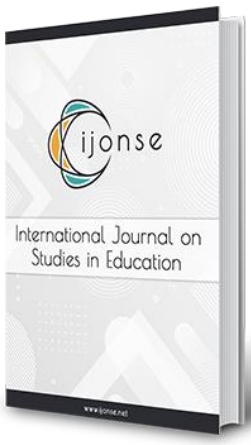

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Developing an Integrated Environmental Education Model

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Abstract

This research is a research and development (R&D) study , primarily based on the Dick and Carey model. The educational model developed focuses on environmental management integrated with Islamic education, specifically utilizing a waste bank approach. This model, which incorporates Direct Interaction (or Direct Instruction) training, was designed with a framework including Training/Learning Implementation Plans, Teaching Materials, Visual PPT Media, and Evaluations. Its development adhered to the ADDIE model , which stands for Analysis, Design, Development or Production, Implementation or Delivery, and Evaluation. Broadly, the ADDIE model involves three stages: identification, development, and evaluation and revision. The research findings indicate that the cooperative learning model for environmental knowledge material was categorized as valid, with an average score of 3.64. The practicality of the cooperative learning model was rated as very practical, with a total average score of 3.66, derived from student and teacher response questionnaires. Furthermore, the effectiveness of the Direct Instruction learning model was categorized as very effective, as 83% of students achieved learning mastery with an overall average score of 84.3.

Introduction

Environmental protection has been a major global concern since the 1972 Stockholm Conference (Luan et al., 2025). Global understanding increasingly indicates that many environmental problems are caused by human actions. Fast population growth, excessive natural resource utilization, and new technologies all lead to environmental issues. These include harm to natural systems, food shortages, diminished natural resources, and pollution of air, water, and soil.

Because of these growing problems, environmental education is recognized as a crucial means to share information about the environment and help protect it. The basic ideas for environmental education were set in 1975 at the Belgrade Charter. This charter aimed to foster awareness, caring, knowledge, and active participation in environmental efforts. Since then, many educational institutions in Indonesia have established environmental education programs, from basic schooling to universities. The government has also trained many teachers and leaders, and some schools even have special environmental activities and competitions.

However, even after about 50 years, environmental education has not shown as much positive change as hoped. It often appears to have little real effect (Ragab et al., 2025). This is because environmental degradation occurs at a rate exceeding current mitigation capabilities. Furthermore, a scarcity of active environmental education practitioners exists in Indonesia, and inter-organizational collaboration in information dissemination is often lacking.

A particularly significant environmental challenge today is waste management. Waste buildup is a critical issue for cities and for the country as a whole, even globally (Wahidyah et al., 2025). Waste generation continues to escalate with human population growth and increasing complexity of human activities. This escalating waste volume consumes space and impedes daily activities, consequently diminishing quality of life. Waste spreads everywhere, and its detrimental environmental impacts manifest more rapidly than current management efforts can address.

While solutions like "Waste Banks" (a community system where people save and sort dry waste for economic benefit) represent effective approaches to waste management and promote reducing, reusing, and recycling, their efficacy relies on adequate knowledge, positive attitudes, and practical skills among participants (Surani et al., 2025). Current training models, especially in non-formal education, frequently emphasize skill acquisition without fostering a comprehensive understanding or a positive disposition toward the environment. Observations from interviews with environmental education tutors and waste management practitioners indicate a predominant focus on practical waste handling skills, often neglecting a broader, deeper, and critical understanding of environmental issues or the development of a robust environmental ethic. This highlights a discernible need for enhanced educational interventions.

To address this identified challenge and enhance environmental management education, especially through waste banks, this study endeavors to develop a novel and efficacious education model. Learning model development consists of a set of activities including planning, development, and evaluation of the developed learning system, which in this study is integrated with Islamic values to foster moral responsibility and ecological stewardship (Tambak & Sukenti, 2025). A pivotal component of this model involves aligning environmental education with Islamic teachings. This aligns with Indonesia's national philosophy of Pancasila, particularly its first principle, "Belief in the One and Only God," which affirms that religious values should guide societal responses to challenges, including environmental concerns. Islamic teachings frame humanity as khalifah (stewards) on Earth, entrusted by Allah SWT to protect and manage nature responsibly.

