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## Illustration Design Strategies of Idioms Series Supporting Primary School Language Textbooks in the Context of Artificial Intelligence--Taking “Picture Idioms” as an Example

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### Abstract

Idioms have various compositions and are part of the long history and culture of the Chinese nation, with their unique ways of expression. In this paper, taking “Pictures of Idioms” as an example, we propose a strategy for designing illustrations for a related series of books on idioms using artificial intelligence technology. Using the LSTM model, the description of the given idiom text is realized to generate images. The generated images are processed by a decoder and fed into a neural network model to generate illustrations that match the description of the idiom text. Further, a diffusion model is proposed to improve the quality of illustration generation and diversify the illustrations by continuously adding conditions to the generation process. Taking “Picture Talking Idioms” as an example, we propose a design strategy for the illustrations of the Idioms series accompanying elementary school language textbooks and quantify the effect of practical application in terms of the design effect of the final product, the reading satisfaction, and the effect of the use of “Picture Talking Idioms.” Students were more satisfied with the use of blue-gray and blue colors in the illustrations in “Diagrams to Tell Idioms,” with ratings of 4.9 and 4.6, respectively. 52% of the students used the diagrammatic method of reading “Diagrams to Tell Idioms” and rated the knowledge content of the books in terms of idioms at 9.458, which is a high satisfaction rate of 98%. The use of diagramming idioms has been very effective in assisting with language text.

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## 1 Introduction

Chinese culture is profound and profound, and Chinese idioms are the crystallization of China's five thousand years of history and civilization. With the accumulation of 5,000 years of history, Chinese idioms have become an indispensable treasure in the Chinese treasury because of their stereotyped structure, concise form, and intelligent meaning [1-2]. If international students want to really learn Chinese well and understand Chinese culture more deeply, they need applicable teaching material for Chinese idioms for foreigners. At present, there are not abundant or even lack of idioms teaching materials on the market for Chinese as a foreign language [3-4]. Therefore, in the teaching of idioms in Chinese as a foreign language, there is a problem that we have to think about, which is the problem of the preparation of teaching materials for idioms in Chinese as a foreign language [5].

Chinese idiom is a kind of fixed phrase inherited by people through various social communication in the process of long-term historical and cultural development [6]. As a kind of familiar language, it is very commonly used in life, with the basic characteristics of stereotyped structure, complete meaning, simplicity, and quantity. Idioms are concise in language and wise in content and are widely used and circulated by the masses, which is a form of language that people must come into contact with for communication [7-9]. Idioms are a special group of Chinese vocabulary, the crystallization of Han culture, and the treasure of the Chinese language; it is a bright pearl of China. Chinese idioms are profound and profound, and the national information it covers is very rich, whether from the level of historical value or cultural value, it has a high value [10-11].

In this paper, based on the means of application of artificial intelligence in illustration design, we use the LSTM neural network model to solve the problem of gradient vanishing and gradient explosion in the RNN model and apply the model to the generation of idiomatic illustrations. To fit the inverse process with a neural network, a diffusion model is proposed, and a mathematical expression is derived. Combining the two models, the LSTM model is used in illustration sequence modeling to learn the information and dependencies of sequence data in context. The diffusion model's unique feature extraction and representation learning capabilities are also utilized in the processing of illustrations. The combined effect of the two drastically improves model generation, modeling, and the ability to focus on important features. Using both text and image encoders, the network structure of the combined LSTM and diffusion model is designed to better realize the generation effect of illustrations. The application of the model in actual illustration design to the strategy is proposed by taking "Picture Idioms" as an example, and the practical effect of the strategy is examined by means of empirical research.

## 2 Exploration of the Application of Artificial Intelligence Technology in the Illustration Design of Idioms Series Books

### 2.1 Means of applying artificial intelligence in illustration design

The application of artificial intelligence in illustration design mainly includes neural network-based illustration generation, assisted illustration design, and style migration. These methods can improve work efficiency and creativity in the early, middle, and late stages of illustration design. In the initial stage of illustration design material search and screening, neural network-based illustration generation technology can quickly complete the material search and screening of illustration designs through image recognition. Then, according to the needs and style requirements of elementary school language textbooks, it generates various elements in the illustration design, such as backgrounds, characters, scenes, and so on. This not only saves time and energy for creative conceptualization in the early stages of illustration design but also produces a more comprehensive creative mind map.

