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The Design of A Multimedia-Assisted Deep Learning (MADL) Module for Chinese Character Learning

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Abstract

This study reports the process of design of a Multimedia-Assisted Deep Learning (MADL) module for primary Chinese character learning, targeting the integration of pronunciation, shape, and meaning while cultivating critical thinking and problem-solving skills. Using a Design and Development Research (DDR) approach operationalized through the ADDIE model, the study intergrate Cognitive Theory of Multimedia Learning, Bloom's Taxonomy, and cognitive semantic theory into concrete instructional decisions. This paper elaborates on the design of learning objectives and content, teaching strategies, multimeida materials, and assessment strategies. These components link radicals to contextualized reading–writing–meaning activities and higher-order tasks, ready for immediate classroom use. This paper contributes replicable, practical, and reusable design guidelines within a DDR/ADDIE–Design focus; a case module exemplifies the approach, comprising a teacher booklet and PPT materials aligned with the target texts.

Keyword: Design and Development Research (DDR), ADDIE Model, Module, Multimedia Learning, Chinese Character Education

Introduction and Problem Statement

Chinese character literacy is a foundational component of chinese language education in the early years of schooling, as it underpins subsequent reading comprehension, written expression, and culturally grounded meaning-making (Jiang, 2017). In contemporary primary education, character instruction is increasingly expected to move beyond rote accumulation of forms toward integrated language competence and the gradual cultivation of higher-order skills such as problem-solving, and critical thniking (Liu, 2020). This expectation is strengthened by wider social and educational shifts, including (a) the rising emphasis on higher-order learning outcomes and learner agency, and (b) the rapid normalisation of digital and multimodal learning environments in and beyond the classroom (Rajaram, 2023).

However, there are several persistent issues hinder this goal. First, the complexity and volume of characters make simultaneous mastery of pronunciation, orthography, and semantics especially demanding for young learners (Yang, 2022). Second, early instruction often over-relies on Pinyin, which scaffolds decoding but can delay the development of direct character recognition and semantic access, weakening form–meaning links (Lee & Jaganathan, 2020; Harvey & Brooks, 2025). Third, while writing practice strengthens orthographic encoding and recall, it is comparatively less effective for meaning retrieval than rich input (e.g., reading, animation), and thus requiring the integration of multimedia technology (Xu et al., 2013). However, integrating multimedia technologies into instruction also faces practical hurdles—tool usability and infrastructure limitations—which can limit their effectiveness in practice (Ye et al., 2025).

These issues call for a balanced, integrated, and workable instructional approach that can overcome current constraints and effectively support lower-grade students' Chinese-character learning. Well-structured instructional modules offer students a comprehensive framework that facilitates students' literacy development (Donnelly & Fitzmaurice, 2005), few existing solutions successfully combine multimedia design with radical-based semantic scaffolding in a manner that is both theoretically grounded and readily feasible for classroom teachers.

For example, game-based learning modules such as the Chinese-PP Game encourage students to build legitimate characters collaboratively by assigning them individual components, thereby fostering peer interaction and social negotiation (Wong & Hsu, 2016). This method has demonstrated strong learning gains and high engagement levels, but lack deep integration with formal semantic structures of characters, which limits long-term transferability of knowledge. In response to the above challenges, this study focuses on designing and developing a multimedia-assisted deep learning (MADL) module.

The MADL module is delivered in the form of a teacher booklet and PowerPoint (PPT) materials. PPT is adopted as a low-threshold, slide-based medium for classroom feasibility, while the underlying design guidelines are portable to other slide tools. The PPT materials are designed in accordance with Mayer's multimedia design principles (11 principles chosen), and the overall module design is guided by three theories—Cognitive Theory of Multimeida Learning (CTML), Bloom's Taxonomy, and cognitive semantic theory—to link radicals with contextualized reading–writing–meaning activities and higher-order tasks.

The research questions that guide this study is: What main knowledge, strategies, activities and exercises should be included in the MADL module to improve deep learning?

Literature Review

Theoretical Foundation

To ground the module's design in established learning science, three theories were adopted. CTML informs the presentation of information (how to show), Bloom's Taxonomy structures task progression and assessment (what learners do), and cognitive semantics guides form–meaning linkage in Chinese characters (what meanings to build).

