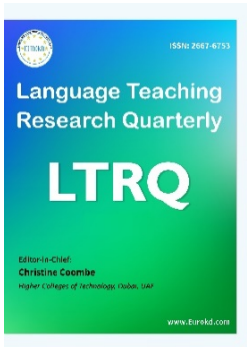

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Technology-Supported Distance Learning of Writing in a Low-Interactivity, Low-Literacy Context: Lessons Learned

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Abstract

The recent pandemic has enabled education stakeholders worldwide to realize the myriad affordances of information and communication technology (ICT) for distance learning. This paper describes lessons learned from an educational design research project involving the low-interactivity information and communication technology-supported distance learning (TDL) of English language arts, particularly writing. Low-interactivity TDL, such as one via datacasting, in which data communication is inherently unidirectional, might not be as engaging as online TDL; however, it is more feasible in areas or countries with low Internet penetration. The project's practical contributions are the lessons and learning materials that were developed to support the low-interactivity TDL of writing, coupled with results showing improved writing outcomes. Theoretical contributions include the frameworks and design guidelines for developing lessons and learning materials to promote structure and interactivity in the low-interactivity TDL of writing, even in a low-literacy context. These guidelines include the use of dynamic graphic organizers to support the genre-process approach to writing instruction in low-interactivity TDL settings, as well as mechanisms to promote learners' sense of familiarity with the language, context, and content of the learning materials, which might be especially important in low-literacy situations.

Keywords: *Low-Interactivity Technology-Supported Distance Learning, Materials Development, Writing Instruction, Pandemic Learning*

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Introduction

Distance learning that is supported by information and communication technology, or technology-supported DL (TDL) for short, is a modality in which teaching and learning occur at different places and in which learning materials, such as documents, videos, or apps, are

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stored and disseminated electronically. In TDL via the Internet, also called online learning, teachers can easily send and receive feedback and other kinds of information to and from students using the same platform used to disseminate the learning materials. Therefore, online learning allows for a high degree of teacher-learner interactivity. On the other hand, TDL via, say, datacasting technology is essentially one-way. Therefore, we call the latter a form of *low-interactivity* TDL (LI-TDL).

A recent second-order meta-analysis (Martin et al., 2022) indicates that distance learning, particularly online learning, might be better in terms of effect size (ES) than face-to-face learning in increasing cognitive outcomes. This is not surprising, given the high degree of interactivity that the Internet enables. However, the authors of the said meta-analysis point out that the ES difference for K-12 distance learning is still nonsignificant due to the scarcity of empirical literature on distance learning in K-12 settings. Therefore, this paper aims to contribute to the empirical literature on distance learning in K-12, especially in lower-income countries, where Internet access reaches only 24% (Azevedo et al., 2022) and LI-TDL might, therefore, be more feasible.

The pandemic caused schools worldwide to shift to one or more forms of distance or remote learning when campuses closed. Most schools in higher-income countries switched to online learning. In contrast, most schools and students in lower-income districts and countries had major technology access problems (Thorn & Vincent-Lancrin, 2022) and, therefore, had to rely on one-way communication strategies (Azevedo et al., 2022). For example, in the Philippines, a vast majority (87%) of students in public schools only received self-learning modules in printed form (Bajo et al., 2021). This was not surprising, given that only 9 to 10 percent of students in public elementary and high schools had Internet connection at home (Orbeta, 2022).

This paper describes an educational design research project involving the development of a set of pedagogical frameworks and learning materials covering the learning outcomes of a streamlined pandemic curriculum for sixth-grade English language arts (ELA) in an LI-TDL context in the Philippines. (The project also covered two other subjects—science and mathematics—but this paper focuses on the ELA component.) Therefore, this paper not only contributes to the empirical literature on distance learning, particularly LI-TDL, in K-12, but also to the empirical literature on the development of teaching and learning materials for ELA, much of which still tends to be observational (Hadley & Hadley, 2022) and evaluated in an ad hoc, impressionistic way (Tomlinson B., 2023). Due to pandemic-related issues, only the materials in the third and fourth academic quarters were field tested fully, and these two quarters mainly involved the macro-skill of writing.

Literature Review

Genre and Process Approaches to Writing Instruction

Though there are several approaches to writing instruction in elementary classrooms, whether in first or second language (L1/L2) contexts, the process and genre approaches, and their combination, are said to be the "more prevailing" approaches in L2 contexts (Zhang, 2023, p. 339).

Most, if not all, process approaches can be viewed as variants of a stage model, in which writing is considered as proceeding in phases, usually called prewriting, writing, and rewriting. Though there is no sole process approach to writing instruction, the influence of the process

model of Flower and Hayes (1981) in ELA has been said to be profound (Zhang, 2023). A recent meta-analysis of studies of students in Grades 6 to 12 showed that the process approach statistically enhanced writing outcomes (ES=0.75) and that writing interventions at various stages, e.g., prewriting activities (ES=0.32) produced statistically significant effects (Graham et al., 2024).

Meanwhile, the genre approach to writing instruction has "gained increasing traction" in the past decade (Fazel, 2025, p. 179). It usually involves teaching about different writing situations and the forms required by each (McQuitty, 2016). For example, the Common Core State Standards for ELA focus on three text types or broad genres: persuasive, narrative, and informational/expository writing (Johnson, 2024). Each has several genres and subgenres with common strategies, rhetorical structures, and linguistic features. A meta-analysis of studies of students in Grades 6 to 12 showed that strategy and text structure instruction statistically enhanced writing outcomes (ES=0.76 and ES=0.39, respectively) (Graham et al., 2023).