## 2.2 Applied Foundations of Illustration Design Using Artificial Intelligence

Artificial Intelligence Painting is an intelligent creation created using deep learning algorithms trained on large scale data. Despite its impeccable operation to output on the surface, it is always the operation of a machine, which inputs programs and algorithms to produce images according to the operator's wishes and does not realize true artistic creation. Therefore, AI drawing still relies on the aesthetic choices of the illustrator in essence and requires the illustrator to have deep artistic aesthetic skills and rich design experience.

## 2.3 Innovative Advancement of Artificial Intelligence for Illustration Design

In illustration design, creative thinking and the creation of artificial intelligence are supervised and promoted together. The illustration design process is optimized by artificial intelligence through automation and intelligent technology to improve design efficiency. Illustration designers will need to constantly think and improve their comprehensive ability in creation to achieve such efficiency, especially when it is closely connected to the speed of dissemination and profitability. Illustrators will continue to try and explore and, through repeated experiments and corrections, constantly improve their creativity and presentation methods.

## 2.4 Model Construction

### 2.4.1 LSTM Neural Network Modeling

The task of the forgetting gate is to sift through the information in the cell state and selectively forget it by accepting the output module  $C_{t-1}$  of the previous cell module and deciding which part to keep and forget  $C_{t-1}$ , with the following formula:

$$f_t = \text{sigmoid}(W_f \times [x_t, h_{t-1}] + b_f) \quad (1)$$

$$C_t = i_t \times \hat{C}_t + f_t \times C_{t-1} \quad (2)$$

$x_t$  is the input of the neuron at moment  $t$ ,  $h_t$  is the output of the neuron at moment  $t$ ,  $W$  represents the weight matrix,  $b$  represents the threshold vector, and *sigmoid* is the neuron activation function in Equation (1)  $f_t$  is the output value of the forgetting gate. The function of the input gate is to selectively record new information in the cell state and decide to store those new information in the cell state (unit module). The input gate consists of layers *sigmoid* and *tanh*, layers that determine the update of HO values and layer *sigmoid* that generates new candidate memories that add supplementary discarded attribute information. The formula is as follows:

$$i_t = \text{sigmoid}(W_i \times [x_t, h_{t-1}] + b_i) \quad (3)$$

$$\hat{C}_t = \text{tanh}(W_i \times [x_t, h_{t-1}] + b_i) \quad (4)$$

In Equation (4)  $\hat{C}_t$  is the input gate result and  $i_t$  determines whether  $\hat{C}_t$  joins the  $t$  moment state. Eventually, the two are multiplied to obtain the final output information, which is given in the following equation:

$$O_t = \text{sigmoid}(W_o \times [x_t, h_{t-1}] + b_o) \quad (5)$$

$$h_t = o \times \tanh(C_t) \quad (6)$$

Equation (6) in  $h_t$  is the final output of the output gate.

The biggest innovation of LSTM is the introduction of three gates, which simplifies the training process of neural networks and solves the problems of gradient explosion and disappearance. LSTM is considered a feedback neural network that has self-learning, associative storage, and guided search for superior solutions. However, the LSTM model is not sensitive to the change of the period and trend of the data and also has the disadvantages of time-consuming computation and not parallel operation. At the same time, when the length of the sequence exceeds a certain limit, the LSTM still suffers from the problem of gradient vanishing [12].

#### 2.4.2 Application of LSTM in Idiom Illustration Generation

In idiomatic illustration generation, LSTM can be used to generate descriptions of idiomatic illustrations or to generate images from a given idiomatic textual description. LSTM can encode an input text sequence into a fixed-length vector representation and then input that vector into a neural network using a decoder to generate an illustration that matches the idiomatic textual description, which itself does not directly generate the content of the image at the pixel level. LSTM can be involved in the natural language description part related to illustration during the illustration generation task, thus enhancing the semantic comprehension of images and expanding the application scenarios.

