

Needs Analysis: Development of an Interactive Digital Storybook in Teaching Mixtures and their Characteristics among Grade 6 Learners

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ABSTRACT

Scientific literacy is a critical skill in the 21st century, yet many Filipino learners struggle to comprehend scientific concepts due to poor reading comprehension and limited access to engaging instructional materials. This study aimed to assess the needs for developing an Interactive Digital Storybook (IDS) as a supplementary tool for teaching *Mixtures and Their Characteristics* among Grade 6 learners. Utilizing a descriptive quantitative design with qualitative support, the research focused on the Define Phase of the 4D Model. Six in-service science teachers from a public elementary school in the West I District of Iligan City served as key informants, selected through purposive sampling. Data were collected using a validated Needs Assessment Questionnaire and analyzed through descriptive statistics and thematic analysis. Findings revealed that learners encounter significant difficulties in understanding mixtures due to the abstract and conceptual nature of the topic, limited visual and hands-on learning experiences, and persistent misconceptions. Teachers reported challenges such as lack of engaging and contextualized materials, low reading comprehension among learners, and limited access to technology. Despite minimal familiarity with digital storybooks, teachers perceived IDS as a useful, engaging, and motivating instructional tool that could enhance comprehension and accessibility in science learning. The study concludes that there is a strong need to design and develop an IDS aligned with curriculum standards to promote inclusive, interactive, and literacy-integrated science instruction, forming a foundation for the succeeding phases of the IDS development process.

Keywords: 4D Model; Grade 6 Learners; Interactive Digital Storybook; Mixtures and Their Characteristics; Needs Analysis; Reading Comprehension; Science Education

INTRODUCTION

Imagine a world where understanding scientific ideas feels like deciphering a secret code. For many learners, this is not just a metaphor but a daily experience. Scientific literacy—the ability to analyze, reason, and make informed decisions about science-related issues—is crucial for active participation in modern society. However, students with limited reading comprehension skills often find it difficult to access and interpret scientific information (Asih et al., 2018). This challenge is particularly evident in Chemistry, especially in the topic Mixtures and Their Characteristics, where learning requires both analytical reasoning and comprehension of scientific texts.

One of the essential components of scientific literacy is the ability to comprehend scientific texts. As Palines (2021) emphasized, low scientific literacy is often rooted in poor reading comprehension, a persistent problem worldwide and in the Philippines. The Technology-Based Divisional Quarterly Assessment of Schools System (TB-DQASS) for School Year 2023–2024 identified Mixtures and Their Characteristics as one of the least-mastered competencies among Grade 6 learners. This concern is consistent with international assessments: the Programme for International Student Assessment (PISA 2022) ranked the Philippines 76th out of 81 countries

in reading comprehension and among the lowest in science literacy (OECD, 2022), while the Trends in International Mathematics and Science Study (TIMSS 2019) revealed that 87% of Filipino learners failed to demonstrate even basic understanding of scientific concepts (TIMSS, 2021).

These findings underscore that students' difficulties in science are not merely due to content complexity but are also rooted in literacy gaps. Reading comprehension and science learning are interdependent (Neri et al., 2019), a relationship that becomes especially evident when students encounter abstract Chemistry concepts such as mixtures. Homogeneous mixtures, for instance, are hard to visualize because their components are not visible to the naked eye. Cahyanto et al. (2019) reported that more than half of students (52.31%) demonstrated incomplete understanding when distinguishing between homogeneous and heterogeneous mixtures. Moreover, Fernando (2022) found that many learners perceive Chemistry as difficult and uninteresting due to complex terminology, leading to decreased motivation and engagement in class.

Recognizing these challenges, the Department of Education (DepEd) continues to promote reading programs that enhance comprehension and strengthen scientific literacy (DepEd, 2015). Teachers are encouraged to adopt innovative instructional strategies that foster inclusivity, engagement, and interactivity (Salic et al., 2024). However, while strategies such as project-based and inquiry-based learning have been beneficial, they often lack tools that directly support reading comprehension within science contexts.