The process and genre approaches can complement each other and can, therefore, be combined. For example, during the prewriting stage, students can familiarize themselves with good examples of texts from a particular genre. Thus, teachers might want to prepare sets of corpora of different genres for their students to analyze, after which they can demonstrate writing in a genre, explaining the mental processes involved (Badger & White, 2000). The integration of process and genre is a recent development in the teaching and learning of L2 writing (Zhang, 2023). Studies have begun to show the promise of the genre-process combination in K-12 (Arteaga-Lara, 2017). However, in the context of TDL, the challenge lies in supporting the genre-process approach when the learner-teacher interaction is low, such as TDL via datacasting.

Datacasting

Datacasting is a telecommunication method in which Internet protocol (IP) content is delivered over a traditional broadcast television signal (Newman et al., 2021), particularly the unused bandwidth of the signal. Datacasting has several compelling use cases, including emergency management communications, public alerting, and distance learning (McCoskey & Molnar, 2025). Distance learning via datacasting (DLD) can be especially useful in countries with low Internet penetration, such as the Philippines, where only 25 percent of households have Internet access, but 75 percent have television sets (Balita, 2024). Some districts in developed countries such as the United States can also have low Internet penetration; hence, DLD was also piloted in South Carolina, Indiana, and Pennsylvania during the pandemic (Newman et al., 2021).

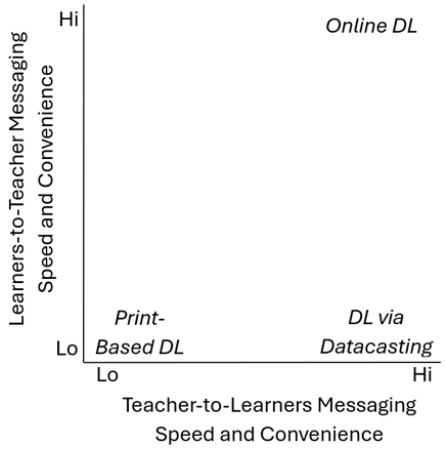
Broadcasting technology is, however, essentially unidirectional: content can only be transmitted from the broadcasting organization to the users, but not the other way around. Due to this one-way limitation, interactivity in DLD is less than in online learning. Thus, we consider DLD a form of LI-TDL. It is, however, faster for teachers to send messages and updated materials to learners via DLD than via print-based DL. Figure 1 illustrates the degrees of interactivity of these three modes of DL.

It is possible to use a different type of network, e.g., an SMS network (International Telecommunications Union, 2021), as a return channel on which learners can send data and feedback to their teachers. However, set-top boxes with this capability have yet to be mass-produced in the country. Another limitation of DLD is that, since datacasting only utilizes the

unused portion of a television signal's bandwidth, the size of the learning content cannot go beyond this unused portion.

Figure 1

Teacher-Learner Interactivity in Distance Learning Modes



Multimedia Principles for E-learning Design

The limited bandwidth of DLD entails organizing learning content into smaller files. Fortunately, the literature on e-learning supports the use of shorter videos. For example, a study of 862 videos of MOOC courses viewed by more than 127,000 students (Guo et al., 2014) showed that videos shorter than 6 minutes were found by the participants to be much more engaging. Qualitative syntheses of video use in online and blended courses also show that shorter videos not only influence student performance but are actually preferred by students (Belt & Lowenthal, 2021; Müller et al., 2023).

Static images have smaller file size requirements than videos. Therefore, Clark and Mayer's (2023) recommendation that static illustrations be used as the default graphic in e-learning materials works well with the bandwidth limitation of DLD. This recommendation is part of their multimedia guideline, one of several evidence-based principles for e-learning design. Following these principles can increase learning in TDL, as meta-analyses have shown (Noetel et al., 2021); however, in LI-TDL, the learners might also need to learn self-regulation.

Self-Regulated Learning

Self-regulated learning (SRL) refers to the use of metacognitive, motivational, and behavioral processes for knowledge and skill acquisition (Zimmerman, 2015). A meta-analysis of SRL programs in elementary schools showed that SRL improves students' academic performance and motivation (Dignath et al., 2008). Meta-analyses of SRL programs for university students (Theobald, 2021) have yielded similar results. A recent systematic review of SRL in ESL/EFL showed relatively significant relationships between SRL and target skills among high school and elementary school students (Ueno et al., 2025).

Given that the interactivity in LI-TDL and print-based distance learning is much less than in classroom learning and online learning, it becomes critical that students in these distance learning contexts be taught SRL skills. A recent bibliometric and content analysis of the use of SRL in ESL/EFL teaching indicates the potential of technology-assisted instruction for

developing students' SRL strategies (Chen et al., 2025). Another recent meta-analysis of SRL interventions in online and blended environments indicates that SRL strategies have a moderate effect on learning outcomes in said environments (Guntur & Purnomo, 2024).

Though there are several models of SRL, Zimmerman's is the most cited (Tinajero, 2024). His model (2015) views SRL as a cyclic process with three phases. The first phase (Forethought) focuses on planning and establishing goals, strategies, and self-motivation beliefs. The second phase (Performance) involves executing and monitoring one's learning plan. The third phase (Reflection) is concerned with thinking about reasons for the (non)attainment of one's goals.

