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Cognitive Load Theory and its Relation to Instructional Design: Perspectives of Some Algerian University Teachers of English

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Abstract
Cognitive Load Theory is a theory that can be used by educators to design effective instructions. It has been applied in many areas, including teaching English as a foreign language as it contributes to positive outcomes. Before designing instructions, teachers should well understand the theory of Cognitive Load alongside human brain architecture. Sometimes students are taught more than they can learn due to their limited cognitive capacities which teachers do not consider. Students, therefore, often experience a cognitive overload which may lead to learning failure. So to what extent Algerian university teachers of English are aware of cognitive load theory? This research aims at exploring the perspectives of Algerian university teachers of English on the theory of cognitive load and its connection to instructional design. The study is expected to increase teachers' awareness of the importance of cognitive load theory in instructional design. 21 English language teachers from different universities of Algeria were enrolled in this query. A questionnaire was used to examine the respondents' knowledge of the theory and their instructional design experiences. Even though the early expectation was that teachers are knowledgeable about the theory, the research findings showed that teachers lack sufficient knowledge of the theory; yet, they tend to work with some of its techniques when they design instructions.
Keywords: cognitive load theory, EFL Algerian University teachers, human cognitive architecture, instructional design, instructional design techniques
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Introduction

Effective teaching/learning process is influenced by various factors including instructional design. In fact, instructional design has a significant impact on students' understanding of knowledge. Hence, in order to improve students' performance, teachers need to understand the evidence base that helps develop students' practice through concepts related to instructional design particularly, those related to cognition. Over the last decade, there has been considerable interest in areas of cognition and education. The knowledge of the cognitive processes involved in understanding instructional material has been progressed by cognitive science to a point where it is becoming evident that the traditional methods of instructional design are inadequate anymore. New Instructional procedures guided by the Cognitive Load Theory (CLT) have become accessible (Chandler & Sweller, 1991).

Cognitive load theory originated in the 1980s and has been developed by researchers around the world in many disciplines since the 1990s (Schnotz & Kürschner, 2007). It can be applied in many areas of teaching including, teaching foreign languages (Diao & Sweller, 2007). The theory highlights the role of cognitive capacity in working memory for successful learning outcomes (Van Merrienboer & Sweller, 2005). Since it is limited in capacity, learners must keep a considerable number of working memory elements while in tandem, relating them to understand the material. This load often results in exceeding working memory capacity, i.e., overloaded. Consequently, successful learning is forced to occur within the limits of working memory. Inevitably, (CLT) provides theoretical and empirical support for explicit models of instruction. Research in (CLT) demonstrates that instructional techniques are most effective when they are designed to accord with human cognitive architecture (Schnotz & Kürschner, 2007).

Foreign languages university students, sometimes, are taught more than they can learn; they are overwhelmed by the enormous amount of knowledge. Sweller (1988) claimed that students sometimes are being taught incorrectly because the teaching strategies do not consider how they learn. According to him, the human working memory capacity is minimal and cannot process a massive amount of information at the same time (Sweller, Van Merrienboer, & Paas, 1998). Therefore, it is of paramount importance for teachers to take into consideration students' cognitive capacities. Otherwise, students will be overwhelmed and the learning outcomes would not comply with the teaching objectives. Consequently, the learning process would fail.

In the same line of thought, Sweller et al. (1998) argued that (CLT) links cognition and instruction, and it has become one of the most critical theories in the field of instructional design. The role of teachers is to analyze, solve performance problems, and implement solutions that make students knowledgeable; they should build instructional materials based on the students' cognitive processing abilities (Sweller, 1994). The present study aims to explore the extent to which Algerian University teachers of English are aware of the theory and its significance and to inquire about teachers' experiences toward instruction design. Hence, the study addresses the following research questions:

1. To what extent Algerian university teachers of English are aware of cognitive load theory?
2. To what extent they apply the techniques of cognitive load theory to instructional design?

The significance of this research is that it intends to add to the theoretical stockpile the way in which teachers can design instructions based on the use of (CLT) and its techniques. Moreover, it will be of considerable value for the practical guidelines with which EFL teachers will be equipped with to design effective instructions that do not overload the students' memory. Finally, the current study is expected to raise teachers' awareness of the importance of (CLT) and its relation to designing instructions.