Amid these challenges, the integration of Interactive Digital Storybooks (IDS) presents a promising approach to improving both literacy and conceptual understanding. IDS combine text, visuals, audio, and interactivity to create immersive learning experiences (Faster Capital, 2025). Grounded in the Cognitive Theory of Multimedia Learning (Abdul Samat, 2022), IDS enhance comprehension by engaging learners through multiple modes of input. Smeda et al. (2014) found that digital storytelling improves academic performance, creativity, and critical thinking, while Tamimi (2024) highlighted its benefits in enhancing language proficiency and learner motivation. Despite these advantages, limited research has examined the use of IDS in teaching scientific concepts such as mixtures. Most studies focus on language and literacy instruction, leaving a gap in understanding how digital storybooks can support conceptual science learning. Furthermore, Bouchrika (2025) observed that many IDS applications face challenges in accessibility, content alignment, and teacher readiness.

Given these gaps, it becomes essential to explore teachers' perspectives and instructional needs before developing an IDS tailored for science education. Understanding these needs will ensure that the material is relevant, pedagogically sound, and responsive to classroom realities.

Therefore, this study aims to assess the needs for an Interactive Digital Storybook (IDS) in teaching mixtures and their characteristics among science teachers. By identifying teachers' instructional challenges, preferred content features, and readiness for technology integration, the findings will serve as a foundation for designing a digital learning tool that aligns with curriculum standards and supports both conceptual understanding and literacy development.

In doing so, the study contributes to the realization of the United Nations Sustainable Development Goals (SDGs)—specifically SDG 4 (Quality Education) by promoting inclusive and equitable learning opportunities, SDG 9 (Industry, Innovation, and Infrastructure) by fostering innovation through educational technology, and SDG 10 (Reduced Inequalities) by addressing learning gaps in under-resourced contexts (Modi et al., 2024). By aligning with these global goals, the study not only addresses a national educational concern but also advances the broader vision of sustainable, equitable, and technology-enhanced science education.

METHODOLOGY

Research Design

This study employed a descriptive quantitative design with qualitative support, anchored in the developmental research framework—specifically the Define Phase of the 4D Model (Define, Design, Develop, and Disseminate). The study focused solely on the needs analysis component, aiming to determine the requirements,

challenges, and preferences of science teachers regarding the development of an Interactive Digital Storybook (IDS) for teaching Mixtures and Their Characteristics in Grade 6 Science. Descriptive research was deemed appropriate because it allows for systematic identification and analysis of teachers' instructional needs, providing baseline data for subsequent phases of IDS design and development.

Research Setting

The study was conducted in a selected public elementary school in the West I District of Iligan City, Lanao del Norte, during the School Year 2025–2026. The school serves learners from kindergarten to Grade 6 and has a population of approximately 957 students and 31 teachers. The site was chosen for its accessibility, availability of digital teaching resources, and inclusion of teachers handling Grade 6 Science classes under the “Matter” learning area, where the topic Mixtures and Their Characteristics is covered in the first quarter.

Respondents of the Study

The respondents consisted of six (6) in-service science teachers who were selected through purposive sampling based on the following criteria:

currently teaching Science in elementary level;

has at least five (5) years of teaching experience; and

has prior experience in using digital or multimedia-based instructional materials in teaching.

These teachers were considered key informants, as they possess relevant classroom experience and insights into learners' difficulties, instructional practices, and technology integration challenges. Their responses provided valuable input for identifying the pedagogical and technical requirements of the proposed IDS.

Research Instrument

The main instrument used was a Needs Assessment Questionnaire for Science Teachers, adapted and modified from Jumawan (2022) and aligned with the principles of the Cognitive Theory of Multimedia Learning (Mayer & Fiorella, 2014). The instrument contained two parts: (1) demographic and professional profile of teachers, and (2) statements measuring instructional needs, challenges, and preferences related to digital storybook integration in science. The items utilized a four-point Likert scale (1 – Strongly Disagree to 4 – Strongly Agree), supported by open-ended questions to capture qualitative insights. The questionnaire underwent expert validation by science educators and ICT specialists to ensure content accuracy and relevance before administration.

