

Utilization and Attitudes Toward Recycled and Reused Materials as Teaching Resources Among Student Demonstrators

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ABSTRACT Growing emphasis on sustainability in education has encouraged the integration of environmentally responsible practices into teaching and instructional-resource development. This study examined the utilization and perceptions of recycled and reused materials as instructional resources among Bachelor of Elementary Education (BEEd) student demonstrators. Specifically, it determined the types and frequency of materials used and described the participants' perceptions of their benefits and challenges. The study employed a descriptive qualitative design supplemented by descriptive quantitative data involving 27 second-year BEEd students. Data were obtained through direct observation of demonstration teaching and post-demonstration interviews. The study used frequencies and percentages to describe material utilization, while recorded interview responses were analyzed thematically. The findings showed substantial use of readily reusable post-consumer materials, particularly plastic-based resources. Participants perceived material reuse in terms of environmental responsibility, economic practicality, creativity and innovation, while also recognizing limitations related to preparation and teacher capability. The study highlights the potential of material reuse as a sustainability-oriented practice in teacher education while emphasizing that its instructional value depends on purposeful preparation and pedagogical application.

Keywords: *ducation for sustainable development, instructional resources, pre-service teachers, recycled materials, reused materials, teacher education*

INTRODUCTION

Growing concerns about resource consumption, solid-waste generation, and environmental sustainability have increased the need for educational institutions to examine how everyday teaching practices can support more responsible patterns of production and consumption. Schools and teacher-education institutions are particularly important settings for sustainability education because they influence not only learners' knowledge of environmental issues but also the practices, values, and behaviors that they may carry into their communities. Education for Sustainable Development (ESD) emphasizes developing the knowledge, skills, values, and attitudes that enable learners to make informed decisions and participate responsibly in creating a sustainable future (UNESCO, 2020). In this context, educational institutions have an important role in translating sustainability principles into concrete practices within the teaching and learning environment.

Teachers are central to this process because they can incorporate sustainability not only through curriculum content but also through instructional practices and the selection and use of learning resources. UNESCO (2020) emphasizes strengthening educators' capacities to employ transformative pedagogies and integrate sustainable development into teaching practice. This responsibility is particularly relevant in teacher education, where pre-service teachers develop the pedagogical knowledge, skills, and resourcefulness that they will eventually apply in actual classrooms. Reusing and transforming discarded materials into instructional resources offers a practical way to integrate sustainability into teaching while encouraging future teachers to consider the environmental implications of their instructional choices.

Using recycled and reused materials as teaching resources also creates opportunities to connect environmental responsibility with creativity and innovation. Recycling and upcycling activities have been linked to educational benefits beyond waste reduction. Flowers et al. (2018) demonstrated that educational experiences involving upcycling and product design could positively influence dimensions of students' environmental attitudes. Similarly, Neinhuis (2021) situated upcycling within design education as an approach for promoting circular-economy thinking and environmental awareness. Chatzopoulos et al. (2023) further demonstrated the potential of upcycled and recycled materials within sustainability-oriented STEM education, illustrating how discarded resources can be transformed and incorporated into authentic design and construction activities.

The educational value of these materials may also be linked to the creativity required to transform ordinary or discarded objects into purposeful teaching resources. Creative projects involving reusable materials require learners to plan, redesign, manipulate, and assign new functions to existing objects. Chystiakova (2022) emphasized the value of creative project work in teacher preparation, suggesting the relevance of

practical and creative activities in developing future teachers' professional competencies. In demonstration teaching, preparing instructional materials from available resources can similarly require student demonstrators to make decisions about design, instructional purpose, suitability, and application. Recycled and reused materials may therefore serve not only as inexpensive alternatives to commercially produced teaching aids but also as concrete resources for demonstrating sustainable practices and pedagogical creativity.

Despite these potential advantages, using recycled and reused materials does not automatically ensure instructional effectiveness. Their educational value depends on their relevance to intended learning outcomes, suitability for learners, safety, durability, preparation requirements, and the teacher's ability to transform available materials into meaningful instructional resources. Sustainability-oriented instructional practices may promote creativity, engagement, problem-solving, and environmental awareness; however, their implementation may also involve challenges related to preparation time, availability of appropriate materials, pedagogical skills, and institutional support. Thus, the environmental and economic value of recycled materials should be distinguished from their pedagogical effectiveness. A material may be environmentally sustainable and inexpensive but may have limited instructional value when it is not appropriately designed or aligned with the objectives of a lesson.

