



Cognitive Load Theory and Textbook Design: An Analysis of Design Problems in the Algerian Third-Grade English Textbook

Nour el houda KHERFANE*

École Normale Supérieure de Laghouat
LSP Lab-Laghouat University
(Algeria)

n.kherfane@ens-lagh.dz

Dr. Lamia BELFERD

École Normale Supérieure de Laghouat
LSP Lab-Laghouat University
(Algeria)

l.belferd@ens-lagh.dz

Abstract

Emphasizing the importance of the visual design of textbooks, this study investigates how the design of the Algerian primary school English textbook for third graders can cause elevated levels of cognitive load. Specifically, the study aims to identify the design elements likely to cause high levels of cognitive load and determine which cognitive load principle is most frequently violated. To achieve these aims, a content analysis approach was adopted, in which researchers utilized a structured checklist to review each task in the book (N=142) and record the frequency of seven design problems related to four key principles of cognitive load theory: redundancy, split-attention, coherence, and transient information. The results revealed that 35.21% of the tasks contained design flaws likely to increase cognitive load, with coherence issues being the most prevalent. In light of these findings, the paper underscores the need for improved textbook design to better support young learners and provides several design recommendations to reduce unnecessary cognitive load.

Article info

Received

October 29.2024

Accepted

November 24.2024

Keywords:

- ✓ Cognitive load
- ✓ Cognitive load theory
- ✓ Visual design
- ✓ Design problems
- ✓ English textbook

* Corresponding author

4. Introduction

The use of textbooks has long been, and continues to be, a fundamental practice in language teaching. Despite the emergence of various other educational tools, textbooks remain widely used worldwide, serving as the primary foundation of school curricula in many countries (Richards, 2014). Advances in the various tools and programs involved in the design of textbooks, combined with the widely spread evidence that learners retain information more effectively when both language and visuals are integrated rather than relying on language alone (Mayer, 2009), have influenced textbook design to evolve with a significant focus on the visual design elements (Bezemer & Kress, 2009). It has been observed that much more emphasis has been placed on the visual appearance of textbooks over time, which can be a factor that makes this material more attractive; however, if this emphasis lacks a solid rationale, it may result in negative effects, that can hinder learning (Yvonne, 2018).

Cognitive load is one factor that can be adversely affected by the visual design of textbooks. It is a construct in cognitive psychology that refers to the demands imposed on learners' limited working memory in a specific learning task. As per Sweller (2011), if a learning task exceeds learners' cognitive resources, their working memory will be overloaded, and this is what will prevent any lasting learning outcomes. Working memory can be overloaded by several factors that can occur in the learning environment, whether related to the content being presented or the

way it is presented. Hence, to address this problem, Sweller (1988) introduced cognitive load theory (henceforth CLT), which is an instructional design framework aimed at leveraging an understanding of human cognition to equip educators with a repertoire of principles and strategies that can guide their teaching practices as well as the design of their educational materials.

The significance of cognitive load theory (CLT) in instructional design is undeniable (Yvonne, 2018), especially when it comes to the design of language textbooks. First, as noted by Hornay (2021), language learning textbooks possess an inherently higher potential to impose cognitive load on learners. This is mainly due to the fact that these materials typically include a range of tasks designed to enhance both micro and macro language skills, rendering them quite complex and, therefore, cognitively demanding.

Additionally, the heavy emphasis placed on the visual elements of language textbooks, along with instructional designers' limited knowledge of cognitive load theory, can lead to design practices that unintentionally hinder learning rather than facilitate it. As Mostyn (2012) points out, because of instructional designers' limited understanding of cognitive load theory, cognitively demanding elements such as the inclusion of distracting shapes, irrelevant pictures, and unnecessary texts are common in educational textbooks. These design elements, while possibly intended to engage and attract learners' attention, can instead result in elevated

cognitive load levels that divert their attention away from the primary learning objectives.

Moreover, the age factor of learners can increase the potential of visually rich textbooks to cause cognitive overload even further. Young learners are often characterized by short attention spans; as Copland et al. (2014) argued, one of the key challenges educators face when teaching English to young learners is maintaining their focus and engagement due to their brief attention spans. Consequently, the use of visually complex designs may heighten the likelihood of distraction, which not only hinders learning but also makes teaching significantly more overwhelming for educators.

