Differentiated Flipped Collaborative Multimodal Reading Comprehension Model for Pharmacy English in Vocational Health Schools

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Abstract

Reading comprehension remains a significant challenge in Indonesian vocational health schools, where the curriculum often emphasizes general English rather than English for Specific Purposes (ESP), particularly English for Pharmacy (EfP). This study developed a Differentiated Flipped Learning-Mode Collaborative Multimodal Reading Comprehension (DFL-Mode CMRC) model using Bannan-Ritland's (2003) Integrative Learning Design Framework (ILDF). Conducted from July–September 2025 at SMK Kesehatan Cianjur, the study involved one English teacher and 33 pharmacy students. The development process followed three ILDF stages: (1) exploration, which identified learners' needs through student questionnaires and a teacher interview; (2) enactment, which involved designing the model and validating it through expert judgment; and (3) local-scale evaluation, which examined its implementation through classroom observation. The resulting DFL-Mode CMRC model integrates Canvas-based self-study and face-to-face instruction, emphasizing multimodal input, collaborative learning, and differentiated tasks. Findings indicate that the model enhanced students' reading comprehension by improving engagement with pharmacy-related texts, supporting vocabulary understanding through multimodal resources, and promoting higher-order thinking through collaborative activities. Although limited to a single context, the study offers a practical and context-sensitive instructional model for ESP in vocational education. It contributes to the development of innovative reading pedagogy by demonstrating how differentiated flipped and multimodal collaborative approaches can be effectively integrated to support discipline-specific literacy.

Keywords: collaborative multimodal reading comprehension, differentiated flipped learning, English for pharmacy, vocational education, English for specific purposes

1. Introduction

"Is it feasible for future pharmacists to deliver pharmaceutical care without a solid foundation in English?" This question underscores the need for English for Specific Purposes (ESP) in vocational health education. English in these schools functions not merely as a general subject but as a tool for interpreting medical texts, communicating in clinical contexts, and accessing global pharmaceutical knowledge (Rosida & Sujannah, 2023).

Pharmacy students in Indonesia commonly struggle to comprehend English literature and technical publications due to limited language and domain knowledge (Mariana & Purwana, 2022; Semartini, 2022). Such difficulties are aggravated by ineffective teaching methods and restricted contact hours. Hence, EfP instruction should prioritize reading comprehension as the gateway to scientific literacy (Filice & Sturino, 2002; Solihati, 2020).

Reading comprehension is central to academic achievement and lifelong learning (Widyaningsih & Ratmanida, 2023; Arwila, 2022). In ESP contexts, learners must decode technical terms and integrate disciplinary information (Grabe & Stoller, 2019). EFL students face additional barriers such as restricted vocabulary and background knowledge (Pratiwi & Meidipa, 2024; Chung et al., 2025). Instructional strategies employing scaffolding and multimodal materials, texts supported by visuals, audio, and video, have been shown to increase motivation and comprehension (Vidal, 2022).

For English as a Foreign Language (EFL) learners, reading comprehension can be particularly challenging as they

often struggle to understand English texts quickly and accurately, sometimes due to limited background knowledge or specific vocabulary (Pratiwi & Meidipa, 2024; Chung et al., 2025). To enhance reading comprehension, various strategies have proven effective. One of the strategies is using instructional scaffolding and multimodal texts (e.g., visual aids, images, audio, and video). This strategy significantly improves comprehension, activates prior knowledge, and increases motivation (Vidal, 2022).

To bridge these gaps, this study introduces a Differentiated Flipped Learning-Mode Collaborative Multimodal Reading Comprehension (DFL-Mode CMRC) model for EfP in vocational health schools, constructed through the Integrative Learning Design Framework (ILDF) (Bannan-Ritland, 2003).

2. Literature Review

2.1 Multimodality in English Teaching and Learning

Multimodality in English teaching involves integrating linguistic, visual, aural, gestural, and spatial modes to enrich meaning-making and accommodate diverse learning styles (Kessler, 2022). It emphasizes the simultaneous use of multiple semiotic systems that appeal to different sensory channels, making learning more engaging and effective (Al-Jarf, 2024). Studies have consistently shown that multimodal approaches enhance vocabulary, reading, and writing skills across educational levels, particularly within ESP and EAP contexts (Rahmanu & Molnár, 2024).

The foundation of multimodal learning rests on Mayer and Moreno's *Cognitive Theory of Multimedia Learning* (1999), which asserts that deeper understanding occurs when learners process information through both verbal and visual channels. In practical settings, teachers integrate videos, graphics, sound, and text to create richer cognitive experiences—helping learners connect abstract concepts to real-world applications (Vidal, 2022). This principle aligns with the *multimedia reading* approach, where interactive, computer-assisted environments (e.g., e-courses, presentations, or online simulations) combine various modes to support comprehension and retention.

In ESP contexts such as English for Pharmacy, multimodal input becomes crucial because technical terminology and visual representation of pharmaceutical processes often complement one another. The use of images, infographics, and animations enables learners to visualize complex ideas, like drug mechanisms or classifications, thereby reducing cognitive load. Such multimodal integration promotes autonomy, accommodates learner diversity, and supports differentiated learning, an essential feature for vocational education where students' abilities and interests vary widely.

2.2 Collaborative Learning

Collaborative learning is grounded in the principles of social constructivism, which view knowledge as co-constructed through social interaction (Vygotsky, 1978; Zhang, 2023). It involves students working together to achieve shared goals, solve problems, and develop mutual understanding (Lu & Smiles, 2022). Within language education, collaborative approaches foster not only cognitive but also affective benefits, enhancing motivation, accountability, and interpersonal skills (Khan, 2024).

Empirical research demonstrates strong correlations between collaborative learning and improved reading comprehension. Fakhruldeen (2021) found that cooperative strategies help learners grasp text cohesion and develop fluency, while group interaction encourages negotiation of meaning and clarification of ideas. In ESP environments, peer dialogue becomes particularly valuable: students collectively interpret discipline-specific vocabulary and authentic materials, bridging linguistic and professional literacy.