Therefore, this research uses a Research and Development (R&D) approach. It follows the Dick and Carey instructional design model and the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) to build a "Direct Instruction" education model (Branson et al., 1975). This model is designed for cleaning service staff at State Islamic Religious Higher Education Institutions (PTKIN) in South Sulawesi. This model is anticipated to effectively enhance their knowledge, attitudes, and skills in environmental management, concurrently fostering their well-being and faith.

Specifically, this research aims to:

1. Assess the validity and reliability of the Direct Instruction learning model for cleaning service staff.
2. Determine the effectiveness of learning outcomes achieved through the use of the Direct Instruction learning model.
3. Evaluate participant attitudes towards environmental concern, particularly concerning its integration with Islamic education.

Method

This research uses a research and development method. Research and development is defined as "a process used to develop and validate educational products". This means that the model to be developed must involve real-life aspects, be more efficient, and be realistic-objective. Thus, the product will be a multimedia-based learning/training system model. The type of research used in this study is development research, more commonly known as Research & Development (R & D). Development research is sometimes also called research-based development. Referring to the Borg & Gall model (1983), this research is directed at developing a product in the form of a Direct Instruction learning model. The learning tools used include a syllabus, Lesson Plan (RPP), teaching materials, and learning outcome tests, learning media, as well as an environmental concern attitude questionnaire integrated with Islamic education. Before being tested, the product is first validated internally and externally, through both qualitative and quantitative analysis.

Data Collection Procedures

1. **Data**. Validation sheet instruments are given to expert validators. All validation sheets in this research are used to measure the validity of the learning/training model, and all media instruments are based on a strong theoretical rationale and internal consistency among the components of the learning/training model in terms of construction and content. Instrument validity was assessed using expert validation, where structured validation sheets were completed by subject-matter experts. This step follows the recommendation by Sugiyono (2017), who emphasizes the use of expert judgment in development research to ensure that instruments reflect both content and construct validity.
2. **Practicality data** is obtained from questionnaires that have been prepared related to learning/training activities during the research using the direct interaction learning/training model. Questionnaires are given to students as respondents. Practicality test data is needed to determine whether the developed product can function in supporting learning/training activities. Practicality data were collected via questionnaires completed by learners and instructors, evaluating how feasible and user-friendly the learning model was during its implementation. This aligns with the practicality testing guidelines in instructional design, which assess usability, clarity, and implementation ease (Ciddi, 20205; Nieveen, 1999; Öztürk, 2023; Plomp & Nieveen, 2013).
3. **Effectiveness data** is collected by providing test items to students. This data is needed to determine the effectiveness level of the developed product, meaning how well this direct interaction learning/training

model can provide results as expected. To assess effectiveness, a pre-post test design was used. Learners completed multiple-choice tests designed to measure knowledge acquisition. This method reflects best practices in experimental educational research and product validation (Gall, Gall, & Borg, 2007).

Data Collection Procedures

The data obtained in this study are grouped into three analyses: validity, practicality, and effectiveness. These techniques will be described as follows:

Validity Analysis

To assess the validity of the developed product, expert validators completed structured validation sheets based on content, construction, and relevance. The collected scores were then processed by calculating the average validation score for each criterion using the following formula.