#### 2.4.3 Diffusion models

The diffusion model can be divided into two parts: the diffusion process and the inverse diffusion process. The diffusion process is to continuously add Gaussian noise to the original data so that the distribution of the original data is converted to a simple standard Gaussian distribution [13]. Inverse diffusion is a process of denoising, sampling from the standard Gaussian distribution, removing a very small Gaussian noise at each step, gradually approximating the real data distribution, and then obtaining the samples from its real data distribution, so as to achieve the purpose of generating data. The diffusion model is characterized by its ability to generate high-quality images and its ability to control the generated images. Different conditions can be introduced in the generation process to achieve diversity and personalization. It has been utilized in various fields, such as data repair, noise reduction, and image enhancement.

Forward process: it is the process of adding noise. The forward process in which the image  $x_t$  is only related to  $x_{t-1}$  at the previous moment, this process can be considered as a Markov process which satisfies the:

$$q(x_t | x_{t-1}) = N\left(x_t; \sqrt{(1-\beta_t)}x_{t-1}, \beta_t I\right) \quad (7)$$

$$q(x_1, x_2, \dots, x_T | x_0) = \prod_{t=1}^T q(x_t | x_{t-1}) \quad (8)$$

Where  $\beta_t$  with different  $t$ 's is predefined to decay gradually and can be Linear, Cosine, etc., is satisfied:

$$0 < \beta_1 < \beta_2 < \dots < \beta_T < 1 \quad (9)$$

Calculated:

$$x_t = \sqrt{(1-\beta_t)}x_{t-1} + \sqrt{\beta_t}z_{t-1} \quad (10)$$

Eq.  $z_{t-1} \sim N(0, I), \alpha_t = 1 - \beta_t$ .

After derivation, the relationship between  $x_t$  and  $x_0$  can be obtained:

$$q(x_t | x_0) = N(x_t; \sqrt{\alpha_t}x_0, (1-\bar{\alpha}_t)I) \quad (11)$$

Inverse process: it is a denoising process using a neural network  $p_\theta = (x_{t-1} | x_t)$  to fit the inverse process  $q(x_{t-1} | x_t)$ . Can be passed:

$$q(x_t | x_0) = N(x_t; \sqrt{\alpha_t}x_0, (1-\bar{\alpha}_t)I) \quad (12)$$

Derivation:

$$p_\theta(x_{t-1}, x_t) = N(x_{t-1} | \mu_\theta(x_t, t), \Sigma_\theta(x_t, t)) \quad (13)$$

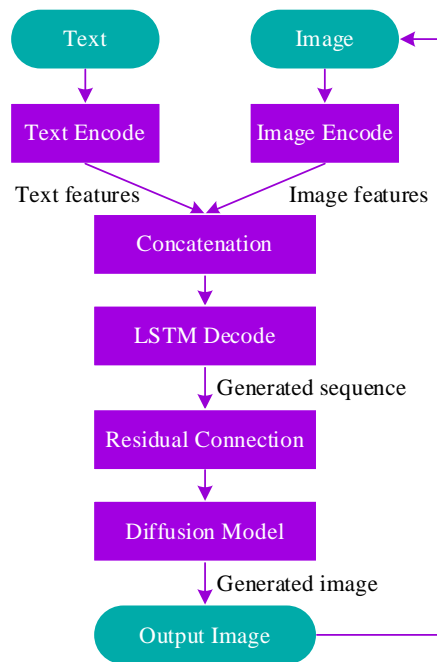
#### 2.4.4 Combination of LSTM and Diffusion Modeling

Two neural net models, LSTM and diffusion modeling, are suitable for various tasks and domains. However, combining them can bring some unique advantages, especially in the conversational illustration generation task. LSTM excels in sequence modeling, where it learns contextual information and temporal dependencies in sequence data. Diffusion models, on the other hand, are good at extracting features and learning representations in image processing. By combining LSTM and diffusion models, contextual information learned by LSTM can be used to guide the diffusion model for more accurate extraction and representation learning of illustration features. By combining LSTM with diffusion models, the model generation capability, long-term dependency modeling capability, and ability to focus on important features can be improved. This combination can be applied to various sequence generation tasks such as natural language processing, image generation, and so on.

