

The 4D Model for Developing Instructional Media in Islamic Religious Education

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Abstract

This article examines the 4D development model, consisting of Define, Design, Develop, and Disseminate, as a systematic framework for developing instructional media in Islamic Religious Education. The study employed a qualitative literature review based primarily on the work of Thiagarajan, Semmel, and Semmel and the academic publications listed in the attached source concerning the 4D model. The literature was analyzed thematically with attention to the model definition, the Define, Design, Develop, and Disseminate stages, validation, revision, product testing, evaluation, packaging, diffusion, and adoption. The review indicates that Define includes front-end analysis, learner analysis, concept analysis, task analysis, and specifying instructional objectives. Design includes criterion-test construction, media selection, format selection, and initial design. Develop includes expert appraisal, product revision, developmental testing, and product evaluation and refinement. Disseminate includes validation testing, packaging, diffusion and adoption, and adoption evaluation. The 4D model can serve as a structured framework for Islamic Religious Education media development when the stages are aligned with content characteristics, learner characteristics, instructional objectives, and implementation conditions. The model provides a basis for documenting development activities from instructional analysis to wider implementation.

Keywords: 4D Model; Instructional Media; Instructional Development

INTRODUCTION

Developments in science and technology have introduced substantial changes in educational practice. Instructional activities increasingly require learning resources that correspond with learner characteristics, curriculum requirements, instructional objectives, and classroom conditions. Instructional media represents one component of this environment because it provides a structured means of presenting content and organizing learning experiences. Arsyad (2011) discusses instructional media as a resource within the learning process, while Mahnun (2012) emphasizes systematic considerations in media selection and implementation. The development of instructional media therefore requires a methodological framework that can organize analysis, design, development, evaluation, and implementation.

Instructional media development involves more than preparing a final product. The process includes identification of instructional needs, analysis of learners and content, formulation of objectives, preparation of assessment criteria, selection of media and format, product construction, expert appraisal, revision, developmental testing, evaluation, packaging, dissemination, and adoption. The attached source presents the 4D model as a development

framework containing four main stages: Define, Design, Develop, and Disseminate. The source identifies the model as a framework developed by Thiagarajan, Semmel, and Semmel in 1974. The structure is presented as a systematic procedure for developing instructional products through successive activities (Sihombing et al., 2024; Thiagarajan et al., 1974).

Islamic Religious Education requires careful consideration in the development of instructional media. Its learning content may include religious texts, concepts, procedures, historical narratives, ethical values, and practical activities. Qur'anic verses and Hadith require accurate representation, while Fiqh topics may require sequential explanations and demonstrations. Aqidah and Akhlaq topics may require conceptual organization, examples, reflection, and contextual discussion. Islamic Cultural History may require chronological, geographical, and contextual presentation of historical information.

The 4D model has been applied to various educational products, including teaching materials, e-modules, instructional videos, and other learning resources. Johan et al. (2023) describe the use of the Four-D model in instructional video development. Salsabella et al. (2023) apply the model to an electronic module, while Maulida et al. (2023) discuss its application to electronic teaching materials. Kurniawan et al. (2022) examine an interactive religious education e-module using the 4D model, while Zain et al. (2025) discuss an e-module developed through the same framework.

Studies concerning the 4D model provide different emphases according to the type of product and instructional context. Sihombing et al. (2024) discuss the model within Islamic education and present its four-stage structure. Indaryanti et al. (2025) review trends, challenges, and opportunities in 4D research and development. Azizah et al. (2025) examine video development using the model, while Montori and Jacobus (2025) discuss video media development through Four-D procedures. The diversity of applications indicates the need for a focused synthesis that explains how the four stages can be organized for instructional media development in Islamic Religious Education.

This article aims to present a comprehensive literature-based analysis of the 4D model for developing instructional media in Islamic Religious Education. The discussion focuses on the conceptual meaning of the model, the activities in Define, the design procedures in Design, the validation and testing activities in Develop, and the dissemination activities in Disseminate. The article further discusses validity, practicality, effectiveness, and implementation considerations reported in the literature. The analysis remains grounded in the terminology and organization presented in the attached source, while additional references are used to strengthen the academic discussion.

METHOD

This study employed a qualitative literature review approach. The approach was used to examine the conceptual and procedural dimensions of the 4D development model in instructional media development. The primary content basis was the attached document entitled *Media Pembelajaran 4D*, which presents the definition, rationale, stages, activities, and references associated with the model. The primary conceptual source identified in the document is Thiagarajan et al. (1974), while supporting sources include books, journal articles, and scholarly works discussing instructional media and 4D-based development. The study does not report primary experimental data from learners or teachers.