Literature Review

Cognitive Load Theory

It is a psychological theory that is originated from the field of cognitive science. Initially, it had emerged from the work of Australian cognitive educational psychologist John Sweller in the late 1980s(Sweller, 1988). It was developed to explain the effects of the design of learning materials on what happens in the human brain when learning takes place. The theory emphasizes that the working memory capacity has limitations when dealing with novel information (Van Merrienboer & Sweller, 2005). That is to say, it is the total amount of mental activity applied to an individual cognitive system within a given time. The theory aims to provide instructional techniques that fit within the characteristics of working memory (Sweller et al., 1998). By simultaneously considering the structure of information and the human cognitive architecture, theorists have been able to generate a unique variety of procedures (Paas, Renkl, & Sweller, 2003).

Human Cognitive Architecture

The efficiency of instructional materials significantly depends on considering the characteristics of the human cognitive system(Sweller, 1994). Researchers have used (CLT) to propose that different used instructional procedures are inadequate because they necessitate students to engage in needless cognitive activities which impose a heavy load on working memory.

The human cognitive architecture has three suppositions. First, the working memory is limited in capacity and duration. This kind of memory is the system where small quantities of information are stored for a short period (Atkinson & Shiffrin, 1968). Clark, Nguyen, and Sweller (2011) claimed that humans are able to process “two or three” items of information at the same time in working memory before it could be stored in long-term memory. However, according to Miller (1956), an individual is capable of retaining only “seven plus or minus two” items of information at any point in time. In consequence, if the amount of information presented exceeds the abilities of students’ working memory, then the information cannot be retained. The second supposition is that long-term memory is unlimited. Long-term memory according to Atkinson and Shiffrin in contrast to working memory, is the kind of memory that stores huge amounts of information for a limited amount of time (Atkinson & Shiffrin, 1968). (CLT) assumes that knowledge is stored in long-term memory in the form of “schemas” (Kalyuga, 2010). In this way, schemas can make the retrieving of knowledge from long-term memory to working memory effortlessly. As a result, the load on working memory will be reduced (Sweller et al., 1998). The last supposition is that the load imposed on students’ working memory during instruction can be adjusted. That is to say, that students’ load impact information processing in working memory so the load can be increased or decreased (Mousavi, Low, & Sweller, 1995).

Types of Cognitive Load

Instructions can impose three kinds of load on students' cognitive system (Van Merrienboer & Sweller, 2005).

Intrinsic Load

It is imposed by the inherent difficulty of the material and the level of expertise of students in the subject matter (Sweller, 1994). In simple terms, it is the natural complexity of information that must be understood. It is caused by cognitive activities that are essential for establishing key connections between elements of information, integrating them with available knowledge and building new knowledge structures in working memory which is referred to as "element interactivity" (Sweller, 2010).

Extraneous Load

Also known as ineffective load, it is a major type of load caused by instructional features that are not beneficial for learning. According to Sweller, it is a diversion of cognitive resources on activities irrelevant to performance and does not directly contribute to learning (Sweller, 2010). It is caused by factors related to design such as poor design, presentation format, and non-essential material.

Germane Load

In contrast, is the effective and beneficial type of load. It refers to the load imposed on the working memory by the process of learning (Sweller et al., 1998). It is the process of transferring information into the long-term memory caused by challenging the student to apply effort toward understanding the material.

Based on the conceptions of load types, theorists assert that instructional material has greatest effectiveness when all types of load should not overburden working memory capacity. Educators must seek to reduce extraneous load, optimize intrinsic load, and increase germane load (Van Merrienboer & Sweller, 2005). The first reason for unsuccessful learning is that working memory overload frequently results from extra extraneous and intrinsic load (Sweller, 2010). A second reason for optimal learning outcomes is that sufficient working memory capacity should be occupied by germane load (Van Merrienboer & Sweller, 2005). In fact, the extent to which instructional features contribute to extraneous or germane load may depend on the learner and the extent to which the individual experiences intrinsic load.

Instructional Design Techniques to Reduce Cognitive Overload

Learning should aid students to manage essential processing so that it does not burden their cognitive system. For example, the most common problem in the learning process occurs when the presented material includes extraneous material. In such a situation, the student is primed to engage in extraneous processing that is not relevant to learning the essential material. The following are set of techniques that have been created by (CLT) to design instructions that do not overload learners' memories, thus achieving successful learning.

