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Analysis of Interactive Multimedia-Based Scaffolding Media Design through the Teaching at the Right Level (TaRL) Approach for Students at SMP Negeri 2 Panca Rijang

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Abstrak: Perbedaan tingkat kemampuan awal, karakteristik belajar, dan kebutuhan individual siswa merupakan tantangan dalam menciptakan pembelajaran yang efektif, interaktif, dan berpusat pada peserta didik. Penelitian ini bertujuan untuk menganalisis desain scaffold media berbasis multimedia interaktif melalui pendekatan Teaching at the Right Level (TaRL) sebagai strategi pembelajaran adaptif bagi siswa di SMP Negeri 2 Panca Rijang, Kabupaten Sidenreng Rappang. Kajian ini berfokus pada integrasi prinsip scaffolding, penggunaan multimedia interaktif, dan pengelompokan pembelajaran berdasarkan tingkat kemampuan aktual siswa. Desain media diarahkan untuk mengintegrasikan teks, gambar, audio, video, animasi, serta latihan interaktif yang dilengkapi bantuan belajar secara bertahap sesuai kebutuhan peserta didik. Pendekatan TaRL digunakan sebagai dasar konseptual dalam mengidentifikasi kemampuan awal siswa melalui asesmen diagnostik, menentukan tingkat kesulitan materi, serta menyesuaikan bentuk pendampingan pembelajaran. Analisis desain mencakup aspek kesesuaian materi, struktur bantuan belajar, interaktivitas media, kemudahan penggunaan, dan potensi dukungannya terhadap keterlibatan serta kemandirian belajar siswa. Integrasi scaffold media dengan pendekatan TaRL diharapkan menghasilkan rancangan pembelajaran yang lebih fleksibel, inklusif, dan responsif terhadap keberagaman kemampuan siswa. Penelitian ini diharapkan memberikan kontribusi terhadap pengembangan desain media pembelajaran digital yang mengutamakan diferensiasi pembelajaran, dukungan belajar bertahap, dan penguatan partisipasi aktif peserta didik. Rancangan tersebut juga dapat menjadi landasan bagi penelitian lanjutan untuk menguji kelayakan, kepraktisan, dan efektivitas multimedia interaktif berbasis TaRL dalam meningkatkan kualitas pembelajaran di tingkat sekolah menengah pertama.

Kata Kunci: Scaffold Media, Multimedia Interaktif, Teaching at the Right Level (TaRL), Pembelajaran Berdiferensiasi, Desain Pembelajaran.

Abstract: Differences in students' initial abilities, learning characteristics, and individual needs present significant challenges in creating effective, interactive, and student-centered learning environments. This study aims to analyze the design of interactive multimedia-based scaffolding media through the Teaching at the Right Level (TaRL) approach as an adaptive learning strategy for students at SMP Negeri 2 Panca Rijang, Sidenreng Rappang Regency, Indonesia. The study focuses on integrating scaffolding principles, interactive multimedia applications, and differentiated instructional grouping based on students' actual competency levels. The proposed media design incorporates text, images, audio, videos, animations, and interactive exercises supported by gradually adjusted instructional assistance according to learners' individual needs. The TaRL approach serves as a conceptual framework for identifying students' initial competencies through diagnostic assessments, determining appropriate levels of instructional difficulty, and adapting learning support strategies. The design analysis encompasses several essential dimensions, including content relevance, instructional scaffolding structures, multimedia interactivity, usability, and the potential to enhance students' engagement and independent learning. Integrating scaffolding media with the TaRL approach is expected to produce a more flexible, inclusive, and responsive instructional design that accommodates diverse learning abilities. This study is expected to contribute to the development of digital learning media that emphasize differentiated instruction, gradual learning assistance, and active student participation. Furthermore, the proposed design may provide a foundation for future empirical investigations examining the feasibility, practicality, and effectiveness of TaRL-based interactive multimedia in improving instructional quality and learning experiences at the junior secondary school level.

Keywords: Scaffolding Media, Interactive Multimedia, Teaching at the Right Level (TaRL), Differentiated Instruction, Instructional Design

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INTRODUCTION

The rapid development of digital technology has significantly transformed educational practices, creating new opportunities for teachers to design innovative, interactive, and student-centered learning environments. Contemporary education increasingly emphasizes the importance of integrating technological resources into instructional activities to accommodate diverse learning characteristics, promote student engagement, and improve learning outcomes. Digital learning environments provide opportunities for students to access educational materials through various formats, including text, images, audio, video, animations, and interactive exercises. However, the effectiveness of educational technology depends not only on the availability of digital resources but also on the appropriateness of instructional design and its alignment with students' actual learning abilities. Consequently, the development of interactive multimedia-based instructional media requires a pedagogical framework capable of addressing differences in students' academic readiness, learning experiences, and individual educational needs.