The literature reviewed in this study consisted of the sources presented in the attached document and additional academic references relevant to instructional development. The source selection focused on publications discussing the Four-D model, instructional media, educational materials, e-modules, instructional videos, Islamic education, and research and development. The attached document served as the principal basis for organizing the terminology and sequence of the discussion. References were compared according to their treatment of Define, Design, Develop, and Disseminate and according to the development activities associated with each stage.

Data collection was conducted through document analysis. Relevant information was extracted from the source material concerning the definition of the model, front-end analysis, learner analysis, concept analysis, task analysis, instructional objectives, criterion-test construction, media selection, format selection, initial design, expert appraisal, product revision, developmental testing, evaluation, validation testing, packaging, diffusion, adoption, and adoption evaluation. The extracted information was organized into thematic categories corresponding to the four stages of the model. The organization preserved the terminology used in the source document.

Data analysis employed thematic synthesis. Statements concerning similar development activities were grouped into common themes, while distinctions among the four stages were maintained. The analysis examined the instructional function of each activity and its relevance to media development in Islamic Religious Education. The synthesis was then presented as an integrated description of the development process. The analytical procedure was interpretive rather than experimental.

The review was conducted in five broad steps: literature identification, relevance screening, thematic extraction, comparison, and synthesis. Identification focused on the sources contained

in the attached material and publications relevant to the Four-D model. Screening considered topical relevance and the presence of identifiable methodological or pedagogical information. Extraction recorded concepts, procedures, examples, and evaluation criteria. Comparison examined recurring descriptions of the four stages, while synthesis organized the information into a coherent article structure.

RESULT AND DISCUSSION

1. Conceptual Foundation of the 4D Model

The 4D model is an instructional development framework consisting of four principal stages: Define, Design, Develop, and Disseminate. The attached source identifies the model as a development model associated with Thiagarajan, Semmel, and Semmel and cites their 1974 work, *Instructional Development for Training Teachers of Exceptional Children*. The four stages provide a sequence for defining instructional requirements, preparing an initial design, developing and evaluating the product, and disseminating the completed product. The model is presented in the source as a systematic framework for instructional and educational product development. Sihombing et al. (2024) discuss the same four-stage structure in the context of Islamic education.

The structure of the 4D model differentiates the functions of the development activities. Define establishes information concerning instructional problems, learners, concepts, tasks, and objectives. Design translates those requirements into assessment criteria, media choices, format decisions, and an initial product design. Develop provides expert appraisal, revision, developmental testing, evaluation, and product refinement. Disseminate extends the development process through validation testing, packaging, diffusion, adoption, and adoption evaluation.

The attached source emphasizes the systematic and structured character of the model. Its discussion presents evaluation and revision as recurring components of development before broader implementation. Research using the model has covered e-modules, videos, teaching materials, and other instructional products. Johan et al. (2023), Maulida et al. (2023), Salsabella et al. (2023), and Azizah et al. (2025) illustrate applications in different educational contexts. The diversity of products provides a basis for considering the model in Islamic Religious Education media development.

2. Define: Establishing Instructional Requirements

The Define stage is the initial stage in the 4D model. The attached source describes Define as a process for determining the requirements needed in instructional development while considering learner needs, instructional content, and learning objectives. The stage contains five principal activities: front-end analysis, learner analysis, concept analysis, task analysis, and specifying instructional objectives. The sequence provides information for subsequent design decisions. Thiagarajan et al. (1974) provide the conceptual basis for these analytical activities.

Front-end analysis examines the basic instructional problem. The attached source describes this activity as a diagnosis of the fundamental problem faced in the learning setting and as a basis for identifying possible solutions. In Islamic Religious Education, the analysis can examine curriculum requirements, learner performance, existing learning resources, classroom conditions, and instructional needs. The information can be collected through curriculum review, classroom observation, teacher interviews, learner information, and examination of existing materials. The resulting profile can be used to establish the scope of the product to be developed.

Learner analysis examines the characteristics of the target learners. The attached source identifies intellectual development, previous experience, cognitive development, learning motivation, and individual or social skills as relevant characteristics. The analysis can inform the selection of content, language, format, instructional activities, and level of difficulty. In Islamic Religious Education, the analysis may consider learners' prior understanding of religious concepts, familiarity with religious terminology, reading ability, and experience with digital learning resources. Learner characteristics need to be represented in the design specifications.