Educational Design Research Method

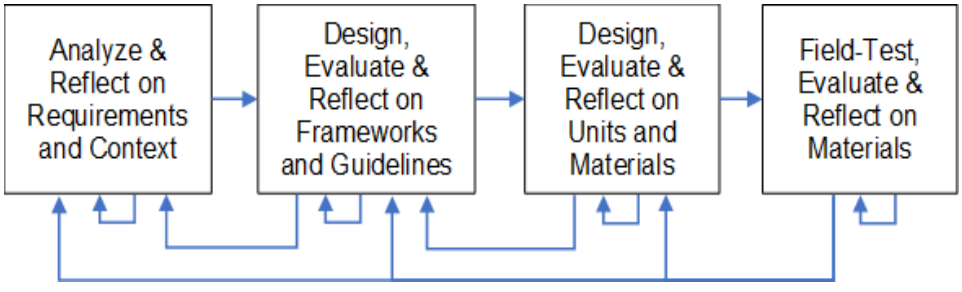
The main research question the project sought to address was: How might learning materials be designed to enable students to achieve learning outcomes in sixth-grade English language arts through distance learning via datacasting? This is an educational design research (EDR) question. Unlike descriptive, interpretive, or predictive research, EDR involves the design, development, and testing of interventions that address teaching, learning, and performance problems, from which may emerge theoretical understandings that can be descriptive, explanatory, or predictive (McKenney & Reeves, 2012, p. 30). EDR, therefore, has practical contributions (e.g., the intervention) as well as theoretical contributions (e.g., design principles or guidelines) (McKenney & Reeves, 2012, p. 19).

To address the above research question, the EDR process model in Figure 2 was designed. It will be noted that this process model serves as both the development *and* research methodology of the project; that is, the methodology for designing and evaluating learning materials is the same as the methodology for proposing, evaluating, and revising design guidelines.

It will also be noted that each phase in the project's process model has a reflection component. This contrasts with most phased methodologies for instructional design, such as the ubiquitous ADDIE model (Branch, 2009), which would only have an explicit evaluation phase at the end of a linear sequence or cycle. It will be further noted that the process model is iterative (the same process is followed every quarter) and incremental (learning materials are developed one lesson at a time following design principles that are revised at the end of each quarter). The EDR was carried out and managed online during the pandemic in the school year (SY) 2021-2022.

Figure 2

An EDR Process Model for Materials Development



Phase 1 involved determining the requirements for the learning materials, given the country's educational context. This meant understanding the curriculum, typical pedagogy, and typical students of the target grade (sixth grade) in public schools. Phase 2 involved designing first an overall pedagogical framework and guidelines (F&Gs) for DLD and then several specific F&Gs for ELA as well as for SRL, multimedia design, and parental engagement for sixth-grade DLD. These F&Gs were initially developed by individual project team members, who were chosen for their expertise in the abovementioned areas. These were then evaluated and reflected on by the project team as a whole and then revised based on comments from everyone in the team. The F&Gs were then further revised based on the evaluation and reflection results of the subsequent phases.

In Phase 3, based on the revised F&Gs of Phase 2, lessons and learning materials were developed to cover the learning competencies identified by the Department of Education (DepEd) in its streamlined pandemic curriculum for ELA. A team of sixth-grade English teachers working with a team of instructional technologists performed the design and development steps of Phase 3. In contrast, the project leader and the ELA, instructional technology, and community engagement experts conducted the evaluation steps.

Phase 4 involved obtaining informed consent and assent from the student participants and their parents; training the participants, their parents, and teachers in the use of the project's technologies and materials; providing necessary technologies and materials to the students and teachers; and the actual use of the lessons and learning materials by the students. Difficulties were encountered in the application for a permit to set up a broadcasting tower at the participants' school and in the development of set-top boxes for all the participants to use, so datacasting was simulated by uploading size-constrained learning materials at the beginning of the week for the students to download.

At the beginning of the study, 56 sixth-grade participants were provided with tablets and mobile Internet access. However, due to the pandemic, which aggravated the participants' difficulties in managing their use of the technologies (tablet, Google Drive, and Gmail), Internet access, and study process, only a few could complete all the lessons for Quarters 1 and 2. Therefore, only the learning materials designed for Quarters 3 and 4 could be field-tested completely. In addition, only 13 student participants remained responsive by the start of Quarter 3 (but until the end of Quarter 4).

Evaluation of the field-tested learning materials followed a convergent mixed-methods design (Creswell & Creswell, 2018, p. 300). The quantitative component of this evaluation used a one-group pretest and posttest design (Edmonds & Kennedy, 2017, p. 64). The qualitative component involved a thematic analysis (Braun & Clarke, 2022, p. 35) of students' responses in surveys and interviews. Based on the quantitative and qualitative results of the pilots of earlier quarters, the frameworks and guidelines were revised for use in subsequent quarters.

Outcomes of the EDR Analysis and Design Phases (Phases 1 and 2)

Analysis of Requirements and Context

The impetus for the project was the need for learning materials for DLD, which certain government agencies viewed as a potential alternative to print-based DL, at least during the pandemic. However, aside from difficulties arising because of the pandemic, the project had to

deal with four other significant contextual challenges. The first was that, in 2019, the learning poverty rate (LPR) of the Philippines was pegged at 90.9 (World Bank, 2022). In other words, only around one in ten Filipino children aged 10 years could comprehend age-appropriate English texts. It will be noted that English was the language of testing (LOT) of Filipino students in the Southeast Asian Primary Learning Metrics (SEA-PLM) assessment, which the World Bank used as the basis for computing the country's LPR. Unfortunately, students in the Philippines only begin to use English as the language of instruction (LOI) in the second semester of the fourth grade.

The second challenge was the lack of higher-order thinking skills (HOTS) of students in the country in general. As the former DepEd Secretary acknowledged in her most recent Basic Education Report, "there appears to be insufficient knowledge on developing…higher-order thinking skills among learners" (Duterte, 2023). The third and fourth challenges were the participants' lack of familiarity with tablets and tools like Google Drive and Gmail, as well as self-regulated learning.

The primary requirements, therefore, for the design of learning materials for DLD in the above context involved (1) supporting the learning of HOTS, (2) by students with low English and digital literacies and self-regulated learning skills, (3) in an LI-TDL environment. All these had to be accomplished in the midst of a pandemic.

