Transactions on Comparative Education (2025)
Clausius Scientific Press, Canada

DOI: 10.23977/trance.2025.070108
ISSN 2523-5818 Vol. 7 Num. 1

Applications of Visualization Tools in English Teaching

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Keywords: Visualization Tools; English Teaching; Word Cloud; Mind Map; Concept Map

Abstract: A large number of studies have shown that visualization tools can help learners better understand and process information by presenting abstract content in intuitive and easily understandable graphic elements. In view of the common problems in English teaching, such as poor self-concept of learners, serious classroom anxiety and low classroom participation, this research has organically integrated visualization tools with English teaching and flexibly applied visualization software, thus improving the quality and efficiency of English teaching. After several rounds of teaching practice, the results indicate that visualization tools can effectively enhance learners' interest in learning and participation, relieve the burden on teachers and effectively improve the teaching efficiency.

1. Introduction

Traditional English teaching relies on blackboards, chalks and textbooks, using verbal expression, that is, oral and written expressions, to address the major issues of teaching input and output. With the development of software technology and cognition, knowledge visualization, a teaching-aiding method that can utilize software to draw graphics, has been receiving increasing attention.

Knowledge visualization refers to the method of communicating and representing knowledge by means of graphics. It is a teaching concept based on graphic design and cognitive science. It can prompt teachers to reflect and assist in instructional design. Its ultimate aim is to promote learners' cognition and improve their language abilities, so as to meet the ultimate goal of students' development.[1]

A large number of studies have shown that human beings' ability to understand and process graphics is higher than that to process words and numbers. This means that when we are faced with graphics, our brains can understand and absorb information more quickly. Visualization tools help learners better understand and process information by presenting abstract content in intuitive and easily understandable graphic elements. Therefore, it is a worthy research topic to concretize and visualize the thinking process in teaching practice.[2]

In English teaching, there are commonly problems such as poor self-concept of learners, serious classroom anxiety, and low classroom participation. In response to these problems, this research attempts to organically integrate visualization tools with English classroom teaching and flexibly apply visualization software, which has improved the quality and efficiency of English teaching. For example, in the teaching of English writing, teachers use mind mapping tools to present the text

structure, helping learners to understand and master the structure of the text. In the brainstorming session, teachers visually present the results of learners' brainstorming through word cloud tools, helping learners to identify key words and effectively enhancing their learning interests and participation. During the teaching process, collaborative editing mini-programs, teaching management platforms and automatic marking platforms are used simultaneously, which has enhanced learners' interests and participation and reduced the burden on teachers. After several rounds of teaching practice, learners' writing interests and classroom participation have been improved, effectively enhancing the teaching efficiency. Applying visual tools such as word clouds, mind maps and concept maps to English teaching has effectively enhanced learners' learning interests and improved the teaching effects.

2. Theoretical Foundations

The term "visualization" originated from English and was first proposed in 2004. It refers to the representation of abstract things and processes in the form of graphics and images, and any such representation can be regarded as visualization. Visualization takes advantage of the merits of vision and the functions of spatial cognition to relieve the cognitive load of processing complex learning information. It renders texts into charts with lines, colors, graphics, etc., presenting individuals' knowledge in a graphic way, thus forming an external manifestation of knowledge that can directly act on people's senses. Visualization can not only provide a visual description of human explicit knowledge but also make tacit knowledge explicit, better realizing the development, dissemination and innovation of knowledge.[3]

In the era of rapid information update, the role of graphics is becoming more and more prominent, and people are paying increasing attention to researching visualization technologies to acquire knowledge. Visualization enables people to express the concepts, knowledge, ideas, etc. formed in their minds in a graphical and vivid form, making tacit knowledge explicit and visual, which is a graphic technology that facilitates people's thinking, expression, understanding and promotes communication. The linear way of organizing text is rather complicated and lacks order. Visualization tools play an important role in promoting meaningful learning and knowledge construction for learners. Introducing visualization tools into teaching brings a way to inspire creative thinking, an active and cooperative teaching method, and improves teaching efficiency.[4]

Most of the information that humans can receive is obtained through vision. A large number of scientific experiments have proven that the information obtained by humans through vision accounts for 83% of the total amount of information obtained by humans. Psychological experiments have confirmed that the information acquired by humans comes 11% from hearing, 3.5% from smell, 1.5% from touch, and 1% from taste. It can be seen that more than 80% of the information about the external world that humans obtain is acquired through visual stimulation. Visualization techniques can transform abstract things or processes into graphic images that are conducive to being accepted and recognized, which will make significant contributions to the understanding and dissemination of knowledge.