Combining multimodal and collaborative elements creates synergistic effects. Multimodality enriches the resources through which meaning is conveyed, while collaboration deepens comprehension through dialogue and shared interpretation. This integration underpins the concept of *Collaborative Multimodal Reading Comprehension (CMRC)*, where learners jointly engage with multimodal texts, interpret information, and construct shared understanding. CMRC thus reflects the sociocognitive dimension of reading, viewing comprehension as an interactive, meaning-making process shaped by both text and context.

2.3 Differentiated Flipped Learning (DFL)

Differentiated Flipped Learning (DFL), also called "flipperentiated learning" (Tung, 2021), merges the flexibility of flipped learning (FL) with the individualized approach of differentiated instruction (DI). The model aims to address learner diversity while maximizing classroom interaction.

Differentiated instruction, rooted in Vygotsky's constructivism and the *zone of proximal development* (ZPD), recognizes learners' varied readiness, interests, and learning profiles (Wibowo et al., 2025). In practice, DI tailors content, process, and product to match individual needs (Tomlinson, 2005; Rizalda, 2022). Flipped learning

complements this by inverting traditional teaching: students first encounter foundational content outside the classroom, through videos or readings, and use class time for higher-order application, collaboration, and feedback (Oudbier et al., 2022; Kiljunen et al., 2024).

Integrating DI into FL creates an adaptive environment where teachers can personalize materials and monitor student progress more effectively. Studies confirm that DFL enhances motivation, engagement, and problem-solving skills (Bārdule, 2021; Tung, 2021). By allocating lower-order cognitive tasks (e.g., comprehension) to pre-class stages and higher-order thinking (e.g., synthesis, evaluation) to classroom interaction, DFL optimizes time and promotes meaningful learning experiences (Nielsen, 2023; Köpeczi-Bócz, 2024).

In the context of EfP, DFL supports the layered process of reading comprehension: pre-class multimodal exposure builds foundational understanding, while in-class collaboration strengthens analysis and application. This arrangement not only increases learner autonomy but also accommodates diverse abilities, a necessity in vocational classrooms where students differ in proficiency and background knowledge.

2.4 Multimodality, Collaborative Learning, and Differentiated Learning Benefit in Teaching English

Many research studies have shown various results of the implementation of multimodality, collaborative learning, and differentiated learning in teaching language. Salamanti et al. (2023) mentioned a significant improvement on students' engagement and motivation in learning English skills after being taught using collaborative and multimodal learning strategies. Elola, Bueno-Alastuey, and Lopez-Perez (2025) reported that a multimodal and collaborative learning integration gave positive results concerning linguistic advancement, motivation, and multiliteracies development. Mustofa (2025) demonstrated the benefit of integrating multimodal and differentiated learning consisting of the provision of equal opportunities for students in order to make a safe and comfortable learning.

2.5 Challenges on the Integration of Multimodality and Collaborative Learning in Teaching English

However, there were several challenges found on the integration process, such as the length of task completion, the difficulty of reaching consensus among peers, and of adapting to various ways of working, that lead to the preference of working individually rather than in group (Elola, Bueno-Alastuey, and Lopez-Perez, 2025). Amalia, et al. (2021) revealed that in the primary curriculum, teachers were mostly using written text with minimal illustration and videos from the internet indicating their lack of multimodal utilization in the teaching learning process.

3. Methods

3.1 Research Design

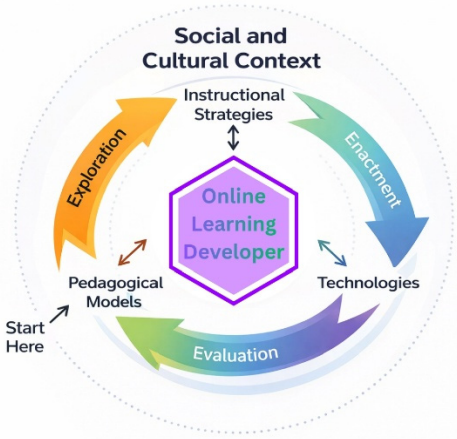

Figure 1. The Integrative Learning Design Framework (Bannan-Ritland, 2003)

This study employed a design-based research approach using Bannan-Ritland's (2003) Integrative Learning Design Framework (ILDF) to develop the Differentiated Flipped Learning-Mode Collaborative Multimodal Reading Comprehension (DFL-Mode CMRC). The ILDF integrates instructional design, empirical inquiry, and iterative refinement, making it suitable for developing context-sensitive educational interventions. The ILDF comprises four phases: exploration, enactment, local-scale evaluation, and broad-scale evaluation. This study implemented the first

three phases—exploration, enactment, and local-scale evaluation—to design, validate, and refine the proposed model within a real classroom context.

3.1.1 Exploration Phase

The exploration phase aimed to identify the contextual needs, challenges, and opportunities in teaching English for Pharmacy (EfP) at SMK Kesehatan Cianjur. A needs analysis was conducted using three sources of data. First, student questionnaires were administered to examine learners' experiences, preferences, and difficulties in reading English texts, particularly those related to pharmacy contexts. Second, a teacher interview was conducted to explore instructional practices, available resources, and perceived challenges in teaching reading comprehension. Third, a literature review on multimodality, collaborative learning, and differentiated flipped learning was undertaken to establish a theoretical foundation and identify pedagogical gaps. The findings from these three sources were triangulated to define the design requirements of the proposed model. This phase resulted in the identification of key needs, including the integration of authentic materials, multimodal resources, collaborative activities, and differentiated instruction to support diverse learners in EfP contexts.

3.1.2 Enactment Phase

The enactment phase concentrated on designing and developing the DFL-Mode CMRC learning model based on the needs identified in the exploration phase. This process involved translating theoretical principles and empirical findings into an articulated instructional prototype.

The model was structured around a differentiated flipped learning format, integrating two complementary modes: (1) Canvas-based self-study and (2) face-to-face (F2F) classroom instruction. The design emphasized three core principles: (a) the use of multimodal resources to support comprehension of discipline-specific texts, (b) the incorporation of collaborative learning to facilitate meaning-making, and (c) the application of differentiated tasks to accommodate learners' varying abilities and learning preferences.