Similarly, the combination of LSTM and diffusion modeling has been shown to perform well in the task of sequential generation of illustrations, where LSTM learns the coherence and structure of the illustration sequence, while diffusion modeling learns the local features and details in the illustrations. By combining the two, the illustrations can be generated in a way that maintains overall coherence while emphasizing local details and textures, resulting in more realistic and expressive continuous illustrations.

### 2.4.5 Network Architecture Design

Combining LSTM and diffusion models, a novel network structure can be designed to achieve better illustration generation. The improved network structure can be seen in Figure 1. In this paper, feature representations of idiomatic text and illustrations are obtained by encoding the input text and illustrations, respectively, using a text encoder and an image encoder. A joint feature representation is formed by connecting the obtained idiom text features and illustration features. Subsequently, the joint features are inputted into the LSTM decoder, which generates a range of feature vectors depending on the input features [14-15]. Finally, these feature vectors are input into the diffusion model through residual concatenation, and the diffusion model generates the image.



**Figure 1.** Improved network structure

## 3 Intelligent design of illustrations to accompany the Idioms in Primary Languages book series

Combined with the LSTM model proposed in this paper, the corresponding intelligent illustration design is proposed with the example of “Diagramming Idioms”, which provides a design strategy for the supporting idiom series of elementary school language under the new curriculum standard.

### 3.1 The Importance of Illustrations for Primary Language Supporting Idioms Series under the New Curriculum Standards

#### 3.1.1 Stimulate students’ reading interest and emotional resonance

Idiom illustrations attract students with vivid pictures and concise words, which stimulate their strong interest in reading. Visualization of idiom illustrations provides students with a pleasant reading experience while also deepening their understanding of the storyline. Idiom illustrations are often presented with touching storylines and warm images, which trigger students’ emotional resonance, inspire students to pay attention to the fate of the characters in the stories, deepen their understanding

and experience of the emotions behind the idioms, and then cultivate their emotional, cognitive ability and emotion management ability. As a form of literature, idiom illustrations, because of their easy-to-understand characteristics, help to attract students to actively read and then expand their reading breadth and depth. In general, idiom illustration is not only a form of language art but also an important tool for educators to stimulate students' interest in reading, enhance their emotional cognition, and promote their overall development.

### **3.1.2 Fostering imagination and creativity**

Idiomatic illustrations are of great significance in the language reading teaching of lower elementary schools, as their fascinating drawings and concise words stimulate students' imagination and creativity. The colorful pictures and words allow students to integrate into the story context and freely imagine the scenes and plots of the story, and students can independently stimulate their creativity in the imagination space, enrich the story content, and even develop the extension of the storyline. The unique artistic expression of idiomatic illustrations and the exquisite matching of words and pictures provide a space for students to give free play to their imagination so that they can explore and discover their heart's content in the process of reading.

### **3.1.3 Helping students understand the background of idioms and traditional stories**

Idiomatic illustrations play an important role in language reading and teaching in the lower primary grades, helping students to understand cultural backgrounds and traditional stories. Through illustrated books, students can come into contact with storylines from various cultural backgrounds and learn about the rich and colorful cultural connotations of folklore, myths, and other stories. Idiom illustrations, as a form of literature, often incorporate elements of local customs, traditional festivals, and customs so that students can experience the unique charm of different cultures through the illustrations. At the same time, idiom illustrations are vivid representations of traditional stories, such as fables and folklore, which can help students understand the values and wisdom of ancient traditional culture in a relaxing and pleasant reading atmosphere.

### **3.1.4 Promote emotional awareness and mood management**

Through the warm, sad, joyful, or tense atmosphere portrayed by the plots and characters in the idiomatic illustrations, students are naturally able to experience various emotions. These stories trigger emotional resonance that assists students in recognizing their emotional changes and promoting their emotional awareness. At the same time, the idiomatic illustrations provide examples of how to deal with emotions, help students learn how to deal with emotions in daily life and develop their ability to express emotions.

## **3.2 Strategies and Cases of Intelligent Idiom Series Illustration Design**

Combined with the language idiom learning needs of primary school students at lower stages, the following illustration design strategies for elementary school language textbooks supporting idiom series are proposed using the model constructed in this paper.