1. Recapitulating the results of expert evaluations into a table that includes: aspects and total values for each validator.
2. Determining the average validation value from all validators for each criterion using the formula: $V^{-}=n1\sum j=1nVj$. The validity category for each criterion, aspect, or overall aspect is determined as follows:

Table 1. Category of Validity Level

Value	Description
$3,5 \leq V \leq 4$	Very valid
$2,5 \leq V < 3,5$	Valid
$1,2 \leq V < 2,5$	Moderately valid
$0 \leq V < 1,5$	Not valid

This method aligns with standard validation approaches in educational product development, particularly as described by Sugiyono (2017) and Azwar (2015), who emphasize the importance of expert judgment for evaluating both content and construct validity. (Sugiyono, 2017; Azwar, 2015)

Practicality Data Analysis

This is done by recapitulating the results of observations of learning/training management. The total average is found with the formula.

Table 2. Criteria for Practicality Level

Value	Description
$3,5 \leq Xi \leq 4$	Very Practical
$2,5 \leq Xi < 3,5$	Practical
$1,2 \leq Xi < 2,5$	Not Practical
$0 \leq Xi < 1,5$	Very Not Practical

Effectiveness Data Analysis

The effectiveness of the developed learning/training media is analyzed through data measurement of student learning outcomes. The achievement of learning outcomes is directed at individual achievement. Students are considered successful (complete) if they obtain a score greater than or equal to the KKM (Minimum Completeness Criteria) value (score ≥ KKM). Learning/training is considered classically successful if minimal 80% of participants achieve a complete score. Student learning outcome data is analyzed quantitatively descriptively.

Table 3. Score Interval for Determining Student Knowledge Learning Outcomes

Persentase Ketuntasan	Kriteria
$p > 80$	Very effective
$60 < p \leq 80$	Effective
$40 < p \leq 60$	Moderately Effective
$20 < p \leq 40$	Less Effective
$p \leq 20$	Very Less Effective

Table 4. Score Interval for Determining Student Learning Outcomes in Attitude

Value	Description
$3,5 \leq Xi \leq 4$	Strongly Agree
$2,5 \leq Xi < 3,49$	Agree
$1,5 \leq Xi < 2,49$	Disagree
$0 \leq Xi < 1,49$	Strongly Disagree

Results

Development of the Direct Instruction Learning Model

The main activities at this stage are analyzing needs in the form of participant characteristics and identifying the training needs of Cleaning Service at UIN Makassar in the form of 1) Participant Analysis, 2) Development Needs Analysis. 3) Design Stage, 4) Determining Learning Indicators. 5) Designing the Direct Instruction Learning Model , 6) Designing Learning Scenarios , 7) Designing Learning Outcome Evaluation. Development (Development), the Direct Instruction learning strategy is carried out by demonstrating various facts through videos and images related to current environmental conditions, and providing opportunities for participants to respond to what they witnessed through videos and images. The next stage is that the media designed by the researcher is then evaluated by expert validators. The validators consist of two instructors from Alauddin State Islamic University Makassar. The names of the validators can be seen in the following Table 5.

Table 5. Names of Validators

No	Validator
1.	Prof. Dr. Muhammad Yaumi, M.Hum., M.A.
2.	Prof. Dr. Misykat Malik Ibrahim,M.Si

Prototype I was then evaluated by the validators. The assessment results for the learning tools were still invalid and revealed various shortcomings, along with several suggestions for improvement from the validators. Suggestions for improving Prototype I of the Direct Instruction learning model are as follows:

Table 6. Suggestions for Prototype I Improvement by Validator I

Category	Suggestion for Improvement
RPP	Addition of verses related to the integration of Islamic teachings with the environment
Teaching Materials	Still needs additional/development of teaching materials, add verses and hadiths
Learning Outcome Evaluation	All questions, whether cognitive, affective, or psychomotor, should be adjusted to KD Indicators
Visual Media PPT	Language used should be adjusted to the participants' level of understanding

Based on the suggestions for improvement provided by the two validators, Prototype I was refined according to the suggestions, resulting in Prototype II. After improvements were made to the shortcomings in Prototype I based on the validators' suggestions, the resulting Prototype II was then pilot-tested on a limited scale with Cleaning Service personnel at UIN Alauddin Makassar. This iterative refinement approach is consistent with educational development protocols that emphasize multiple validation cycles to enhance product quality and alignment with learning objectives (Plomp & Nieveen, 2013). After revision, Prototype II was obtained and moved to the second validation stage.