During this phase, learning materials and activities were developed, including Canvas modules, multimodal reading texts, interactive tasks, and collaborative classroom activities. The initial prototype was then subjected to expert judgment, involving one pedagogy expert and one information technology (IT) expert, to evaluate its instructional quality, technical feasibility, and alignment with learning objectives. Feedback from these experts was then used to refine the design, resulting in an improved and more coherent version of the DFL-Mode CMRC model.

3.1.3 Local-Scale Evaluation Phase

The local-scale evaluation phase aimed to examine the feasibility, practicality, and initial effectiveness of the developed model in an authentic classroom setting. The refined prototype was implemented in 12 instructional sessions, consisting of six Canvas-based self-study sessions and six face-to-face meetings. Data were collected through classroom observations, focusing on students' engagement, interaction patterns, and responses to multimodal and collaborative learning activities. The observations also captured how the integration of flipped and differentiated strategies supported reading comprehension processes.

The results of this phase informed further refinement of the model, leading to the final version of the DFL-Mode CMRC learning model. This phase provided evidence of the model's applicability and its potential to enhance reading comprehension in vocational ESP contexts.

3.2 Participants

The participants of this study were 33 twelfth-grade students enrolled in a pharmacy program and one English teacher at a vocational health school in Cianjur. Participants were selected using purposive sampling (Tongco, 2007), as they were directly involved in English for Pharmacy instruction and represented the target context for the model implementation.

3.3 Research Instruments

This study employed multiple instruments aligned with each phase of the ILDF. During the exploration phase, a needs analysis was done using student questionnaires and a semi-structured teacher interview. In the enactment phase, expert judgment checklists and evaluation forms were used to assess the instructional and technical quality of the model. In the local-scale evaluation phase, classroom observation sheets were used to document student engagement and instructional processes during implementation.

3.4 Data Analysis

Data were analyzed using both quantitative and qualitative approaches. Quantitative data from student questionnaires

were analyzed descriptively to identify patterns in learners' needs and preferences. Qualitative data from teacher interviews, expert feedback, and classroom observations were analyzed using thematic analysis to identify recurring themes related to instructional challenges, model effectiveness, and areas for improvement. Data triangulation from various sources guaranteed the credibility and validity of the results. The analyzed data from all phases were integrated to iteratively refine the DFL-Mode CMRC learning model.

4. Findings

This section presents the results of data analysis from the needs analysis, expert validation, and DFL-Mode CMRC implementation, focusing on the development and effectiveness of the DFL-Mode CMRC learning model (see Figure 2).

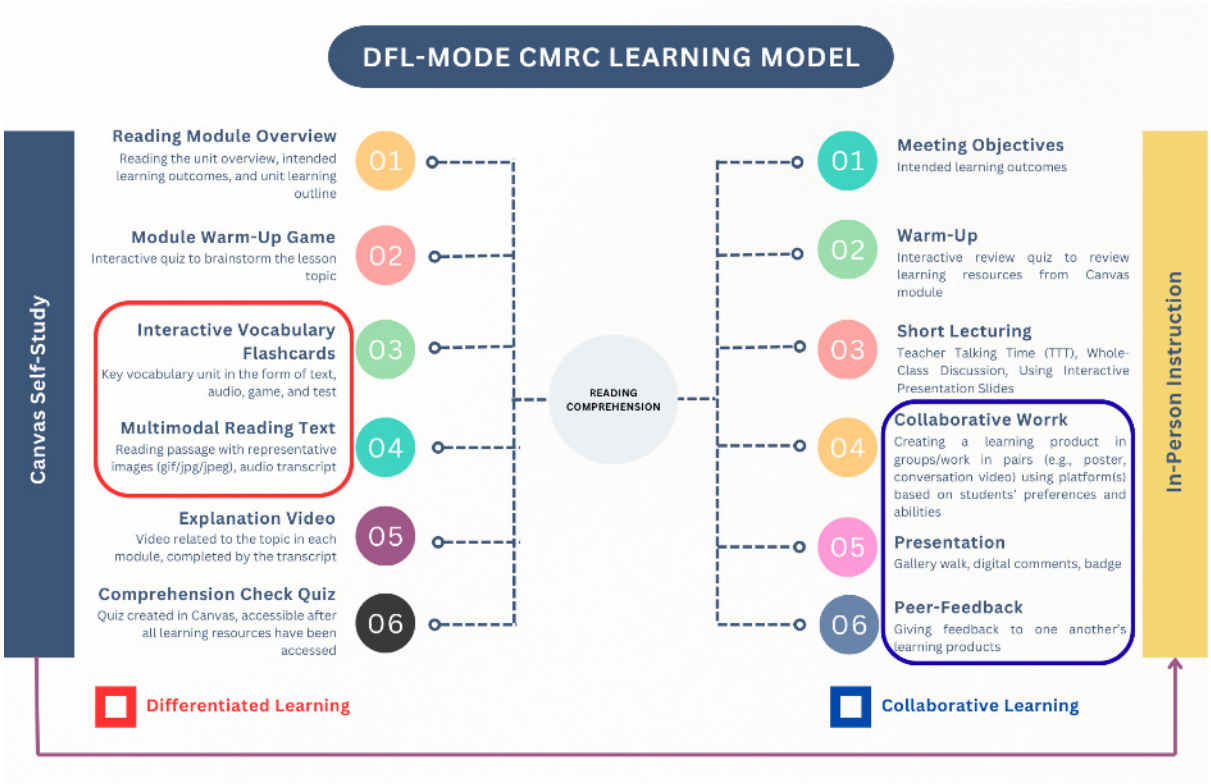

Figure 2. The Detailed Prototype of the DFL-Mode CMRC Learning Model

4.1 Needs Analysis Results (from Exploration Phase)

The needs analysis revealed consistent patterns from both quantitative and qualitative data. Quantitative data from the student questionnaires revealed several key trends. First, despite most students' prior experience learning English, only 73% had encountered pharmacy-related texts, indicating limited access to discipline-specific materials. This also indicates a gap between general English instruction and ESP needs, supporting Rahayu's (2020) finding that vocational materials often lack specificity.