Worked Example Effect

According to Sweller, is about providing explicit details regarding the steps required to solve a problem so that students will be able to focus on a particular learning goal rather than expending cognitive resources (Sweller et al., 1998). In other words, it provides procedures to solve a specific problem that has already been solved. Yet, it is crucial to consider the students' level of expertise because as their expertise increases, the heavy use of worked examples becomes less and less effective ultimately becoming redundant (Pachman, Sweller, & Kalyuga, 2013).

Split Attention Effect

Sometimes, students are required to process multiple sources of information at the same time to understand the material. Hence, it occurs in the inefficient acquisition of information (Chandler & Sweller, 1991). In this case, students are required to hold both sources of information in their working memory simultaneously and to mentally integrate them resulting in a high load on the working memory. For effective instructional design, split attention can be minimized by presenting information with a dual-mode (Chandler & Sweller, 1992).

RedundancyEffect

Students do not learn effectively when they are presented with supplementary information that is not directly relevant to learning objectives (Diao & Sweller, 2007); this is because they have to process irrelevant information attempting to settle the two incoming streams so that their working memory is directed to unnecessary information. Sweller (1998) asserted that people believe that providing students with extra information is advantageous. However, redundancy might be harmless when it provides redundant information which may lead to an instructional failure (Diao & Sweller, 2007).

Modality Effect

There are auditory and visual streams which process information in a largely independent manner so that the amount of information that can be processed by working memory may be determined by the modality of presentation (Tindall-Ford, Chandler, & Sweller, 1997). It can help manage essential processing via distributing the cognitive processing across both processing channels (Mousavi et al., 1995).

Complexity Effect

Direct instructions tend to agree on how the human brain learns efficiently so that such explicit models of instructions are supported by (CLT) (Kirschner, Sweller, & Clark, 2006). Explicit instruction is an approach in which the teacher provides partial guidance for students by telling them how to handle a situation. Nevertheless, this direct guidance depends on the level of students' expertise (Luke, 2014).

Learning a foreign language tends to be hard when considering how the human brain holds an enormous amount of information in working memory, and then moves it into long-term memory to construct schema. It is important to carefully research the various types of cognitive load so that designing educational materials that will help promote, not hinder, English language learning. However, (CLT) has not been extensively researched in the Algerian context. Therefore, it is important for university teachers in Algeria, especially English language teachers, to refer to what is in the brains of their students by considering (CLT) and its useful techniques for instructional design.

Methods

Research Design

In order to examine the perspectives of university teachers of English on the concept of (CLT) and its connection to instructional design, the current exploratory research embodied a quantitative approach through the use of a questionnaire for data collection, selecting the department of English in different Algerian universities to be the fieldwork.

Participants

The subject population in the present research was permanent English language teachers from several Algerian universities in different cities. The key selection criterion was based, first, on the assumption that permanent English language teachers do know procedures to design instruction and to express their opinions out of their experiences, and, second, on the supposition that the selection of different universities might lead to valid data that can be generalized over all universities of Algeria. The sample under exploration consists of twenty-one teachers who were randomly selected and volunteered to participate in this research study. As far as their academic level is concerned, they were ranged between: Assistant lecturers (A and B), Associate professors (A and B), and Professors. As for their experience, they were teaching English at the university for at least more than two years to more than fifteen years.

Instruments

One research tool was used to gather data in this study. The researchers developed a questionnaire with a deliberate focus on the research questions identified previously. The questionnaire comprised three main parts including, a combination of multiple-choice, close-ended, and open-ended questions (see Appendix). Part one deals with the background information and characteristics of the participants. Part two examines teachers' knowledge of (CLT).The last part scrutinizes teachers' experiences to instruction design. For valid results, the questionnaire was piloted by three university teachers who made some remarks and recommended changes.

Setting

Data were collected during May 2020. However, due to the pandemic of Covid-19, it was not possible to distribute the questionnaire to teachers, but it was sent to them through e-mails via Google forms.

Data Collection and Analysis Procedures

This questionnaire allowed for the collection of quantitative data that were analyzed by the Statistical Package for Social Sciences software program (Version 26) alongside qualitative data in which themes and patterns were identified.