Data Gathering Procedure

Prior to data collection, formal letters were sent to the Schools Division Superintendent and the School Principal to request permission to conduct the study. Upon approval, the researcher personally administered the survey to the teacher-respondents and explained the study's purpose and confidentiality provisions. Respondents were informed of their right to refuse or withdraw participation at any time without penalty.

Data collection focused on determining the teachers' perceptions of students' difficulties with the topic, current instructional practices, available resources, and perceived need for an Interactive Digital Storybook (IDS) as a supplementary teaching tool. Responses to quantitative items were tabulated and analyzed statistically, while open-ended responses were examined qualitatively to identify common themes.

Data Analysis

Quantitative data from the questionnaire were analyzed using descriptive statistics, particularly mean and standard deviation, to summarize teachers' levels of agreement and perceived needs.

The following scale was used for interpretation:

Mean Interval	Description
3.25 – 4.00	Strongly Needed
2.50 – 3.24	Moderately Needed
1.75 – 2.49	Slightly Needed
1.00 – 1.74	Not Needed

Qualitative data from open-ended responses were analyzed through thematic analysis (Caulfield, 2023), which involved identifying recurring ideas and clustering them into themes such as content gaps, pedagogical needs, and preferred digital features. The integration of both quantitative and qualitative findings provided a comprehensive view of teachers’ needs regarding IDS integration in science instruction.

Ethical Considerations

This study strictly adhered to established ethical standards for educational research (Creswell & Creswell, 2018; Cohen et al., 2018). Participation was voluntary, and informed consent was obtained from all respondents. Data were anonymized using code identifiers (e.g., K1–K6) to ensure confidentiality. Responses were stored in password-protected files accessible only to the researcher. The study posed minimal risk to participants and aimed to generate constructive insights for instructional improvement rather than evaluative judgments.

RESULTS AND DISCUSSIONS

Summary of Key Informants’ Needs Assessment Results

The six (6) in-service Grade 6 Science Teachers were among the respondents in the need’s assessment survey. To ensure respondent privacy, the study employed data coding, where K1, K2, K3, K4, K5 and K6 referred to the Grade 6 Teacher Handling Science Subject 6.

Table 1 Summary of Identified Learning Competency with the Most Difficulty and Misconceptions Among Learners

Learning Competencies	F	%
Describe the appearance and uses uniform and non-uniform mixtures (S6MT-Ia-c-1)	4	66.67
Enumerate techniques in separating mixtures such as decantation, evaporation, filtering, sieving and using magnet; and (S6MT-Id-f-2)	2	33.33
Tell the benefits of separating mixtures from products in community (S6MT-Ig-j-3)	0	0
Overall	6	100

Table 1 presents the teachers’ responses on the learning competencies where learners experience the most difficulty and misconceptions. The competency “Describe the appearance and uses of uniform and non-uniform mixtures” recorded the highest difficulty with four (4) responses or 66.67%, which implies that learners struggle most in distinguishing and describing mixtures. The competency “Enumerate techniques in separating mixtures” followed with two (2) responses or 33.33% suggesting challenges in recalling or applying separation methods. Meanwhile, “Tell the benefits of separating mixtures in the community” received zero (0) responses, showing that learners generally understand this concept well, likely due to its real-life relevance.

Thus, misconceptions are most evident in learners’ conceptual understanding of mixtures, followed by difficulties in separation techniques, while competencies linked to everyday applications are better understood.