Second, a strong preference for contextualized and engaging materials was observed. Approximately 86% of students expressed interest in discipline-related materials, while 93% indicated that multimodal resources (e.g., images, videos, and audios) and collaborative activities helped them better understand English texts. These findings highlight the importance of integrating multimodality and collaboration to support comprehension, consistent with Vidal (2022).

Qualitative data from the teacher interview further supported these findings. The teacher reported that reading instruction was primarily translation-based, with limited use of authentic materials and minimal integration of multimedia resources. As stated:

> Students often read texts, translate it, and discuss vocabulary, but this doesn't build deeper comprehension.

The teacher also acknowledged limited experience in implementing multimodal and collaborative strategies, despite recognizing their potential benefits:

> I know combining texts with audio would help students… but I haven't had the resources or training to apply it yet.

Overall, the needs analysis highlights three major issues: (1) limited exposure to authentic EfP materials, (2) lack of multimodal support, and (3) insufficient collaborative learning opportunities. These findings informed the development of the DFL-Mode CMRC Model.

4.2 Expert Validation Results (Expert Judgment)

The enactment phase produced an articulated prototype of the DFL-Mode CMRC learning model, which was evaluated through expert judgment involving one pedagogy expert and one information technology (IT) expert.

The IT expert confirmed that the Canvas LMS effectively supported the integration of multimedia elements, including videos, quizzes, and interactive elements. Although the interface was considered less visually dynamic compared to other platforms, its structured layout and accessibility were seen as beneficial for vocational learners.

The pedagogy expert rated the model as "very good, innovative, and relevant" (4/5) for vocational health contexts. The expert highlighted the model's alignment with ESP needs and its integration of differentiated, multimodal, and collaborative principles. However, several improvements were recommended: (1) adding time allocation for activities, (2) improving language clarity and fixing minor technical issues, and (3) incorporating role-play, assessment rubrics, and a teacher's guide.

These results indicate that the model is both technologically feasible and pedagogically sound, while also highlighting areas for improvement. The expert feedback guided revisions that resulted in the finalized DFL-Mode CMRC learning model (see Figure 2).

4.3 The Implementation of DFL-Mode CMRC Learning Model

The refined DFL-Mode CMRC learning model, as illustrated in Figure 2, was implemented over 12 instructional sessions as well as examined how this learning model functioned in practice and its impact on students' engagement interaction, and reading comprehension. The model integrates Canvas-based self-study (pre-class) and face-to-face (F2F) instruction, forming a coherent flipped learning cycle.

4.3.1 Canvas Self-Study (Pre-Class Preparation)

The Canvas self-study session functioned as the foundation for building students' initial comprehension through multimodal and differentiated input.

a. Module Overview

Each unit began with a structured overview outlining learning objectives and activities (see Figure 3). This component helped students understand the learning goals and improved their readiness and engagement, consistent with findings by Sana et al. (2020) and Orr et al. (2022).

Figure 3 displays the Canvas module overview page, which introduces key themes, objectives, and lesson structure. Its interactive dropdown menu and color-coded tabs support easy navigation, while the pharmaceutical-themed banner enhances contextual relevance. This interactive design promotes engagement, self-regulation, and deep learning by encouraging active rather than passive participation (Cairncross et al., 2001).

Figure 3. Module Overview Page

b. Warm-Up Game

Interactive quizzes (see Figure 4) activated prior knowledge and increased motivation. Students showed higher engagement during this stage, supporting findings that gamified activities enhance motivation and participation (Humaera & Mukhtar, 2021; Astutik et al., 2023).

Each module includes a unique gamified quiz, such as Zep Quiz, Quizizz, Wordwall, or LearningApps, to maintain variety and engagement. As shown in Figure 4, the Zep Quiz interface resembles a game map with background music, motivating students through step-by-step progress and achievement. These multimodal, gamified features build cognitive readiness and emotional engagement for upcoming reading tasks.

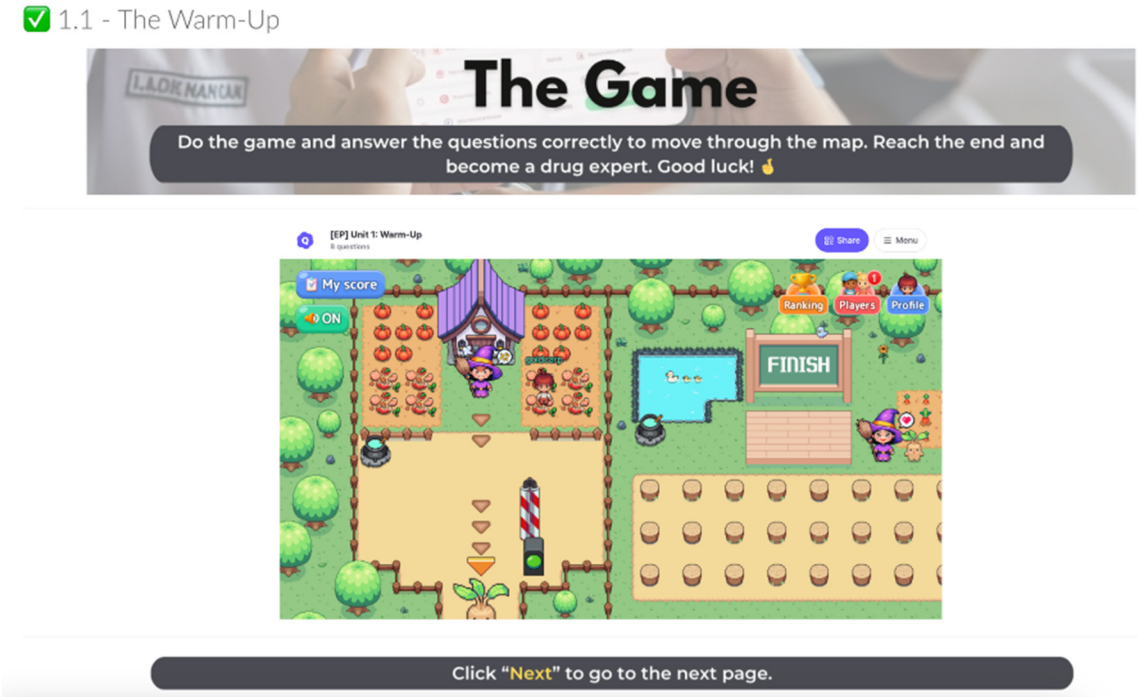

Figure 4. Module Warm-Up Game

c. Multimodal Reading Text

Students engaged with texts presented through text, audio, images, and interactive quizzes (see Figure 5). Classroom observations indicated that students were more able to identify key ideas, understand technical vocabulary, and connect concepts, demonstrating improved literal comprehension. This aligns with multimodal learning principles (Mayer, 2024; Vidal, 2022).