General Pedagogical Framework and Design Guidelines

Given the limitations of datacasting technology, such as low interactivity and smaller bandwidth, DLD can be situated between print-based DL and ODL in terms of *structure* and *interactivity*, constructs adapted from Moore's (2018) theory of transactional distance. In this project, structure refers to how activities and assessments are organized in lessons and to what degree this organization is fixed or flexible. On the other hand, interactivity refers to how and to what degree learners are able to engage in conversations. In the conversational model of online learning (Sison, 2003), learners engage in learner-teacher, learner-peer, and learner-self conversations to construct knowledge. In the said model, a learning material (e.g., a lesson video or a worksheet activity designed by the teacher) can be viewed as a complex message from the teacher to the learner. Therefore, enhancing the learner's engagement with the learning material can be viewed as indirectly enhancing learner-teacher conversation.

To ensure the achievement of learning outcomes (LOs), especially higher-order LOs, in an LI-TDL context, three general guidelines were initially formulated for designing lessons and learning materials in all the subjects covered by the project, including ELA. Following the EDR process model described earlier, these guidelines were revised several times depending on the results of the reflection and evaluation components of each of the project's EDR phases, iterations, and increments.

In addition to the overall F&Gs, specific F&Gs were also developed for ELA, multimedia design, SRL, and parental engagement. The specific F&Gs for ELA are described next, but the rest of the specific F&Gs, which drew mainly on the well-known, research-based works of Clark and Mayer (2023) on multimedia design, Zimmerman (2015) on SRL, and Goodall (2014) on parental engagement will no longer be discussed in this paper.

Subject-Specific Framework and Design Guidelines for English Language Arts

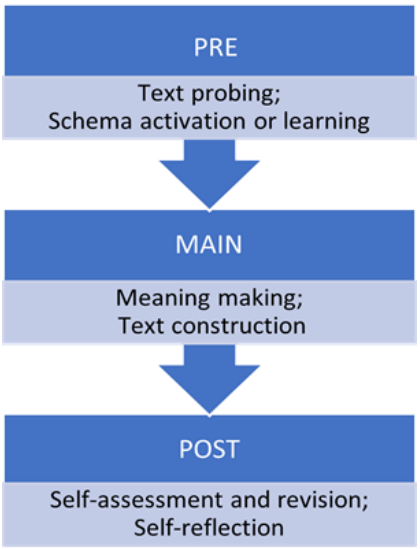
This project's underlying theory of language is functional. It takes the view that "language is first and foremost an instrument for communication between human beings" (Butler, 2003, p. 2). A functional approach supports L2 acquisition, which can be viewed as an unconscious and implicit process focused on exposure to comprehensible, message-oriented texts instead of explicit grammatical rules (Benati, 2020, p. 79). This functional or communicative approach underlies most of the "current" (Richards & Rodgers, 2014, p. 81) language teaching methods, including those that are content-based (Peng, 2022; Munoz, 2003) as well as the genre-based approach discussed earlier.

Our ELA teaching framework takes a three-stage process view with respect to language instruction, as discussed in the literature review. As shown in Figure 3, the "Pre" (e.g., prewriting or prereading) stage involves activities that prepare a student for the "Main" stage. These "Pre" activities help students activate or implicitly acquire background knowledge (e.g., schematic structures or language features of texts of a genre) that could help them perform the language activities in the "Main" stage. On the other hand, the "Post" (e.g., postwriting or postreading) stage involves activities that enable students to assess their outputs and reflect not only on their outputs but also on the process and any strategies they use.

Based on the framework in Figure 3, three specific guidelines were initially formulated for designing lessons and learning materials for ELA. As with the general F&Gs, these guidelines were revised several times following the results of the reflection and evaluation done in each of the project's EDR phases. The final set of guidelines is shown and discussed in the section that follows.

Figure 3

A Process Model for ELA DLD



Lessons and Learning Materials

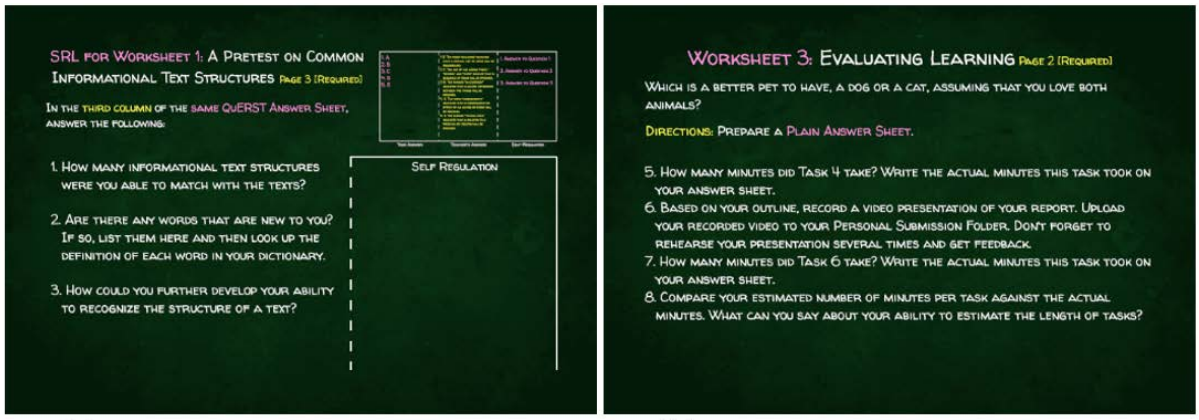
Eighteen lessons, including 54 worksheet activities, were developed following the general and specific F&Gs. All lessons begin and end with a video. In the intro video, a human teacher welcomes the students, reviews previous lessons, introduces a new lesson, relates it to prior lessons, and explains why the new lesson is essential. In the outro video, a human teacher

summarizes the essential points of the lesson, congratulates the student for doing all the activities, and provides the student with a glimpse of the next lesson.