This issue is particularly important in pre-service teacher education because demonstration teaching gives future teachers opportunities to translate pedagogical principles into instructional decisions. During demonstration teaching, student teachers are expected to select and develop resources that present concepts, encourage learner participation, and support intended learning outcomes. The selection of recycled and reused materials therefore reflects not only resource availability but also the student demonstrators' ability to identify instructional possibilities in ordinary materials. Understanding which materials they use and how they perceive the advantages and limitations of these resources can provide insights into how sustainability and resourcefulness manifest during their professional preparation.

Although previous studies have examined recycling, upcycling, sustainability education, environmental attitudes, and the creative transformation of discarded materials (Chatzopoulos et al., 2023; Flowers et al., 2018; Neinhuis, 2021), limited attention has been given to the actual utilization of recycled and reused materials by pre-service elementary teachers during demonstration teaching. In particular, there remains a need to document the types of recycled and reused materials selected as instructional resources and to understand how student demonstrators perceive their environmental, economic, creative, and instructional benefits as well as the challenges associated with their preparation and use. Addressing this gap matters because pre-service teachers' experiences with instructional-resource development may influence how they later incorporate sustainable, resource-conscious practices into their teaching.

Constructivism provides a useful pedagogical lens for understanding the use of recycled and reused materials in demonstration teaching. From a constructivist perspective, knowledge and understanding develop through active experience, interaction, and reflection. Preparing instructional resources from discarded materials involves an active process in which student demonstrators identify available resources, assign new functions, redesign them for instructional purposes, and determine how to incorporate them into teaching activities. In this study, however, constructivism is not treated as a learning outcome to be measured. Instead, it serves as an interpretive perspective for understanding how the active transformation and application of available materials may support resourceful, experience-based teaching practices.

Conceptually, the study is situated within the demonstration teaching context, in which student demonstrators select and use recycled and reused instructional resources, resulting in two principal areas of examination: utilization patterns and perceived benefits and challenges. Utilization patterns refer to the types and frequency of recycled and reused materials employed during demonstration teaching, while perceived benefits and challenges refer to student demonstrators' views regarding the environmental, economic, creative, practical, and instructional implications of using such resources. This framework avoids assuming a causal effect of recycled materials on learning and instead focuses on documenting their actual utilization and the experiences and perceptions of the student demonstrators.

Figure 1. Conceptual Framework of the Study



Against this background, the study generally aimed to examine the utilization and perceptions of recycled and reused materials as instructional resources among Bachelor of Elementary Education (BEEd) student demonstrators. Specifically, it sought to determine the types and frequency of recycled and reused materials used by the student demonstrators as instructional resources and to describe their perceptions of the benefits and challenges associated with using these materials in demonstration teaching. Through these objectives, the study seeks to provide evidence that may contribute to developing sustainability-oriented, resource-conscious, and pedagogically appropriate instructional-resource practices in pre-service teacher education.

METHODOLOGY

Research Design

The study used a descriptive qualitative design, supplemented by descriptive quantitative data, to examine the use and perceptions of recycled and reused materials as instructional resources during demonstration teaching. The descriptive quantitative component identified the types and frequency of recycled and reused materials used by the student demonstrators, while the qualitative component described their perceptions of the benefits and challenges of using these materials.

This design was considered appropriate because the study did not manipulate variables, assign participants to experimental and control groups, or measure changes in learning outcomes. Instead, it documented the instructional materials used during demonstration teaching and examined participants' experiences and perceptions of their use. The study used frequency and percentage distributions to summarize utilization patterns and qualitatively analyzed interview and observational data to identify recurring perceptions of using recycled and reused instructional resources.

Participants and Sampling

The participants were 27 second-year Bachelor of Elementary Education (BEEd) students who were undertaking demonstration teaching in the researcher's class. The study included the entire population of second-year BEEd students involved in the demonstration-teaching activity. The participants were included because their demonstration-teaching activities provided the specific context in which the utilization of recycled and reused instructional materials could be directly observed and documented.

As part of the demonstration-teaching activity, the student demonstrators prepared and used recycled and reused materials as instructional resources. Following their demonstrations, they were interviewed about the types of materials they used and their experiences and perceptions of the benefits and challenges of using these materials as instructional resources.