- Text: The passage was displayed in a structured layout, using headings, highlights, and formatting to make it visually clear and appealing. This supported students who prefer traditional text-based modes and allowed careful rereading. To this point, Balasubramaniam (2025) noted that traditional text-based methods excel at providing "structured learning" and focus on "grammatical competence." Furthermore, Rashid (2020) argued that text-based approaches enable comprehensive skill integration and promote learner autonomy through systematic text analysis and production activities.
- Audio: An accompanying audio transcript enabled students to listen while reading along. This dual-channel approach supported auditory students, strengthened pronunciation and listening comprehension, and catered to students who may struggle with text-heavy input alone. The integration of audio narration alongside written text demonstrates the role of multimodal input in supporting diverse learners. This aligns with the Cognitive Theory of Multimedia Learning (CTML) developed by Mayer (2024), which argues that learning is enhanced when information is processed through both visual and auditory channels, supported by extensive experimental evidence. By engaging in the auditory pathway, the activity reduced cognitive overload and helped learners construct meaning efficiently. The dual-channel design also reflects the principles of multisensory learning, allowing students to synchronize decoding (reading) with comprehension (listening). Similar results were observed by Vidal (2022), who reported that audio-supported reading enhances comprehension and vocabulary retention in ESP contexts. In this study, the audio feature thus functioned not only as pronunciation support but also as a cognitive bridge connecting reading fluency and understanding of pharmacy-specific terminology.
- Images: Representative images complemented the text, offering a visual anchor that connected abstract pharmacy terms with real-world meaning. For instance, drug classification categories were paired with relevant images, supporting visual students. This reminds us of Paivio's (2010) Dual Coding Theory, which posits that information encoded both verbally and visually leads to stronger retention and deeper understanding. Images are also supported by differentiated instruction by catering to visual learners and lowering the comprehension barrier for students who are less confident with text-heavy materials. These findings are consistent with multimodal pedagogy research (e.g., Walsh, 2018), which emphasizes that visual representation not only aids recall but also facilitates meaning making in specialized language contexts. In the context of English for Pharmacy, the use of representative visuals made technical terminology more tangible and improved engagement with scientific texts.
- Interactive quizzes: At the end of the passage, students engaged with interactive games and quizzes (e.g., the horse-race quiz). Interactive quizzes serve multiple critical roles in online learning environments, such as enhancing student engagement, improving learning outcomes, enabling self-assessment, and providing immediate feedback to support active learning (Zainuddin et al., 2020; Jiemsak et al., 2020; Cook & Babon, 2017).

Through this layered design, the module embodied multimodality by blending text, sound, image, and interactivity. It also illustrated differentiated learning, since students had the flexibility to focus on their preferred mode (e.g., listening instead of reading, or combining both), move at their own pace, and receive immediate feedback from the interactive tasks. In essence, the multimodal reading text went beyond passive reading. It encouraged students to see, hear, and interact with the text simultaneously, making comprehension deeper (Zhang & Peng, 2024), more engaging (Yanto et al., 2020), and more adaptable to various learning needs (Pan & Zhang, 2020).

Figure 5. Multimodal Reading Text

d. Explanation Video

The video component (see Figure 6) reinforced understanding by combining visual and auditory explanations. Students reported fewer difficulties in interpreting complex pharmacy concepts, indicating improved inferential comprehension.

To accommodate diverse learning preferences, each video was paired with a full transcript, allowing students to watch, listen, or read according to their needs. This multimodal and differentiated approach supported learners with varying abilities and learning styles. As noted by Jamal et al. (2020), transcripts enhance bottom-up processing skills and help overcome listening task challenges, reinforcing the pedagogical value of such integration.

Pedagogically, the explanation video acted as a bridge between the earlier warm-up and reading/listening activities and the upcoming F2F discussions. It reinforced conceptual understanding, contextualized the vocabulary, and provided real-life examples, all while maintaining a concise format that sustained attention. In sum, the Explanation Video in Canvas was intended to not only deepen students' comprehension through multimodal input but also enhance their autonomy by giving them flexible pathways to engage with the material according to their individual preferences.