### **3.2.1 Using Illustrations to Vividly Recreate Classic Historical Situations**

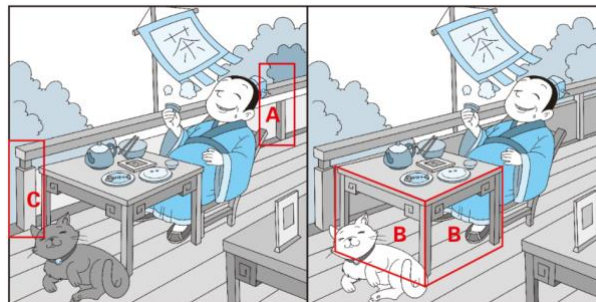
The book series "Idioms in Pictures" aims to find the history and wisdom hidden in idioms. Through vivid stories, the book shows the ins and outs of idioms, comprehensively explains the ancient and

modern meanings of idioms, and realizes the implementation of words and phrases, as well as accurately analyzes the original meanings and metaphors. Through wonderful illustrations, classic situations are vividly reproduced, making the book more full of liveliness and a sense of the times, effectively attracting the attention of students. The illustrations' distinctive images, engaging plot design, and multi-layered composition help students understand idioms and develop good aesthetic abilities.

### 3.2.2 Two-color illustration design to enhance the aesthetic context

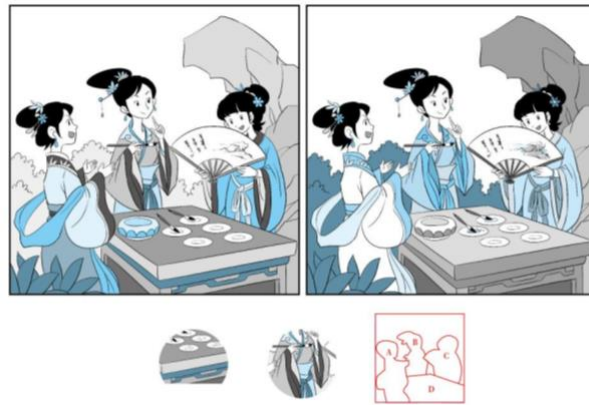
In the overall design of the graphic arrangement of the Idioms series, combined with LSTM and diffusion model, it should be tailored to the teaching needs of elementary school language textbooks, closely follow the new teaching materials, and realize the integration of in-class and out-of-class. For example, "Diagramming Idioms" comprehensively analyzes each idiom from its interpretation, allusion, proximate meaning, antonym, example sentence and identification. The idioms are arranged in phonetic order for quick and accurate searching to make access easier for readers. Meanwhile, the design of idiom categorization and idiom solitaire game blocks is added to guide students in developing the good habit of knowing how to look up and learn, making learning easy and interesting. The contrast of image tones is enhanced by the design of two-color illustrations. Changing the combination relationship between the two colors and applying appropriate color effects preserves the original layers and tonal information in the images.

When the structure of the object is not clearly represented, it is necessary to use a uniform contrast between light and dark so that the direction of the light source within the picture is uniform. The Illustrated Idioms illustrate uniform performance requirements, as shown in Figure 2. For example, in some images in the design, in order to pursue the diversity of the color scheme, deliberately and frequently used the blue system, gray system, and blue-gray system collocation so that the scene in the picture is abrupt, and the characters can not be coordinated and unified, interfering with the overall expression of the picture.



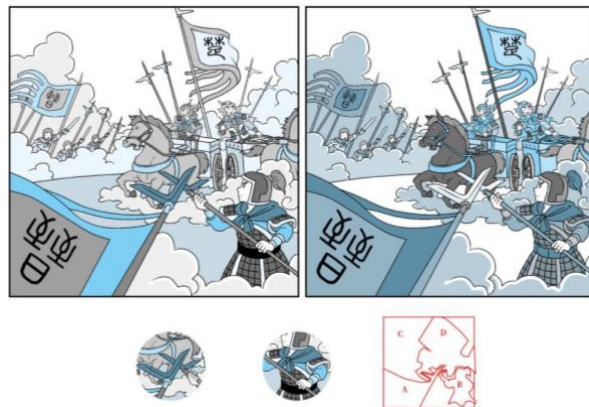
**Figure 2.** The illustrations in "Illustration Idiom" show uniform requirements

Post-adjustment, the use of color whole block partition method, the role of calling a higher contrast blue system with the design, the scene using a lower contrast gray and blue-gray system design, so that the overall performance of the screen effect is full, easier for readers to identify, Figure 3 for the "Tu Shuo Chengyu" in the illustration of the color matching specification requirements.



