Split Attention and Redundancy Effects in English Reading

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Abstract
This article briefly discusses the cognitive load theory; split attention and redundancy effects; existing problems in university English classrooms; the implication of cognitive load theory in English teaching and learning. Suggestions are implied in conducting reading and constructing reading texts, not to use edge windows to supply explanations to adult learners in order to avoid split attention, redundancy effects and adding more load on their working memory. By applying cognitive load theory into language practice to improve expertise in adult English reading.

Key Words: cognitive load, split attention effect, redundancy effect, schema, working memory,

Overview
Recent years some people in China do care about why English learners find it so difficult to read efficiently when they reach an advanced level, see at the university level, particularly when learners sit for the tests as CET Band 4 or 6, they found reading (reading speed and accuracy) is a big obstacle. Some language educators and researchers correlate learners reading difficulty with cognitive load theory, myself as one of them (although, of cause, I am only a novice). Some famous educators have already made some breakthrough in applying cognitive load theory in other educational field, like mathematics. In comparison, the theory used in language learning is not as much. It is relatively a new research field and we do not have plenty of references to lean on.

Definition and Principles of Cognitive Load Theory
As Graham Cooper (1998) describes “Cognitive load refers to the total amount of mental activity imposed on working memory at an instance in time. The major factor that contributes to cognitive load is the number of elements that need to be attended to.” Concerning reading, it refers to the learner’s mental process while they read a sentence in the target language. The more phrases or clauses a sentence contains, the more cognitive load is added to the mental process. If there are too many unknown elements in the sentence, then learning is impeded. Graham Cooper (1998) also points out that cognitive load theory focuses on the role of working memory in the learning process. In his opinion working memory is very much limited while long-term memory is essentially unlimited. The biggest limitation of working memory is its capacity to deal with no more than about seven elements of information simultaneously (Miller, 1956). The process of learning requires working memory to be actively engaged in processing reading material in order to input new information into long term memory. If the reading material exceeds the resources of
working memory, then learning will be hindered. This forms the basis of cognitive load theory.

Cognitive load can be described as intrinsic cognitive load and extraneous cognitive load. Intrinsic cognitive load is due solely to the intrinsic difficulty of some to-be-learned content. Intrinsic cognitive load cannot be modified by instructional design. For example, content which is high in element interactivity remains high in element interactivity regardless of how it is presented. Extraneous cognitive load is due to the instructional materials used to present information to students. Teaching materials addressing a concept such as continental drift, for example, will be more effective if it makes an appropriate use of graphics rather than a text only presentation. Graham Cooper (1998). By changing the instructional materials presented to students, the level of extraneous cognitive load may be modified, thus may facilitate learning. This theory means much for reading texts designers.

Cognitive load may come from a variety of ways, split attention and redundancy effects are just two of them. Split attention effect means the learners’ attention is distracted by many irrelevant means-ends analysis when they are focusing on a specific problem. For example, when the learners’ main task is to understand the meaning of the material they are reading, but they spend a lot of time analyzing the sentence structure or memorizing the new words in the passage, thus their attention is distracted, split attention effect is produced. Redundancy effect means when learners are solving a specific problem, their attention is disturbed by some additional information. While digesting the irrelevant information, redundancy effect is produced.

Sweller and Chandler(1991) says “the common technique of having students solve many conventional problems would not be very effective, because cognitive resources are devoted to a whole range of activities during means-ends analysis that are irrelevant to schema acquisition. Thus, according to cognitive load theory, preventing students from using a means-ends strategy and encouraging them to attend to problem states and their associated moves should reduce extraneous cognitive load and so facilitate schema acquisition.” The method used by novices to solve conventional problems imposes a relatively high level of cognitive load (Sweller, 1988). Usually it is not very effective when students are asked to analyze the structure of the sentences in English reading comprehension. This is because cognitive resources are wasted in analyzing so many parts of the sentences irrelevant to schema acquisition. In schema acquisition, students are encouraged to avoid means-ends analysis and focus their attention on the meaning of the material. Cognitive resources should be used on effective problem solving, rather than on analyzing and studying the structure of the problem in order to avoid increasing extraneous cognitive load on learners.