Concept analysis identifies the main concepts and relevant supporting information within the learning material. The attached source describes concept analysis as a procedure for identifying core concepts, procedural knowledge, conceptual hierarchy, relevant material, and learning resources. In Islamic Religious Education, concept analysis can be used to organize concepts in Aqidah, Akhlaq, Fiqh, Qur'an and Hadith, and Islamic Cultural History. The procedure can distinguish essential concepts from supporting details and organize the content in a logical sequence. The resulting conceptual structure provides a reference for media content.

Task analysis identifies the principal skills and supporting skills required within the learning material. The attached source describes the activity as an analysis of the tasks learners need to

complete in relation to the instructional problem. Task analysis can be particularly useful for procedural competencies in Islamic Religious Education. Examples include demonstrating religious procedures, analyzing a Qur'anic passage, explaining a legal concept, interpreting historical information, or applying an ethical principle to a case. The task structure can be translated into learning activities and assessment criteria.

Specifying instructional objectives summarizes the intended learner performance. The attached source describes objectives in terms of expected behavioral changes expressed through operational verbs. Objectives provide a basis for preparing tests and designing instructional materials. In media development, objectives can guide content selection, activity design, assessment construction, and product evaluation. Clear objectives provide a reference for determining whether the final product corresponds with the intended instructional scope.

3. Design: Planning the Instructional Product

The Design stage prepares the initial structure of the instructional product. The attached source identifies four activities: criterion-test construction, media selection, format selection, and initial design. The stage represents a transition from instructional analysis to product planning. Each design decision is expected to correspond with information generated during Define. Saputra (2020) and other studies in the source list apply Four-D procedures to educational material development.

Criterion-test construction provides assessment criteria based on instructional objectives and learner analysis. The attached source describes the criterion-referenced test as a connection between Define and Design. Test specifications can include indicators, item forms, scoring procedures, answer keys, and scoring guidelines. In Islamic Religious Education, assessment can include selected-response items, short answers, essays, performance tasks, demonstrations, or reflective activities. The selected assessment format needs to represent the intended competency.

Media selection identifies the instructional medium that corresponds with the material, objectives, learners, and dissemination plan. The attached source emphasizes correspondence among media characteristics, concept analysis, task analysis, target users, and distribution plans. Media selection in Islamic Religious Education can include printed modules, electronic modules, instructional videos, digital worksheets, presentations, or interactive learning resources. The selected medium should be considered in relation to available devices, user competence, access conditions, and instructional activities.

Format selection determines the organization and presentation of the learning content. The attached source describes format selection in relation to instructional content, strategies, approaches, methods, and learning resources. An e-module may use sections for objectives, explanations, activities, exercises, and assessment. A video may use an introduction, explanation, demonstration, practice prompt, and summary. An interactive resource may use menus, navigation, activities, feedback, and assessment.

Initial design presents the essential instructional content through an appropriate medium and sequence. The attached source describes initial design as the preparation of the complete learning device or product before testing. The initial design may include content outlines, scripts, storyboards, page layouts, assessment items, activities, and supporting materials. Islamic Religious Education media requires attention to accurate religious terminology and textual representation. The prototype produced in this stage becomes the basis for expert appraisal.

4. Develop: Validation, Revision, Testing, and Evaluation

The Develop stage transforms the initial design into a product that can be evaluated. The attached source describes Develop as the stage involving validation, revision, product testing, evaluation, and refinement. The stage is presented as a process for improving the product before wider implementation. Sihombing et al. (2024), Indaryanti et al. (2025), Salsabella et al. (2023), and Montori and Jacobus (2025) discuss development activities within Four-D research. The evidence collected during this stage provides information for product revision.

Expert appraisal is the first major activity in Develop. The attached source identifies experts in areas such as subject matter, media, language, and educational practice as possible validators. Validation instruments can examine material suitability, media design, language, usability, and instructional objectives. In Islamic Religious Education, subject matter validation requires attention to the accuracy and appropriateness of religious content. Media validation can examine presentation, navigation, technical quality, and consistency with the intended learning activity.

Product revision follows expert appraisal. The attached source describes revision as a process based on suggestions and feedback from validators. Revisions may concern content, design, language, navigation, technical features, or other components of the instructional product. Documentation of revision can include the original condition, validator comments, revision decisions, and revised components. Repeated revision may occur when further findings emerge during validation or testing.