Given the predominantly visual nature of the Algerian English textbook for third graders, “*My Book of English*”, and the limited application of Cognitive Load Theory within the Algerian context (Houichi & Sarnou , 2020), the present study seeks to examine the frequency of cognitive load issues in the textbook. The gained insights will allow us to offer design suggestions that could enhance the management of cognitive load through the design of the textbook. To achieve these objectives, the paper will address the following research questions:

- What specific design elements in “*My Book of English*” textbook are most likely to cause high levels of cognitive load?
- What is the most commonly recognized cognitive load design problem in the textbook?

2. Literature Review

2.1. Cognitive Load Theory

Cognitive Load Theory, introduced by psychologist John Sweller (Sweller et al., 2011), is an instructional design framework grounded in the understanding of human cognitive architecture. It emphasises that instruction should be delivered with consideration of learners’ limited working memory and their unlimited long-term memory (Van Merriënboer & Sweller, 2010). The theory deals primarily with what is known as biologically secondary knowledge, which, according to Geary (2007, 2008, as cited in Plass et al., 2010), is the type of knowledge acquired consciously in educational institutions such as schools and universities.

Cognitive load is a central construct in CLT. It refers to the mental effort and working memory resources needed to complete a particular cognitive task. It is a theoretical concept that represents the interaction between a learner’s cognitive abilities and the complexity of the information being processed (Kalyuga, 2009). CLT suggests that to promote better learning outcomes; educators should avoid any sources and tasks that impose excessive demands on working memory, which will lead to elevated levels of cognitive load (Sweller,1994). Consequently, the theory strives to minimize unnecessary cognitive load by introducing a range of teaching strategies and techniques (Sweller et al., 2011).

2.2. Cognitive Load Effects

In an attempt to minimise the working memory burden, several cognitive load effects were introduced. These can be defined as instructional techniques that

educators can employ to mitigate the different types of cognitive load encountered throughout the learning process (Sweller et al., 2011). A collection of these effects are summarised in the following table:

Table 1 Cognitive Load Effects Summarized (Adapted from (Sweller, 2019),(Plass et al., 2010) with additional information from (Sweller et al., 2011); and (Sweller, 1994)).

Cognitive Load Effect	Description
Worked example	Cognitive load decreases when a step-by-step solution guide to a given learning problem is provided (Sweller et al., 2011).
Split-Attention	Cognitive load increases when learners have to split their attention among various sources of information and integrate them mentally. Hence, information should be presented in an integrated format (Sweller , 2019).
Modality	Cognitive load increases when multiple sources of information that are incomprehensible on their own are presented in single-modality rather than dual-modality format (Low & Sweller, 2005, as cited in Plass et al., 2010).
Redundancy	Cognitive load increases when learners receive redundant, unnecessary information (Sweller et al., 2011).
Transient Information	Cognitive load increases when learners attempt to revisit a piece of information that disappears over time (Sweller , 2019).
Element interactivity	Cognitive load effects can occur only if the level of element interactivity is high ((Sweller et al., 2011); (Sweller, 1994)).
Isolated/interacting elements	Cognitive load decreases when a highly interactive material is first presented in separated elements and then as a whole (Pollock et al., 2002 as cited in Plass et al., 2010).
Variable examples	Learning is enhanced by using examples with different surface characteristics rather than examples with similar characteristics (Paas & Van Merriënboer, 1994, as cited in Plass et al., 2010).
Imagination	Learning is enhanced when imagination is used rather than relying mainly on reviewing study materials (Leahy & Sweller, 2004, as cited in Plass et al., 2010).

2.3. Cognitive Load Theory and Teaching Materials

Teaching materials are often argued to be a core source of cognitive load for learners (Sweller et al., 2011). Because the majority of materials used in language teaching are multimedia-based, the use of these materials typically necessitates the combination of words and pictures, which, if not integrated effectively, can result in an

additional load on working memory (Mayer, 2009). This argument has driven a range of research investigating the application of cognitive load theory across various learning environments (see Skulmowski & Xu, 2021; Song et al., 2023) and on various learning tools (see Asari, et al., 2023; Chang & Chen, 2024). Textbooks, widely used in EFL teaching, are no exception.