Table 7. Suggestions for Prototype I Improvement by Validator II

Category	Suggestion for Improvement
RPS	Clarify learning indicators in accordance with KD, adjust material in RPP with learning objectives to be achieved, improve writing
Visual Media PPT	
Teaching Materials	-
Learning Outcome Evaluation	Create questions in accordance with KD and indicators
Participant Response Questionnaire	Use language that complies with PUEBI (Pedoman Umum Ejaan Bahasa Indonesia)

In the second validation stage, quantitative data was obtained using media, RPP, and test item validation instruments. Quantitative data from the second validation process can be seen in the section on the validity level of the Direct Instruction learning model in the subsequent discussion. The Prototype II media, after passing the second validation and being declared valid, was then tested.

1. Implementation Phase (Implementation). The developed Direct Instruction learning model was then implemented in a real setting, specifically in the classroom. The implementation phase was carried out on April 28, 2023, specifically for Cleaning Service employees with high school degrees in UIN Makassar, totaling 30 participants. Implementation is a critical step in instructional design, as it ensures that theoretical learning strategies are aligned with real-world conditions and learner needs (Branch, 2009).

2. Evaluation Phase (Evaluation). Evaluation is the process of determining whether the created media aligns with initial expectations. Evaluation can occur at each previous stage and is called formative evaluation, as its purpose is for revision needs. Meanwhile, summative evaluation is conducted at the final stage of the ADDIE model development. Evaluation was performed by administering tests to participants, and the results were used as data to determine the effectiveness of the developed media. The instrument used consisted of multiple-choice test items, totaling 20 questions. This two-pronged evaluation approach is a core component of instructional system design, ensuring both usability and learning impact are adequately assessed (Dick, Carey, & Carey, 2015).

Validity Level of Direct Instruction Learning Model Development

The media designed by the researcher was assessed by expert validators. The validators consisted of two instructors from Alauddin State Islamic University Makassar.

Table 8. Names of Validators

No	**Validator**
1.	Prof. Dr. Muhammad Yaumi, M.Hum., M.A.
2.	Prof. Dr. Misykat Malik Ibrahim,M.Si

Based on the suggestions for improvement provided by the two validators, Prototype I was improved according to these suggestions, resulting in Prototype II. The resulting Prototype II was then assessed by the validator. The assessment results can be summarized as follows:

Table 9. Validator Assessment Results for Direct Instruction Learning Model Development Tools

Category	Research Results		Results
	Validator I	Validator II	
RPS	3.60	3,73	Valid
Teaching Materials	3.45	3,61	Valid
Visual Media Transparency	3.66	3,70	Valid
Participant Respondent Questionnaire	3.56	3,67	Valid
Learning Outcome Evaluation	3.70	3,70	Valid
Average	3.59	3, 68	Valid
Final Total Average		**3.64**	Valid

Based on the assessment results obtained from the validators, the overall average validity of Prototype II is 3.64. According to this value, the media can be categorized as "Very Valid" ($3.5 \leq V \leq 4$).

Practicality Level of Direct Instruction Learning Model Development

The practicality level of the developed learning media was measured using research instruments in the form of instructor response questionnaires and participant response questionnaires. The results of instructor and participant responses regarding the practicality aspect of the learning media are presented in the following table.

Table 10. Overall Response Results

No.	Assessment Type	Average
1.	Participants' Response	3.77
2.	Lecturer's Response	3.65
Average Total		**3, 71**
Assessment Criteria		**Very Practical**

Based on the table above, the total average obtained from the overall responses of participants and instructors is 3.66. The media is considered "very practical" because it has a feasibility interval value of $3 \leq Xi < 4$. Based on the result, the practicality level of media feasibility falls into the "very practical" criterion.