Problems in English Teaching

Since the new English syllabus came into being in the mid 80s in the 20th century, university English teaching has been undergoing tremendous change in China. English teaching before the 80s can be concluded as “full explanation of new words, means-ends analysis of the sentence structure, word to word translation of the material.” On class the teacher gave detailed explanation of every new words with a couple of examples, its synonyms, antonyms, derivations. As for sentence structure the teacher will pull the sentence into small fragments, analyzing its part of speech and functions, etc. then put the parts back again, and translate the sentence into Chinese. Most schools neglected other skills as listening, speaking and writing. New syllabus put forward a higher demand on the four skills and emphasized language application. The old teaching method
and teaching materials were far behind the new requirement, thus thrown into the trashcan. Since then various text books, teaching methodology and medium actively found their ways on the English teaching theater. English teaching and learning has experienced a great leap forward since then. The English learners have improved a lot in listening, speaking, reading and writing today.

Yet in some universities, the old teaching idea still affects English teaching and learning. In College English band 4 and Band 6 test, most students can’t get a pass within the first 2 years of basic English learning. There are 3 parts that hinder students to pass the test, reading, listening and writing. In Inner Mongolia Agricultural University (where the author has been teaching for 24 years) it is found that around 70% of the students score half (around 20 out of 40 points of the reading section). What’s more, they can’t finish the reading section within the estimated time, often occupies more time of other sections (usually the writing section). Therefore reading is a headache to most students.

The observation on students reading activity revealed such a fact: when a passage is given to the students, most of them begin to read intensively one sentence after another, they will stop many times during the reading, because there are new words in the sentence, they’ll either refer to the glossary or look them up in the dictionary. They won’t go on reading until they believe that they are sure they understand every word of the sentence. As a result, a 500 words passage will take them 40 to 60 minutes. After reading if you ask them to outline the main things of the passage, they feel confused, or can only remember the meaning of a few sentences which may be not important at all, Yu (2002). Then the reader must want to know what leads to such an outcome.

**Cognitive Load and English Reading**

From the point of cognitive psychology, split-attention (Sweller, 1994) may have explained the reason. During the reading process, frequent referring to the glossary or looking up in the dictionary interfere with schema acquisition. Students focus their attention on the meaning of a particular word or sentence but not the text as a whole. Besides they also analyze the sentence structure while reading, which distracts their attention on the comprehension of the meaning of the text, split attention effects take place. That’s why after reading they can only remember some new words and a few sentences. Split attention increased cognitive load, they wasted their cognitive resources on some words, rather than focusing on the meaning of the whole passage.

Another reason is, when students meet with long sentences or sentences with a couple of new words, they tend to read the sentences (no matter they are significant or not) again and again in order to have a complete understanding, without knowing that while repeatedly reading these sentences, cognitive resources are wasted, redundancy effect takes place. This kind of redundancy effect comes from the students’ own reading habit and believes, not from the textbook design. But students’ problem reflects instructor’s teaching idea.

Traditionally in China, teachers try in every way to tell the learners all the knowledge they know themselves. That’s why in English teaching, no matter in primary school, middle school or even in university, teachers spend a great deal of classroom time to explain every thing much in detail, from every new words to analysis of the sentence structure, word to word translation of the whole passage. That’s why the learners form the habit of reading everything in detail. Both teachers and learners have no idea that this kind of learning is not only inefficient but rather adding cognitive load. As Jeannette Vos and Gordon Dryden tell us in their great book “The
Learning Revolution” (1998 Chinese version translated by Gu RuiRong) that different reading materials have their unique style of writing, and the readers should choose a proper reading technique for different reading passages, and the learners can focus on different parts according to their reading goal. Actually in reading, some of the insignificant information can be neglected, particularly sometimes a couple of new words or some insignificant sentences, because the purpose of reading is for meaning. In most cases, if readers understand what the passage mainly conveys to them is good enough. If they are interested in the texts, they can read in detail for a second time or even a third time.