The reason why visualization tools are conducive to learning lies in their mechanisms of action. They provide support through relatively low-level cognitive activities to share the cognitive load, so that learners can reserve cognitive resources for higher-level thinking processing activities. According to the sources of cognitive load, Sweller and others divided cognitive load into intrinsic cognitive load determined by the complexity of the learning materials themselves and the learner's original knowledge level, extraneous cognitive load caused by the information presentation method and the learner's learning activities, and germane cognitive load triggered by schema construction and automation during the learning process. During the teaching process, when organizing learning

materials based on the teaching tasks and learners, the resulting intrinsic cognitive load is relatively fixed. Among the extraneous cognitive load and germane cognitive load that can be adjusted and controlled, the former is an ineffective load that hinders learners' cognitive processing, while the latter is an effective cognitive load that encourages learners to invest their remaining cognitive resources in deep-level cognitive processing and continuously apply and strengthen their cognitive schema to promote the automation of information processing. Therefore, the essence of instructional design is precisely to achieve the transformation from extraneous cognitive load to germane cognitive load.

3. Applications of Visualization Tools in English Teaching

Nowadays, more and more people are starting to pay attention to the application of visualization tools in teaching. Visualization tools structure and present the learning content in an appropriate way, effectively reducing the extraneous cognitive load caused by the information presentation method, thus enabling learners to focus their attention on establishing the connections between the contents.

In order to enhance the practical effects of applying visualization tools in teaching, teachers should adhere to the learner-centered principle, be problem-solving oriented, combine strategy tools, respect the existing cognition of learners, and seek the focus and carry out interventions in the zone of proximal development of learners' thinking. Teachers should uphold the dominant position of learners. The core value of cognitive tools lies in empowering learners, enabling them to participate more deeply in cognitive processing rather than passively accepting the results processed by others.

Visualization is not about drawing for the sake of drawing, but aims to solve specific problems. Also, teachers should respect the existing cognition of learners and give full play to the functions of visualization tools, finding the zone of proximal development and set the optimal development points for different learners. In practical operation, it is necessary to respect the cognitive development level of learners and set training points in the zone of proximal development of learners.[5]

3.1 Word Cloud

As a medium for mastering knowledge in the classroom, the word cloud transforms a large amount of information and knowledge in the classroom into prominent and concise word cloud graphs. This latest technology display technique has the potential to become a new approach to computer-assisted foreign language learning. Making a word cloud is very simple, and the production tools are also easily accessible. Applying word clouds in English teaching can improve the quality of teaching and enhance teaching efficiency. For a large amount of language data, the principle of "frequency priority" is adopted to highlight high-frequency language phenomena.[6] The source of the corpus can be a complete text or extensive online resources.The software uses an automated analysis method. After conducting probability statistics and analysis, it visually highlights the keywords that appear with a relatively high frequency in the text.

Word clouds are of great significance in English writing teaching. On the one hand, word clouds can improve the quality of writing teaching. Since visualization tools are of great help in information acquisition, the visual stimulation of word clouds enables writing teachers to achieve twice the result with half the effort. On the other hand, word clouds also have a positive effect on English writing teaching. By having learners observe word cloud images and quickly obtain the information on them, they can predict the relationship between the theme of the article and related vocabulary.[6]

In English teaching, by using word-cloud generation software to automatically generate

objective word-cloud graphs that carry a large amount of information, the learners' memory capacity is increased accordingly. As shown in Figure 1, in English writing teaching, teachers present the vocabulary brainstormed by learners in the form of a word cloud. This is more conducive to learners' understanding of the core vocabulary in the brainstorming results. Learners can quickly and effectively remember the content, and at the same time, their cognitive load is reduced. This approach emphasizes a learner-centered concept. In the classroom, learners become the main body of information processing and active constructors of meaning. The process of learners' discussion is also a process of collaborative learning, which can cultivate their spirit of cooperation. As a carrier for knowledge presentation and transmission in English learning, word clouds fully implement the "visualization" of English teaching. They present information in both visual and linguistic forms, thus fully tapping into human visual potential and brain functions.[6]