Developmental testing involves the intended users of the product. The attached source describes individual testing, small-group testing, and field testing as possible forms of product testing. Individual testing can identify basic errors and unclear instructions. Small-group testing can provide information concerning user responses and product usability. Field testing can provide information concerning ease of use, attractiveness, user acceptance, and learning-related outcomes.

Evaluation and refinement constitute the final activities within Develop. Evaluation uses information obtained from validation and testing to identify strengths and weaknesses of the product. The attached source describes the evaluation process as a basis for final improvement before dissemination. Product quality can be discussed in terms of validity, practicality, effectiveness, usability, or other criteria selected by the researcher. These criteria need to be reported according to the instruments and procedures used in the study.

5. Disseminate: Validation, Packaging, Diffusion, and Adoption

Disseminate is the final stage of the 4D model. The attached source defines the stage as the distribution and implementation of the developed product for broader users. The stage includes validation testing, packaging, diffusion and adoption, and adoption evaluation. Dissemination extends the development process beyond the initial development setting. Sihombing et al. (2024) describe dissemination within Islamic education as part of the broader 4D development process.

Validation testing at the dissemination stage examines the product in an implementation context. The attached source describes validation testing as an activity involving product quality, field conditions, and broader user responses. The testing can involve teachers, learners, or institutions beyond the initial development group. Information can be collected through questionnaires, interviews, observations, implementation records, or learning assessments. The resulting evidence can inform decisions concerning broader use.

Packaging prepares the final product for distribution and adoption. The attached source identifies several packaging activities, including preparing the validated final product, arranging visual presentation and layout, preparing user instructions, providing supporting materials, and ensuring accessible distribution formats. Digital products may require appropriate file formats and technical guidance. Printed products may require final layout, printing specifications, and supporting manuals. The packaging needs to reflect the actual conditions of intended users.

Diffusion distributes the product to teachers, schools, or educational institutions and communicates information about its use. The attached source mentions distribution, socialization, journal publication, conference presentation, and digital platforms as possible channels. Adoption involves training, workshops, technical support, mentoring, and implementation in real instructional settings. Adoption evaluation examines levels of use, user feedback, and the contribution of the product to instructional quality. Dissemination therefore includes both distribution and implementation support.

6. Relevance of the 4D Model to Islamic Religious Education

The 4D model has relevance for instructional media development in Islamic Religious Education because its analytical stages can accommodate diverse content characteristics. Define can identify learner needs and the structure of religious content. Design can translate those requirements into media and instructional formats. Develop can provide opportunities for expert review of religious content and media characteristics. Disseminate can prepare the product for implementation within broader educational settings.

Qur'an and Hadith learning can use the Define stage to identify competencies involving reading, pronunciation, memorization, comprehension, interpretation, and contextualization. Design can organize text, translation, explanation, recitation, exercises, and assessment. Develop can include review of Arabic text, translation, pronunciation, and instructional presentation. Disseminate can prepare the product with appropriate instructions for teachers and learners. The development process needs to preserve textual accuracy throughout each stage.

Fiqh learning includes conceptual and procedural content. Define can identify the concepts and procedures that learners need to understand or perform. Design can organize explanations, examples, demonstrations, guided activities, and assessments. Develop can include subject matter validation and user testing. Disseminate can provide implementation guidance for teachers and supporting materials for learners.

Aqidah and Akhlaq learning may require conceptual organization and reflective activities. Define can identify prior knowledge, learning needs, values, concepts, and expected competencies. Design can use cases, narratives, concept maps, questions, and reflective tasks. Develop can review terminology, content, language, and contextual appropriateness. Disseminate can provide teachers with guidance for discussion and learning facilitation.

Islamic Cultural History can use media to organize chronology, geography, figures, institutions, and historical events. Define can establish the required historical concepts and

learning tasks. Design can incorporate timelines, maps, narratives, illustrations, and structured activities. Develop can review historical accuracy and source documentation. Disseminate can prepare the product for classroom use and independent learning.

7. Validity, Practicality, and Effectiveness

Validity is one of the principal criteria used in instructional product development. Content validity concerns correspondence between the product and the intended subject matter. Media validity concerns the suitability of design, presentation, navigation, and technical characteristics. Language validity concerns clarity, readability, terminology, and linguistic accuracy. The attached source reports expert validation as a central activity within Develop.