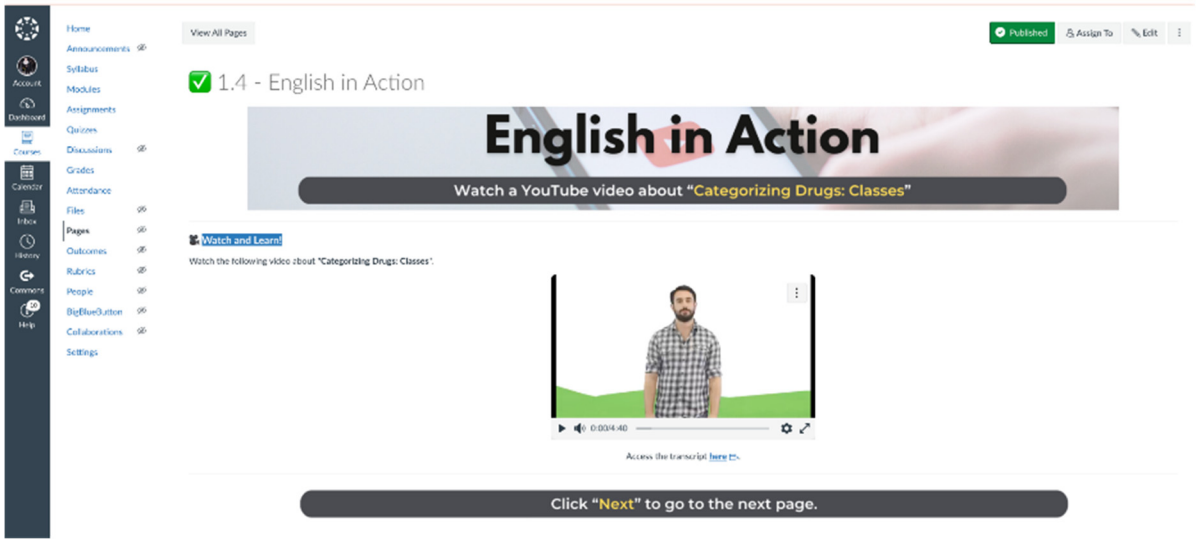

Figure 6. English in Action: Explanation Video

e. Comprehension Check Quiz

The final quiz (see Figure 7) showed that most students were able to correctly answer questions across multiple formats (e.g., multiple-choice questions, matching, short answers), suggesting improved comprehension across cognitive levels. Immediate feedback also supported self-regulated learning (Zainuddin et al., 2020). To boost engagement, the quiz was embedded in an interactive Canvas page with an encouraging banner and optional background music to create a calm atmosphere. Students had 15 minutes, with shuffled answers, multiple attempts, and instant feedback to support mastery learning. As part of Gagné's Step 9, Assessing Performance (Zhu & St. Amant, 2010), this end-of-cycle quiz enabled self-monitoring and preparation for higher-level, collaborative discussions in the following F2F session.

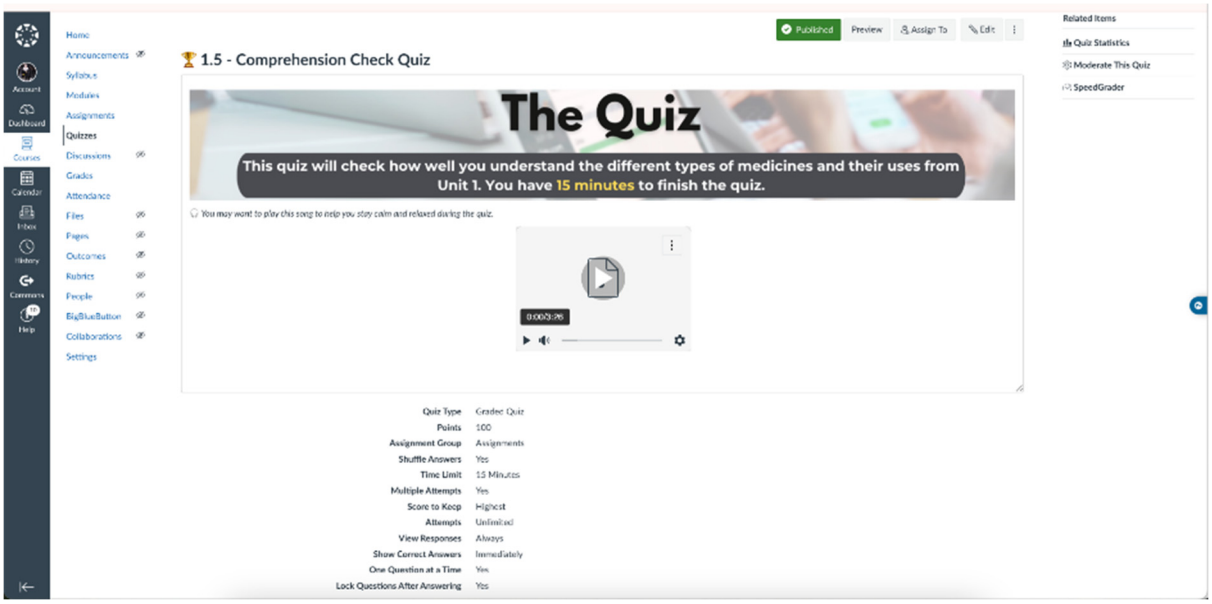

Figure 7. Comprehension Check Quiz

In summary, the Comprehension Check Quiz not only evaluated students' grasp of materials but also played a motivational role, reinforcing the flipped classroom cycle where individual preparation in Canvas feeds directly into more interactive, application-based F2F learning.

Overall, the Canvas self-study enhanced students' individual reading comprehension, particularly at the literal and inferential levels, while preparing them for collaborative learning.

4.3.2 In-Person Instruction (F2F Sessions)

The F2F sessions extended learning through collaborative and higher-order activities. This session was closely observed by the researchers. Classroom observations conducted during the implementation session at SMK Kesehatan Cianjur revealed a significant evolution in student autonomy and pedagogical engagement. Initially, students required guidance navigating the Canvas LMS; however, by the third session, they demonstrated high levels of self-regulation. Observers noted that students actively engaged with pre-class multimodal resources—such as audio-narrated slides and interactive vocabulary flashcards—to resolve decoding issues independently. This pre-class preparation allowed face-to-face sessions to bypass rote translation, moving directly into higher-order analysis and the professional application of pharmacy-specific English.

During collaborative phases, observations highlighted the efficacy of multimodal meaning-making. Working in small groups, students interpreted authentic pharmaceutical texts, such as drug classification charts and medicine labels, by cross-referencing their digital modules. A key finding was the emergence of "peer scaffolding," where higher-proficiency students assumed leadership in explaining technical concepts, while lower-proficiency students contributed through the visual and spatial organization of group tasks. This dynamic confirmed that differentiated tasks successfully accommodated diverse readiness levels. Furthermore, the teacher's role shifted from being the main lecturer to becoming a facilitator who offered specific, timely feedback. The low-anxiety setting made students more willing to try out technical terms, which helped them move from digital self-study to interactive professional literacy.