Table 2 Summary of the Responses of the Key Informants on Difficulties of Learners in learning the Competencies

Themes	Codes	Mentions	Utterances
Conceptual Complexity and Abstract Nature	Difficulty in understanding concepts; Abstract ideas; Complexity of mixtures	3	K1: Learners have difficulty of learning the concept and connecting these concepts to everyday life. Mixtures and its classifications can be complex to learners making it challenging to visualize and understand between two mixtures. K3: It is often the most confusing for learners because it involves abstract concepts and requires distinguishing between similar separation techniques such as decantation, filtration, and evaporation based on properties like solubility, particle size, and density. K5: Understanding the underlying principles—such as differences in particle size, solubility, or magnetic properties—can be abstract and difficult to grasp initially.
Misconceptions and Confusion	Misunderstandings; Difficulty differentiating techniques	2	K2: Because of some misconceptions on the topic. K6: Maybe confused on different techniques.
Lack of Hands-on and Visual Learning Opportunities	Limited practical activities; Lack of visual aids	2	K3: Without hands-on experience or visual aids, learners may struggle to grasp when and how to apply each method effectively. K5: Limited opportunities for practical experimentation can hinder understanding and confidence.
Learner Readiness and Academic Gaps	Below grade-level readiness; Foundational gaps	1	K4: Some of my learners are behind in their grade level.

Table 2 presents the responses of the key informants on the difficulties of learners in learning the competencies. Based from the table, their responses reveal four major themes underlying the learners' difficulties in mastering the competencies in grade 6 science, particularly on describing the appearances and uses of uniform and non-uniform mixtures.

The most frequently mentioned theme is conceptual complexity and abstract nature. Teachers emphasized that learners find it difficult to understand and visualize the concepts of mixtures, particularly in distinguishing between uniform and non-uniform types. Learners also struggle with the underlying principles, such as solubility, particle size, and density. This finding implies that learners face challenges in bridging scientific theories with real-world examples, resulting in persistent misconceptions and incomplete understanding. This aligns with the findings of Taber (2015), who emphasized that science topics involving microscopic properties are particularly prone to learner difficulties due to their abstractness.

The Second most prominent theme is the lack of hands-on and visual learning opportunities. Several teachers underscored that the absence of practical experimentation and visual aids hinders learners' ability to fully grasp how mixtures are separated in practice. Without engaging, experiential approaches, the topic remains theoretical and difficult for students to internalize. This indicates that learners' understanding could be improved by integrating interactive activities, simulations, and laboratory-based exercises. This is supported by Hofstein and Lunetta (2004), who highlighted that laboratory and hands-on activities significantly enhance students'

conceptual understanding and engagement in science. Moreover, visual aids and interactive learning tools have also been shown to reduce cognitive load and support comprehension of complex concepts (Mayer, 2009).

The third theme identified is misconceptions and confusion. Some learners hold inaccurate preconceptions about mixtures, while others become confused when differentiating among similar separation methods such as decantation, filtration, and evaporation. According to Driver et al. (1994), misconceptions in science are common because learners tend to construct their own explanations based on everyday experiences, which may conflict with scientific views. This confusion highlights the need for teachers to diagnose and correct misconceptions early in the learning process through reinforcement and clarification.

Lastly, learner readiness and academic gaps were reported as an additional source of difficulty. Teachers observed that some students are performing below the expected grade-level standards, which affects their ability to cope with the abstract and technical aspects of the topic. Vygotsky's (1978) concept of the Zone of Proximal Development (ZPD) underscores that learners require targeted support to bridge the gap between what they can do independently and what they can achieve with guidance. Thus, scaffolding, remediation, and differentiated instruction in addressing learners' diverse levels of readiness is important.

Overall, the result demonstrates that the difficulties in learning mixtures and their classifications are primarily rooted in the abstractness of the concepts and are further compounded by the lack of experiential learning, misconceptions, and learner readiness gaps. These highlights the necessity of adopting contextualized, learner-centered and activity-based strategies to enhance and reduce misconceptions in science learning.