Results

Part One: Background Information

Table 1. *Participants' background information*

Description	Frequency	Percentage (%)

Gender		
Male	15	71.4%
Female	6	28.6%
University		
Laghouat, Annaba, Batna, Khenchela, Mostaganem, Djelfa, Maghnia, Ouargla, Adrar, and Setif	1	4.7%
Algiers, Tlemcen, Mascara, and Oran	2	9.5%
Constantine	3	14.2%
Academic Level		
Assistant Lecturer B	4	19.04%
Assistant Lecturer A	2	9.5%
Associate Professor B	3	14.2%
Associate Professor A	8	38.09%
Professor	4	19.04%
English Teaching Experience		
Less than 5 years	5	23.8%
5 – 10 years	3	14.3%
10 – 15 years	9	42.9%
More than 15 years	4	19%
Task of Instruction Design		
Easy	1	4.8%
Moderate	17	81%
Difficult	3	14.3%

Table one displays different background information related to the participants. Firstly, the majority were males (15) and only (6)females. As one can notice, the universities were from the different regions of Algeria: east, west, north, and south. We estimated that this diversity would lead to valid data that can be generalized over all Algeria universities. Thirdly, the majority of teachers (71.46%) had high academic ranks: Associate professors (A and B) and Professors, and only 28.54 were Assistant lecturers (A and B); this also corresponded to their experience in teaching English; in fact, 62% of participants have more than ten years of experience in teaching English at university while (38%) had less than ten years of teaching experience. These data were relevant as this research involves teachers to share their opinions regarding instruction design based on what they have experienced. In the last section, we identified the selected teachers' perceptions towards the task of designing instructions. Unexpectedly, only one teacher asserted that the task of instruction design is easy, while the majority (81%) declared to be moderate and (14.3%) claimed to be a difficult task.

Part Two: Section One: Teachers' Knowledge of (CLT)
When designing instructions, which model (s) or theory do you rely on?
From the teachers' answers, various models and theories were suggested: socio-constructive theory, (CLT), kemp's model, and Bloom's Taxonomy, etc. As teachers claimed, they select the

model which best suits the organization of the lecture or the task while taking into account students' learning styles, learning strategies, and individual differences.

Are you familiar with (CLT)?

Responses to this question were divided almost equally; (47.6%) of the respondents confirmed their knowledge of the theory while (52.4%) indicated their ignorance.

What do you know about it?

All participants (47.6%) shared their opinions and knowledge concerning (CLT). The following are some answers of the teachers who claimed that they know (CLT):

> *Too much information kills information, the active dynamic working memory cannot process many things at the same time; cognitive load can be negative if it is not structured in carefully designed instructions according to thinking levels and learning strategies.*

Another respondent asserted,

"(CLT) is built on the premise that the brain can only do so many things at once and we should be intentional about what we ask it to do."

All teachers agreed on the fact that (CLT) aims at understanding the link between the load produced by the learning task and the students' ability to process new data. Moreover, they stressed its importance in designing instructions.

Could you identify cognitive load's different types?

Among (47.4%) who claimed that they are familiar with (CLT), only (28.6%) could demonstrate the three types of cognitive load.

Do you think that (CLT) may impact effective teaching practice?

The majority of teachers (71.4%) said that they have no idea. Interestingly, no respondent stated the reverse of the claim, and only (28.6%) confirmed the significant impact of (CLT) on teaching practices. One participant clarified this idea saying that:

"(CLT) is important in the way that it helps teachers to design lessons in relation to students' cognitive capacities."

Do you think that it is essential to design instructions in a manner that reduces a particular load type?

Most participants claimed that they do not know how instructional design can reduce or increase a particular load type. However, only 7 teachers could demonstrate positive responses. These findings can be traced back to what was discussed earlier in which their refrain from answering was due to the lack of awareness towards that theory. The following comment of a respondent argues his viewpoint:

"I can't really say more, for as I mentioned earlier, I don't know a lot about the theory."

To what extent instructional design, according to how human brains process and store information, can be effective?

The majority of answers were: "no idea"; yet (28.6%) have provided their viewpoints and the following themes were disclosed: Instructional design can be effective when,

- The lecture is well designed.
- There is a progression of instructional design.
- Meeting students' needs.

- Respecting the way the brain processes information.