Practicality concerns the usability of the product within the intended instructional context. Indicators may include ease of use, clarity of instructions, navigation, technical accessibility, time requirements, teacher response, and learner response. Practicality can be assessed through questionnaires, interviews, observations, and implementation records. The evidence needs to reflect the conditions in which the product is intended to be used.

Effectiveness concerns evidence related to the achievement of instructional objectives. The attached source connects product testing with the examination of effectiveness and learning-related outcomes. Evaluation can use written tests, performance assessments, rubrics, task completion measures, or other appropriate instruments. The selected assessment method should correspond with the objectives specified during Define. Effectiveness claims therefore need to be based on reported evaluation procedures rather than product characteristics alone.

8. Strengths and Limitations of the 4D Model

The 4D model provides a recognizable and structured framework for instructional product development. The four stages are clearly differentiated and can be documented in a research report. Define establishes instructional requirements, Design organizes product planning, Develop provides validation and testing activities, and Disseminate addresses broader implementation. The structure can help researchers maintain a visible connection between instructional analysis and product development.

The model can be adapted to different instructional products. The source document lists applications involving modules, videos, interactive multimedia, Android-based learning applications, and instructional devices. Studies cited in the source demonstrate applications in e-modules, videos, and other educational materials. The adaptability provides opportunities for use in different Islamic Religious Education topics and learning contexts. Researchers can adjust instruments and testing procedures according to the product.

Implementation of the complete model requires time, expertise, and coordination. Detailed analysis, expert validation, revision, testing, packaging, dissemination, and adoption evaluation may require substantial resources. Some development studies may emphasize Define, Design, and Develop without conducting broad dissemination. The attached source presents Disseminate as a distinct stage, so research reports should state clearly which activities were completed. Transparent reporting is important when describing the extent of model implementation.

The model does not prescribe one universal instrument for every product. Researchers need to construct validation, practicality, usability, and effectiveness instruments according to the product and research objectives. A video product requires different technical indicators from an e-module or printed module. Islamic Religious Education products require disciplinary review in addition to general media evaluation. Methodological decisions therefore need to be documented explicitly.

9. Practical Framework for 4D-Based IRE Media Development

A practical 4D framework for Islamic Religious Education media development can be organized as a sequence of evidence-based decisions. Define produces an instructional profile containing learner characteristics, instructional problems, content concepts, tasks, and objectives. Design converts the profile into assessment criteria, media choices, format decisions, and a prototype. Develop uses expert appraisal, revision, developmental testing, and evaluation to refine the prototype. Disseminate prepares the validated product for packaging, diffusion, adoption, and adoption evaluation.

The framework can be summarized through the following development logic: instructional requirements are established before product specifications are finalized; assessment criteria are prepared before product testing; expert review precedes user testing; revisions are documented before finalization; and broader implementation follows product refinement. This sequence reflects the organization of the attached source. The framework can be applied to different IRE topics by changing the content analysis, task structure, media format, validation criteria, and testing instruments. The central structure remains the four-stage development process.

Table 1. Four-D Model Development Stages

Stage	Primary Focus	Core Activities	Expected Output
Define	Instructional requirements	Front-end, learner, concept, task, objective analysis	Development requirements
Design	Product planning	Criterion-test construction, media selection, format selection, initial design	Initial product design
Develop	Product refinement	Expert appraisal, revision, developmental testing, evaluation	Refined and validated product

Disseminate	Wider implementation	Validation testing, packaging, diffusion, adoption, adoption evaluation	Ready-to-use product
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CONCLUSION

The 4D development model provides a structured framework for developing instructional media through four stages: Define, Design, Develop, and Disseminate. Define identifies instructional problems, learner characteristics, concepts, tasks, and instructional objectives. Design prepares criterion-referenced assessment, selects media and format, and develops an initial product design. Develop includes expert appraisal, revision, developmental testing, evaluation, and product refinement. Disseminate includes validation testing, packaging, diffusion, adoption, and adoption evaluation.

The model is relevant to instructional media development in Islamic Religious Education when the development procedures correspond with content characteristics, learner needs, instructional objectives, and implementation conditions. Qur'an and Hadith, Fiqh, Aqidah, Akhlaq, and Islamic Cultural History require different forms of content organization and instructional representation. Expert review remains important for disciplinary accuracy, while user testing provides information concerning usability and implementation. The development process needs to document each stage clearly so that readers can identify the procedures used and the evidence obtained.