In the face-to-face session, learning begins with clarifying objectives, followed by a review quiz to activate prior knowledge from the Canvas module. The teacher then provides a brief lecture using interactive slides before students engage in collaborative tasks, such as creating posters or conversation videos in groups. Students share these products through presentations or gallery walks, concluding with peer feedback. All these activities support the self-study phase by encouraging guided teaching, teamwork, and thoughtful learning within the DFL-CMRC framework.

a. Meeting Objectives

The F2F session consistently began with clarifying the meeting objectives, which provided students with a clear sense of direction. This practice not only oriented students toward the intended learning outcomes but also reinforced the connection between online and classroom components. By understanding what they were expected to achieve, students approached the activities with a stronger sense of purpose. In this way, the explicit articulation of objectives acted as a bridge between self-study preparation and the collaborative classroom work, aligning well with the learner-centered principle of flipped learning.

This activity aligns with studies showing that clear learning goals boost motivation and engagement in flipped classrooms (Su & Chen, 2018; Sofya & Hayati, 2020). Explicit objectives facilitate the integration of previous self-study with in-class collaboration (Reed, 2012), acting as a conduit between individual and collective learning. This learner-centered approach encourages students to understand both what they learn and why each activity is meaningful.

b. Warm-Up

This activity, usually in the form of an interactive review quiz, played a crucial role in activating prior knowledge from Canvas. This activity created an engaging and non-threatening entry point into the lesson while also functioning diagnostically for the teacher to assess students' initial understanding. Students reported that the quiz format made it easier to recall the multimodal input (text, audio, images, and videos) encountered online. In the same vein, previous studies also emphasized the value of varied inputs for memory recall and deeper processing. Thus, the warm-up energized learners and validated the relevance of their prior effort in the self-study stage.

The interactive format resonates with the motivational principle of active learning, where low-stakes competition and immediate feedback sustain engagement and lower anxiety (Currie & Ryan, 2023; Kapoor et al., 2018; Hood et al., 2020). Overall, the warm-up session not only energized learners but also reinforced the pedagogical continuity of the DFL-Mode CMRC model by validating students' prior effort and preparing them cognitively for deeper collaborative learning.

c. Short Lecturing

The short lecturing component was not a traditional monologic delivery but a carefully balanced session where Teacher Talking Time (TTT) was minimized in favor of discussion prompts and interactive slides. This approach demonstrated how in-person sessions can shift from content delivery to meaning negotiation, in line with flipped learning pedagogy.

Students particularly benefited from this segment when misconceptions arose from the Canvas materials, as the teacher provided clarification through discussion rather than extended explanation. Hence, the short lecturing reinforced the flipped learning design by positioning the classroom as a space for consolidation and dialogue rather than initial exposure to content.

As argued by Marie Musni & Garrett (2021), the flipped classroom was redefined in-class time as a forum for higher-order thinking and dialogue. Minimizing TTT also reflects the communicative principles proposed by Long back in 1985, who suggest that learning is deepened through interaction and negotiation of meaning rather than unidirectional instruction (Auquilla et al., 2005). By transforming the lecture into a dialogic process, the teacher positioned students as active participants in constructing and validating knowledge. Consequently, the short lecturing component served a critical consolidative function within the DFL-Mode CMRC model, bridging the self-study phase and collaborative tasks while reinforcing learner autonomy and engagement in the reading comprehension process.

d. Collaborative Works

One of the strongest features of the F2F sessions was the emphasis on collaborative work. Students worked in pairs or small groups to produce learning products, such as posters, infographics, or short conversation videos. This stage highlighted two key aspects of the DFL-CMRC model: collaborative learning and differentiated learning. Students were able to choose tools or platforms based on their preferences and abilities, which accommodated varied learning styles and technological competencies. More importantly, the collaborative nature of the task required students to negotiate meaning, apply comprehension skills, and co-construct knowledge, thereby extending their engagement with the reading materials beyond simple recall.

These findings align with Vygotsky's view that learning occurs through interaction and shared meaning-making (Muniyappan & Sivakumar, 2018). Collaborative projects allowed students to express ideas, consider peers' perspectives, and solve problems collectively key elements of deep learning. Reflecting Tomlinson's (2005) concept of differentiation, students demonstrated understanding through varied modalities suited to their readiness and interests. Thus, collaboration in the DFL-Mode CMRC model functioned as a purposeful design for higher-order comprehension, turning reading into a socially and multimodally mediated process.

e. Group Presentation

Group presentations through gallery walks or digital commenting allowed students to showcase their work and learn from peers, fostering authentic communication and collective knowledge-building. These multimodal assessment practices encouraged diverse interaction and reflection, illustrating how collaborative learning outcomes can be shared and critiqued within a supportive, social-constructivist framework. The use of gallery walks and online commenting mirrors multimodal assessment practices, as discussed by Moore-Russo & Shanahan (2014), where learning products are not limited to written outcomes but extend to visual and interactive representations. Furthermore, this activity reinforced the collaborative ethos of the DFL-Mode CMRC model by fostering an environment of mutual validation and constructive critique. Through these interactions, students not only consolidated their comprehension but also strengthened confidence and reflective thinking, key outcomes in English for Pharmacy education.

f. Peer-Feedback

The final stage, peer feedback, emerged as a critical mechanism for reflective learning. Students were encouraged to provide constructive comments on one another's products, focusing on aspects such as clarity, creativity, and accuracy. This process not only enhanced the products themselves but also nurtured students' evaluative skills. Importantly, peer feedback extended the collaborative ethos of the session, as students were positioned not merely as consumers of teacher evaluation but as active co-assessors in the learning process. Such practices resonate with differentiated learning principles, as feedback often reflects diverse perspectives and highlights strengths that might otherwise be overlooked.

These findings align with formative assessment principles that treat feedback as a dialogic process promoting reflection and self-regulation (López-Pastor & Sicilia-Camacho, 2017; Doolan & Morris, 2010). Peer evaluation helped students internalize assessment criteria and develop autonomy, while the variety of feedback reflected differentiated learning principles (Blaz, 2023). Incorporating multiple perspectives made evaluation more inclusive and strengthened the model's collaborative and reflective learning culture.

Overall, the F2F activities contributed significantly to the development of students' reading comprehension by transforming individual exposure from Canvas into collective meaning-making in the classroom. The clarification of objectives and warm-up tasks activated schema and oriented learners toward purposeful reading, while short lecturing provided scaffolding that addressed linguistic and conceptual difficulties often encountered in subject-specific texts.