Between these intro and outro videos are lesson videos that alternate with worksheet activities, which students have to do and submit by the end of the week. SRL activities are also interspersed throughout the lessons. Most SRL activities are relatively simple, such as the one shown in Figure 4a, which asks how many questions a student has answered correctly and how they could improve their performance in subsequent activities. These simple SRL activities typically fall under the third SRL phase, Reflection. However, there are also a few SRL activities that are more complex. For example, Figure 4b shows half of a worksheet activity in which different SRL tasks are interspersed throughout the process of preparing a multi-viewpoint (MV) video report. Specifically, these SRL tasks involved estimating the time to prepare an MV video report on a given topic (step 1, not shown), recording how many minutes it took the student to do the various steps in the MV report writing process (step 3, not shown, and steps 5 and 7, in Figure 4b), and comparing one's estimated and actual time and reflecting on one's time estimation skills (step 8 in Figure 4b). These SRL steps cover all three phases in Zimmerman's SRL model: Forethought (step 1), Performance (steps 3, 5, and 7), and Reflection (step 8).

Figure 4

Self-Regulated Learning Activities: Simple (a) and Complex (b)



(a) (b)

We eventually realized that we had to design special graphic organizers per quarter/unit to facilitate understanding, lessen the cognitive load of writing, and increase learner-content interaction. Meta-analyses have shown that graphic organizers have a significant positive effect on students' success in language teaching and learning areas, especially at the primary school level (Kansızoğlu, 2017). Table 1 shows the genre focus of the writing lessons in each quarter and the main graphic organizers that were specially designed for each quarter.

For example, Figure 5a shows a snapshot of a video of a VTS+ Table being filled out incrementally as the teacher models the interpretation of a visual narrative. A VTS+ Table is a special graphic organizer based on the Visual Thinking Strategies (Hailey et al., 2015) approach to visual literacy, adapted to an LI-TDL context (Sison, 2022).

Table 1

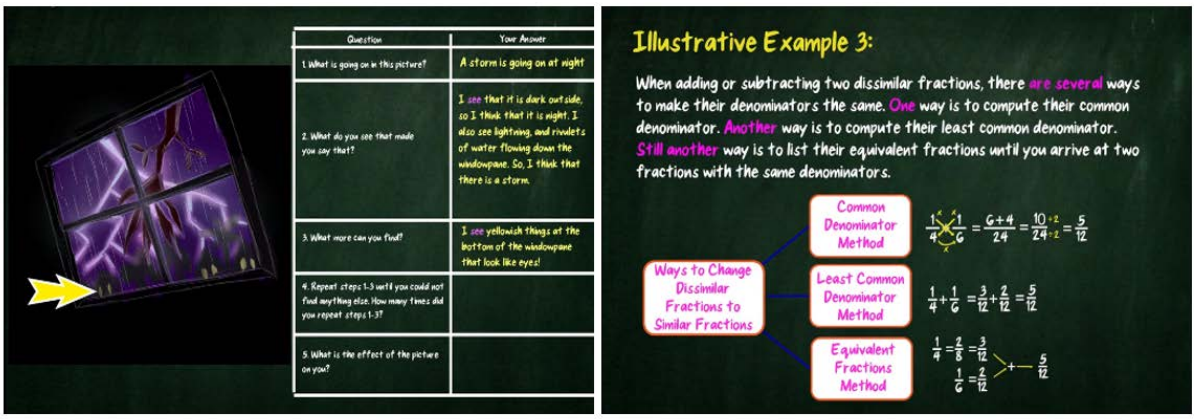
Writing Focus and Main Graphic Organizers per Quarter

Quarter	Broad Genre	Main Graphic Organizer
1	Narrative (visual interpretation)	• VTS+ Table
2	Informational (Basic) (5 subgenres: enumeration, sequence, comparison-contrast, cause-effect, problem-solution)	• Structure Diagrams (one per subgenre)
3	Informational (Complex) (multi-viewpoint report)	• Structure Diagram (for a multi-viewpoint report) • Report Outline • Information Gathering Grid • Writing Rubric
4	Persuasive	• Structure Diagram (for a persuasive essay) • Writing Rubric

Another example of a specially designed graphic organizer is shown in Figure 5b, in which an Enumeration Structure Diagram (ESD) illustrates the structure of an enumerative informational text adapted from one of the mathematics lessons in Quarter 2. This ESD will be combined with another structure diagram to form a more complex structure diagram for an MV report in Quarter 3 (Figure 6a).

Figure 5

Graphic Organizers: A VTS+ Table Being Filled Out (a) and an Enumeration Structure Diagram Showing Mathematics Procedures Learned in a Previous Quarter (b)

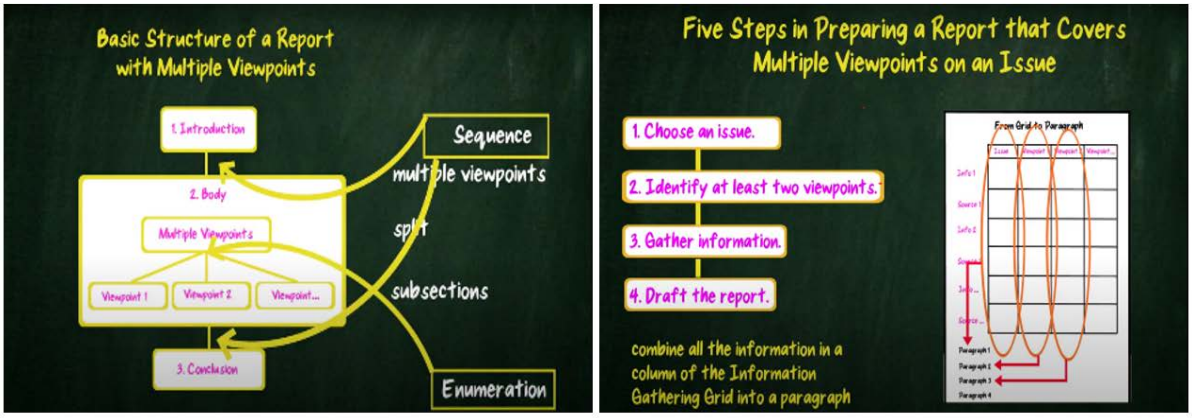


(a) (b)