**Figure 3.** Specification for color matching of illustrations in "Illustration Idiom"

Considering the object itself's light and dark processing and texture performance, in similar objects with the color, strengthening the contrast effect of the color, contrast relative to the contrast effect is prominent can make the object's texture performance more prominent. At the same time weakens the color of the foreground objects with the span to reduce the surrounding objects with the color contrast and saturation to strengthen the integrity of the picture, Figure 4 for the illustration of the "Figure of Idioms" in the color matching specification requirements. Picture lines are drawn with a 14-pixel line width, and the lines are proportionate and of equal width, which ensures that the illustrations will not lose details during indentation.

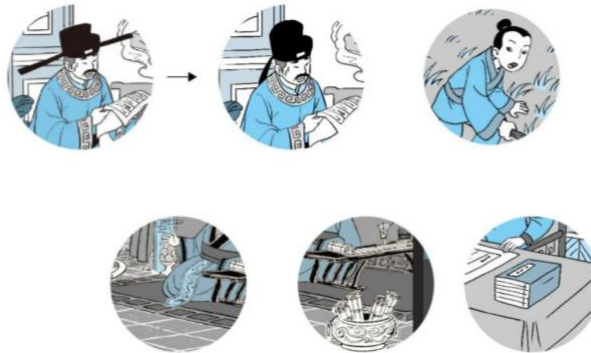


**Figure 4.** Specification for color matching of illustrations in "Illustration Idiom"

### 3.2.3 Creating Idiom Learning Pivot Points and New Ideas for Reading

The illustration design of "Pictures of Idioms" is based on traditional elements, and most of the situations are designed in the history and folk scenes of different dynasties. The attire of the characters, the scenes of the story, the props used, and the writing of the text all need to focus on the embodiment of the general knowledge of ancient culture after a large amount of information search and rigorous examination. In the design of the characters, according to the historical records, combined with LSTM and diffusion modeling, the appearance characteristics and personality traits need to be in line with the characterization in the story when the characters are designed. In the historical background of each different dynasty, the matching of characters' clothing and styling is also different. Men in the stories associated with the Qin Dynasty typically wear robes, while officials wear crowns on their heads and swords on their waists. Peasants opt for red felt scarves made of coarse hemp instead of wearing crowns. It is important for furniture to match the historical environment. For example, there

were no stools before the Han Dynasty, and people usually sat on the ground with fur and grass products, while beds, tables, chairs, stools, cabinets, and shelves should pay attention to the use of the era in which they appeared. Props need to pay attention to the Western Han Dynasty, which used bamboo writing, and the Eastern Han Dynasty, after the period of writing with paper. In the design of the house building, it is necessary to consider the architectural characteristics of different dynasties and technologies. Each type of architectural art style represents the architectural culture of the period. For example, the Qin-Han period of architecture to brick and tile wooden structures is dominated by the so-called “Qin brick and Han tile,” which is the overall generalization of the house building at that time, the examination of the requirements as shown in Figure 5.