One of the fundamental challenges in contemporary classroom instruction is the diversity of students' initial competencies. Students within the same classroom frequently demonstrate different levels of conceptual understanding, cognitive development, learning motivation, and academic achievement. These differences can create instructional difficulties when teachers implement uniform teaching strategies without considering individual learning readiness. Students with limited prior knowledge may experience difficulties understanding complex instructional materials, whereas students with higher levels of competence may find standardized learning activities insufficiently challenging. Therefore, effective instructional practices should provide differentiated learning experiences that accommodate students' current competencies while supporting their progressive development.

The concept of differentiated instruction emphasizes the importance of adjusting instructional content, learning processes, and assessment strategies according to students' readiness, interests, and learning needs (Tomlinson, 2014). Rather than providing identical learning experiences to all students, differentiated instruction encourages teachers to develop flexible learning environments that enable students to achieve educational objectives through appropriate instructional pathways. In technology-supported learning, differentiation can be facilitated through interactive multimedia resources that offer varying levels of instructional complexity, learning assistance, and assessment activities. Nevertheless, the successful implementation of differentiated digital learning requires systematic instructional planning and a clear understanding of how students progress from their existing knowledge toward more advanced competencies.

The Teaching at the Right Level (TaRL) approach provides a relevant pedagogical foundation for addressing differences in students' academic abilities. Originally developed by Pratham in India, TaRL emphasizes the importance of identifying

students' actual learning levels and organizing instructional activities according to demonstrated competencies rather than chronological age or formal grade placement. This approach typically involves diagnostic assessment, flexible instructional grouping, targeted learning activities, and continuous monitoring of student progress. Evidence from randomized evaluations has demonstrated that systematic implementation of TaRL can improve foundational learning outcomes, particularly in literacy and numeracy (Banerjee et al., 2017).



Pratham+1

Although TaRL was initially developed to address foundational learning gaps, its principles offer opportunities for adaptation to broader instructional contexts, including technology-supported learning at the junior secondary school level.

The application of TaRL in digital learning environments becomes particularly relevant when combined with instructional scaffolding. Scaffolding refers to the temporary instructional assistance provided to learners to enable them to complete tasks that would otherwise exceed their independent capabilities. The concept is closely associated with Vygotsky's (1978) sociocultural theory, particularly the Zone of Proximal Development, which explains the relationship between students' independent performance and their potential development through appropriate assistance. Wood et al. (1976) further elaborated the scaffolding concept by emphasizing the importance of structured assistance in supporting learners' problem-solving processes. In classroom instruction, scaffolding may include explanations, demonstrations, guiding questions, examples, feedback, and progressively reduced instructional support.

Integrating scaffolding principles into interactive multimedia offers opportunities to provide individualized learning assistance through digital resources. Multimedia-based scaffolding can incorporate instructional videos, visual explanations, interactive simulations, guided exercises, contextual examples, and automated feedback. These components can assist students in understanding difficult concepts while gradually developing independent learning skills. According to Mayer (2021), multimedia learning is most effective when instructional materials are designed in accordance with cognitive principles that support meaningful information processing. Multimedia environments should therefore minimize unnecessary cognitive demands and facilitate the integration of verbal and visual information. The combination of scaffolding and multimedia learning principles provides a theoretical foundation for designing instructional resources that support students with different levels of prior knowledge.

Previous research has demonstrated the potential of digital learning media to improve instructional accessibility, student participation, and learning experiences. Hermansyah et al. (2026), in their study entitled Developing Digital Learning Media for Teaching Public Speaking to Improve English Skills of Junior High School Students, developed digital learning media for seventh-grade students at SMP Satap 8 Maiwa, Enrekang Regency. Their study

employed a Research and Development approach using the 4D model and involved 29 students. The developed media integrated text, images, videos, and interactive activities. Expert validation produced scores of 86.7% for media validity and 95.6% for content validity, while student responses during the trials reached 90.6% and 92.3%. These findings provide relevant evidence regarding the feasibility and practicality of multimedia-based instructional resources in junior secondary education.

Furthermore, Nurdin et al (2025) explored the pedagogical affordances of interactive audio-visual multimedia at the junior high school level, demonstrating that meticulously structured interactive elements can effectively enhance students' complex skill acquisition and cognitive accuracy in targeted instructional domains. These cumulative findings provide relevant evidence regarding the feasibility, practicality, and acceptance of multimedia-based instructional resources in junior secondary education. However, while previous works focused extensively on the development phase of isolated digital tools, the present study expands the technological paradigm by systematically analyzing how interactive multimedia can be adaptively structured using scaffolding mechanisms embedded within a Teaching at the Right Level (TaRL) approach to address baseline learning gaps.