The long-standing practice of using textbooks in education (Bezemer & Kress, 2009) underscores the importance of continuously improving these tools to enhance learning outcomes (Kovac & Kepic Mohar, 2022). Hence, in light of cognitive load theory, several studies have

emerged, highlighting common issues found in textbooks and emphasizing the need to address these problems to optimize learning experiences. Three of the most influential studies in this regard are summarized in the following table:

Table 2 Textbook Design Practices that Can Result in Cognitive Overload

Study	CLT effects/ principles	CLT informed design problems
(Castro-Alonso, de Koning, Fiorella, & Paas, 2021)	Multimedia principle	The use of texts only with no visuals
	Split-attention effect	Presenting texts and visualizations separately
	Redundancy effect	Presenting redundant or nonessential information
	Signaling principle	Presenting essential information with no emphasis
	Transient effect	Presenting many transient visual information
(Castro-Alonso, Ayres, & Sweller, 2019)	Split attention effect	Using unintegrated visuospatial information
	Modality effect	Using pictures with written explanations rather than spoken one
	Redundancy effect	Using unimportant visuospatial information
	Signaling principle	Avoiding the use of visual cues
	Transient effect	Using transient visuospatial information
(Nurjanah & Retnowati, 2018)	Split attention	Using interconnected images, graphics, or textual information that are presented separately over multiple pages or on the same page
	Redundancy	Presenting information in multiple forms Providing unnecessary elaborations
	Signaling principle	Presenting essential information without the use of visual cues
	Coherence Principle	Presenting tasks with unclear instructions
		Using unnecessary images or words that do not contribute directly to the learning process

3. Methodology

The current paper aims to discover the extent to which cognitive load problems are likely to occur in the design of Algerian third-grade primary school English textbook. The researchers opted for a quantitative content analysis approach, which is a research approach that considers the gathering of numerical data out of a textual message as its end goal. (Neuendorf, 2017). This approach was fulfilled through the utilization of a structured checklist measuring the

frequency of occurrence of seven design problems that are covered in four main CLT principles.

3.1. Textbook Description

“*My Book of English*” for third-grade primary school learners (62 pages), was first published by the Algerian Ministry of Education in 2022 as an initial step to support the policy of integrating the English language into the primary level.

Table 3 “My Book of English” Descriptive Features

Units	Title	Tasks	Pages
-	My First English Class	8	6-7
1	Me, My Family and My Friends	26	8-18
2	My school	27	19-29
3	My Home	22	30-37
4	My Playtime	16	38-44
5	My Pets	21	45-51
6	My Fancy Birthday	30	52-62
Total		142	62

Targeted at 8-year-old learners, the textbook is designed to engage them actively in the learning process. It primarily consists of interactive language tasks that develop all four language skills (listening, speaking, reading, and writing). The book's design is visually rich, featuring various characters, illustrations, and images. As detailed in **Table 3**, the book comprises six main units and an introductory unit, encompassing a total of 142 tasks ($N=142$). These tasks are distributed unevenly based on the requirements of the different topics of each unit, which include talking about: one's self, family and friends, school, home, playtime, pets, and birthdays. At the end of each unit, the book presents tasks on pronunciation, handwriting, and a final project.

3.2. Data collection

Data was collected using a seven-item structured checklist developed based on the three studies discussed earlier (see Section 2.3). The researchers measured seven

design problems related to four main CLT principles: split attention, redundancy, coherence, and transient information. The data were collected through a straightforward coding approach, where researchers reviewed each task in the book and recorded every instance in which design problems related to CLT were identified. Each problem was documented individually; hence, any task that contained problems from different categories (e.g., split-attention and redundancy) was recorded more than once. However, tasks containing multiple problems of the same category were recorded only once. To organize the analysis process, the researchers followed the same unit order as the book. The gathered data was then statistically analysed.

4. Results

4.1. Checklist results

Table 4 represents the frequency of occurrence of the seven investigated design problems obtained through the structured checklist. The results revealed that Unit 1 and “My First English Class” Unit had the highest percentage (50%) of tasks with design problems, whereas Unit 6 had the lowest (28.57%). Further, while numerous problems were identified in Unit 2, with 6 out of the 7 design problems recorded in it, other units like “My First English Class” and Unit 4 had very few, with only three problems each.