Prior to the collection of research data, approval was obtained from the participants for their involvement in the study and for the recording of their interview responses. The researcher explained the study's purpose and procedures before conducting the interviews and recording participants' responses.

Participation in the research component, including the video-recorded interviews, was voluntary and separate from the students' academic requirement to conduct demonstration teaching. Students' decisions to participate in the research component were independent of their grades and academic standing. This distinction was observed to minimize possible pressure arising from the researcher's concurrent role as their instructor.

The study therefore distinguished between the demonstration teaching as an academic activity and the collection and use of observation and interview data for research purposes. Only data from students who provided approval for their participation and for the use of their recorded responses were included in the research analysis.

Data Sources and Instruments

The study used direct observation and post-demonstration interviews as primary data sources. These data sources addressed the two objectives of the study: documenting the types and frequency of recycled and reused materials used during demonstration teaching and describing participants' perceptions of the benefits and challenges associated with their use as instructional resources.

For the first objective, the researcher obtained data through direct observation of the demonstration teaching sessions conducted by the 27 second-year BEEd student demonstrators. The researcher observed the instructional resources used during each demonstration and recorded the recycled and reused materials incorporated into the lessons. The researcher also prepared observational notes during the teaching demonstrations to document the materials actually used. These records served as the basis for identifying, classifying, and determining the frequency of use of the different recycled and reused materials.

For the second objective, post-demonstration interviews gathered participants' accounts of their experiences and perceptions of using recycled and reused instructional resources. Based on the questions documented in the original study, the interviews focused on two areas: (1) the recycled and reused materials utilized during demonstration teaching and (2) the participants' perceptions of using these materials as instructional resources. The interview questions were:

1. What recycled and reused materials did you use in your demonstration teaching?
2. What are your perceptions of the benefits and challenges of using recycled and reused materials as instructional resources in demonstration teaching?

The participants' interview responses were video-recorded, with their approval, to provide an accurate record and facilitate subsequent review and analysis. The recorded responses, along with the researcher's observational notes, formed the qualitative data used to identify recurring ideas about the environmental, economic, creative, practical, and instructional aspects of using recycled and reused materials.

Observation and interviews provided complementary sources of information. Observation documented which materials were actually used during the teaching demonstrations, while interviews provided information about how the student demonstrators perceived their use. Together, these sources enabled the study to describe both the utilization patterns and the perceived benefits and challenges associated with recycled and reused instructional resources.

Data Collection Procedure

Data were collected during the demonstration teaching activities of the 27 BEEd student participants. The researcher observed each demonstration without interfering and documented the recycled and reused materials used as instructional resources. After the demonstrations, the researcher interviewed participants about the materials they used and their experiences and perceptions of their use. With the participants' approval, interview responses were video-recorded to facilitate accurate documentation and subsequent analysis. The recordings and observational notes were then organized and reviewed for data analysis.

Data Analysis

Data were analyzed according to the study's two objectives. For the first objective, the recycled and reused materials observed during demonstration teaching were classified and tallied. Frequency and percentage distributions were used to describe their utilization

For the second objective, the recorded interview responses were analyzed thematically. The responses were reviewed to identify meaningful statements concerning participants' experiences and perceptions of recycled and reused instructional resources. Statements expressing similar ideas were grouped into categories, and recurring patterns were organized into four themes: (1) environmental responsibility through material reuse, (2) economic and practical value of reused materials, (3) creativity and innovation through repurposing, and (4) pedagogical value constrained by preparation and teacher capability.

The first theme encompassed perceptions related to reducing waste, protecting the environment, and giving discarded materials another useful purpose. The second reflected participants' views regarding cost savings, availability, convenience, and the practical use of materials found at home or in their surroundings. The third captured perceptions of creativity, innovation, discovery, and resourcefulness in transforming discarded objects into instructional resources. The fourth represented concerns regarding preparation difficulty, artistic or creative capability, and uncertainty about the direct instructional value of recycled and reused materials. Because individual responses could express more than one idea, statements were considered across relevant themes rather than being restricted to a single category. Participant codes (P1–P27) were used when presenting representative responses.