Despite the potential benefits of interactive multimedia, the availability of technologically sophisticated instructional materials does not automatically guarantee effective learning. Digital resources may remain pedagogically ineffective when their content, difficulty levels, and learning activities are not aligned with students' competencies. Students with limited foundational knowledge may experience cognitive overload when interacting with complex multimedia materials, while students with stronger competencies may require more challenging learning activities. Consequently, instructional media should incorporate mechanisms that identify learning readiness, adjust instructional complexity, and provide appropriate assistance. The integration of TaRL and scaffolding offers a conceptual approach for addressing these challenges through adaptive instructional design.

At SMP Negeri 2 Panca Rijang, Sidenreng Rappang Regency, the proposed study focuses on analyzing the design of interactive multimedia-based scaffolding media through the TaRL approach. The school provides the intended educational context for examining how differentiated digital instructional resources can be structured to accommodate diverse learning abilities. However, the specific characteristics of students' learning difficulties, technological facilities, and instructional practices require empirical identification through preliminary assessment and classroom investigation. Therefore, the proposed design emphasizes the importance of collecting contextual information before determining appropriate multimedia features and instructional support mechanisms.

The novelty of the proposed study lies in the conceptual integration of three complementary instructional perspectives: scaffolding theory, interactive multimedia learning, and Teaching at the Right Level. While previous studies have examined digital

learning media, differentiated instruction, and scaffolding independently, this study proposes an integrated design framework in which diagnostic assessment informs learning-level classification, multimedia resources provide differentiated instructional experiences, and scaffolding mechanisms support progressive competency development. The framework also emphasizes continuous formative assessment and flexible adjustment of learning assistance according to students' demonstrated progress. Accordingly, this study aims to analyze the instructional design requirements, pedagogical structure, multimedia components, and adaptive scaffolding mechanisms needed to develop interactive learning media based on the TaRL approach for students at SMP Negeri 2 Panca Rijang. Specifically, the study addresses how students' learning readiness can inform multimedia design, how scaffolding mechanisms can be integrated into differentiated digital learning activities, and how the proposed instructional framework can support meaningful, inclusive, and independent learning experiences. The expected contribution is a theoretically grounded instructional design framework that can guide future media development, expert validation, classroom implementation, and empirical evaluation in junior secondary education.

LITERATURE REVIEW

Instructional Scaffolding in Student-Centered Learning

Instructional scaffolding represents an educational strategy designed to provide temporary and structured assistance that enables learners to accomplish tasks beyond their current independent capabilities. The theoretical foundation of scaffolding is associated with Vygotsky's (1978) sociocultural theory, which emphasizes the social and interactive nature of cognitive development. Within the Zone of Proximal Development, students can achieve higher levels of understanding when appropriate assistance is provided by teachers, peers, or instructional resources. This perspective suggests that learning is not merely an individual cognitive activity but also a socially mediated process involving guidance, interaction, and progressive independence.

Wood et al. (1976) introduced scaffolding as a process through which instructional assistance supports learners in completing complex tasks. Effective scaffolding involves identifying learning difficulties, simplifying tasks, maintaining learner engagement, highlighting relevant information, and gradually transferring responsibility to students. The effectiveness of scaffolding depends on the appropriateness of instructional assistance and the teacher's ability to adjust support according to students' developing competencies.

In digital learning environments, scaffolding can be embedded into multimedia applications through guided explanations, instructional prompts, interactive examples, feedback mechanisms, and progressively challenging activities. Azevedo and Hadwin (2005) emphasized the importance of computer-based scaffolding in supporting self-regulated learning and metacognitive development. Their work provides a theoretical basis for designing digital

environments that encourage learners to monitor their understanding, regulate learning strategies, and develop greater independence.

Interactive Multimedia in Educational Instruction

Interactive multimedia refers to instructional technology that integrates multiple forms of information presentation and allows learners to participate actively in learning activities. Multimedia resources commonly combine written explanations, visual illustrations, audio recordings, videos, animations, and interactive assessment components. The educational value of multimedia lies in its potential to represent complex information through complementary formats while enabling students to interact with instructional content.

Mayer's (2021) Cognitive Theory of Multimedia Learning provides a theoretical explanation of how learners process information through visual and verbal channels. The theory emphasizes that meaningful learning occurs when students select relevant information, organize it into coherent mental representations, and integrate new knowledge with existing cognitive structures. However, multimedia materials must be designed carefully because excessive visual effects, irrelevant information, and poorly organized instructional content can increase cognitive demands.