Cognitive Theory of Multimedia Learning (CTML)

CTML explains learning through dual channels (visual–pictorial, auditory–verbal), limited working-memory capacity, and active processing (Mayer, 2009). Effective multimedia design therefore reduces extraneous load, manages intrinsic load, and fosters germane processing, improving retention, transfer, critical thinking and problem solving (Putra, Nurdin & Fathimah, 2024; Meryastiti et al., 2023). In line with this account, Mayer (2009) proposes a set of multimedia design principles to guide the construction of effective instructional materials—Multimedia, Coherence, Signaling, Redundancy, Spatial Contiguity, Temporal Contiguity, Segmenting, Pre-training, Modality, Personalization, and Voice—all of which are applied in this study. An additional Image principle is not adopted here, as current evidence does not consistently show a learning benefit.

In Chinese-character learning, some studies have shown significant benefits of applying the multimedia design principles of CTML. For example, She et al. (2009) typically advises against presenting the same information in multiple formats, because this violates the redundancy principle. Instead, designers should avoid adding onscreen captions to narrated graphics. Furthermore, principles such as signaling, spatial/temporal contiguity, modality, redundancy control, and segmentation help learners handle complex graph forms without overload. Accordingly, the MADL module specifies slide-level practices—highlighting key information, controlling information density and pacing, and aligning graphics with narration—to support attention allocation and representation building across reading–writing–meaning.

Bloom's Taxonomy

The revised Bloom framework organizes cognitive objectives from Remember and Understand to Apply, Analyze, Evaluate, and Create, capturing the progression toward deeper learning (Anderson & Krathwohl, 2001; Armstrong, 2010). Bloom's Taxonomy has proven adaptable across instructional contexts, including digital environments where its levels inform the design of search, multimedia, and discussion tasks (Hu, Xiao, & Chen, 2023). In outcome-based education it scaffolds higher-order thinking (Ravichandran & Virgin, 2024), and in teacher preparation it helps novices plan structured, learner-centred lessons (Nurmatova & Altun, 2023). Taken together, this flexibility makes Bloom a suitable backbone for Chinese-character instruction aimed at deep learning goals.

In this study, Bloom provides the backbone for task sequencing and assessment alignment: each lesson moves from recognition/understanding of form–meaning to application in context, then to analysis and evaluation (e.g., contrasting semantically related radicals/morphemes), and culminates in small creative outputs (oral/written), thus linking surface mastery with higher-order transfer.

Cognitive Semantics

Cognitive semantics emphasizes that meaning is constructed and contextual, drawing on perception, memory, inference, and cultural schemas (Kövecses, 2012). For Chinese-character instruction, semantic components/radicals, graphic motivation, and etymological–cultural narratives act as cognitive cues that promote direct form-to-meaning access and contextual verification (Wang et al., 2024). MADL therefore foregrounds "component–meaning–context" linkages as a design principle: grouping characters by semantic

components, using them to cue inference, and validating meanings within texts and tasks to stimulate generative processing and the growth of semantic networks.

Taken together, CTML's load-regulation and presentation rules, Bloom's task progression with assessment alignment, and cognitive semantics' component–meaning–context mechanism are unified in MADL as a design framework of goals → task sequences → slide-level rules to drive reading–writing–meaning integration and the cultivation of higher-order thinking.

Advantages of Using Low-Threshold PowerPoint in Education

As a low-threshold tool, PowerPoint's user-friendly interface and cost-effectiveness allow teachers to get started with minimal training or financial outlay, supporting broad uptake in everyday classrooms (Chen, 2012; Mitchell, 2003). It seamlessly integrates text, images, audio, video, and simple animations, turning abstract content into concrete learning materials and thereby enhancing students' engagement, comprehension, and retention (Pan, 2024; Staneviciene & Žekienė, 2025). Furthermore, using PowerPoint in educational settings can help develop students' digital literacy, creativity, and independent learning skills. These skills are essential in the digital age and can be fostered through interactive and multimedia-rich presentations (Sarder, 2014; Staneviciene & Žekienė, 2025).

At the same time, effective use depends on basic technical readiness and continuing teacher development; tool limitations and the need for ongoing training can temper classroom impact (Staneviciene & Žekienė, 2025). Accordingly, the multimedia PPT materials for the module were designed in accordance with Mayer's principles, and supplies teacher notes, step-by-step guidelines, and reusable PPT templates to support consistent, high-quality implementation.