From the themes above, it is apparent that they are dissimilar; this is reflected in the nature of teachers' unrelated and imprecise responses. This assumes that even those teachers who claimed that they are familiar with the theory, do miss in-depth knowledge. One respondent claimed that:
"It can be effective when there is a progression of instructional design according to lower-order thinking skills towards higher-order thinking skills."
Another teacher explained:
"It takes into account the way the brain processes knowledge and information."
Do you think that explicit instructions are more effective than partial guidance?
From the participants' answers, three main themes emerged. They are ordered according to the recurrence:

- It depends on the students' needs, capacities, task, learning styles, learning strategies, etc.
- Agreed, in which it can give positive results.
- Disagreed, in which partial and gradual guidance is more effective than explicit and direct instructions.

The following comments are from the respondents:
"I think this largely depends on the students you teach. Direct instructions can be very good. Also, gradual guidance can give great results."
"For sure. The process is clear for the students from the beginning, nothing is fuzzy."
"That partial guidance may serve in strengthening the instruction where learners act with their critical thinking, so it is pedagogically better than direct and explicit instruction."
What do you know about the worked example effect?
The majority of the answers were "no idea". Only three participants provided their responsesindicating that the strategy was somewhat effective in reducing cognitive overload. One teacher explained the idea by saying:
"This technique is very effective since information enters our brain via working memory. That is the memory we use while paying attention to details in the classroom."
From the respondents' answers, it seems that they lack a big deal of knowledge on what (CLT) is and what it is concerned with.
When do you support the gradual incorporation of independent problem-solving tasks?
Three major themes have emerged:

- A high degree of difficulty
- All the time
- No idea

From the themes above, those who are not familiar with (CLT) could not share their opinions. Yet, from those who pretended familiarity with the concept, two suggestions were provided; the gradual incorporation of problem-solving can be used all the time or when there is a high degree of difficulty.
Does the redundancy effect produce a positive learning outcome?
From the respondents' responses, three themes were disclosed:

- Positive outcomes.
- Negative outcomes.
- No idea.

One teacher explained:
"Yes it does, in the sense that it provides more opportunities for practice, consolidation, rehearsing, and improvement of learner strategy use."
Another teacher clarified:
"I don't think so. It might deviate the students from what they really need to learn and grasp."
How can you eliminate the split-attention effect when providing instructions?
The majority of the answers were vague and imprecise. It is apparent that teachers were not sure about their answers as it is reflected in the nature of their broad and unclear responses. The following are some comments of respondents that may illustrate their viewpoints:
"It can be eliminated by varying the modes of communication while designing the tasks."
"Writing instructions is a skill that shows to what extent instructions lead learners to perform what they are supposed to do. Clarity, precision, concision, and exemplification of instructions reduce to a great extent the split attention."
"We have to present the information related t the instruction in an integrated format."
Do you think that using more than one mode of communication facilitates effective learning?
All participants approved the fact that using multiple modes of communication may bring effective and positive outcomes. Some teachers justified their response, saying that:
"Yes, I believe in the eclecticity of materials. Our students have different learning styles which must be taken into consideration while designing instructions."
Another teacher emphasized the idea by saying:
"Definitely, incidental or programmed learning experiences depend on our senses and our perceptions of knowledge. So modes of communication have to be diversified."

Section Two: Teachers' Experiences to Instructional Design

Table 2. *Participants' knowledge towards instructions and human brain*

Category	**Description**	**Disagree**		**Neutral**		**Agree**	
		Freq	%	Freq	%	Freq	%
Knowledge related to Instruction Design	I can design effective learning instructions.	0	/	3	14.2%	18	85.7%
	I make instructions transparent to students.	0	/	3	14.2%	18	85.57%
	I introduce the appropriate amount of information to explain the material.	0	/	3	14.2%	18	85.7%
	I provide clues about how to process, select, and organize the material.	0	/	3	14.2%	18	85.7%
	I demonstrate instructions by modeling.	0	/	9	42.8%	12	57.1%
	I evaluate instructions by checking for understanding.	0	/	3	14.2%	18	85.7%
Human Brain	I think that instructional techniques are most effective when they are designed to accord with how human brains use knowledge.	0	/	6	28.5%	15	71.4%

I support explicit models of instruction because they accord with how human brains learn.	0	/	11	52.3%	10	47.6%
I think that if working memory is overfull, there is a risk that the content being taught will not be understood, and learning will slow down.	0	/	11	52.3%	10	47.6%

In the first category, most teachers (85.7%) stated that they could design effective learning instructions through making instructions transparent to students, introducing the appropriate amount of information to explain the material, and providing clues about how to process, select, and organize the material. Teachers, also, said that they evaluate instructions by checking for understanding, while no one asserted the opposite concerning the previous claims. Whether they demonstrate instructions by modeling or not, the majority (57.1%) agreed.