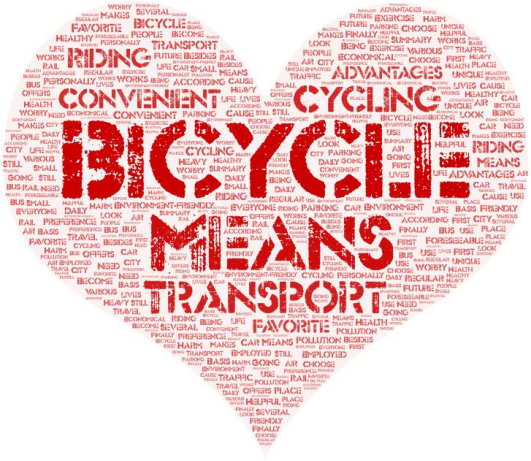

Figure 1: Word cloud in English teaching.

3.2 Mind Map

It is a memory-friendly tool invented by Tony Buzan. It presents a thinking process through a tree-like structure, making the radiating thinking concrete. Mind maps can display the thinking process, clarify the thinking context, and enhance learners' divergent thinking abilities. They follow rules that are simple, orderly, natural, and easily acceptable to the brain. Mind maps present the thought process, which aids learners in processing and organizing relevant information, as well as cultivating divergent thinking. They can vividly present related information in a concise and straightforward manner.

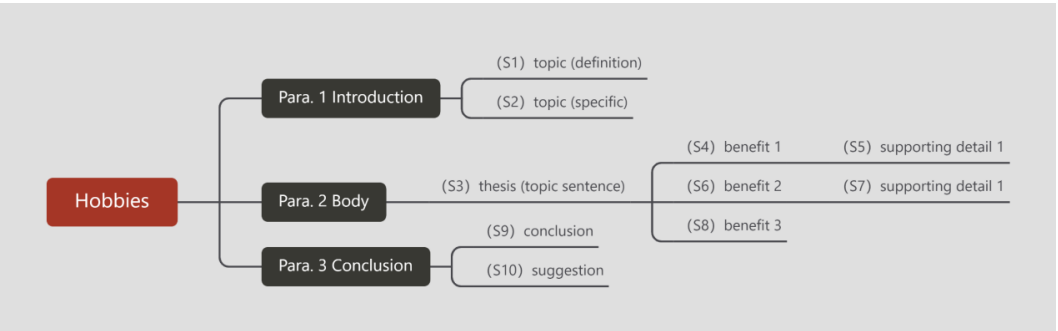

Figure 2: Mind map in English teaching.

Learners can use mind maps to organize relevant topics. By arranging and presenting complex information in the form of icons according to their own thinking patterns, it helps to reveal the

connections between different pieces of information. As depicted in Figure 2, during English writing instruction, teachers illustrate the structure of model essays in the form of a mind map. This enables learners to gain a more intuitive understanding of the model essay's structure, which is conducive to improving learning efficiency. This not only cultivates learners' information-organizing ability but also significantly boosts their enthusiasm for English learning.[7]

3.3 Concept Map

Concept map, also known as concept mapping or conceptual diagram, was first proposed by Dr. Novak from Cornell University in 1984. Aimed at reflecting the organization of knowledge, concept maps can quickly assist learners in clarifying their thinking and summarizing related concepts, continuously enriching their knowledge network.[8] A concept map is a tool used to organize and represent knowledge. Typically, it places concepts related to a certain topic within circles or boxes, and then connects relevant concepts or propositions with lines, indicating the semantic relationships between the two concepts on the lines. Concept maps facilitate learners in grasping the entire knowledge structure and can promote knowledge transfer. One can intuitively and rapidly understand the whole concept system through a single concept map.[9]

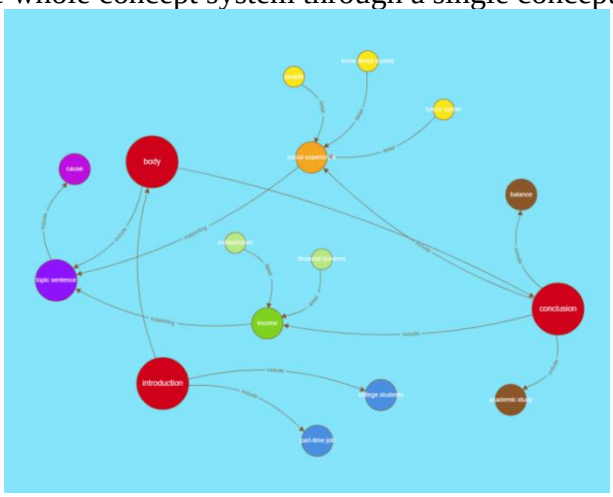

Figure 3: Concept map in English teaching.