Table 3 Summary of the Key Informants Responses on the Teaching Strategies Used when Discussing Mixtures and their Characteristics

Teaching Strategies	F	%
Traditional lecture and discussion	3	21.43
Visual aids (e.g., charts, diagrams)	2	14.29
Interactive activities (e.g., experiments, hands-on demonstrations)	5	35.71
Digital tools (e.g., videos, apps, or simulations)	4	28.57
Others: _____	0	0
Overall	14	100

Table 3 presents the summary of the key informants' responses on the teaching strategies used when discussing mixtures and their characteristics. The findings reveal that interactive activities such as experiments and hands-on demonstrations are the most frequently used teaching strategy ($f=5$). This indicates that teachers prefer active, learner-centered approaches to make abstract scientific concepts on mixtures more tangible and relatable to students. These strategies align with constructivist learning theories (Piaget, 1972; Vygotsky, 1978), which posit that learners actively construct knowledge through direct experiences and social interaction. Engaging learners in inquiry-based and experiential tasks fosters deeper understanding of mixtures and their characteristics (Bybee et al., 2006).

Meanwhile, digital tools such as videos, apps, and simulations rank second ($f=4$), showing that teachers increasingly integrate technology into their instruction. This reflects the shift towards digital learning resources that enhance visualization and engagement in science education. The use of videos, apps, and simulations supports visualization of abstract concepts, increases student motivation, and caters to 21st-century learners' digital engagement (Prensky, 2001; Mishra & Koehler, 2006). Digital tools help bridge the gap between traditional methods and interactive learning, creating a more blended and dynamic classroom environment.

Traditional strategies such as lecture and discussion ($f=3$) and the use of visual aids ($f=2$) are still practiced but less dominant. These methods remain supportive in providing foundational explanations and structures content delivery but are often complemented by interactive and technology-based strategies to address diverse learning needs. Although effective for foundational knowledge, they may limit active participation (Orlich et al., 2013).

These findings imply that teachers employ a blended approach that balances traditional instruction with modern, interactive, and digital strategies to enhance student understanding of mixtures and their characteristics.

Table 4 Summary of the Key Informants Responses on the Teaching Challenges Encountered when teaching Mixtures and Their Characteristics

Teaching Challenges	F	%
Students struggle with reading comprehension.	4	28.57
Students find it difficult to differentiate homogeneous and heterogeneous mixtures.	2	14.29
Lack of engaging materials or resources.	5	35.71
Limited access to technology in the classroom.	2	14.29
Others: Limited classroom space to conduct experiments	1	7.14
Overall	14	100

Table 4 presents the responses of the key informants on challenges faced when teaching Mixtures and their Characteristics. The results show that the most common challenge reported by teachers is the lack of engaging materials or resources ($f = 5$), which suggests that the absence of interactive and contextualized teaching tools makes it difficult to sustain students' interest and effectively present the concepts of mixtures. Research by Aksela (2010) and bybee et al. (2006) emphasized that science learning becomes more effective when supported by engaging, inquiry-based, and visual materials that help learners connect abstract concepts to real-life situations. Lacking of such resources makes it difficult for teachers to move beyond rote instruction and foster meaningful understanding.

Another significant issue is that students struggle with reading comprehension ($f = 4$). This challenge directly affects their ability to follow instructions, analyze scientific texts, and understand the characteristics of mixtures. Cervetti and Hiebert (2019) noted that reading comprehension is strongly linked to science achievement, as literacy skills provide the foundation for constructing meaning from scientific texts. Poor comprehension limits students' ability to analyze mixture classifications and apply knowledge to experiments. Reading difficulties often hinder students from fully engaging with science content, which relies heavily on technical vocabulary and comprehension skills.

Additionally, conceptual understanding also presents a difficulty, as some students find it hard to differentiate between homogeneous and heterogeneous mixtures ($f = 2$). This indicates that learners may have misconceptions or limited ability to apply theoretical distinctions in practical contexts. According to Driver et al. (1994), misconceptions are common in science learning, particularly when abstract ideas such as particle distribution in mixtures are introduced. Without sufficient scaffolding, learners may fail to distinguish between uniform and non-uniform mixtures, resulting in superficial understanding.