Design Method and Module Specification

This section integrates the research method and the resulting design. Design and Development Research (DDR) was adopted to generate a tangible product and portable design knowledge through iterative specification, review, and revision. ADDIE structures the work: Design translates theoretical lenses into objectives, strategies, media rules, and procedures. The Analysis, Development, Implementation, and Evaluation stages are treated in separate manuscripts, keeping this paper focused on Design. Teacher-ready materials, including booklet and PPT templates, are presented as the primary design outcomes.

The design process includes several key components. According to Branch (2009), Tu et al. (2021), and Boyman et al. (2020), this stage needs to include learning objectives, instructional strategies, and testing strategies. In addition, choosing the right type of media, how to take the instructional steps, and determining how to achieve the instructional objectives should also be included in this phase (Uzunboylu & Kosucu, 2017; Oliver et al, 2017). During the design phase, the content, instructional strategies, multimedia aids and key activities were prepared and planned. All data collected in the analysis phase (which is the first phase in DDR/ADDIE) were considered in this design phase. In this study, the requirements and objectives of the Chinese literacy of the lower primary level covered by the curriculum standards for the compulsory education level issued by the Chinese Ministry of Education (MOE, 2022) are identified as the goals and learning outcomes to be achieved by the students.

Learning Objectives' Design

Module-level and lesson-level objectives were aligned with the MOE (2022) curriculum standards for lower-primary literacy, the learner profile (cognitive characteristics, prior knowledge and skills, proficiency), and 21st-century competencies (cognitive domain). In line with MOE expectations, lower-grade learners are guided to attend to characters in authentic public texts; recognise high-frequency characters in signs/diagrams/pictographs; use Pinyin as a scaffold toward direct character recognition; infer pronunciation/meaning via radicals; and verify inferences when encountering unfamiliar characters. Therefore, in this study, the overall goal of the MADL module is to improve:

- Core academic content (Chinese-character knowledge): reading, writing, and comprehension;
- Problem-solving: posing questions of interest and applying character knowledge to everyday tasks;
- Critical thinking: describing observations and reasoning, and expressing justified viewpoints orally or in writing/drawing.

Lesson objectives are derived from the overall goal and specified in each lesson plan. Bloom's Taxonomy structures the progression, with objectives distributed across lower- and higher-order levels (Remember–Understand → Apply–Analyze–Evaluate–Create) according to each lesson's intent. The following Table 1 shows an example of the table of specification of learning objectives of a specific Unit in this module, as follows:

Table 1

Specification of Content

Learning Objectives	**Bloom's Taxonomy (level 1-6)**						**Relevant deep learning skills**				
							Master academic knowledge		core	PS	CT
	L1	L2	L3	L4	L5	L6	R	W	U		
1. Recognise and read correctly 15 characters such as "州 zhou、华 hua".	/						/				
2.Show correct and aesthetical writing of 9 Chinese characters, such as '州 zhou、华 hua', and 10 words, such as '神州 shenzhou、中华 zhonghua'			/					/			
3.Accumulate and apply 8 words such as '中华儿女 children of China, 华夏子孙 children of the Yellow Emperor' in contexts, as well as to experience the expressive effects of words, such as '奔、涌' in videos, ancient poems, and sentence-making			/						/	/	/
4.Differentiate similar shaped words.				/					/		/
5. Discover and evaluate the magnificent beauty of the					/				/		/

motherland's mountains and rivers in China through reading the text aloudly, and correctly and appreciating the pictures of the sceneries.												
6. Recite the signs of the Chinese zodiac in order	/						/					
7. understanding of the culture of the Chinese zodiac, and be able to describe it by self.		/							/			
8. Design and creat own name cards.						/		/	/		/	/
9. Act as a tour guide to introduce the great mountains and rivers of China to foreign friends through group work.					/	/			/		/	/
Total	2	1	2	1	2	2	1	2	6		3	5

*R=reading, W=writing, U=understanding, PS=problem-solving, CT=critical thinking

Instructional Content Selection and Design

The selection of course content and the setting of topics in this module are based on the recommendations of MOE (2022). MOE (2022) recommends that students in the lower grades should know the commonly used words related to the human body and behavior, the world, and all things in nature, as well as the commonly used words in family life, school life, and social life. Materials were chosen to (a) foreground Chinese-character knowledge (form–sound–meaning), (b) enable radical–meaning mapping in context, and (c) create entry points for problem solving and critical thinking. Sequencing considered difficulty, theme coherence, and school timetabling (integration in April 2024 during the school's scheduled units).