Table 4 Frequency of the Occurrence of CLT-informed Design Problems per units (F: Frequency/ %: Percentage/ FEC: My First English Class/ DP: Design problems)

Activity First English Class 214 Design Problems															
		FEC		Unit 1		Unit2		Unit3		Unit4		Unit5		Unit6	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
Split-attention	Presenting interconnected information over multiple pages	0	0%	1	3,8%	1	4%	4	18,2%	0	0,0%	1	4,8%	2	6,7%
	Presenting unintegrated visual information	1	12,5%	1	3,8%	1	4%	0	0,0%	0	0,0%	0	0,0%	0	0,0%
Redundancy	Presenting the same information in words and pictures	0	0,0%	0	0.0%	1	4%	0	0,0%	0	0.0%	0	0,0%	0	0,0%
	Presenting the same information multiple times	1	12,5%	1	3,8%	2	7%	3	13,6%	0	0,0%	0	0,0%	2	6,7%
Coherence	Presenting tasks with unclear instructions	0	0,0%	1	3,8%	3	11%	0	0,0%	3	18,8%	2	9,5%	1	3,3%
	Using unnecessary images, shapes or words that do not contribute directly to the learning process	2	25,0%	8	30,8%	4	15%	4	18,2%	4	25.0%	4	19,0%	2	6,7%
Transient	The use of oral language that disappears over time	0	0%	0	0%	1	4%	1	4,5%	0	0%	1	4,8%	0	0%
Number of Tasks with DPs		4	50%	9	50%	9	34.62%	9	33.33%	7	31.82%	6	37.5%	6	28.57%

These findings indicate a wide variation in the occurrence of different problems across the units. For example, the issue of presenting the same information in both words and pictures (redundancy) was observed only in Unit 2 (4%). Slightly more frequent were the problems of presenting unintegrated visual information (split-attention) and transient information,

which were recorded in no more than three units, with percentages ranging from 4% to 13.6%. However, the results show consistency across all units when it comes to the use of unnecessary images or words that do not directly contribute to the learning process (Coherence), as this design problem was the most recurrent

across all units, with percentages ranging from 6.7% to 30.8%.

This variation in results can be attributed to the uneven distribution of tasks among the different units (see **Table 3**), as well as the nature of the topics and types of tasks included in each unit. For instance, some units contained more visuals (e.g., Unit 1) compared to others (e.g., Unit 4). Additionally, it was noted that problems such as presenting the same information in both words and pictures (redundancy) were unlikely to occur, as the book did not contain large texts or passages.

Table 5 Overall Frequency of Occurrence of CLT-informed Design Problems (DP: Design Problems)

	Frequency	Percentage
Split-attention	12	8.45%
Redundancy	9	6.34%
Coherence	38	26.76%
Transient information	3	2.11%
Total DP instances	62	43.66%
Tasks with more than one DP	12	8.45%
Total number of tasks with DP	50	35.21%

In addition, as detailed in **Table 5**, the results revealed that problems related to split-attention, redundancy, and transient information are much less likely to occur compared to coherence problems. The findings highlighted that only 8.45%, 6.33%, and 2.81% of the tasks have split-

attention, redundancy, and transient information problems, respectively; however, more than one-fourth (26.75%) of the tasks have coherence problems. Overall, the findings revealed that there are 50 tasks with cognitive load-informed design problems, 12 of which contain more than one problem (two design problems in each task). This suggests that CLT-informed design problems affect over a third (35.21%) of the tasks in the book, with a likelihood of occurrence in approximately one out of every two to three tasks (*Average* = 2.3). This percentage of CLT-informed design problems is relatively high, indicating that a significant portion of the tasks in the textbook may cause high levels of cognitive load.

4.2. CLT-informed Design Problems in the Book

4.2.1. Split-attention



Figure 1 Split-attention Example from Unit3 (Task 7/ P32)

The book included several tasks where learners were asked to refer back to a previous picture and act out the scene. However, these tasks were not classified as instances of split attention because, once learners read the question, they were not required to split their focus between two different sources of information simultaneously (Sweller, 2019). After excluding such tasks, it was observed that Unit 3 contained the majority of split-attention instances. In this unit, learners were presented with a large picture of a house at the beginning of the unit, and in multiple tasks, they were instructed to refer back to it to answer questions. As illustrated in **Figure 1**, the task appears on page 32, while the picture is located on page 30. This layout requires learners to divide their attention between two separate sources of information that need to be integrated. Hence, as shown in the modified version, this problem can be solved by presenting the visual information that requires mental integration in close proximity, both spatially and temporally.