Furthermore, limited access to technology in the classroom ($f = 2$) restricts teachers from integrating videos, simulations, or digital applications that could enhance visualization and engagement. Finally, a contextual concern was raised regarding limited classroom space for experiments ($f = 1$), which poses a barrier to conducting hands-on activities that are essential in science teaching. This finding aligns with Rodriguez (2021), who highlighted that many Philippine classrooms still face gaps in digital infrastructure, restricting teachers from using simulations, videos, and applications that enhance visualization of concepts like solubility and mixture composition.

With these challenges faced by teachers, it highlight the need for innovative, engaging, and accessible instructional materials—such as interactive digital storybooks—that address comprehension, enhance conceptual understanding, and overcome limitations in resources and learning environments. This is consistent with the call for technology-supported, constructivist-based approaches in contemporary science education (Doolittle & Hicks, 2003; Mishra & Koehler, 2006).

Key Informants Familiarity with Interactive Digital Storybooks

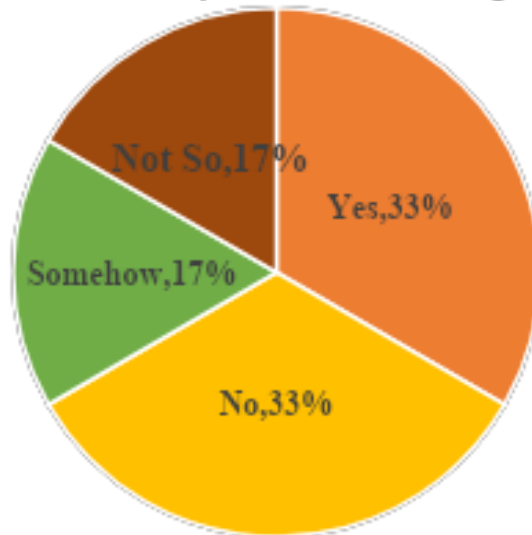


Figure 1. Key Informants Familiarity with Interactive Digital Storybooks

The results reveal varied levels of familiarity among respondents regarding Interactive Digital Storybooks (IDS). Specifically, two respondents reported being familiar with IDS, while two admitted no familiarity. Meanwhile, one respondent indicated partial knowledge (“somehow”), and another noted minimal familiarity (“not so”). This indicates that while a portion of the group is aware of IDS, a majority remain either unfamiliar or only superficially knowledgeable.

This finding reflects the broader challenge of integrating digital innovations in classroom settings. According to Neumann (2018), many teachers and learners are still in the early stages of exposure to digital storybooks, which can hinder their effective utilization in educational contexts. Similarly, Ihmeideh (2014) emphasized that teachers’ limited awareness and training in using digital storybooks often restricts their adoption in science and literacy classrooms. The mixed responses suggest that professional development and targeted training are necessary to bridge this gap.

Moreover, research highlights that familiarity with IDS directly influences their perceived usefulness and integration in teaching (Korat & Shamir, 2012). Teachers who are more knowledgeable are more likely to use IDS as an engaging instructional tool, while those with limited awareness may underutilize or overlook its potential. In the Philippine context, where digital tools are increasingly seen as essential for 21st-century education, building teachers’ awareness and confidence in IDS becomes crucial (Estrella, 2021).

Table 5 Summary of the Responses of the Key Informants on their View of Interactive Digital Storybook

Themes	Codes	Mentions	Utterances
Digital Adaptation of Traditional Storybooks	Digital version of printed storybooks	2	K4: is an interactive and engaging electronic version of a traditional storybook. It leverages technology to enhance the reading experience, going beyond simply presenting text and illustrations." K5: An Interactive Digital Storybook is a digital version of a traditional storybook that engages readers through multimedia elements such as animations, sounds, videos, and interactive features.
Engagement and Interactivity	Interactive and engaging features	3	K1: As the name suggests, storybook that is digitally constructed to make activities more engaging. K2: an app where the k-learner can manipulate.