The module aligns with the Grade-2 textbook. Unit 3 ("Traditional Culture") offers rich, contextual texts that support vocabulary expansion and radical–meaning mapping, including content on landscapes, festivals, etymological notes, and food culture. Unit 5 ("Approach") provides narratives and tasks that naturally elicit multiple perspectives, judgment, and solution seeking, such as fables and situational problem contexts. Non-core extension pieces (for example, long independent-reading passages) were not included so that contact time could focus on guided in-class tasks.

The MADL module is organised under the overarching theme "Wisdom Inheritance: Exploring the Fusion of Traditional Culture and Modern Approaches" and is delivered across three sub-themes comprising seven lessons. Unit 1 ("Introduction") includes two lessons: Lesson 1, "Evolution and Construction of Chinese Characters," addresses character structure, radicals, and basic form–meaning links; Lesson 2, "Problem Solving—I Can Do It," develops observational strategies, guides students to verify their conjectures with a dictionary, and consolidates the meanings of selected radicals. Unit 2 ("My Journey to Traditional Culture"), which corresponds to Textbook Unit 3, also includes two lessons: Lesson 3, "Exploring the Chinese Landscape," develops contextual learning from poetic or ballad excerpts with in-situ radical–meaning mapping; Lesson 4, "I Love My Country," integrates multiple Unit-3 texts on festivals and culture to consolidate reading–writing–meaning. Unit 3 ("Let's See Whose Idea

Is Best"), which corresponds to Textbook Unit 5, contains three lessons: Lesson 5, "Look from a Different Perspective," contrasts viewpoints and semantic nuances using materials such as "Painting Poplar Peaches" and "Language Garden 5"; Lesson 6, "Which Way Works Best?," analyses solutions with the story "A Little Horse Crosses the River" and related language tasks; Lesson 7, "Little Tricks to Set a Convention," uses an oral-communication scenario on setting a book-saving convention to elicit applied reasoning and expression.

This selection prioritises pieces that directly support radical cues, contextual verification, and higher-order questioning, while excluding extensive independent-reading sections to preserve time for CTML-aligned multimedia tasks and formative checks. The schedule and instructional hours for each lesson in each unit of the MADL module are shown in Table 2.

Table 2
The schedule and study hours of each course in each unit of the MADL module

Theme	Unit	Content of Lesson		Academic hour
Wisdom Inheritance: Exploring the Fusion Journey of Traditional Culture and Modern Approaches	1. Introduction	1	Evolution and Construction of Chinese Characters	1.5
		2	Problem solving-- I can do it	1.5
	2. My Journey to Traditional Culture	3	Learning Chinese Characters to Explore the Chinese Landscape	1
		4	I Love My Country	2
	3. Let's see whose idea is the best	5	Look At It from a Different Perspective	2
		6	Whose Way is the Most Useful	3
		7	Little Tricks to Set a Convention	1

Instructional Strategies Selection and Design

Instructional strategies were selected to connect objectives, content, and activities in a logical progression that supports knowledge construction (Branch, 2009; NSW DoE, 2023). Decisions were informed by the MOE (2022) goals, students' current learning status, and a focused review of strategies shown to promote deep learning in Chinese-character instruction.

Core strategies used across nearly all lessons are: (1) cooperative learning (Millis, 2014; Fang et al., 2022), with structured roles and interdependence to increase participation, explanation, and peer feedback, which are key levers for higher-order thinking and transfer; (2) CTML-aligned multimedia support (Tao, 2021), with PPT materials designed using signaling, contiguity, modality, redundancy control, and segmentation to reduce extraneous load and focus processing; (3) Character Etymology Method for Literacy (Zhang et al., 2023), with explicit use of radicals/semantic components and etymological cues to strengthen form–meaning mappings, cultural understanding, and motivation.

Supporting techniques are incorporated as needed. Contextualisation/situation tasks (e.g., public signs, school/home scenarios) elicit reasoning in authentic constraints (Xu, 2022). Questioning and problem-based learning drive inquiry, explanation, and justification (Zhao, 2015). Gamification are suitable to sustain attention and rehearsal through quick challenges

aligned to objectives (Xu, 2022). Thinking visualisation (e.g., mind maps/graphic organisers) externalises reasoning and support recall, comprehension, and critical thinking (Schraw & Richmond, 2022).