4.2.2. Redundancy

The limited occurrence of the redundancy problem can be attributed to the fact that the researchers excluded all the tasks that require the combination of two learning modalities, spoken and written, such as “listen and read” tasks, which are very common throughout the book. This is because such a type of redundancy can have a significant positive impact when it comes to language learning (Sweller et al., 2011). Thus, the problem of redundancy was recorded only in instances such as the one shown in **Figure 2**. The objective of the task

16. Read and find the intruder. Put a cross in the right box on your copybook.

A	1. Sunday	☐	2. brown	☒	3. Friday	☐	4. Saturday	☐
B	1. chair	☐	2. table	☐	3. civics	☐	4. crayon	☐
C	1. tablet	☐	2. green	☐	3. blue	☐	4. yellow	☐
D	1. science	☐	2. chair	☐	3. history	☐	4. geography	☐

25

Figure 2 Redundancy Example from Unit 2 (Task 16 / P 25)

is to identify the “intruder” word. Although this might seem like a simple question, the design of the task may introduce some ambiguity. Learners are presented with four groups of words listed horizontally, labelled A to D, to identify each group. However, the words within each group are also unnecessarily numbered from 1 to 4, creating redundant vertical lists for each number. This type of redundancy can distract learners and confuse them about which list they should focus on to find the intruder. This is why, in such a situation, it is highly recommended to use only one type of numbering, as shown in the modified version of the figure.

4.2.3. Coherence

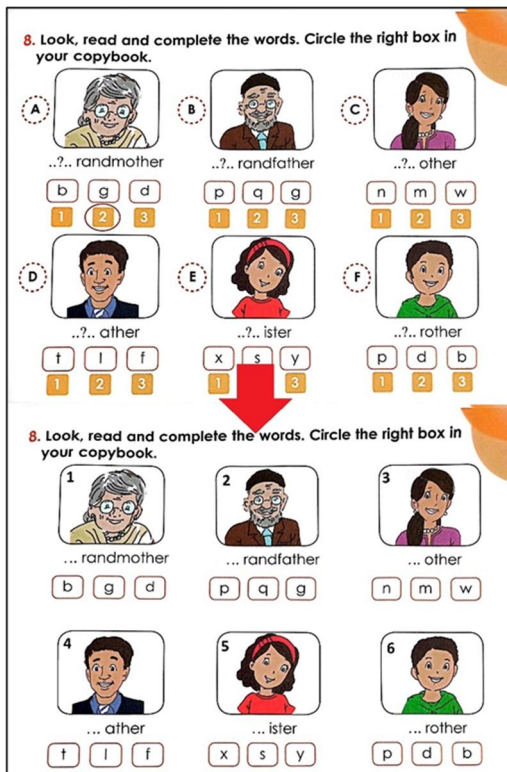


Figure 3 Coherence Example From Unit 1 (Task8/ page 11)

Coherence problems constituted the majority of the issues identified in the textbook. Due to the frequent use of colours, shapes, numbering, and pictures, coherence problems were prevalent throughout the material (Clark & Mayer, 2016). In many instances, it was observed that the tasks contained unnecessary design features that did not contribute to the learning process. As shown in **Figure 3**, the learner is asked to circle the missing letters for specific words. In such cases, the required information includes pictures that reflect the intended words, words with missing letters, and letters; however, the task contains several other extraneous elements such as numbers in coloured boxes, question marks, and circled letters meant for numbering the pictures. These additional elements clutter the task and render the question ambiguous.

Learners are instructed to circle the boxes, but they encounter two sets of boxes under each picture, one for letters and one for numbers. This raises the question of which set of boxes they should circle and what is the objective behind including the numbers in such an activity. Furthermore, the choice of letters inside red circles for numbering in this activity is not ideal. First, students might confuse these letters for the correct answers or assume they are part of the options. Second, even if learners understand that the letters are used solely for numbering purposes, they still need to split their attention to match each letter to its corresponding picture. Therefore, if any form of numbering is deemed necessary, letters should be replaced with numbers and integrated into the picture without unnecessary shapes or colours, as clarified in the modified version in the figure.