In the next category, the majority of respondents (71.4%) believe that instructional techniques are most effective when they are designed to accord with how the human brain learns and uses knowledge. When they were asked if they support explicit models of instructions, of the teachers, only (47.6 %) have agreed. In accordance, (47.6%) of the participants think that if working memory is overfull, there will be a risk that the content being taught will not be understood and that learning will slow down.

Table 3. *Participants' experiences towards instructional design*

Category	**Description**	**Disagree**		**Neutral**		**Agree**	
		Freq	%	Freq	%	Freq	%
Complexity	I take prior knowledge of the learner into account when designing instructions.	2	9.5%	1	4.8%	18	85.7%
	I take the complexity of the material into account when designing instructions.	1	4.8%	3	14.3%	17	80.1%
	I introduce the elements of the material in a simple-to-complex order.	2	9.5%	4	19.1%	15	71.4%
	I introduce the material in its full complexity from the beginning, and then I direct the learners' attention to the individual interacting elements.	7	33.3%	8	38.1%	6	28.5%
WorkedEx apmle	I provide explicit details regarding the steps necessary to solve a problem, rather than having students discover information by themselves.	7	33.3%	5	23.8%	9	42.8%

	I use problems that have already been solved to design tests.	2	9.5%	9	42.8%	10	47.6%
	I use gradual integration of examples as students gain expertise.	0	/	4	19.1%	17	80.1%
Redundency	I usually use redundant information in learning materials.	6	28.5%	6	28.5%	9	42.8%
	I do not provide an unneeded repetition of essential material.	4	19.1%	10	47.6%	7	33.3%
	I eliminate interesting but extraneous material.	6	28.5%	9	42.8%	6	28.5%
	I usually design instructions by reducing what is not directly relevant to learning.	0	/	10	47.6%	11	52.3%
Split Attention	I present the same information in multiple forms.	3	14.3%	9	42.8%	9	42.8%
	I provide engaged processing pathways; two separate sources of information simultaneously.	4	19.1%	4	19.1%	13	61.9%
	I require students to focus on multiple disparate objects at once.	3	14.3%	10	47.6%	8	38.1%
Modality	I avoid presenting identical streams of printed words and/or verbal words and graphics.	3	14.3%	11	52.3%	7	33.3%
	I present printed words and/or verbal words and corresponding graphics simultaneously.	3	14.3%	5	23.8%	13	61.9%

For the first category, the majority (85.7%) claimed that they take prior knowledge of the students into account when designing instructions. Nonetheless, only two teachers(9.5%) showed disagreement. (80.1%) participant indicated that they take materials' complexity into account when designing instructions whereas one teacher said that he/ she would not do that. Most teachers (71.4%) asserted that they introduce the elements of the material in a simple-to-complex order with (9.5%) claiming the opposite. Interestingly, last item results were almost similar, (28.5%) agreed, (33.3%) disagreed.

In “Worked Example”, only (42.8%) teachers showed interest in providing explicit details regarding the steps necessary to solve a problem, rather than having students discovering information by themselves, with (33.3%) claimed the reverse. In the same direction, half of the respondents(47.6%) stated that they use problems that have already been solved to design tests. In comparison, the other half (42.8%) said they do not. Nonetheless, most teachers (80.1%) declared that they use gradual integration of examples to gain expertise.

The following category is “Redundancy”; when teachers asked if they use redundant information, (42.8%) of the participants agreed, yet (28.5%) disagreed with the statement. Half of the teachers (47.6%) were neutral to give their viewpoint whether to provide an unneeded repetition of essential material, while (33.3%) showed interest and (19.1%) disagreed. Following the previous findings, (28.5%) reported that they instead eliminate interesting but extraneous material and the same percentage declared the opposite. (52.3%) claimed that they usually design instructions by reducing what is not directly relevant to learning.

As table 3. reveals, concerning “Split Attention”, only (14.3%) disagreed, yet (42.8%) agreed to present the same information in multiple forms. Nevertheless, (61.9%) claimed that they provide engaged processing pathways, yet, only (19.1%) disagreed with the claim. When asked if they require students to focus on multiple disparate objects at once, (14.3%) disagreed and (38.1%) agreed.