Effectiveness of Direct Instruction Learning Model Development

The effectiveness level of the media can be measured from the participants' mastery level of the material that has been taught. The instrument used was a written test consisting of 50 multiple-choice questions, with 30 research subjects. The participants' test results can be seen in the following table.

Table 11. Percentage of Environmental Management Knowledge Learning Outcomes

No	Score	Category	Frequency	Percentage (%)
1	$40 < p \leq 60$	Moderately Effective	0	0%
2	$60 < p \leq 80$	Effective	5	17%
	$p > 80$	Very Effective	25	83 %
Total				**100**

The effectiveness level of environmental management knowledge learning outcomes was measured through a structured 30-item multiple-choice test designed to assess conceptual understanding and applied knowledge. Of the total participants, 25 individuals (83%) fell into the "very high" category (scores ranging from 80 to 100), while 5 participants (17%) achieved "high" scores (65–78). No participants fell into the moderate or lower performance categories. The average score across all participants was 84.3, indicating a high level of mastery and suggesting that the Direct Instruction learning model effectively facilitated content acquisition.

This finding aligns with previous research indicating that Direct Instruction—when applied in structured, context-relevant settings—can significantly improve learner comprehension and outcomes, particularly in non-traditional or vocational learning environments (Restela et al., 2025). Structured instructional formats appear to support procedural and declarative learning, especially among adult or service-oriented learners. In addition to knowledge acquisition, participants' attitudes toward environmental concern were evaluated using a 30-item Likert-scale questionnaire. The items spanned personal responsibility, stewardship, waste management, and religious-environmental ethics. The results showed that 24 participants (80%) "strongly agreed" with pro-environmental statements, while 6 participants (20%) "agreed." No participants selected "disagree" or "strongly disagree" on any of the statements. These outcomes reflect a very strong affective response to the learning content.

Such attitudinal change is consistent with findings from Pacini et al. (2025), who reported that environmental education interventions—even short-term—can significantly impact student attitudes when they are emotionally relevant and contextually grounded. Similarly, Sehar et al. (2025) emphasized that environmental consciousness and biospheric values are key predictors of pro-environmental attitudes, especially when reinforced by social or institutional influences. The integration of Islamic teachings in this model may have served as a form of value alignment, strengthening internal motivation and affective commitment to sustainable behavior.

Taken together, the combination of high cognitive achievement and strong affective responses in this study underscores the efficacy of Direct Instruction approaches when embedded in culturally and morally resonant frameworks.

Table 12. Percentage of Environmental Management Attitude Learning Outcomes

No	Score	Category	Frequency	Percentage (%)
1	$3.5 \leq Xi \leq 4$	Strongly Agree	24	80 %
2	$2.5 \leq Xi < 3.49$	Agree	6	20%
3	$1.5 \leq Xi < 2.49$	Disagree	0	0%
4	$0 \leq Xi < 1.49$	Strongly Disagree	0	0%
Total				**100%**

The effectiveness data of learning outcomes from the aspect of environmental concern attitude with an integrated Islamic education approach can be measured from participants' attitude responses to the material taught using the direct instructional learning model. The type of test given was a questionnaire using a Likert scale, with four options: strongly agree, agree, disagree, and strongly disagree. There were 30 choice statements with a frequency value for each statement ranging from 1 to 4. The calculation results, as shown in the table above, indicate that 14 or 46% of participants strongly agreed, 16 or 54% of participants agreed, while there were no participants who disagreed or strongly disagreed. Based on the quantitative calculations, it is concluded that the attitude of environmental management concern is agreeable or satisfactory, as shown in Table 13.