Collaborative group work and presentations required students to move beyond literal comprehension, pushing them into inferential and evaluative domains of understanding, consistent with higher-order levels of Bloom's taxonomy. These tasks encouraged synthesis of ideas and transfer of textual knowledge into multimodal outputs such as presentations, posters, or videos. Ultimately, peer feedback fostered critical reading skills as students evaluated the accuracy, clarity, and relevance of peers' interpretations, leading them to reconsider and refine their own understanding. In this way, the sequence of F2F activities supported comprehension at multiple levels—literal, inferential, and evaluative—demonstrating how the DFL-CMRC model effectively integrates multimodal, flipped, and collaborative strategies to enhance reading comprehension outcomes.

5. Discussion

The findings of this study demonstrate that the DFL-Mode CMRC learning model offers a pedagogically robust approach to addressing persistent challenges in English for Pharmacy (EfP), particularly in improving students' reading comprehension. More importantly, the results highlight how the integration of multimodality, flipped learning, collaboration, and differentiation creates a synergistic effect that supports both lower-order and higher-order comprehension processes.

The integration of multimodal resources significantly enhanced students' ability to comprehend pharmacy-related texts. The combination of textual, auditory, and visual inputs enabled learners to construct meaning through multiple cognitive channels, thereby reducing cognitive overload and facilitating deeper understanding (Mayer, 2024). This is particularly critical in ESP contexts, where technical vocabulary and abstract concepts often hinder comprehension (Vidal, 2022). The findings suggest that multimodality not only supports vocabulary acquisition but also functions as a scaffold that bridges linguistic and conceptual understanding. However, this benefit also introduces a potential challenge: if not carefully designed, excessive multimodal input may overwhelm learners or distract from key learning objectives. Thus, the effectiveness of multimodality depends on principled selection and alignment of resources.

Furthermore, the flipped learning structure contributed to more efficient use of instructional time and promoted higher-order thinking. By relocating foundational learning to the Canvas self-study phase, classroom sessions were transformed into spaces for analysis, discussion, and collaborative problem-solving. This aligns with previous research indicating that flipped learning enhances active engagement and deeper learning (Oudbier et al., 2022; Nielsen, 2023). In this study, students demonstrated improved inferential and evaluative comprehension during in-class activities, suggesting that the flipped model successfully supports cognitive progression. Nevertheless, this approach assumes that students complete pre-class activities consistently. In a context where learner autonomy or access to technology is limited, the effectiveness of flipped learning may be reduced, highlighting the need for monitoring mechanisms and scaffolding.

The incorporation of collaborative learning, then, fostered meaningful interaction and collective knowledge construction. Through group work, presentations, and peer-feedback, students engaged in negotiation of meaning, which is central to social constructivist learning (Muniyappan & Sivakumar, 2018). These interactions enabled learners to clarify misunderstandings, exchange perspectives, and co-construct interpretations of complex texts. The findings indicate that collaboration not only enhances comprehension but also promotes critical thinking and communicative competence. However, challenges related to unequal participation and group dynamics were observed, suggesting that effective collaboration requires structured roles, clear guidance, and ongoing facilitation.

Differentiated instruction, additionally, ensured that the model accommodated diverse learners' needs. The availability of multiple learning pathways and task formats allowed students to engage with content according to their readiness and preferences, supporting inclusive learning environments (Tomlinson, 2005). This flexibility is particularly important in vocational settings, where students' proficiency levels vary widely. At the same time, differentiation increases instructional complexity and demands greater teacher expertise in designing adaptive materials and managing diverse learning trajectories.

Importantly, the study also demonstrates that the challenges associated with integrating these approaches, such as technological constraints, instructional complexity, and increased teacher workload, can be mitigated through systematic design. The structured framework of the DFL-Mode CMRC learning model (Figure 2) provided coherence and alignment across learning stages, while the use of Canvas offered a practical platform for delivering multimodal content. However, sustained implementation requires institutional support and teacher professional development.

Despite its contributions, the study is limited to its small sample size and single-context implementation, which may affect generalizability. Future research should involve larger and more diverse populations and incorporate more

rigorous measures of learning outcomes. Overall, this study advances ESP pedagogy by demonstrating how a systematically integrated model can enhance reading comprehension while addressing the complexities of contemporary language learning environments.

6. Conclusion

This study addresses the critical instructional gap in vocational English for Pharmacy (EfP) by developing the Differentiated Flipped Learning-Mode Collaborative Multimodal Reading Comprehension (DFL-Mode CMRC) model. Findings confirm the model's feasibility and effectiveness in overcoming barriers to technical vocabulary mastery through the integration of Canvas-based self-study and collaborative multimodal instruction. Evaluation results demonstrate that this approach effectively enhances student engagement across varying readiness levels by providing essential multimodal scaffolding. The primary contribution of this research is the delivery of a validated, localized ESP instructional prototype specifically designed for vocational education. Theoretically, the study strengthens the concept of "flipperentiated" learning, proving its ability to reduce cognitive load when navigating complex pharmacy texts. Practically, this model provides a framework for educators to transition from conventional lectures toward student-centered, multimodal meaning-making. This implementation serves as a sustainable solution for advancing professional English proficiency and literacy within vocational health school settings.

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Authors contributions

Dr. Nia Kurniawati, M.Pd was responsible for planning, preparing proposals, managing administration, leading and overseeing research implementation, drafting progress reports, reporting results and fund utilization, serving as the primary liaison between the research team and external parties, and evaluating research achievements against established targets. Anisa Sofarini, S.Pd., M.Sc., and Vina Aini Salsabila, M.Pd., were conducting literature reviews and theoretical analysis; collecting and analyzing data; writing specific sections of reports or scientific articles; assisting with data collection, experiments, or field surveys; processing data using tools (such as SPSS); and preparing draft reports or presentations of interim results. These authors contributed equally to this work

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These authors confirm that the research is conducted with full objectivity, free from any financial or personal conflicts of interest that could bias the study's findings.

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Data sharing statement

No additional data is available.