“Modality”, (33.3%) indicated that they avoid presenting identical streams of printed words and/or verbal words and graphics, whereas, (14.3%) had an opposing viewpoint. Most teachers (61.9%) claimed that they present printed words and/or verbal words and corresponding graphics simultaneously, while (14.3%) claimed the opposite.

Discussion

As discussed earlier, the capacity of the human working memory is quite limited and cannot process massive amount of information simultaneously (Sweller et al., 1998). Thus, teachers and instructional designers should take into consideration students’ cognitive capacities. Otherwise, students will be overwhelmed by a massive quantity of information presented and the learning outcomes would not comply with the teaching objectives. Consequently, the learning process would fail. According to Sweller, the ultimate aim of (CLT) is to build effective instructional materials based on learners’ cognitive processing abilities and generates useful instructional techniques (Sweller, 1994). The urge to conduct this article was to explore the awareness of university teachers of English to the theory as well as their experiences to the use of (CLT) as a framework for the design of instructions.

The literature calls for applying of cognitive load principles to instructional design, and illustrates how (CLT) offers a useful framework for effective instructional designs. Throughout the analysis of the article’s findings, Algerian university teachers of English were not aware of the theory and its principles to design instructions. Inevitably, they are not ignorant only of the theory but also of the human brain architecture, how the brain processes information, how to design instructions that do not overload students’ cognitive capacities, and how to design effective instructions generated by (CLT). As stressed throughout this article, (CLT) is of great value to instruction design (Paas et al., 2003). Thus, the ignorance of the theory, especially, the human cognitive architecture can lead to serious problems that would impair learning (Sweller, 1994), as the instructional design that does not emphasize cognitive load factors is likely to be deficient through imposing a heavy extraneous load interfering learning.

In this research, we detected that teachers’ lack of awareness might lead to a significant challenge for instruction design in which, as Sweller (2010) argued, meaningful learning can require a massive amount of necessary cognitive processing, but the cognitive resources of the students' information processing system are severely limited. Consequently, special attention must be devoted to eliminating all sources of unproductive processing of irrelevant information such as split elements of information that need to be integrated in order to achieve understanding, excessive information that introduces huge new elements into working memory quickly to be organized and comprehended, and excessive redundant knowledge (Sweller, 2010).

Notwithstanding the teachers' ignorance of (CLT) and its procedures, results of the analysis of their responses revealed that they use some of its principles when designing instructions as part of their attitudes and experiences. For instance, they believe that unnecessary redundant support could be timely removed as students become more experienced with the task domain. Moreover, they think that information presentation could be dynamically tailored to changing levels of students' proficiency in the field.

In accordance with the findings discussed previously, teachers have to simultaneously consider the structure of information and the cognitive architecture that allows students to process information (Chandler & Sweller, 1991). Cognitive theorists generated a unique variety of principles and procedures for the design of instructions. Thus, instructional designers, in particular, need to reduce extraneous load and manage essential load that would free cognitive capacity for deep processing (Sweller et al., 1998).

Conclusion

Foreign languages university students are taught more than they can learn; they are overwhelmed by the massive amount of knowledge and the set of activities. According to John Sweller, the capacity of the human working memory is very limited and cannot process a tremendous amount of information at the same time. Therefore, it is of paramount importance for teachers to build instructional materials based on the students' cognitive abilities. Otherwise, students will be overwhelmed by the vast quantity of information presented and the learning outcomes would not comply with the teaching objectives. Consequently, the learning process would fail.

The genesis of this research study began with the issue of the application of (CLT) in the Algerian context. The main findings of the study revealed that university teachers of English lack sufficient knowledge of the theory and its principles to instructional design. The effective instructional design depends on sensitivity to cognitive load which, in turn, relies on an understanding of the human cognitive architecture and how it processes information (Sweller et al., 1998). Hence, knowing how to introduce information to their students and the amount of data their students can process so that they do not overload their memories.

Based on (CLT), the study offers suggestions to teachers and instructional designers in order to reduce cognitive overload, thus, designing effective instructions. Worked examples, complexity, split-attention, redundancy, and modality effects are examples of the theory's fruits (Mayer & Moreno, 2010). Through these techniques, a reduction in extraneous load by using a more effective instructional design can free capacity for an increase in germane load (Van Merrienboer & Sweller, 2005). That is to say, if learning is enhanced by an instructional design that reduces extraneous load, the development in learning may have occurred because the additional working memory capacity freed by the reduction in extraneous load has now been allocated to germane load.