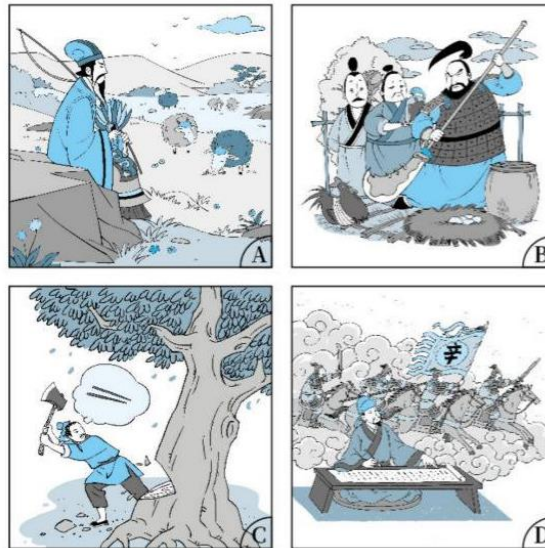


**Figure 5.** The reference requirements of illustrations in “Illustration Idioms”

### 3.2.4 Contextual and Imaginative Space Creation Supplementation

In some interpretations and allusions, certain idioms are expressed very briefly, and there is rich extensibility in the description, which provides students with space for thinking and imagination. Dynamic and contextual illustrations can make the static picture “alive”, thus utilizing the LSTM diffusion network structure model to make corresponding additions to the gaps in the interpretation of the text. For example, the idiom “Bright and Straightforward” in “Pictures of Idioms” comes from the allusion to “Zhu Zi’s Classes of Words - Yi Jiu”, which says: “What the sages say is bright and straightforward, and we must first pay attention to a bright and straightforward program entry.” There is no specific storyline design in the allusion, and the illustration skillfully borrowed the example of the performance of the Northern Song Dynasty minister Bao Zheng for people to deal with the bright and upright, honest and clean as the material, to Bao Qingtian’s image as the main picture, to show that it is upright and resolute, the iron face of selflessness. Both portrayed a distinctive character image, but also helped guide students through the process of observation, imagination, expanding their reading knowledge, and deepening their impression of learning.

Another example is the idiom of “making little use of big materials”, which comes from Lu You’s poem “Sending Xin You’an to Write a Poem”: “Making little use of big materials is something that has been lamented in ancient times, and Guan Zhong Xiao He has actually flowed into Asia.” There is no specific storyline in the allusion. Through the interpretation of the idiom, the vivid picture depicting the near-synonym of “don’t use a bull’s knife to kill a chicken” is designed, and you can also use your imagination to make chopsticks by chopping down a big tree, which is a funny expression of the idiom’s interpretation, and conveys it to the readers concisely and clearly, regarding the ideology of the illustration. Figure 6 outlines the requirements for the illustrations.



**Figure 6.** The ideographic requirements of illustrations in the “Illustrated Idiom”

The ideographic requirements for illustrations in the Idioms in Pictures are depicted in Figure 7. The idiom “Beat the Grass to Frighten the Snake” tells the story of Wang Lu in the Tang Dynasty, “Though you beat the grass, I have already frightened the snake”. Through the use of the model, the design of the picture is combined with the interpretation of the textual information and the story, and the expressive consciousness of the picture is refined as much as possible to serve the expression of the storyline. You can use multiple angles and directions to present the situation of Wang Lu by reading the certificate paper in the government office and using your imagination. For example, the bubble imagery shows the actual picture of scaring the snakes, highlights Wang Lu’s exaggerated expression of fear, or depicts Wang Lu thinking about the certificate paper on the desk. Rich scenarios of imagination for the original plain text narrative added a vivid creation of supplement so that students experienced from the rational knowledge of the text to the picture of the sensibility of the experience, and then to evoke the rich imagination of students, to achieve the analysis and the ability to create a double training. Students’ motivation to learn idioms is increased by the exploratory activities introduced by the illustrations.



**Figure 7.** The ideographic requirements of illustrations in the “Illustrated Idiom”

## 4 Analysis of the practical application of Idioms in Pictures

### 4.1 Analysis of empirical research

The previous review of information can be found in most of the illustrated textbooks for the lower elementary school. Of course, this is closely related to the physical and mental development of students. At this time, the students are in the process of transitioning from concrete image thinking to abstract logical thinking, and thus the illustration-based language textbooks can better help students to memorize and understand difficult concepts of idioms. Although older students are in the stage of transitioning to abstract logical thinking, do they still need to be presented with books that illustrate idioms as concrete images? Fourth-grade language reading content has generally risen in terms of number of words and degree of difficulty. Students are psychologically a little timid and fearful. It is because they are at a turning point. When there are abstract idioms, students find it very difficult to understand, even if the teacher talks about them in words. It is also difficult then we need a more visual form with the teacher's answer to let students gradually understand the abstract concepts. When the abstract idioms appear again, the student's mind will appear in the picture and be expressed in the language of the students.