As another example, Figure 6a shows that the structure of an MV report combines two structures (i.e., sequence and enumeration) learned in a previous quarter. The frame in Figure 6a is part of an animated video in which the sequence and enumeration boxes and the arcs from them to the central structure diagram are shown one after the other. Meanwhile, the frame in Figure 6b illustrates the fourth step in writing an MV report. The frame is part of an animated video in which the contents of a column in the Information Gathering Grid (on the right side of the frame) are combined to form a paragraph, a process that is repeated for all the columns. These paragraphs can form part of an initial draft of the MV report.

Figure 6

Frames from Animated Lesson Videos Illustrating the Combination of Genre Structures (a) and the Combination of Contents in Each Column of the Information Gathering Grid to Form Paragraphs of a Report (b)



(a) (b)

The Evaluation Components of the EDR Design and Field-Test Phases (Phases 3 and 4)

Quantitative Results

As mentioned earlier, the evaluation of the field-tested learning materials followed a convergent mixed-methods design, while the quantitative component used a one-group pretest and posttest design. Table 2 shows the students' mean pretest and posttest writing scores in Quarters 3 and 4, the improvements in these test scores, and the significance and effect sizes. Twelve students (n=12) were able to take the pretest and posttest in Quarter 4, which were administered in person due to the easing of pandemic-related restrictions. Only seven students (n=7) could take the pretest and posttest in Quarter 3, during which face-to-face meetings were still prohibited.

As the table shows, the mean posttest scores of the students were higher than their mean pretest scores in both quarters, indicating that learning occurred after the use of the learning materials. It can also be seen from the table that, in Quarter 4, the test score improvement was greater (than in Quarter 3), was statistically significant (Wilcoxon Signed Rank Test $\alpha = 0.05$), and had a large effect size (d=1.350). The improvement in test scores in Quarter 3 was more modest, only marginally significant, and had a moderate effect size.

Table 2

Improvements in Test Scores in Quarters 3 and 4

Quarter	Mean Pretest Writing Score	Mean Posttest Writing Score	Percentage Improvement in Mean Writing Score	Statistical Significance of Improvement (p) at $\alpha = 0.05$	Effect Size (Cohen's d)
Quarter 3	3.50	5.36	53.1%	0.090 (marginally significant)	0.788 (moderate)
Quarter 4	2.67	5.00	87.5%	0.004 (significant)	1.350 (large, d>0.8)

Qualitative Results

As mentioned earlier, the evaluation of the field-tested learning materials followed a mixed-methods design. The qualitative component of this evaluation involved a thematic analysis of student interviews, open-ended survey responses, and submission data. Five themes resulted from the thematic analysis, and, generally speaking, the qualitative results support the quantitative results. However, due to space constraints, only one of the five themes will be discussed in this paper, specifically the one that would trigger the addition of a guideline to the general design guidelines. This theme is called "Theme 2: Prerequisites and Familiarity."

When asked how the lessons could be improved, the students gave suggestions that could be grouped into two categories. The first category stems from requests to provide instruction in English as well as Tagalog, the language they spoke at home. Translanguaging refers to the use of different languages for input and output (Cenoz & Gorter, 2021, p. 17). Several studies have demonstrated that pedagogical translanguaging can lead to higher levels of academic performance and affirm learners' identities (Cummins, 2021). In ELA, the pedagogical translanguaging that was done was the provision of Tagalog translations of the English instructions that prefaced worksheet activities and assessments in Quarter 4.

The second category of student suggestions can be viewed as a request for differentiated instruction. This approach to instructional planning involves the modification of content, process, product, and affect depending on the readiness, interest, and learning profile of students or groups of students (Tomlinson & Imbeau, 2023). So, for example, when asked how the lessons could be improved further, some students suggested that more activities should be provided. However, other students requested the opposite: a reduction in activities. To address the suggestions of both groups, we increased the number of activities but gave the students options. In ELA, students were given options on what topics or themes to write paragraphs or essays about in Quarter 4.

Contextualization, which involves connecting the subject knowledge being learned to the world (Giamellaro, 2017), can also be used to increase the sense of familiarity with the learning materials. Contextualization of content helps students recognize personal relationships to abstract concepts by connecting ideas from familiar contexts to these concepts (Krause, et al., 2016). In the project, contextualization in ELA was provided through examples and worksheet activities that involved things the students could readily observe in their household (e.g., coins and notes bearing portraits of national heroes) or neighborhoods (e.g., their pets and those of their neighbors).

Revised Process Model and Design Guidelines

As mentioned earlier, the EDR process model was revised incrementally. Most significantly, as the project progressed, the need to include a reflection component in each of the EDR process model's phases (recall Figure 2) became increasingly evident. In addition, revisions were also made to the initial general and specific design guidelines based on the results of the evaluation and reflection components of the design and field-testing phases. For brevity, we discuss only the revisions here. These revisions are shown as italicized in the following two tables.

Two guidelines—the second and fourth in Table 3—had to be added to the initial set of three *general* design guidelines. Because these two turned out to be language-related (and also because of space constraints), only these two guidelines will be discussed in this paper.

