joy Magsayo and Dr. Jun Karren V. Caparoso, for their constant assistance and for giving insightful and thoughtful suggestions that greatly enriched the research.".

To my panel members, Ellen J. Castro, Sotero O. Malayao Jr., and Elesar V. Malicoban, for their valuable feedback and constructive critiques.

To MSU-IIT and DOST-CBPSME for their support and resources, which were instrumental in the success of this study.

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