Incorporating Technology in 4th Grade Science: Plant Structure and Function Unit

Thomas Sauer

Colorado State University-Global Campus

Dr. James Brown

October 5, 2025

Incorporating Technology in 4th Grade Science: Plant Structure and Function Unit

Evaluating the Current Scenario

Current Technology Use Analysis

Mr. Brown's current approach, which involves using PowerPoint presentations and online videos, represents a foundational level of technology integration in his 4th-grade science classroom. Research indicates that while PowerPoint presentations can improve student attitudes toward instruction and class presentations, they may not significantly enhance learning outcomes when used in isolation (Nouri & Shahid, 2005). The study found that PowerPoint presentations primarily affected student perceptions of the instructor rather than improving short-term or long-term memory retention. This suggests that Mr. Brown's current approach, while beneficial for engagement, may not be maximizing learning potential.

The use of online educational videos shows promise, as demonstrated in studies examining their impact on student learning. Gerhart and Anderton (2021) found that educational videos featuring contemporary scientific research could reinforce topics introduced in lecture while providing students with novel insights into the nature of scientific research. However, their research emphasizes the importance of selecting videos that incorporate documentary-style filming, clear links to course content, and charismatic narrators to maximize student engagement.

Areas for Improvement

The current educational environment shows multiple opportunities to improve technology implementation. The absence of interactive features in the current system prevents students from fully participating in class activities. The classroom lacks digital tools that prevent students from learning from each other through peer-to-peer interactions. The classroom also lacks systems to create personalized learning plans, which would support students with different learning needs

and preferences. Students need to observe plant structures closely as they learn about different plant types and their functional relationships during the "Plant Structure and Function" unit. The educational content provided through.

Technology Integration Plan

Selected Digital Tools

The integration plan selects Nearpod for interactive presentations, while Plant static presentations and videos fail to deliver the necessary hands-on experience that students need to understand botanical concepts deeply. A net mobile application for plant identification and Padlet are used for collaborative learning and feedback to achieve unit objectives and research evidence. Nearpod stands out as the best platform for interactive presentations because Le and Doan (2023) proved in their research that this platform boosts student participation in virtual learning environments. The research showed that Nearpod's interactive features, including polls, draw-it tools, matching pairs, quizzes, and open-ended questions, enable students to participate actively while teachers receive immediate feedback (Alawadhi & Thabet, 2023).

The PlantNet mobile application provides students with authentic plant identification experiences that meet the requirements of biodiversity education. The research by Coşkunserçe (2024) demonstrates that utilizing mobile plant identification tools in conjunction with outdoor learning approaches enables students to learn more about plants and develop more effective biodiversity-related behaviors. Students can use the application to identify plants by examining their leaves and flowers, sharing their observations and feedback, and reflecting on their thoughts with each other. Rath (2025) found, through his research and findings, that they enable an in-depth exploration of botany.

The platform Padlet enables students to engage in asynchronous and anonymous communication, allowing them to have in-depth discussions while increasing their participation and receiving helpful feedback from their peers. Students can use the platform to combine various media formats, including images, drawings, and written notes, into a single shared collaborative space.

Alignment with Learning Objectives

The chosen digital resources establish a unified system that directly supports the primary educational targets of plant identification and functional comprehension. The interactive features of Nearpod help students learn plant structure identification through various activities, including polls, matching games, and drawing exercises, which use multiple learning methods. Students can apply theoretical knowledge by identifying actual plants in their surroundings using PlantNet, connecting classroom education to real scientific work. The practical application of learning about plant diversity and structural differences becomes more effective because of this real-world connection. Students use Padlet to combine their findings and discuss their observations about plant structure functions through peer-to-peer interactions. The combination of these tools enables students to learn through multiple points while supporting different learning approaches and encouraging direct involvement with botanical subjects.