Table 13. Percentage of Environmental Management Attitude Learning Outcomes Integrating Islamic Education

No	Score	Category	Frequency	Percentage (%)
1	$3.5 \leq$ Xi ≤ 4	Strongly Agree	14	46%
2	$2.5 \leq Xi < 3.49$	Agree	16	54%
3	$1.5 \leq Xi < 2.49$	Disagree	0	0%
4	$0 \leq Xi < 1.49$	Strongly Disagree	0	0%
Total				**100%**

Discussion

The findings of this study confirm the effectiveness of the Direct Instruction model in improving environmental education outcomes among non-formal learners, specifically cleaning service personnel at UIN Alauddin Makassar. The model, developed using the ADDIE framework, demonstrated strong validity (average score = 3.64), high practicality (average score = 3.66), and exceptional effectiveness, with 83% of learners achieving mastery in the environmental knowledge test and 80% expressing high environmental care attitudes.

Interpretation of Model Validity and Practicality

The validation process highlighted that both content and delivery of the instructional model were well-aligned with learners' needs, including its integration of Islamic teachings on environmental stewardship. This echoes global educational trends emphasizing culturally contextualized and values-based education for sustainable development (Luan et al., 2025). The practicality score indicates that the model is not only theoretically sound but also feasible for direct implementation in real-world nonformal settings—a finding supported by recent research that promotes structured and replicable instructional methods to foster pro-environmental behavior (Palheta et al., 2025).

Impact on Environmental Knowledge and Attitudes

The high effectiveness of the model is in line with studies that underline the benefits of Direct Instruction in structured knowledge delivery, especially for adult or vocational learners with diverse educational backgrounds (Arantes et al., 2025). The study’s emphasis on visual and interactive elements such as videos and guided

discussions may have reinforced cognitive engagement and knowledge retention, which are critical for building foundational environmental literacy (Luan et al., 2025).

Additionally, the integration of Islamic values in environmental messaging likely enhanced the affective component of learning, promoting a deeper sense of responsibility and stewardship. This aligns with findings that biospheric values and environmental consciousness are strong predictors of pro-environmental attitudes, particularly when supported by social and cultural reinforcement (Sehar et al., 2025).

Broader Educational and Social Implications

This study reinforces the need for environmental education models that are not only pedagogically robust but also socio-culturally grounded. The use of Islamic principles provided moral legitimacy and relevance for the target population, supporting behavior change more effectively than secular models alone. Similar contextualized approaches are being recognized globally as essential for education for sustainable development, particularly in culturally diverse and religious societies (Sehar et al., 2025; Palheta et al., 2025). Moreover, this model supports inclusive environmental education by targeting overlooked community groups like cleaning staff. Empowering these groups with environmental literacy can catalyze bottom-up change, creating ripples of behavioral shifts in the broader community.

Conclusion

Based on the results of data analysis and discussion, the following conclusions can be drawn: First, the Direct Instructional learning model, which refers to the ADDIE Development model, along with the developed tools, is empirically valid and reliable with a "Very Good" category, with a frequency value of 3.64, making this learning model suitable for use as a relevant learning model. Second, the Direct Instructional learning model has a significant influence on knowledge learning outcomes about environmental management with a "Very Effective" category, with a frequency of 25 or 86%. Third, the learning model has a significant influence on environmental management attitudes with a "very satisfactory" category, with a frequency of 24 or 80%. Fourth, the development of the Direct Instructional learning model has a significant influence on the attitude of environmental concern with an approach integrating Islamic teachings, for cleaning service personnel, with a frequency of 14 or 46% strongly agreeing and 16 or 54% agreeing.

Recommendations

This research suggests five recommendations for improving environmental education in non-formal settings. First, the Direct Instruction-based model should be implemented more widely in community centers, Islamic boarding schools, and other informal institutions. Second, educators should integrate religious and cultural values, like the Islamic principle of *khalifah*, into environmental education to deepen awareness. Third, provide training for educators in non-formal environmental education, possibly through collaborations between the Ministry of Religious Affairs, NGOs, and higher education. Fourth, policymakers should consider incorporating this faith-

informed model into national environmental education initiatives to support sustainable development. Finally, further research is needed to examine the model's adaptability across diverse demographics and environmental themes, and compare it with other instructional models.

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