4.2.4. Transient Information

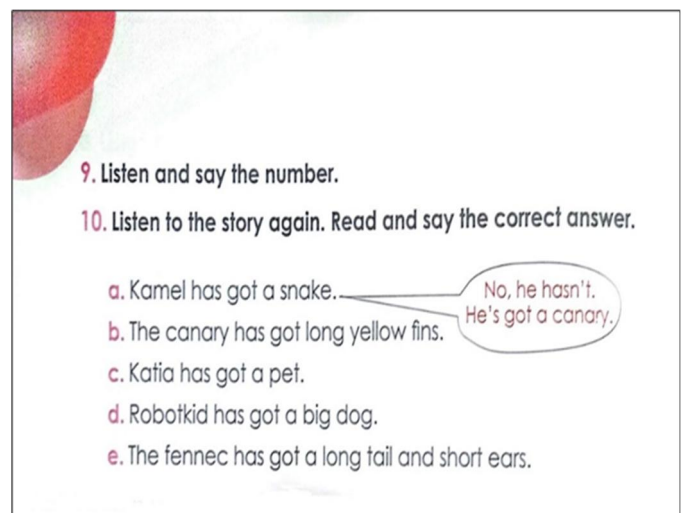


Figure 4 Transient Information Example from Unit 5 (Task 10, P 48)

Although there were many tasks in the book that used spoken transient language, such as “listen and repeat,” “listen and tick,” and “listen and match,” these tasks were not

considered examples of transient information problems. This is mainly attributed to the low element interactivity levels in these tasks. Sweller et al. (2011) explain that when tasks involve presenting simple words orally, they do not demand high element interactivity due to the language's simplicity. Therefore, no extra demands will be imposed on the working memory. Taking that into account, only tasks similar to the one presented in **Figure 4** were recorded. The task in the figure is an example of high element interactivity due to its simultaneous combination of three skills: listening, reading, and speaking, where none of these skills can be achieved without the co-occurrence of the others. Given the elementary level of the learners, such a task imposes an additional cognitive load on the learners, which could be reduced by minimizing the transient information.

5. Discussion

The current paper examined the extent to which cognitive load-informed design problems can occur in the Algerian primary school English textbook for third graders. The study focused on identifying seven key design issues related to four cognitive load theory principles: split-attention, redundancy, coherence, and transient information. The results revealed that 35.21% of the tasks contained design flaws that could potentially increase cognitive load. That is to say; in every two to three tasks, there is a likelihood of encountering at least one design element that can impose high levels of cognitive load, with coherence being the most commonly violated principle.

The findings suggest that issues related to split-attention, redundancy, and transient information were minimal in the textbook. Such problems can arise from using two types of visual information separately, presenting the same information in two different modes, or presenting information that disappears over time (Sweller et al., 2011). Although all three problems were identified in several tasks, it was observed that they were much less likely to occur due to the limited written texts in the book and the simple language used. This was largely because the book focused on words and short sentences rather than long, complex texts and conversations, as it is targeted at elementary-level learners. Consequently, it was noted that even in situations where learners had to split their attention or engage with redundant or transient information, the likelihood of experiencing high levels of cognitive load remained low. This finding is supported by Shojaeizadeh et al. (2017), who demonstrated through pupil dilation research that attending to simple texts can, in fact, reduce cognitive load.

Despite the limited occurrence of split-attention, redundancy, and transient information problems, the findings revealed that issues related to the coherence principle were the most prevalent. This result is not surprising, as Clark and Mayer (2016) argue that while the coherence principle can be easily integrated into instructional design, it is frequently violated. The findings indicated that the coherence problem arising from the use of unnecessary words, shapes, and images was pervasive throughout the textbook, reflecting a significant emphasis on its visual design. This is in line with

Bezemer and Kress (2009), who argued that textbooks are becoming increasingly visually oriented. While such emphasis on the visual presentation of textbooks may be perceived to have positive effects on young learners (West et al., 2020), it can also have negative consequences. The overemphasis on visual appeal can result in overly complex designs that distract and confuse learners, ultimately reducing their ability to focus on the content, as highlighted by (Drexler et al., 2018).

Furthermore, the results demonstrated that instructional clarity is not receiving the attention it requires. Many tasks in the textbook were observed to have unclear instructions, indicating a need for reformulation to make them more accessible to young learners. This raises concerns that some tasks may not fully align with the learners' language levels, potentially hindering their understanding and progress. This conclusion is not new, as previous research has shown that school textbooks can sometimes fail to meet learners' language levels and needs (Ullah et al., 2022; Abdul et al., 2022).