Detailed Lesson Plan

Unit Overview: Plant Structure and Function (5-day sequence)

Day 1: Introduction to Plant Structures

- **Opening Activity (10 minutes):** Nearpod poll - "What plant parts can you name?"
- **Interactive Presentation (20 minutes):** Nearpod presentation introducing the four primary plant parts

    - Virtual field trip slides showing various plants
    - Draw-it activity: Students sketch a plant and label known parts
    - Matching activity: Plant parts to their primary functions
- **Hands-on Exploration (15 minutes):** Students examine real plant specimens
- **Digital Documentation (10 minutes):** Students photograph specimens and upload to the class Padlet
- **Closure (5 minutes):** Exit ticket via Nearpod - One thing learned, one question

Day 2: Root Systems Investigation

- **Review (5 minutes):** Nearpod quiz on previous day's content
- **Root Function Exploration (20 minutes):** Interactive presentation on root types and functions
    - Virtual microscopy images of root structures
    - Collaborative board activity: Students add examples of different root systems
- **Field Investigation (20 minutes):** Using PlantNet to identify plants around school grounds
    - Focus on observing and photographing root systems where visible
    - Students work in pairs with tablets/smartphones
- **Digital Sharing (10 minutes):** Upload findings to Padlet with observations
- **Reflection (5 minutes):** Open-ended Nearpod response about root function discoveries

Day 3: Stem Structures and Functions

- **Engagement (10 minutes):** Nearpod presentation with time-lapse videos of plant growth
- **Investigation Activity (25 minutes):**
    - Virtual stem cross-section exploration

    - Students use PlantNet to identify woody vs. herbaceous stems in the school environment
    - Collaborative data collection on stem variations
- **Digital Analysis (10 minutes):** Students compare findings on Padlet
- **Assessment (5 minutes):** Quick formative assessment via Nearpod matching activity

Day 4: Leaf Structure and Photosynthesis

- **Hook (5 minutes):** Nearpod poll on leaf shapes students have observed
- **Interactive Lesson (25 minutes):**
    - Virtual leaf structure exploration with Nearpod
    - PlantNet identification of leaves with different shapes and arrangements
    - Students create digital leaf collections with photographs and descriptions
- **Collaborative Analysis (15 minutes):** Padlet discussion on leaf variation patterns
- **Synthesis (5 minutes):** Students share one surprising discovery via Nearpod

Day 5: Flower Functions and Plant Reproduction

- **Review Game (10 minutes):** Nearpod quiz covering all plant parts
- **Flower Investigation (20 minutes):**
    - Interactive presentation on flower structures and reproduction
    - PlantNet identification of flowering plants (seasonal availability permitting)
    - Virtual dissection of flower parts
- **Culminating Project (20 minutes):** Students create digital plant profiles on Padlet
    - Include photographs, PlantNet identification results, and functional descriptions
- **Sharing and Reflection (10 minutes):** Gallery Walk of digital plant profiles
    - Peer feedback using Padlet commenting features

Differentiation Strategies

The lesson plan supports diverse learning needs through a range of instructional approaches. Visual students learn best from interactive presentations that combine with plant photographs. Students who learn best through touch activities participate in plant observation sessions and outdoor fieldwork. The learning process for auditory students includes both group discussions and verbal information exchange. Students who need extra help can work together while using visual aids, while advanced learners can utilize PlantNet to study a broader range of plant species.

Addressing Implementation Challenges

Technology Accessibility Strategy

The plan for technology accessibility requires both device management strategies and backup educational methods because of restricted access to technology. The first approach to device management involves alternating student groups between PlantNet identification tasks and plant examination activities. The system allows every student to experience both digital and traditional botanical exploration techniques. The second approach relies on utilizing the technology resources that students already possess. Research shows that students possess smartphones and tablets as home devices (Wäldchen et al., 2018). Students can complete PlantNet exploration tasks at home with their family members through optional homework assignments, which link classroom learning to home activities while supporting different levels of technology equipment availability.

Digital Literacy Development

Students need help to master new application systems effectively. The first strategy for application support involves students who understand technology to help their peers learn how to

use these programs. Students develop digital competencies while gaining social learning experiences through this collaborative teaching method. The second teaching method provides step-by-step guidance that begins with basic application functions before progressing to more complex capabilities. Students begin with PlantNet's fundamental plant identification tools before advancing to search and documentation features.

Assessment and Evaluation Methods

Formative Assessment Through Technology Integration

The Nearpod assessment system enables teachers to monitor student responses in real-time through its continuous formative assessment feature. Research shows that digital platforms help teachers deliver instant feedback, enabling them to modify their teaching methods based on students' comprehension levels (Le & Doan, 2023). Teachers can track student responses to polls, quizzes, and open-ended questions during each lesson to detect misunderstandings, which guide their teaching adjustments. The platform's reporting tools enable teachers to monitor student development at an individual level, allowing them to create data-driven plans for teaching diverse students. The real-time assessment system of this platform converts traditional delayed feedback into immediate teaching responses.