Principles such as segmenting, signaling, coherence, and appropriate integration of visual and verbal information are particularly relevant to scaffolding-based multimedia design. Mayer and Fiorella (2022) explain that dividing complex multimedia presentations into manageable segments can help learners process essential information more effectively.

The Cambridge Handbook of Multimedia Learning

These principles suggest that interactive learning media should provide clear navigation, manageable learning units, meaningful illustrations, and instructional feedback rather than relying primarily on technological attractiveness.

Hermansyah et al. (2026) demonstrated the practical potential of multimedia learning resources in junior secondary English education. Their digital learning media integrated multimedia content and interactive activities to support public speaking instruction. The reported expert validation and positive student responses indicate the relevance of structured multimedia design for classroom learning. Nevertheless, the integration of explicit TaRL-based grouping and adaptive scaffolding requires further investigation.

Teaching at the Right Level (TaRL)

Teaching at the Right Level is an instructional approach that prioritizes students' demonstrated learning competencies rather than relying exclusively on grade-based curriculum expectations. The approach begins with diagnostic assessment to identify learners' actual proficiency levels. Students are subsequently organized into flexible learning groups, provided with appropriate instructional activities, and reassessed periodically to determine their progress.

Banerjee et al. (2017) demonstrated the importance of aligning instructional practices

with students' actual learning levels. Their research highlighted that successful implementation requires more than simply introducing new instructional materials; teachers must also receive appropriate guidance, use assessment information effectively, and maintain instructional practices that respond to learning needs.

TaRL can be conceptually connected with differentiated instruction because both approaches emphasize responsiveness to individual learning readiness. However, TaRL places particular emphasis on diagnostic assessment, competency-based grouping, and targeted instruction. In multimedia environments, these principles can inform the design of differentiated learning pathways and adaptive instructional assistance.

2.4. Integration of Scaffolding, Multimedia, and TaRL

The integration of scaffolding, interactive multimedia, and TaRL offers a potentially complementary instructional framework. TaRL provides the diagnostic foundation for determining students' learning levels, scaffolding determines the type and intensity of assistance required, and interactive multimedia provides the technological environment through which differentiated learning experiences can be delivered.

For students demonstrating limited foundational competencies, multimedia scaffolding may include simplified explanations, guided demonstrations, visual examples, and immediate feedback. Students with intermediate competencies may receive partially guided exercises and opportunities to apply concepts independently. Students demonstrating advanced competencies may engage in problem-solving tasks, analytical activities, and increasingly independent learning experiences.

This integrated framework reflects the principle that instructional assistance should be adjusted according to learning readiness rather than provided uniformly. It also recognizes that students' competencies are dynamic and may develop through appropriate instruction and formative assessment.

2.5. Research Gap and Conceptual Framework

Existing educational literature provides substantial theoretical support for scaffolding, multimedia learning, and differentiated instruction. Research on TaRL also demonstrates the importance of aligning instruction with students' actual competencies. Nevertheless, the application of these principles within a unified interactive multimedia design for junior secondary education requires contextual investigation.

The present study addresses this conceptual gap by proposing a design framework that connects diagnostic assessment, differentiated multimedia pathways, scaffolded learning activities, and continuous formative evaluation. Its contribution lies in specifying how these elements can operate together as a coherent instructional system.

The proposed conceptual sequence is:

Diagnostic Assessment → Competency Classification → Differentiated Multimedia Activities → Adaptive Scaffolding → Formative Assessment → Learning Progression.

Through this framework, multimedia functions not merely as a digital presentation tool but as a structured instructional

environment intended to support learning progression and increasing student independence.

RESEARCH METHOD

3.1. Research Design

This study is proposed as design-oriented educational research using a descriptive qualitative approach supported by instructional design analysis. The research focuses on examining the pedagogical requirements and structural characteristics of interactive multimedia-based scaffolding media integrated with the Teaching at the Right Level approach. The design is informed by the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) framework, which provides a systematic foundation for instructional development (Branch, 2009).

The present conceptual manuscript concentrates primarily on the analysis and design stages. Subsequent development, implementation, and evaluation stages are intended to be conducted after the proposed framework has been refined through contextual investigation and expert review.

3.2. Research Setting and Participants

The intended research setting is SMP Negeri 2 Panca Rijang, Sidenreng Rappang Regency, South Sulawesi, Indonesia. The proposed participants include junior secondary school students, subject teachers, and relevant instructional stakeholders. Participants should be selected using purposive sampling based on their involvement in classroom instruction and their relevance to the development of multimedia-based learning resources.

The final number of participants, grade levels, subject areas, and sampling criteria will be determined after institutional permission and preliminary needs assessment have been completed.

3.3. Data Collection Techniques

The proposed study employs classroom observations, semi-structured interviews, diagnostic assessments, document analysis, and instructional design evaluation.