			K3: I think it is a digital story that allows learners to click, listen, and interact with the content, making reading more engaging and fun.
Uncertainty of Definition	Incomplete understanding	1	K6: Maybe

Table 5 presents responses of the key informants view an Interactive Digital Storybook (IDS) as a technologically enhanced version of traditional storybooks, incorporating features such as animations, sounds, videos, and interactive activities to promote engagement (K4, K5). This is consistent with previous research defining IDS as multimedia-based educational resources that enrich learners' reading experiences and foster comprehension (Shahid et al., 2022; Sung & Wu, 2022).

K1, K2, and K3 highlighted the interactive and participatory role of learners, reflecting constructivist perspectives where learners actively engage with the material by manipulating and exploring digital content. Literature supports that IDS enhances learner motivation and encourages active learning through interactivity (Fang et al., 2023).

However, one response (K6) reveals uncertainty or lack of familiarity with IDS, suggesting that not all teachers share the same conceptual understanding. This highlights the need for professional development and training to ensure that educators are fully equipped to integrate IDS in science instruction effectively.

Key Informants Attendance in Seminars/ Webinars on Interactive Digital Storybook

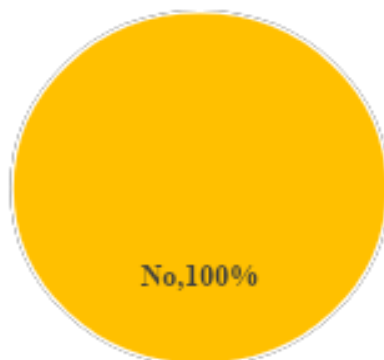


Figure 2. Key Informants Attendance in Seminars/ Webinars on Interactive Digital Storybook

The results indicate that none of the respondents (0) have attended seminars or webinars related to Interactive Digital Storybooks (IDS), while all six reported no prior participation. This finding suggests a complete lack of formal training or professional development opportunities in this area among the respondents.

Lack of exposure is consistent with studies highlighting the limited professional development programs focusing on digital pedagogy in the Philippine education system (Espino-Díaz et al., 2020). Teachers' lack of participation in training directly impacts their capacity to adopt innovative teaching tools such as IDS. According to Tondeur et al. (2016), structured training and professional development are critical in helping teachers integrate digital resources into their teaching practices. Without such opportunities, many educators remain hesitant or underprepared to utilize technology-enhanced instructional strategies.

Furthermore, the lack of professional development in IDS may also contribute to the earlier finding that only a minority of respondents are familiar with IDS. As emphasized by UNESCO (2019), continuous professional learning is essential to equip teachers with digital competencies, particularly in integrating interactive storybooks that support both scientific understanding and literacy. This suggests an urgent need for schools and educational institutions in the Philippines, particularly in Mindanao, to design and implement seminars or training programs that strengthen teachers' knowledge and confidence in using IDS as part of 21st-century science instruction.

Table 6 Summary of the Key Informants Responses on the Usefulness of Interactive Digital Storybook (IDS) in Teaching Mixtures and Their Characteristics

Themes	Codes	Mentions	Utterances
Accessibility and Contextual Learning	Limited access to real-life materials	1	K3, K4, K5: Yes, I believe an Interactive Digital Storybook (IDS) is useful in teaching Mixtures and Their Characteristics, considering our school is in a hinterland area. Our learners have limited access to real-life science materials, so using a digital storybook with visuals and interactive features can help them understand abstract concepts better. I believe it will make the lesson more engaging and accessible, especially when hands-on activities are not always possible.
Engagement and Motivation	Interactive and enjoyable learning	1	K3: Yes, The interactive elements—such as animations, sounds, and clickable features—capture students' attention and make learning more enjoyable. This increased engagement can lead to better understanding and retention of concepts.
Uncertainty of Definition	Incomplete understanding	1	K6: Maybe

Table 6 presents the key informants' responses on the usefulness of interactive digital storybook (IDS) in teaching mixtures and their characteristics which reveals that all six respondents agreed that an Interactive Digital Storybook (IDS) is useful in teaching Mixtures and Their Characteristics. However, two respondents (K1 and K2) simply answered "Yes" without providing specific reasons, suggesting a general acceptance of IDS as a potentially beneficial tool even without deep reflection on its pedagogical role.