The literature and the attached source support the use of the 4D model as a systematic framework for educational product development. Its value lies in the organization of development activities from analysis to wider implementation. The model does not replace methodological judgment, so researchers need to select appropriate instruments, validation criteria, testing procedures, and dissemination strategies. Future development studies in Islamic Religious Education can strengthen the use of the model through transparent reporting of product specifications, validation results, user testing, implementation conditions, and adoption evaluation.

REFERENCE

- Ananyarta, P., & Afafa, W. (2023). Pengembangan e-module fungi berbasis problem based learning menggunakan model 4D. *Jurnal Bioeducation*, 10(2), 83–92.
- Arsyad, A. (2011). *Media pembelajaran*. PT RajaGrafindo Persada.
- Azizah, A., Khaerudin, & Suprayekti. (2025). Pengembangan video animasi teori asal-usul demografi menggunakan model 4D. *Jurnal Pembelajaran Inovatif*, 8(1), 55–64.
- Hulu, O. (2023). Pengembangan modul berbasis inkuiri pada mata pelajaran gambar teknik. *Jurnal Suluh Pendidikan*, 11(2), 101–110.

- Indaryanti, R. B., et al. (2025). 4D research and development model: Trends, challenges, and opportunities review. *Jurnal Kajian Ilmiah*, 25(1), 35–45.
- Johan, J. R., Iriani, T., & Maulana, A. (2023). Penerapan model Four-D dalam pengembangan media video keterampilan mengajar kelompok kecil dan perorangan. *Jurnal Pendidikan West Science*, 1(6), 108–116.
- Khaerul, & Fajri, T. (2017). Pengembangan buku ajar menggunakan model 4D dalam peningkatan keberhasilan pembelajaran Pendidikan Agama Islam. *JPII*, 2(1), 1–10.
- Kurniawan, I. K. S., Suartama, I. K., & Simamora, A. H. (2022). E-modul interaktif agama Hindu dengan model 4-D. *Jurnal Pendidikan Multikultural Indonesia*, 5(1), 21–30.
- Lastri, Y. (2023). Pengembangan dan pemanfaatan bahan ajar e-modul dalam proses pembelajaran. *Jurnal Citra Pendidikan*, 3(3), 1139–1146.
- Mahnun, N. (2012). Media pembelajaran: Kajian terhadap langkah-langkah pemilihan media dan implementasinya dalam pembelajaran. *Jurnal Pemikiran Islam*, 37(1), 27–35.
- Maulida, L., Murtinugraha, R. E., & Arthur, R. (2023). Model Four-D sebagai implementasi untuk pengembangan bahan ajar elektronik modul mata kuliah K3. *Jurnal Pendidikan West Science*, 1(7), 433–440.
- Montori, S., & Jacobus, S. N. H. (2025). Penerapan model Four-D (4D) dalam pengembangan media video materi keanekaragaman. *Innovative: Journal of Social Science Research*, 5(1), 447–456.
- Nafiyanto, N. R., & Pebriana, I. N. (2023). Pengembangan e-modul dinamika partikel model guided discovery learning berbasis STEM. *Jurnal Pendidikan Matematika dan Sains*, 11(2), 165–176.
- Salsabella, S., Iriani, T., & Saleh, R. (2023). Pengembangan bahan ajar e-modul mata kuliah konsep arsitektur menggunakan model 4D. *Jurnal Pendidikan dan Konseling*, 5(2), 541–550.
- Saputra, N. W. (2020). Pengembangan bahan ajar data mining menggunakan Four-D model dalam kerangka kerja CDIO. 3(November), 48–58.
- Sihombing, B., Zamsiswaya, & Sawaluddin. (2024). Model pengembangan 4D (Define, Design, Develop, dan Disseminate) dalam pembelajaran Pendidikan Islam. *Journal of Islamic Education El Madani*, 4(1), 11–19.
- Sukmadinata, N. S. (2013). Metode penelitian pendidikan. PT Remaja Rosdakarya.
- Thiagarajan, S., Semmel, D. S., & Semmel, M. I. (1974). Instructional development for training teachers of exceptional children. Leadership Training Institute/Special Education, University of Minnesota.
- Zain, S. T., Yakub, E., & Oktary, D. (2025). Development of an emotional regulation e-module for guidance and counseling teachers using the 4D model. *Jurnal Bimbingan dan Konseling Pandohop*, 6(1), 89–98.