In Figure 3, by presenting the relationships among various key words, learners can better understand the internal logic of the learning content. From the perspective of visual presentation, concept maps have an advantage in presenting hierarchical relationships of concepts. The hierarchical relationships in concept maps provide learners with a way and technique to understand the relationships between concepts, which helps learners form a clear understanding of these relationships in their minds. Practice has proven that concept maps are effective tools for identifying important concepts and their relationships within learning content.[7]

4. Conclusion

Multimedia, with its various means of presenting information and powerful functions of providing and transforming information, has been widely applied in the field of education. Therefore, in the context of multimedia and network technology, the way of presenting information has become an important topic. Applying visual representation methods to promote the dissemination and innovation of group knowledge essentially means expressing people's individual knowledge through graphic means, forming an external manifestation of knowledge that can directly act on people's senses, thus facilitating the dissemination and innovation of knowledge.

Knowledge visualization tools have been developed. There are an increasing number of production tools, with simpler production methods and more diverse forms of expression. As a new educational concept, knowledge visualization has significantly transformed the way of cognition and enhanced meaningful learning.[6]An effective teaching process encompasses both the teacher's teaching and the learner's learning. These two aspects are indispensable and mutually influential. In English teaching, more attention should be paid to the deep-thinking process. Graphic tools can engage learners in comprehension activities. That is, they reflect the drawer's understanding in the form of graphics and summarize it with language text using information points as keywords. There are both textual information presenting key concepts and visual graphics showing logical relationships. For the implicit, ambiguous information within the text content, graphic means can help teachers easily identify learners' comprehension deviations or logical confusion during the learning process. When understanding the text and acquiring information, they reduce the cognitive burden on readers.

Knowledge visualization is one of the important resources for English learning. Both teachers and learners can utilize it in teaching activities. From the teacher's perspective, it can provide certain scaffolds for learners, enabling them to achieve a clearer understanding. It helps teachers find an explanatory and auxiliary method that goes beyond pure text for teaching. As for learners, by using diagrams to illustrate their understanding, it helps teachers understand the specific comprehension of different learners, such as logical thinking and information integration. As an auxiliary means to test teaching efficiency, graphics can clarify and visualize complex information.[1]

Acknowledgement

Research Planning Project of Philosophy and Social Sciences in Heilongjiang Province: “Research on the Translation Strategies of Linguistic Landscape in Red Tourism Scenic Spots in Heilongjiang Province” (24YYE002).

References

[1] Kou Furong. Exploration on Improving the Effectiveness of Reading Teaching with Knowledge Visualization Tools [J]. Teaching and Management, 2016, (1):103-105.

[2] Jiang Qingyan. The Application of Thinking Visualization Tools in Post - reading Continuation Writing of Senior High School English[J].Journal of the Chinese Society of Education, 2022, (01):106.

[3] Xu Yan, Zheng Liping. Theories and Application Methods of Thinking Visualization Tools in Supporting Learning[J]. Journal of Hotan Normal College, 2009, (02):170-171.

[4] Wang Huixia, Wang Yarong. The Teaching Application of Thinking Visualization Tools[J]. Computer Knowledge and Technology, 2015, (01): 108-110.

[5] Zhao Guoqing, Yang Xuanyang. On the Principles and Focuses of the Teaching Application of Thinking Visualization Tools [J]. E-Education Research, 2019, (09): 59-67.

[6] Yuan Zaicheng. Research on the Application of the Visualization Tool "Word Cloud" in English Teaching[J]. Journal of the Chinese Society of Education, 2016, (12): 102-103.

[7] Wang Jing, Luo Shuanglan.Research on Information Technology Teaching Strategies Based on Knowledge Visualization Tools [J]. Software Guide, 2008, (10): 15-17.

[8] Wang Dan. Research on the Application of Knowledge Visualization Tools in Teaching[J]. Software Guide, 2013, (7): 33-34.

[9] Wang Huixia, Dai Zhaoxia. Analysis of the Application Value of Thinking Visualization Tools[J]. China Medical Education Technology, 2015, (02): 111-115.