Among those who provided explanations (K3, K4, K5), three key themes emerged: accessibility and contextual learning, engagement and motivation, and conceptual understanding.

First theme, IDS was viewed as an important tool for accessibility and contextualized learning. For instance, K3 emphasized that their school is located in a hinterland area where learners have limited access to real-life science materials. This highlights how IDS can serve as a substitute for scarce laboratory resources, enabling students to visualize and understand abstract concepts despite environmental and logistical constraints. This finding aligns with Nguyen et al. (2021), who noted that digital resources enhance science learning in resource-limited settings, and Alkahtani (2017), who stressed the role of technology in bridging gaps where hands-on experiments are not always possible.

Second theme, engagement and motivation was strongly emphasized by K3, who noted that interactive features such as animations, sounds, and clickable tasks make learning more enjoyable and interesting. This supports the claim of Korat and Shamir (2012) and Verhallen et al. (2006) that multimedia storybooks promote active participation and sustain attention, which in turn improve comprehension and retention. Furthermore, Talan (2021) found that digital story-based teaching enhances attitudes and motivation in science classrooms, reinforcing the perception that IDS can increase students' willingness to learn.

Third theme, IDS was recognized as a tool for improving conceptual understanding. Both K3, K4, and K5 suggested that IDS helps learners better grasp complex and abstract scientific concepts. This is consistent with Rafiq and Hashim (2018), who argue that interactive storytelling enhances comprehension by combining narrative and multimedia features, and Iskandar and Rizal (2020), who highlight that stories contextualize knowledge and make science learning more meaningful.

The data suggest that while teachers generally perceive IDS as useful, the strength of their reasoning varies. Those who provided detailed explanations highlighted its role in addressing resource gaps, engaging learners, and deepening conceptual understanding. These findings underscore the potential of IDS as both a pedagogical aid and an equity tool in science education, particularly in marginalized and resource-constrained schools in the Philippines.

CONCLUSION

The findings of this study revealed a strong need for the development of an Interactive Digital Storybook (IDS) as a supplementary tool for teaching Mixtures and Their Characteristics in Grade 6 Science. Teachers identified that learners struggle most with describing and distinguishing between homogeneous and heterogeneous mixtures, primarily due to the abstract nature of the concepts, lack of visual and hands-on learning opportunities, and persistent misconceptions. The results further showed that while teachers employ a blend of traditional, interactive, and digital strategies, the scarcity of engaging and contextualized instructional materials continues to hinder conceptual understanding and learner motivation.

The study also found that teachers possess limited familiarity and training in the use of interactive digital storybooks, underscoring a gap in professional development programs on digital pedagogy. Despite this, respondents expressed a positive perception of IDS, recognizing its potential to enhance learner engagement, conceptual understanding, and accessibility—especially in resource-constrained environments. These insights affirm the importance of integrating technology-supported, constructivist-based learning tools to address both literacy and content learning challenges in science education.

Overall, the needs analysis underscores the urgent call to design and develop an Interactive Digital Storybook (IDS) that aligns with the Department of Education's learning competencies, supports visualization of abstract concepts, and promotes inclusive, engaging, and literacy-enhancing instruction. The findings serve as a foundational basis for the subsequent phases of the 4D Model—Design, Develop, and Disseminate—in the creation of the IDS. Furthermore, the results highlight the necessity of providing continuous teacher training and institutional support to ensure the effective integration of digital innovations into classroom instruction, advancing the goals of quality and equitable science education.

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