The first of the two involved the design of special graphic organizers to illustrate the major concepts (e.g., genres/subgenres and their structures) and strategies (e.g., strategies for writing in the genre), as discussed earlier (recall Table 1 and its discussion). The second involved the inclusion of language and examples familiar to the target audience using pedagogical translanguaging and contextualization, also discussed earlier (recall Theme 2 above). To further increase contextualization as well as engagement, activities were designed so that students would interview or observe individuals in their household or neighborhood or perform experiments using readily available items, such as those typically found in their houses.

Another approach that we used to increase the sense of familiarity with the learning materials was to utilize content-based instruction (CBI) when exemplifying genre structures and processes. Recalling Figure 5b, for example, an Enumeration Structure Diagram was used to show three different approaches to computing the common denominator of fractions. These three approaches were taken from the project's mathematics lessons. CBI is an approach to L2 instruction organized around the subject matter that students will learn (Richards & Rodgers, 2014, p. 116).

Table 3

Revised General Design Guidelines (Revisions are italicized)

1. (Structure) *Carefully* identify the process in the revised Bloom's taxonomy (RBT) for each learning outcome in the prescribed curriculum, and then design assessment tasks and learning activities that are aligned with the outcome and its RBT process category, paying *careful* attention to higher-order learning outcomes.
2. (Structure) Design graphic organizers for major concepts and strategies.
3. (Structure, Interactivity) Intersperse short (10 to 15-minute) engaging videos (including the animation of the specially designed graphic organizers in Guideline 2) throughout a lesson to increase motivation and understanding. Use Clark and Mayer's (2023) multimedia guidelines where appropriate.
4. (Interactivity) Include language and examples familiar to the target audience using pedagogical translanguaging, contextualization, and content-based instruction, among others, to promote a sense of familiarity with the learning materials' language, context, and content.
5. (Structure) Design activities *of sufficient complexity* to develop self-regulated learning *and technology management* skills.

Meanwhile, the *specific* design guidelines only had to be revised in three ways, as seen in Table 4. The primary revision is the addition to the second guideline of the sentence, "Use animated graphic organizers to illustrate these dynamically." This reinforces the revised third general guideline in Table 3 above. Therefore, how to fill out an Information-Gathering Grid and how to transform it into paragraphs for an initial draft of an MV report were animated (recall Figure 6b), as was the "combination" of the Enumeration Structure Diagram and the Sequence Structure Diagram to form the structure diagram for MV reports (recall Figure 6a).

The second revision is the addition of the phrase "just the right number of" to the SRL-related aspects of all three specific guidelines. This is consistent with the revised fifth general guideline in Table 3 above on designing SRL activities of sufficient complexity.

Table 4

Revised Specific Design Guidelines (Revisions are italicized)

1. Use the Prewriting stage to a) familiarize students with sample texts of the genre, b) probe texts, c) review schematic structures relevant to the genre, or d) activate background knowledge that might be helpful. Also, use this stage for *just the right number of* SRL-Forethought activities, *including goal setting, planning, and encouraging a growth mindset.*
2. Use the Main writing stage to explain the genre structure and demonstrate the process of writing text in the genre. *Use animated graphic organizers to illustrate these dynamically.* Also, use this stage for *just the right number of* SRL-Performance activities.
3. Use the Postwriting stage for self-assessment and revision. *Demonstrate the use of rubrics for self-assessment.* Also, use this stage for *just the right number of* SRL-Reflection activities.

The third revision is the addition of the sentence, "Demonstrate the use of rubrics for self-assessment." It will be noted that rubrics do not appear in the print-based modules created by the DepEd for student use during the pandemic. However, without rubrics, it would be difficult for students to do self-assessment, which is an important aspect of the "Post" phase of our ELA process model (recall Figure 3) as well as the Reflection phase of Zimmerman's SRL model. A recent meta-analysis showed that rubrics positively affect academic performance as well as self-regulated learning (Panaderos et al., 2023), even among lower elementary students (Bradford et al., 2015). Videos and animated graphic organizers were also used to demonstrate rubric use.

Discussion

Although test performance improvement occurred after participants used the learning materials in both quarters, the improvement in Quarter 4 was more remarkable in terms of effect size and statistical significance compared to Quarter 3. This could be because the Quarter 3 lessons were more complex than those for Quarter 4. For example, basic multi-viewpoint texts, which were the focus of the writing lessons in Quarter 3 (recall Table 1) are structurally more complex than basic persuasive texts, which were the focus of the writing lessons in Quarter 4. Second, more writing tools, including the Information Gathering Grid and the Writing Rubric (recall Table 1), were first introduced in Quarter 3 and then continued to be used in Quarter 4.

A third possible reason could be that the SRL activities in Quarter 3 were more complex than in Quarter 4. For example, the SRL activities in Quarter 4 only involved looking at certain metrics of one's performance at a task (e.g., how many structures one was able to match correctly with texts) and reflecting on how one could further develop the ability to perform the task (recall Figure 4a). In contrast, the SRL activities in Quarter 3 involved not just the above but also estimating the time to be spent per writing task, measuring the actual time spent, comparing the estimated time and the actual time, and reflecting on one's ability to estimate the time to perform an academic task (recall Figure 4b).

A fourth possible reason could be the pedagogical translanguaging and differentiation provided in Quarter 4. Translanguaging can increase the sense of familiarity of a student with the teacher and learning material, which in turn can enhance motivation (Wang et al., 2025). Even if, as stated earlier, the only translanguaging done in ELA was the provision in Quarter 4 of Tagalog translations of the English instructions that prefaced worksheet activities and assessments, a student's fuller understanding of what is required of them could have increased

their self-confidence and self-motivation beliefs in their performance of the required task, which are important in self-regulated learning.