Trustworthiness of the Data

Credibility of the findings was supported by comparing information obtained from direct observation, observational notes, and recorded participant responses. The video recordings provided a documented source for reviewing participants' statements during analysis, while observational records documented the materials used during demonstration teaching. Comparing these sources helped establish consistency between the observed use of recycled and reused instructional resources and the participants' accounts of their experiences and perceptions.

Ethical Considerations

Approval was obtained from the participants before the collection and video recording of their responses. The purpose and procedures of the study were explained, and participation in the research component was voluntary and separate from the academic requirement to conduct demonstration teaching. Participation or non-participation did not affect the students' grades or academic standing. Participant identities were kept confidential in reporting the findings, with participant codes used when presenting representative statements. These measures were observed to minimize potential pressure arising from the researcher's concurrent role as instructor and researcher.

RESULTS AND DISCUSSION

Types and Frequency of Recycled and Reused Materials Used as Instructional Resources

Table 1 presents the types and frequency of recycled and reused materials utilized by the student demonstrators as instructional resources. Plastic bottles emerged as the most frequently used material, with 24 of the 27 participants (88.89%) incorporating them into their demonstration teaching. Drinking cans ranked second, with 20 participants (74.07%), while plastic water containers and plastic cups were each used by 15 participants (55.56%). Cartons were documented among 12 participants (44.44%), followed by drinking straws and glass/breakable bottles, each used by 11 participants (40.74%). Newspapers and brochures were each used by 10 participants (37.04%), while wood sticks were the least frequently utilized material, with five participants (18.52%).

The findings show that student demonstrators used a variety of readily reusable post-consumer materials to prepare instructional resources, with plastic-based materials appearing prominently among the most frequently documented categories. Plastic bottles, plastic water containers, plastic cups, and drinking straws were all incorporated into demonstration teaching.

The observed use of discarded materials as instructional resources aligns with sustainability-oriented educational practices that give existing materials new functions rather than discarding them immediately. Neinhuis (2021) emphasized the role of upcycling plastic waste in design education as a way to promote

environmental awareness and circular-economy thinking. Similarly, Chatzopoulos et al. (2023) demonstrated that recycled and upcycled materials can be incorporated into sustainability-oriented educational activities in which learners transform available resources into functional products. Although these studies were conducted in contexts different from elementary teacher preparation, they support the broader educational principle that discarded materials can be intentionally repurposed for learning-related activities.

The variety of materials documented in the present study also indicates that the student demonstrators did not depend on a single type of recycled resource. In addition to plastics and cans, paper-based materials such as newspapers, brochures, and cartons, as well as wood sticks and bottles, were incorporated into their teaching demonstrations. This reflects the practical application of material reuse within instructional-resource preparation. These practices align with Education for Sustainable Development, which encourages educators and educational institutions to translate sustainability principles into concrete educational practices (UNESCO, 2020).

The findings also relate to preparing future teachers. Demonstration teaching requires pre-service teachers to make instructional decisions about selecting, preparing, and applying learning resources. The documented use of recycled and reused materials shows that student demonstrators could incorporate discarded or previously used objects into this process. Chystiakova (2022) similarly emphasized creative project activities in teacher preparation, while Flowers et al. (2018) showed that educational experiences involving upcycling can shape environmental attitudes. Together, these studies suggest that engaging future teachers with reusable materials may provide opportunities to connect instructional-resource development with creativity and environmental responsibility.

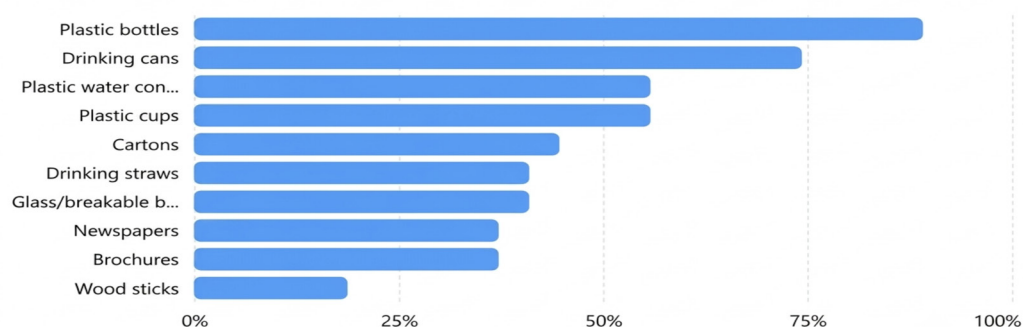
Table 1. Types and Frequency of Recycled and Reused Materials Used as Instructional Resources