Teachers utilize Padlet contributions as continuous formative assessments to gauge student understanding through written reflections, photo annotations, and peer interactions. The platform enables teachers to assess students' learning progress while also monitoring how students collaborate in groups. The platform demonstrates how students enhance each other's work through their interactions, while teachers can provide feedback that indicates their scientific communication skills are developing. The asynchronous nature of Padlet enables

students to think carefully before revising their work, as it provides sufficient time for processing.

Summative Assessment Integration

The digital plant profile project serves as a comprehensive summative evaluation, assessing students' ability to identify plants using PlantNet, their knowledge of botany, and their skills in digital communication. Students demonstrate their understanding by correctly identifying plant structures and explaining the functional connections between them, as well as by presenting their findings through multimedia content. The assessment method replicates real-world scientific work, as scientists utilize digital platforms and multimedia presentations to document and disseminate their research findings. The project rubric assesses both scientific accuracy and digital literacy skills to provide comprehensive feedback on 21st-century learning competencies.

A traditional summative assessment provides students with the opportunity to demonstrate their knowledge without requiring access to technology. The combination of digital and traditional assessment methods provides a comprehensive evaluation, supporting students with diverse learning preferences and varying technology access capabilities. The assessment combination enables teachers to evaluate student performance through various methods, which helps them identify students' strengths in specific formats and make more informed instructional choices.

Professional Development Recommendations

Technology Integration Training

Mr. Brown requires professional training in the implementation of educational technology, with a focus on interactive presentation software and mobile learning platforms. The

educational potential of Nearpod will reach its maximum when Mr. Brown learns to create lessons and analyze data through its advanced features. Understanding mobile application integration in science education will enable Mr. Brown to create more effective outdoor learning experiences. Professional development in botanical education apps and their pedagogical applications will provide Mr. Brown with additional tools to teach students about nature-based learning.

Collaborative Learning Facilitation

The implementation of Padlet requires teachers to receive professional development about effective collaborative learning methods. The training program should teach methods for leading productive virtual classroom discussions, maintaining digital classroom order, and instructing students on providing helpful peer feedback. Research by Rath (2025) on feedback literacy in educational environments indicates that teachers require proper training to facilitate effective collaboration and critical thinking among students. The training should teach methods to support students during their online interactions while building secure digital learning spaces.

References

Alawadhi, A., & Thabet, R. A. (2023). Using Nearpod to Promote Engagement in Online ESL Classes: A Mixed-Methods Study in the Context of Higher Education. In K. Al Marri, F. Mir, S. David, & A. Aljuboori (Eds.), *BUiD Doctoral Research Conference 2022: Multidisciplinary Studies* (pp. 117–129). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-27462-6_11

Coşkunserçe, O. (2024). Use of a mobile plant identification application and the out-of-school learning method in biodiversity education. *Ecology and Evolution*, *14*(4), e10957. https://doi.org/10.1002/ece3.10957

Gerhart, L. M., & Anderton, B. N. (2021). Engaging students through online video homework assignments: A case study in a large-enrollment ecology and evolution course. *Ecology and Evolution*, *11*(11), 5777–5789. https://doi.org/10.1002/ece3.7547

Le, H. H. V., & Doan, T. K. O. (2023). EFL Students' Perceptions of Using Nearpod in Online English Learning. *ICTE Conference Proceedings*, *3*, 98–117. https://doi.org/10.54855/ictep.2338

Nouri, H., & Shahid, A. (2005). The effect of PowerPoint presentations on student learning and attitudes. *Global Perspectives on Accounting Education*, *2*, 53–73. https://www.wcu.edu/gpae/vol2/04-046%20The%20Effect%20of%20PowerPoint%20Presentations%20on%20Student%20Learning.pdf

Rath, A. (2025). Padlet: a tool for fostering collaborative learning and feedback literacy in dental education. *Frontiers in Medicine*, *11*, 1357068. https://doi.org/10.3389/fmed.2024.1357068

Wäldchen, J., Rzanny, M., Seeland, M., & Mäder, P. (2018). Automated plant species identification-Trends and future directions. *PLoS Computational Biology*, *14*(4), e1005993. https://doi.org/10.1371/journal.pcbi.1005993