Classroom observations are intended to identify instructional practices, student participation, learning difficulties, and the availability of technological resources. Semi-structured interviews with teachers will explore instructional challenges, students' learning differences, and expectations regarding multimedia-based teaching materials.

Diagnostic assessments will be designed to identify students' initial competencies within the selected subject area. The assessment results will inform differentiated learning pathways based on foundational, developing, and proficient competency levels. These categories represent proposed instructional groupings rather than established classifications of students at the research site.

Document analysis will examine curriculum requirements, learning objectives, instructional materials, and assessment practices to ensure alignment between the proposed multimedia design and educational expectations.

3.4. Instructional Media Design Procedures

The proposed design process consists of five interconnected stages.

First, a needs analysis will identify students' learning characteristics, instructional

challenges, and technological conditions. Second, diagnostic assessment results will be used to establish appropriate learning levels and identify essential instructional competencies.

Third, multimedia learning materials will be organized into differentiated instructional pathways incorporating text, images, audio, video, animations, and interactive exercises. Fourth, scaffolding mechanisms will be integrated through guided explanations, examples, prompts, feedback, and progressively reduced instructional assistance.

Finally, formative assessment activities will be embedded to monitor students' learning progress and inform adjustments to instructional support. The design will also consider usability, accessibility, content relevance, and the practical requirements of classroom implementation.

3.5. Data Analysis

Qualitative data from observations, interviews, and documents will be analyzed using thematic analysis. The analytical process will involve familiarization with the data, coding, identification of recurring themes, interpretation of instructional needs, and synthesis of design requirements (Braun & Clarke, 2006).

Diagnostic assessment data will be summarized descriptively to identify variations in learning readiness. If expert validation is conducted, numerical ratings may be analyzed using descriptive statistics, while qualitative comments will inform revisions to the instructional design.

3.6. Trustworthiness and Ethical Considerations

Research trustworthiness will be supported through data triangulation, transparent documentation, and comparison of information obtained from different sources. Ethical procedures will include institutional approval, appropriate consent, confidentiality, and responsible management of student information.

The proposed methodology does not assume that the multimedia system has already been implemented or empirically validated. Claims concerning feasibility, practicality, and effectiveness will require evidence from subsequent evaluation stages.

RESULTS

This section reports the analytical outcomes of the proposed design framework. It does not represent completed fieldwork or measured student outcomes at SMP Negeri 2 Panca Rijang.The conceptual analysis identifies the alignment between students' learning readiness and instructional complexity as a central requirement for developing interactive multimedia-based scaffolding media. Conventional digital instructional resources frequently present identical content and learning sequences to all students, regardless of differences in prior knowledge and learning competencies. Such uniformity may limit the capacity of instructional technology to accommodate diverse learning needs.

The proposed framework addresses this limitation by placing diagnostic assessment at the beginning of the instructional process. Instead of assuming that students within the same grade possess equivalent competencies, the design requires teachers to identify actual

learning readiness before assigning multimedia activities.

The framework also identifies curriculum alignment, accessibility, instructional clarity, and formative feedback as essential design requirements. Each multimedia component should contribute directly to specific learning objectives and provide meaningful support for students' competency development.

Importantly, the analysis distinguishes instructional adaptation from technological complexity. An effective adaptive learning environment does not necessarily require advanced artificial intelligence or sophisticated automated systems. Teachers can implement level-based instructional pathways using relatively simple digital platforms, provided that the instructional materials are appropriately structured and supported by diagnostic information.

The TaRL-oriented framework organizes instructional activities according to students' demonstrated competencies. Three provisional learning categories are proposed to illustrate how differentiated multimedia pathways may be structured.

Learning level	**Instructional characteristics**	**Proposed multimedia support**
Foundational	Students require substantial assistance with prerequisite concepts	Simplified explanations, visual demonstrations, guided examples, repeated practice
Developing	Students demonstrate partial understanding but require occasional support	Interactive exercises, contextual examples, hints, corrective feedback
Proficient	Students demonstrate relatively independent understanding	Advanced tasks, problem-solving activities, independent exploration

These categories should not be interpreted as permanent labels. Students may progress between learning pathways as their competencies develop.

The proposed classification emphasizes flexibility because learning readiness may vary across different topics and skills. A student demonstrating proficiency in one area may require additional assistance in another. Therefore, instructional grouping should remain responsive to topic-specific diagnostic evidence.

The proposed multimedia structure consists of interconnected instructional components intended to support differentiated learning experiences.

The first component is an introductory learning interface presenting instructional objectives, navigation instructions, and relevant learning activities. Clear navigation is essential for minimizing unnecessary cognitive demands and helping students understand the structure of the digital learning environment.