Recycled/Reused Material	Frequency (n = 27)	Percentage (%)	Rank
Plastic bottles	24	88.89	1
Drinking cans	20	74.07	2
Plastic water containers	15	55.56	3.5
Plastic cups	15	55.56	3.5
Cartons	12	44.44	5
Drinking straws	11	40.74	6.5
Glass/breakable bottles	11	40.74	6.5
Newspapers	10	37.04	8.5
Brochures	10	37.04	8.5
Wood sticks	5	18.52	10

Note. Multiple materials could be used by each participant; therefore, the frequencies and percentages across categories do not total 27 and 100%, respectively. Percentages were calculated based on the 27 student demonstrators.

Utilization of recycled and reused instructional materials

Percentage of 27 BEd student demonstrators who used each material during demonstration teaching.



Multiple materials could be used by each participant; percentages therefore do not total 100%.

Figure 2. Utilization of Recycled and Reused Materials as Instructional Resources

Perceived Benefits and Challenges of Using Recycled and Reused Materials in Demonstration Teaching

The second objective described student demonstrators' perceptions of the benefits and challenges of using recycled and reused materials as instructional resources. Analysis of the participants' recorded responses revealed four recurring themes: (1) environmental responsibility through material reuse, (2) economic and practical value of reused materials, (3) creativity and innovation through repurposing, and (4) pedagogical value constrained by preparation and teacher capability. Table 2 summarizes these themes and representative participant statements.

Environmental Responsibility Through Material Reuse

Environmental responsibility emerged prominently in the participants' perceptions. Several student demonstrators linked recycled and reused materials to reducing garbage, protecting the environment, and extending the usefulness of materials that might otherwise be discarded. P1 described the practice as useful because it could "lessen the garbage in the environment," while P4 emphasized that students could learn to value things around them rather than simply discard used materials. Similar environmental concerns also appeared in responses from participants who described recycling and reuse as helping reduce waste in their surroundings.

These perceptions indicate that the student demonstrators recognized an environmental dimension in their choice of instructional resources. Their responses are consistent with the principles of Education for Sustainable Development, which emphasize developing knowledge, values, attitudes, and practices that enable learners to participate responsibly in creating a more sustainable future (UNESCO, 2020). In teacher education, incorporating material reuse into instructional-resource preparation may offer a practical way to connect environmental awareness with everyday teaching practices.

The findings are also consistent with Flowers et al. (2018), who found that educational experiences involving upcycling and product design could positively influence dimensions of environmental attitudes. Similarly, Neinhuis (2021) highlighted upcycling as an educational approach for promoting environmental awareness and circular-economy thinking. Although the present study did not measure changes in environmental attitudes, the participants' responses demonstrate that environmental responsibility was among the benefits they personally associated with using recycled and reused instructional resources.

Economic and Practical Value of Reused Materials

A second theme concerned the economic and practical value of recycled and reused resources. Several participants indicated that using available materials reduced the need to purchase new instructional resources. P22 explained that no money was spent because they collected and reused empty materials available at home, while other participants similarly mentioned saving money, availability, convenience, and usefulness.

The responses suggest that the student demonstrators viewed recycled and reused materials as practical alternatives to commercially purchased instructional resources. This consideration is particularly relevant to pre-service teachers who may need to prepare instructional materials using resources readily available within their immediate environment. Material reuse therefore provided not only an environmental function but also an economic one.

Creativity and Innovation Through Repurposing

Creativity and innovation constituted another recurring theme. Several participants described transforming recycled and reused materials into instructional resources as requiring creativity, discovery, and creating something new from existing objects. P11 referred to "creating another thing" from the materials, while P23 described the experience as helping one "to be creative and to be a discoverer." P20 also described preparing visual aids from recycled and reused materials as challenging but enjoyable.

These responses suggest that repurposing discarded materials gave student demonstrators opportunities to exercise resourcefulness in preparing instructional materials. Rather than using discarded objects in their original form, participants had to consider how to modify existing materials and assign them new instructional functions.

This finding aligns with Chystiakova (2022), who emphasized creative project activities in teacher preparation, and with Chatzopoulos et al. (2023), who showed how recycled and upcycled materials can be incorporated into sustainability-oriented design and construction activities. Neinhuis (2021) likewise associated upcycling with transforming waste into resources with new purposes. Collectively, these studies support the potential of material repurposing as an educational activity involving creativity and practical problem-solving.