Translanguaging and differentiation are two categories that emerged from the qualitative analysis. They can be viewed as responses to student difficulties arising from the lack of prerequisite competencies, particularly in English, their language of instruction (LOI). As mentioned earlier, in public schools in the Philippines, English only begins to be used as the LOI in the major subjects in the second semester of the fourth grade. This, among others, might have led to the high learning poverty rate (LPR) mentioned in the previous section, especially since English was the language of testing (LOT) in the international assessment used as the basis for computing the country's LPR.

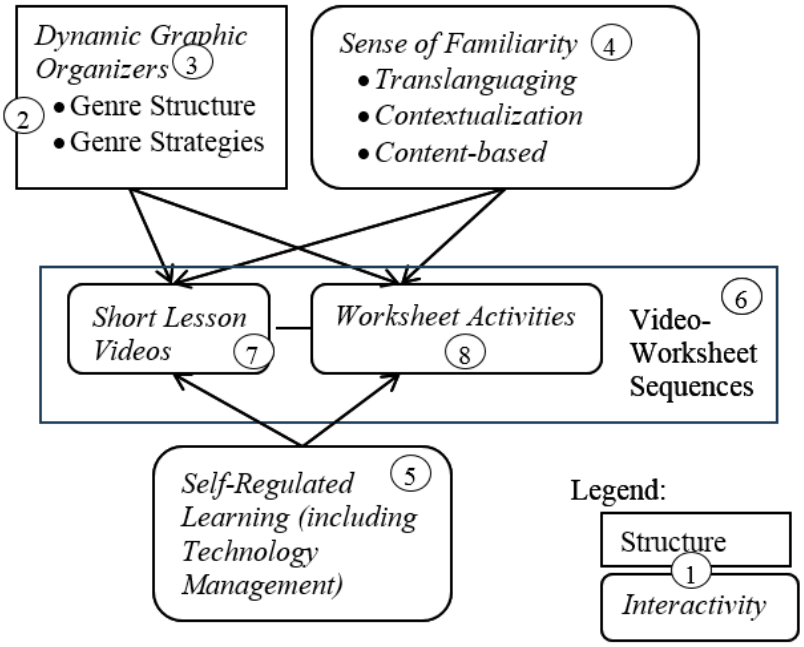
In addition, translanguaging can also increase the sense of familiarity of the student with the teacher and learning material, which in turn can increase positive affect (Garcia-Marques et al., 2016). When learners are taught in a language that they can speak and understand, they not only enjoy an academic experience, but they also learn more and are more likely to remain in school (World Bank, 2021).

The components of the design guidelines in Table 3 and Table 4, including those that emerged as a result of the EDR process (recall Figure 2), which includes the quantitative and qualitative analyses discussed above, are not unrelated. Figure 7 shows a way to view their relationships. These components can be viewed as "features" that support the LI-TDL of ELA, particularly writing. These features are 1) the use of structure and interactivity to support the learning of higher-order thinking skills, 2) the use of the genre-process combination to strengthen structure, 3) the design and animation of special graphic organizers to promote structure and interactivity, 4) the use of various mechanisms (e.g., pedagogical translanguaging, contextualization, and content-based instruction) to increase the student's sense of familiarity with the learning materials through language, context, and content to promote interactivity, 5) the provision of self-regulated learning and technology management support, and 6) the incorporation of all these into sequences of 7) short video lessons and 8) worksheet activities, all in the context of LI-TDL. The implication is that these features could be considered if not included when designing materials for low-interactivity TDL of writing.

A limitation of this research, being EDR, is that it does not explain the separate effects on writing of each of the eight features supporting the LI-TDL of writing shown in Figure 7. For example, referring to the box in the upper left corner of the said figure, the current research cannot disentangle feature 2 (genre structures and genre strategies, i.e., content knowledge) from feature 3 (dynamic graphic organizers, i.e., pedagogical content knowledge). Being EDR, the research indicates that the combined use of these eight features can lead to writing improvement, even in a low-literacy and low-interactivity TDL context. An experimental research design would be needed to explain the separate effects of each of the eight features.

Figure 7

Features Supporting Low-Interactivity Technology-Supported Distance Learning of Writing



Conclusion

This paper has described an educational design research (EDR) project involving the development of frameworks and materials for sixth-grade English language arts, particularly writing, in the context of distance learning via datacasting, a form of low-interactivity technology-supported distance learning (TDL). Results of the field test suggest that writing skills can be learned by students even in a low-interactivity TDL context.

Whereas the lessons and learning materials for TDL via datacasting make up the practical contribution of this EDR project, it also has theoretical contributions, which include the iterative and incremental EDR process model (Figure 2), as well as the general and specific frameworks and design guidelines (Table 3 and Table 4) and their features (Figure 7). Specifically, the use of the genre-process combination to strengthen the content structure; the design and animation of special graphic organizers to promote structure and learner-content interactivity; the use of various mechanisms (e.g., pedagogical translanguaging, contextualization, and content-based instruction) to foster a sense of familiarity with the language, context, and content; the provision of self-regulated learning and technology management support; and the incorporation of all these features into sequences of short video lessons and worksheet activities all together conduce to the effectiveness of materials for low-interactivity TDL of English language arts, particularly writing, even in a low-literacy context.

Future work can look into the relative contribution of each of these features to the effectiveness of learning materials for low-interactivity TDL in particular or TDL in general. It will be noted that, though this project focused on low-interactivity TDL, the EDR process model and the general as well as specific design guidelines and features can also be applied in higher-interactivity TDL contexts, such as online learning.

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Ethics Declarations

Competing Interests

No, there are no conflicting interests.

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