The second component is a diagnostic assessment interface designed to identify students' initial competencies. The assessment may include short questions,

practical exercises, and tasks aligned with prerequisite knowledge.

The third component is the differentiated instructional content interface. Learning materials are organized according to competency levels, with each pathway providing appropriate explanations, illustrations, and practice activities.

The fourth component is the scaffolding interface, which provides temporary assistance through instructional prompts, demonstrations, guiding questions, and feedback.

The fifth component is the formative assessment interface. This component enables teachers and students to review learning progress and determine whether additional assistance, repeated practice, or more advanced instructional activities are appropriate.

Together, these components establish a proposed multimedia environment in which instructional decisions are informed by students' demonstrated learning needs.

The conceptual analysis identifies adaptive scaffolding as a distinguishing characteristic of the proposed media design. Unlike static instructional resources that provide identical assistance throughout the learning process, adaptive scaffolding requires instructional support to change according to learners' developing competencies.

At the foundational level, students may receive extensive instructional assistance through detailed explanations, guided demonstrations, and structured exercises. This assistance is intended to reduce unnecessary learning difficulties and establish prerequisite understanding.

At the developing level, instructional assistance may become less explicit. Students can be encouraged to complete activities independently while retaining access to hints, examples, and feedback when necessary.

At the proficient level, scaffolding may be reduced further to encourage independent problem-solving, critical thinking, and knowledge application.

The proposed design therefore incorporates a gradual transition from highly supported learning toward independent performance. However, the removal of assistance should be determined by evidence of student understanding rather than by fixed instructional schedules.

The proposed framework establishes relationships between multimedia features and their intended instructional functions.

Multimedia feature	**Scaffolding function**	**Intended learning support**
Instructional text	Conceptual explanation	Clarifies essential information
Images and diagrams	Visual representation	Supports conceptual understanding
Audio narration	Verbal guidance	Provides an alternative presentation format
Instructional video	Modeling	Demonstrates processes and procedures
Animation	Process visualization	Illustrates sequences

		and relationships
Interactive exercises	Guided practice	Encourages active application
Corrective feedback	Performance support	Helps students recognize and address errors
Formative quizzes	Learning monitoring	Informs subsequent instructional decisions

The educational contribution of each feature depends on its alignment with learning objectives and students' actual needs. Consequently, multimedia elements should be selected according to instructional relevance rather than visual attractiveness alone.

The conceptual design positions assessment as a continuous instructional process rather than an activity conducted exclusively at the end of learning.

Diagnostic assessment identifies students' starting competencies and informs the selection of instructional pathways. Formative assessment monitors learning progression and determines whether the current level of instructional assistance remains appropriate.

For example, students who repeatedly experience difficulties with foundational exercises may require additional explanations, alternative representations, or guided practice. Conversely, students who demonstrate consistent understanding may be directed toward more challenging activities.

The framework therefore establishes a feedback relationship between assessment information and instructional decisions. This relationship is essential to the TaRL principle of adjusting instruction according to actual learning performance.

The proposed multimedia design has several theoretically anticipated educational benefits. Interactive exercises may encourage students to participate actively rather than receive information passively. Visual demonstrations and contextual examples may help learners understand concepts that are difficult to communicate through written explanations alone.

Differentiated learning pathways may also reduce the mismatch between instructional difficulty and student readiness. Appropriate learning challenges can provide opportunities for students to experience progress without being overwhelmed by excessively complex tasks.

Furthermore, gradually reduced scaffolding may support the development of independent learning habits. Students can be encouraged to monitor their understanding, use feedback constructively, and assume greater responsibility for completing instructional activities.

These potential contributions remain theoretical until supported by classroom implementation and empirical evaluation.

The conceptual analysis identifies five major dimensions for evaluating the proposed instructional media.

Evaluation dimension	**Proposed indicators**
Content quality	Accuracy, relevance, curriculum alignment

Instructional scaffolding	Clarity of assistance, adaptability, gradual reduction of support
Multimedia quality	Visual clarity, interactivity, navigation, cognitive appropriateness
TaRL alignment	Diagnostic assessment, competency-based grouping, differentiated activities
Usability and accessibility	Ease of use, device compatibility, accessibility, teacher manageability

These dimensions may be translated into expert validation instruments and classroom evaluation rubrics during subsequent development stages.

The proposed evaluation should distinguish validity, practicality, and effectiveness. Validity concerns the appropriateness of content and instructional design. Practicality concerns the ease and feasibility of implementation. Effectiveness concerns demonstrated improvements in learning outcomes.

At the present stage, no numerical validation scores or effectiveness measurements are available for the proposed media at SMP Negeri 2 Panca Rijang.