Since there is no research in Algeria concerning (CLT), future further studies are needed to explore the theory more and experiment with other features of the theory in the Algerian context, such as how the level of complexity of the presented material can be measured, and how the amount of extraneous and essential processing required to can be adjusted. To sum up, the study concludes that instruction design could be improved by knowing (CLT) to better match the nature of the human cognitive architecture.

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Appendix

Questionnaire

Dear teachers,

This questionnaire is an attempt to gather information needed to explore tertiary English language teachers' perspectives on the concept of (CLT) and its connection to instructional design. This questionnaire aims to explore the experiences of teachers towards instructional design. It will be completed by a randomly selected sample of EFL teachers from different Algerian Universities. We would be very grateful if you could answer the following questions which will form the ground for this study. Your data is anonymous and will be used only for research purposes.

Part One: Background Information

1. Your gender.

 Male ☐ Female ☐

2. Your university.

 ....

3. Your academic level.

 ....

4. How long have you been teaching English at university?

 Less than 5 years ☐ 5-10 years ☐ 10-15 years ☐ more than 15 years ☐

5. How do you find the task of designing instructions?

 Easy ☐ Moderate ☐ Difficult ☐

Part Two:

You are kindly requested to respond to the following questions:

1. When designing instructions, which model (s) or theory do you rely on?

……………………………………………………………………………………………

2. Are you familiar with Cognitive Load Theory (CLT)? If yes,
   - What do you know about it?

……………………………………………………………………………………………

   - Could you identify cognitive load's types?

……………………………………………………………………………………………

3. Do you think that (CLT) may impact effective teaching practice?

……………………………………………………………………………………………

4. Do you think that it is essential to design instructions in a manner that reduces a particular load type?

……………………………………………………………………………………………

5. To what extent instructional design, according to how human brains process information, can be effective?

……………………………………………………………………………………………

6. Do you think that explicit instructions are more effective than partial guidance?

……………………………………………………………………………………………

7. What do you know about the worked example effect?

……………………………………………………………………………………………

8. When do you support the gradual incorporation of independent problem-solving tasks?

……………………………………………………………………………………………

9. Does the redundancy effect produce a positive learning outcome?

……………………………………………………………………………………………

10. How can you eliminate the split-attention effect when providing instructions?

……………………………………………………………………………………………

11. Do you think that using more than one mode of communication facilitates effective learning?

……………………………………………………………………………………………

Please share any comments on the content or format of the questionnaire.

……………………………………………………………………………………………
…

Part three:

Please indicate the extent to which you agree or disagree with the following statements.

	Disagree	Neutral	Agree
1. I can design effective learning instructions.			
2. I make instructions transparent to students.			
3. I introduce the appropriate amount of information to explain the material.			
4. I provide clues about how to process, select, and organize the material.			
5. I demonstrate instructions by modeling.			
6. I evaluate instructions by checking for understanding.			

7. I think that instructional techniques are most effective when they are designed to accord with how human brains learn.			
8. I support explicit models of instruction because they accord with how human brains learn.			
9. I think that if working memory is overfull, there is a risk that the content being taught will not be understood, and that learning will slowdown.			
10. I take prior knowledge of the learner into account when designing instructions.			
11. I take the complexity of the material into account when designing instructions.			
12. I introduce the elements of the material in a simple-to-complex order.			
13. I introduce the material in its full complexity from the beginning, and then I direct the learners' attention to the individual interacting elements.			
14. I provide explicit details regarding the steps necessary to solve a problem, rather than having students construct information by themselves.			
15. I use problems that have already been solved to design tests.			
16. I use gradual integration of examples as students gain expertise.			
17. I usually use redundant information in learning materials.			
18. I do not provide an unneeded repetition of essential material.			
19. I eliminate interesting but extraneous material.			
20. I usually design instructions by reducing what is not directly relevant to learning.			
21. I present the same information in multiple forms.			
22. I provide engaged processing pathways; two separate sources of information simultaneously.			
23. I require students to focus on multiple disparate objects at once.			
24. I avoid presenting identical streams of printed words and/or verbal words and graphics.			
25. I present printed words and/or verbal words and corresponding graphics simultaneously.			

THANK YOU FOR YOUR COOPERATION!