From the constructivist perspective adopted in the study, this process may be understood as an active form of resource development in which student demonstrators interact with available materials, reconsider their original functions, and transform them according to an instructional purpose.

Pedagogical Value Constrained by Preparation and Teacher Capability

Despite the positive environmental, economic, and creative perceptions, participants also identified limitations. Some described preparing recycled instructional materials as difficult, while others questioned whether these resources necessarily produced substantial instructional benefits. P18 characterized their use as acceptable but “hard to prepare,” while P25 similarly recognized an environmental benefit but noted difficulty in preparing the materials. P16 indicated that usefulness depended on the individual's creativity, and P27 perceived little direct effect on teaching while acknowledging that the process encouraged teacher creativity.

These responses provide an important counterpoint to the predominantly positive perceptions. They indicate that the student demonstrators did not automatically equate using recycled materials with effective instruction. Instead, some participants perceived their instructional usefulness as dependent on the teacher's creativity, preparation, and ability to transform discarded objects into appropriate learning resources.

This distinction is important because environmental sustainability and pedagogical effectiveness are not necessarily equivalent. A material may be inexpensive, reusable, and environmentally beneficial but still require considerable preparation or may have limited instructional value if it is poorly aligned with the lesson objectives. Thus, select recycled and reused materials not simply because they are available or environmentally desirable, but because they can meaningfully support the intended teaching and learning process.

Overall, the findings revealed a balanced perception of recycled and reused materials as instructional resources among the student demonstrators. The participants primarily valued these materials for promoting environmental responsibility, economic practicality, and creativity and innovation, while also recognizing challenges related to preparation and teacher capability. These findings suggest that the value of recycled and reused materials extends beyond their environmental and economic benefits; their instructional usefulness depends on how appropriately they are selected, prepared, and integrated into the lesson. Thus, incorporating material reuse into pre-service teacher preparation may strengthen sustainability awareness and resourcefulness while developing the pedagogical judgment needed to transform available materials into meaningful instructional resources.

Table 2. Themes on the Perceived Benefits and Challenges of Using Recycled and Reused Instructional Resources

Theme	Description	Representative Participant Statement
Environmental Responsibility Through Material Reuse	Participants associated material reuse with reducing waste, protecting the environment, and giving discarded materials continued value.	“...lessen the garbage in the environment.” (P1)
Economic and Practical Value of Reused Materials	Participants viewed reused materials as economical, readily available alternatives to purchased instructional resources.	“I did not spend money to buy my materials...” (P22)
Creativity and Innovation Through Repurposing	Participants associated transforming discarded materials with creativity, discovery, innovation, and resourcefulness.	“...to be creative and to be a discoverer.” (P23)
Pedagogical Value Constrained by Preparation and Teacher Capability	Some participants reported difficulty preparing the materials and saw their instructional usefulness as depending on the teacher's creativity and skills.	“...it depends on how creative the individual is.” (P16)

Note. Participant codes (P1–P27) are used to maintain anonymity. Individual responses could reflect more than one theme; therefore, themes were not treated as mutually exclusive categories.

Limitations of the Study

While ethical precautions were taken to separate the research from course grading, the dual role of the researcher as the participants' instructor presents a potential limitation. Despite assurances of confidentiality and voluntary participation, student demonstrators may have been susceptible to social desirability bias, potentially overreporting positive attitudes or aligning their interview responses with perceived instructor expectations. Future research could mitigate this power dynamic by utilizing independent interviewers or examining pre-service teachers across multiple institutions.

CONCLUSION

The study underscores the potential of recycled and reused materials as practical resources for integrating sustainability into pre-service teacher preparation. Their value lies not simply in providing alternatives to commercially produced instructional materials but in creating opportunities for student demonstrators to connect environmental responsibility and resourcefulness with instructional practice. However, using recycled materials does not inherently ensure meaningful instruction. Their educational value depends on purposeful selection, appropriate preparation, and alignment with lesson objectives and learners' needs. Teacher-education programs may therefore consider strengthening opportunities for pre-service teachers to develop sustainable instructional resources while emphasizing pedagogical appropriateness, safety, functionality, and instructional purpose.

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