Yeung and Sweller (1997) found in their experiments that more knowledgeable readers performed better in reading comprehension without additional materials while the less knowledgeable readers required additional materials for comprehension. It can be understood that reduced test made more knowledgeable readers process the text more actively and more directly and it is this factor that improved performance. And for more knowledgeable readers more explanatory notes acted as redundancy which increases rather than reduces cognitive load. Jeannette Vos and Gorden Dryden also found that people learned more from newspaper titles. This suggests that proper way of reading may help reduce cognitive load and learning may be more effective.

Implication in English Teaching and Learning

English teaching, like everything else, should be adapted to the learners’ actually situation. The materials and teaching techniques should be adjusted according to the learners’ age and knowledge of the learning target. Different text formats should be designed for different level of learners. Accordingly different teaching techniques should be applied to different stage of learning. Even when designing a classroom activity teachers should always keep the learners special condition in mind. In English teaching and text book designing, teachers’ awareness of the learners’ special condition is a very important factor, try in every to reduce split-attention effect and redundancy effect. Particularly in university language teaching and learning, teachers should encourage learners use acquired schema of their first language and the target language to facilitate their foreign language learning.

Mayer and others (1996) found that high school students take in more information from outlines than full length texts, because reading outlines eliminates the effect of redundancy and split-attention. It implies that while we teach English to adult learners or university learners, we can introduce some reading skills, such as to catch the main idea from the topic sentences or outlines, or to use the context to help reading the whole text smoothly for the first or second time, then slow down to learn the new words or phrases or sentences which hold difficult elements (of cause vocabulary is always an important part in language learning, yet we can learn vocabulary at proper time). For in this way the learners can form a good habit of paying attention to to-be-learned information (meaning) rather than the insignificant part of the texts (form), and more important is to avoid split attention and redundancy effects. It is the same to grammatical things. Since grammar has been learned during middle school and they’ve already acquired this scheme in their first language, it can be neglected in university language learning. In China language teaching and learning is much influenced by Russian. It is still very common in China universities classes that teachers spend a great deal of time explaining grammar while conducting a reading class. It is not only a waste of the precious time, but also wrong directing to the learners.
One of the university teachers’ jobs is to direct learners to use their limited working memory effectively.

**Implication in Material Designing**

As English is becoming more and more demanding, to meet the needs, hundreds and hundreds of reading texts and testing material are coming into being. Texts are arranged in a variety of ways. Some have colorful pictures, others use different font to make new words standing out, still others highlight new words and important sentences in different color. They have their advantages if used properly, but at the same time they may have their disadvantages. For example, some advanced texts use explanatory notes at edge in order to facilitates comprehension, yet in a series of research carried out by Yeung (1997) revealed that explanatory notes didn’t help comprehension for university learners instead their test results dropped, because they brought about a redundancy effect. Yu (2002) also noticed that when students read texts with glossary their reading speed and accuracy dropped. Because the learners couldn’t help but keep looking at the glossary from time to time, the glossary list didn’t help the learners to improve their general understanding of the text but decreased their reading speed as a result of split attention effect, besides cognitive resource is wasted because a university students can understand the main idea of the text by context (acquired schema in the first language or the target language).

Recently some texts are designed with windows up or below or at the sides of the texts to supply explanations to some of the seemingly difficult sentences or topic sentences. The purpose is to facilitate learners to comprehend the texts. According to the cognitive load theory, it is probably not encouraged on the grounds that these windows may serve as extractors rather than helpers, split attention and redundancy may occur, i.e., instead of attending to one text, learners have to attend to two texts, add more load to the working memory. As a result cognitive load may increase rather than reduce as planned.

While designing a text the above considerations should be taken into account so as to reduce extraneous cognitive load.

Of cause this is only a new way to look at this kind of design, whether useful or not needs further research into the topic.

Since this is a relatively new area, many things remain open to be discussed. This author sincerely wishes to discuss and continue research with specialists and colleagues in this field. Since this author is a new hand in this field, experiences and more sources are needed, criticisms are sincerely welcome.

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