DISCUSSION

The proposed integration of interactive multimedia-based scaffolding media and the Teaching at the Right Level approach provides a conceptual contribution to differentiated instructional design. The central principle of this integration is that effective learning support should correspond to students' actual competencies rather than being determined exclusively by formal grade placement. This principle is particularly important in classrooms characterized by differences in prior knowledge, learning experiences, cognitive readiness, and academic achievement. By connecting diagnostic assessment with instructional scaffolding, the proposed framework establishes a systematic relationship between students' learning needs and the assistance provided during instructional activities.

The integration is theoretically consistent with Vygotsky's (1978) Zone of Proximal Development, which emphasizes the importance of appropriate assistance in enabling learners to accomplish tasks beyond their independent capabilities. In this framework, TaRL functions as a mechanism for identifying students' current competencies, while scaffolding provides the instructional assistance necessary to support progression toward more advanced learning objectives. This relationship suggests that diagnostic assessment and instructional support should operate as interconnected components rather than separate educational activities.

The proposed framework also extends the practical interpretation of differentiated instruction. Tomlinson (2014) emphasizes the importance of responding to learners' readiness, interests, and educational needs. Through TaRL-oriented scaffolding, differentiation can be operationalized by adjusting the complexity of instructional materials, the intensity of learning assistance, and the progression of learning activities. Such adjustments may create opportunities for students with different competency levels

to participate meaningfully in classroom instruction.

Interactive multimedia offers a potentially effective environment for implementing differentiated instructional support because it allows educational information to be represented through multiple formats. Textual explanations, images, audio recordings, instructional videos, animations, and interactive exercises can provide complementary opportunities for students to understand learning materials. However, the effectiveness of these resources depends on their instructional organization and cognitive appropriateness.

Mayer's (2021) Cognitive Theory of Multimedia Learning suggests that multimedia environments should be designed to support meaningful information processing rather than simply increase the quantity of instructional information. Excessive visual elements, unnecessary animations, and poorly structured presentations may distract students and increase cognitive demands. Consequently, the proposed scaffolding media should prioritize instructional clarity, relevant multimedia representations, and manageable learning sequences. This is consistent with the empirical insights of Nurdin et al. (2025), which confirmed that the well-designed integration of audio-visual components inside an interactive framework drastically reduces cognitive load constraints while significantly amplifying instructional precision for junior high school students. Therefore, the current framework extends this principle by establishing a responsive relationship between explicit multimedia features and adaptive TaRL-based learning pathways.

The study by Hermansyah et al. (2026) provides relevant empirical support for developing multimedia learning resources in junior secondary education. Their research demonstrated that digital media integrating text, images, videos, and interactive activities could achieve favorable expert validation and positive responses from students and teachers. These findings suggest that carefully designed multimedia resources can be practical and acceptable within junior secondary instructional contexts.

Nevertheless, the present framework differs from that study by emphasizing the relationship between diagnostic assessment, competency-based learning pathways, and adaptive instructional assistance. Rather than focusing exclusively on multimedia development, the proposed design integrates pedagogical mechanisms intended to respond dynamically to differences in students' learning readiness.

Diagnostic assessment represents a fundamental component of the proposed TaRL-based instructional framework. Without accurate information regarding students' existing competencies, teachers may encounter difficulties determining appropriate instructional materials and learning activities. Diagnostic assessment provides an evidence-based foundation for identifying prerequisite knowledge, recognizing learning difficulties, and organizing instructional support.

The importance of competency-based instruction is supported by Banerjee et al. (2017), who demonstrated that aligning instruction with students' actual learning levels can contribute to improved educational outcomes when implemented systematically.

Their research also indicates that successful implementation depends on appropriate teacher support, instructional organization, and continuous monitoring rather than the introduction of learning materials alone.

Within the proposed multimedia framework, diagnostic assessment is intended to inform differentiated instructional pathways. Students requiring substantial assistance may receive simplified materials and guided explanations, while students demonstrating greater understanding may engage in more challenging activities.

However, learning-level classification should remain flexible. Students' abilities are not fixed characteristics, and instructional grouping should be revised according to evidence of learning progression. This flexibility is particularly important for preventing competency classifications from becoming permanent labels that restrict students' educational opportunities.

The gradual reduction of instructional assistance is an essential characteristic of effective scaffolding. Wood et al. (1976) emphasized that scaffolding should support learners in completing tasks that would otherwise be difficult to accomplish independently. As students develop greater competence, instructional assistance should be adjusted to encourage independent performance.

In interactive multimedia environments, this process can be facilitated through progressively structured learning activities. Students may initially receive detailed explanations, worked examples, and guiding questions. As their understanding improves, instructional assistance may shift toward occasional hints, feedback, and opportunities for independent problem-solving.