In essence, the results signify the critical need to simplify the design of “*My Book of English*” textbook and place greater emphasis on the clarity and precision of the instructions. Simplifying the design would reduce unnecessary cognitive demands on learners, freeing up valuable mental resources (Mayer, 2009). By achieving these improvements, learners will not only have additional cognitive capacity to focus on the tasks at hand but also be better equipped to concentrate on the primary objective of language learning.

6. Textbook Design Recommendations

In light of the results of our paper, which shows that coherence is one of the most occurrent cognitive load problems in “*My Book of English*” textbook, the following design implications can be suggested:

- Tasks should focus on a single learning objective and minimise the repetition of vocabulary that does not directly aid in answering task questions.
- Not every picture, word, letter, or number should be coloured or placed within shapes to capture learners' attention.
- All forms of numbering within tasks should be minimised, especially when they do not serve the instructions.
- Information that needs to be integrated, such as written text and pictures or spoken texts and pictures, should be brief and presented in close proximity, both spatially and temporally.
- Large pictures intended to present specific items should only depict the targeted objects, people, and places, omitting any extraneous items that could distract learners.
- Instructions should always be clear and straightforward, taking into account learners' language levels and explicitly outlining what is expected regarding the included visuals (text or images).

7. Conclusion

Following a content analysis approach, the current paper evaluated the occurrence of cognitive load theory-informed design problems in the Algerian textbook “*My Book of English*”. By assessing the frequency of design flaws that can lead to cognitive overload, the findings revealed that 35.21% of the tasks in the textbook may cause high levels of cognitive load. The main issues identified were related to redundancy, split attention, transient information, and, most notably, coherence. The results indicated that coherence problems were present in all units of the book, suggesting that greater emphasis is placed on the aesthetic visual elements of the textbook, with limited consideration for learners’ language level. These findings demonstrate that simplifying the textbook’s design could help optimise learners’ cognitive resources and direct them toward the primary goal of language learning.

Disclosure of interest

The authors report that there are no competing interests to declare.

References

- Sweller, J., Ayres, P., & Kalyuga, S. (2011). *Cognitive Load Theory*. Springer Science+Business Media.
- Yvonne, B. (2018). Textbook effects and efficacy. In E. Fuchs, & A. Bock (Eds.), *The Palgrave handbook of textbook studies* (pp. 383-398). New York: Palgrave Macmillan.
doi:https://doi.org/10.1057/978-1-137-53142-1_28
- Abdul Samat, N., Alwani Syahirah Azmi, N., & Abdullah, T. (2022). The voice of learners on English literary texts: Passing on the mantle. *Arab World English Journal* (AWEJ), 12. Retrieved from <https://ssrn.com/abstract=3998339>
- Asari, M. A., Kasim, F., Mohd Yusof, N., Simok, A. A., Shamsuddin, S. A., Ikhwan Mohd Amin, M. S., . . . Mohd Ismail, Z. (2023). A Seven-Step Technique on PowerPoint Slide Preparation for Anatomy Lectures: A Cognitive Load Theory Approach. *Educational Resource*, 113-121. doi:<https://doi.org/10.21315/eimj2023.15.1.9>
- Bezemer, J., & Kress, G. (2009). Visualizing English: a social semiotic history of a school subject. *Visual communication*, 8(3), 247-262. doi:<https://doi.org/10.1177/1470357209106467>
- Castro-Alonso, J. C., Ayres, P., & Sweller, J. (2019). Instructional visualizations, cognitive load theory, and visuospatial processing. In *Visuospatial processing for education in health and natural sciences* (pp. 111-143).
- Castro-Alonso, J. C., de Koning, B. B., Fiorella, L., & Paas, F. (2021). Five strategies for optimizing instructional materials: Instructor-and learner-managed cognitive load. *Educational Psychology Review*, 33(4), 1379-1407. Retrieved from <https://doi.org/10.1007/s10648-021-09606-9>
- Chang, C. C., & Chen, T. C. (2024). Emotion, cognitive load and learning achievement of students using e-textbooks with/without emotional design and paper textbooks. *Interactive Learning Environments*, 32(2), 674-692. Retrieved from <https://doi.org/10.1080/10494820.2022.2096639>
- Clark, R. C., & Mayer, R. E. (2016). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. New Jersey: John Wiley & Sons.
- Copland, F., Garton, S., & Burns, A. (2014). Challenges in teaching English to young learners: Global perspectives and local realities. *Tesol Quarterly*, 48(4), 738-762. doi: 10.1002/tesq.148
- Drexler, M., Drexler, D., & Sládek, P. (2018). Eye tracking as a Tool for Measuring Students' Attention When Working With Physics Textbooks. *EDULEARN* (pp. 9219-9228). IATED.
- Hornay, P. A. (2021). Cognitive load theory and the English language instruction. *ACCENTIA: Journal of English Language and Education*, 1(1), 43-55. Retrieved from <https://doi.org/10.37598/accentia.v1i1.1015>
- Houichi, A., & Sarnou, D. (2020). Cognitive Load Theory and its Relation to Instructional Design:

Perspectives of Some Algerian University Teachers of English. *Arab World English Journal*, 11(4), 110-127. doi:DOI:

<https://dx.doi.org/10.24093/awej/vol11no4.8>

Kalyuga, S. (2009). *Cognitive load factors in instructional design for advanced learners*. New York: Nova Science Publishers, Inc.

Kovac, M., & Kepic Mohar, A. (2022). The changing role of textbooks in primary education in the digital era: What can we learn from reading research? *CEPS Journal*, 12(2), 11-27. doi:10.25656/01:25210; 10.26529/cepsj.1290

Mayer, R. E. (2009). *Multimedia Learning* (2 ed.). Cambridge: Cambridge University Press.

Mostyn, G. R. (2012). Cognitive load theory: What it is, why it's important for accounting instruction and research. *Issues in Accounting Education*, 227-245. doi:10.2308/iace-50099

Neuendorf, K. A. (2017). *The content analysis guidebook*. Sage.

Nurjanah, A., & Retnowati, E. (2018). Analyzing the extraneous cognitive load of a 7th grader mathematics textbook. *Journal of Physics: Conference Series*. 1097, p. 012131. IOP Publishing. doi:10.1088/1742-6596/1097/1/012131

Plass, J. L., Moreno, R., & Brünken, R. (2010). *Cognitive load theory*. New York: Cambridge University Press.

Richards, J. C. (2014). The ELT textbook. In *International perspectives on materials in ELT* (pp. 19-36). London: Palgrave Macmillan UK. Retrieved from https://doi.org/10.1057/9781137023315_2

Shojaeizadeh, M., Djamasbi, S., Chen, P., & Rochford, J. (2017). Text simplification and pupillometry: an exploratory study. In *Augmented Cognition. Enhancing Cognition and Behavior in Complex Human Environments: 11th International Conference, AC 2017, Held as Part of HCI International 2017, Vancouver, BC, Canada* (pp. 65-77). Springer International Publishing.

Skulmowski, A., & Xu, K. M. (2021). Understanding Cognitive Load in Digital and Online Learning: a New Perspective on Extraneous Cognitive Load. *Educational Psychology Review*, 34, 171-196.

Song, C., Shin, S. Y., & Shin, K. S. (2023). Optimizing foreign language learning in virtual reality: a comprehensive theoretical framework based on constructivism and cognitive load theory (VR-CCL). *Applied Sciences*, 13(23), 12557. Retrieved from

<https://doi.org/10.3390/app132312557>

Sweller, J. (2019). Cognitive load theory and Educational Technology. *Education Technology Research Development*, 1-16.

Sweller, J. (1988). Cognitive Load During Problem Solving: Effects on Learning. *Cognitive Science*, 257-285.

Sweller, J. (1994). Cognitive Load Theory, Learning Difficulty, and Instructional Design. *Learning and Instruction*, 295-312.

Sweller, J. (2011). Cognitive load theory. *Psychology of Learning and Motivation*, 37-76.

Ullah, I., Zeb, S., & Aryan, A. A. (2022). Designing Textbook for English Language Learning at Primary Level: An Analysis. *Journal of Social Sciences Review*, 2(3), 269-277. Retrieved from <https://doi.org/10.54183/jssr.v2i3.147>

Van Merriënboer, J. J., & Sweller, J. (2010). Cognitive load theory in health professional education: design principles and strategies. *Medical education*, 44(1), 85-93. Retrieved from <https://doi.org/10.1111/j.1365-2923.2009.03498.x>

West, D., Allman, B., & Kimmons, R. (2020). Visual Aesthetics: The Art of Learning. In R. Kimmons, & S. Caskurlu (Eds.), *The Students' Guide to Learning Design and Research*. EdTech Books. Retrieved from https://edtechbooks.org/studentguide/visual_aesthetics