Multimedia Materials Design

The module employs PowerPoint as a low-threshold, slide-based carrier to integrate text, graphics, audio, video, and simple animation. Design choices are guided by CTML (Mayer, 2009/2021) to align cognitive processing with learners' capacities and to support reading–writing–meaning integration. The design goals for slides are specified to (a) reduce extraneous processing, (b) manage essential processing, and (c) foster generative processing.

According to Mayer (2009), principle of Coherence, Signaling, Redundancy, Spatial/Temporal Contiguity can be used to reducing extraneous processing. Nonessential decorations (e.g., flashing text, unrelated images) are removed; one-idea-per-slide is enforced. Key elements are highlighted via color/shape cues and concise labels; graphics are placed adjacent to their corresponding words and presented in synchrony with explanations. On-screen text is kept minimal to avoid duplicating narration.

For managing essential processing, principle of Segmenting, Pre-training, Modality are useful. Explanations are micro-segmented into short steps, with pauses for brief checks or prompts. A pre-training unit introduces character evolution and structure and basic strategies (radicals, problem-solving, critical-thinking routines) before the main lessons. When feasible, spoken explanation with graphics is preferred over dense on-screen prose.

For fostering generative processing, principle of Personalization and Voice are effective. Teacher scripts use conversational style to invite prediction, explanation, and justification; audio resources use human voice (teacher-recorded or professionally narrated) to maintain social presence and engagement.

For example, in the lesson "Which Way Works Best?" the character "棚(stables)" (see Figure 1) is introduced with recognisable images placed beside the corresponding labels, while colored cues mark the character's components. The slide avoids long prose, synchronizes the reveal of parts with narration, and prompts learners to infer and verify meaning and pronunciation using radicals—thereby combining signaling, contiguity, redundancy control, modality, and segmentation in a single page.

Figure 1 *"Recognising the word '棚' in relation to its meaning"*

Assessment Strategies Design

The assessment plan combines formative and summative approaches to monitor progress toward module objectives and to align evidence with the cognitive dimension of deep learning (Branch, 2009; Dolin, Black, Harlen, & Tiberghien, 2018).

For formative assessment, each lesson embeds brief checks linked to its objectives, including in-class tasks (e.g., quick reads, radical identification, context use), exit mini-quizzes, and short after-class exercises. Teachers also use analytic rubrics to capture performance on (i) reading (fluency and accuracy), (ii) writing (form and structure), (iii) understanding (meaning in context), and (iv) problem solving & critical thinking (analysis, evaluation, application and creation). To develop learners' metacognition and collaboration, the module provides student self-assessment (reflection on mastery, participation, clarity of expression) and peer assessment (contribution, responsiveness, on-task behavior). These tools supply rapid feedback for instructional adjustment and for students' self-regulation.

For summative assessment, a curriculum-aligned test administered after all units evaluates (1) knowledge and skill acquisition and (2) application in context, the two levels most relevant to the module's cognitive focus (Branch, 2009). Instruments consist of pre- and post-tests designed from the course objectives and mapped to Bloom's taxonomy. A table of specifications links items to objectives and cognitive levels to ensure content coverage and difficulty balance.

Conclusion, Implications, Limitations, and Future Directions

This design-focused study adopts CTML, Bloom's Taxonomy, and cognitive semantics into a practical framework, producing a teacher-ready booklet and PPT materials for Grade-2 Chinese-character instruction. MADL module integrates reading–writing–meaning with higher-order tasks while managing essential processing, fostering generative processing, and reducing extraneous processing through following muletimedia design pronciples. The framework and materials offer a replicable pathway for classrooms operating under resource constraints.

The implications of this study lie in several aspects. For classroom teachers, the MADL module provide clear, actionable conventions that support consistent delivery and quick adaptation to lesson aims. For school-based professional development, the framework can be used for joint lesson planning, lesson study, and micro-training in multimedia design literacy. For textbook alignment, the approach scales to other texts within the same grade and to adjacent grades with recalibrated objectives and task difficulty, preserving the underlying rules while adjusting content scope.

However, this study exists limitations. This study adopts ADDIE instructional design model, alternative design frameworks were not examined. Future research could probe alternative design models (e.g., Dick–Carey, Kemp, Design Thinking, or Learning Experience Design) to compare workflows and design yield against the ADDIE approach used here. The module is context-bound to Grade-2 learners, specific textbook units, and a fixed semester timetable. Future research can extend the design to other grades, curricula, and schedules, with systematic re-specification of objectives and tasks and comparative evaluation of usability and learning effects.

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