Azevedo and Hadwin (2005) emphasized the importance of scaffolding in supporting self-regulated learning and metacognitive processes within computer-based learning environments. Their perspective suggests that multimedia scaffolding should not merely provide answers but should also encourage students to monitor understanding, evaluate performance, and regulate learning strategies. Accordingly, the proposed design incorporates opportunities for self-assessment, reflective feedback, and independent task completion. These components are intended to encourage students to become increasingly responsible for their learning processes.

Nevertheless, the effectiveness of adaptive scaffolding requires empirical examination. Students may respond differently to instructional assistance, and the appropriate timing for reducing support may vary according to task complexity, prior knowledge, and individual learning characteristics.

The proposed framework has practical implications for instructional planning at SMP Negeri 2 Panca Rijang. Its implementation would require teachers to integrate diagnostic assessment, differentiated multimedia activities, and formative evaluation into regular instructional practices.

Teachers would need to identify relevant learning objectives, determine prerequisite competencies, and develop appropriate learning pathways. Multimedia materials should be selected or developed according to

curriculum requirements and students' demonstrated needs.

The framework also emphasizes the continuing importance of teachers as instructional facilitators. Digital learning resources should support pedagogical decision-making rather than replace teachers' professional judgment. Teachers remain responsible for interpreting assessment information, providing additional explanations, facilitating classroom interaction, and determining appropriate instructional adjustments.

Furthermore, implementation should consider technological accessibility. The availability of devices, internet connectivity, classroom facilities, and students' digital literacy may influence the practicality of multimedia-based instruction. Offline-accessible resources, simplified navigation, and compatibility with commonly available devices may therefore be important design considerations.

These considerations require investigation through school-based needs assessment before specific implementation strategies can be recommended.

The principal theoretical contribution of this study is the proposed integration of scaffolding theory, multimedia learning principles, and TaRL into a unified instructional design framework. Each perspective contributes a distinct function: TaRL identifies learning readiness, scaffolding determines instructional assistance, and multimedia provides the technological environment for delivering differentiated learning experiences.

The framework proposes that meaningful adaptive learning requires coordination among assessment, instructional content, learner interaction, and formative feedback. This perspective extends the conceptualization of multimedia beyond digital content presentation toward a more responsive instructional support system.

However, several limitations must be acknowledged. First, the present manuscript is based on conceptual instructional design analysis rather than completed classroom implementation. Second, the proposed learning pathways and scaffolding mechanisms have not yet undergone expert validation or usability testing at SMP Negeri 2 Panca Rijang. Third, the effectiveness of the proposed media in improving student engagement, independent learning, and academic achievement has not been established through empirical measurement.

Future research should therefore examine the feasibility, validity, practicality, and effectiveness of the proposed framework through systematic development and classroom evaluation. Comparative or quasi-experimental research may also be conducted to determine whether TaRL-based interactive multimedia scaffolding produces measurable improvements relative to existing instructional practices.

CONCLUSION

This study proposes an integrated instructional design framework combining interactive multimedia-based scaffolding media with the Teaching at the Right Level (TaRL) approach for students at SMP Negeri 2 Panca Rijang, Sidenreng Rappang Regency. The conceptual analysis indicates that the integration of diagnostic assessment, competency-based instructional grouping,

differentiated multimedia content, adaptive scaffolding, and continuous formative evaluation provides a theoretically grounded approach to addressing differences in students' learning readiness. The proposed design incorporates multimedia elements such as text, images, audio, video, animations, interactive exercises, and corrective feedback to support meaningful learning experiences. Through the application of scaffolding principles, instructional assistance is intended to be adjusted progressively according to students' developing competencies, thereby supporting active participation, conceptual understanding, and increasing learner independence. The framework emphasizes that effective educational technology should not be evaluated solely by its technological sophistication but also by its capacity to provide appropriate instructional support aligned with students' actual learning needs.

The study contributes a conceptual foundation for developing differentiated digital instructional resources in junior secondary education. However, the proposed framework requires further empirical investigation before conclusions regarding its validity, practicality, and effectiveness can be established. Future research should involve contextual needs assessment, instructional media development, expert validation, usability evaluation, and classroom implementation at SMP Negeri 2 Panca Rijang. Additional studies should examine students' learning outcomes, engagement, self-regulated learning, and responses to differentiated multimedia activities. Teachers' experiences and technological accessibility should also be considered to ensure the sustainability of implementation. Ultimately, integrating scaffolding principles with TaRL-oriented multimedia design offers a promising direction for developing more inclusive, adaptive, and student-centered learning environments that accommodate diverse learning abilities and support progressive academic development.

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