The study was focused on the fourth grade A class of Primary School T, with the fourth grade being chosen as the grade level. The class has 50 students, with 31 boys and 19 girls. Through observation and feelings in the class, it can be known that the class as a whole is an excellent class with a good classroom culture, and it has always been at the top of the whole grade in learning. Apply "Picture Idioms" to the teaching of T Primary School 4A class, and analyze the actual application effect of teaching.

### 4.2 Analysis of practical effects

#### 4.2.1 Color and Illustration Style Analysis

Color is the most important factor in the layout design of the illustrated picture book of "Tu Shuo Chengyu." as mentioned in the previous design strategy, the theme color palette of "Tu Shuo Chengyu" is a high-contrast blue color scheme with design, and the scenes are designed using a low contrast gray and blue-gray color scheme. Next, the color preferences of the students in the subject class were studied to determine the usability of the color design strategy.

Figure 8 shows the color preference ranking of the students, where the preference level is replaced by a score of 1-5, with higher scores indicating that the students are more satisfied with the use of the color. From the selection results, it can be seen that the students' color preference ranking is blue-gray (4.9) > blue (4.6) > green (4.1) > orange (3.8) > purple (3.3) > red (3.2) > cyan (3.1) > yellow (2.7). It can be seen that children like colors that are more colorful and saturated, and the color style of the illustrations proposed in this paper is in line with the color preference level of students.

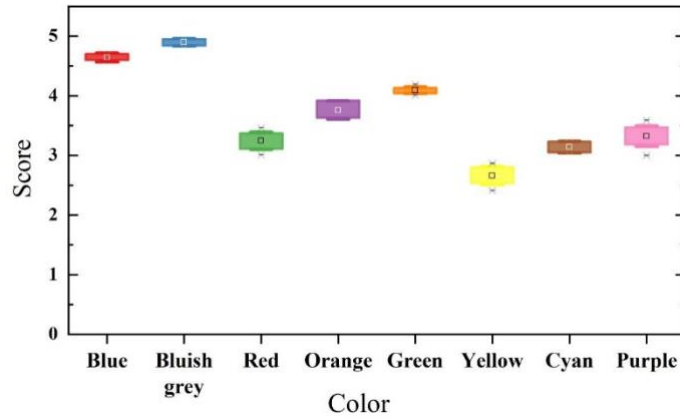


Figure 8. Color preference ranking of students

#### 4.2.2 Satisfaction analysis

##### 1) The basic situation of reading Picture Books of Idioms in Pictures

The basic situation of reading Picture Books of Idioms in Pictures is illustrated in Table 1. The reading method of the picture books is mainly based on the picture reading method (52%), followed by the point reading method (26%), and the recitation method and the follow-along method are less common, accounting for 14% and 8%, respectively. The duration of reading picture books was mostly concentrated in >15 minutes (66%), while 34% were less than 15 minutes. During the reading process, 76% of the students were active and able to read together with their parents, while another 10% only liked to look at the pictures and did not pay attention to the text content. All the knowledge of idioms in the picture book was mastered by 66% of the students after they finished reading.

Table 1. The basic situation of picture book reading of Picture Idioms

Group	Total	Men	Women	$\chi^2$	P
Picture book reading time / [n(%)]					
≤ 15 minutes	17(34)	11(35.48)	6(31.58)	1.4584	0.3445
>15 minutes	43(66)	20(64.52)	13(68.42)		
Picture book reading					
Graph reading method	26(52)	16(51.61)	10(52.63)	5.4786	0.2687
Dot reading method	13(26)	7(22.58)	6(31.58)		
Recitation	7(14)	5(16.13)	2(10.53)		
The following method	4(8)	3(9.68)	1(5.26)		
Student's attitude towards reading picture books					
Be proactive and read with your parents	38(76)	23(74.19)	15(78.95)	4.4878	0.0764
Passive, does not like to listen to and read picture books	7(14)	5(16.13)	2(10.525)		
Like to look at pictures, do not pay attention to the text	5(10)	3(9.68)	2(10.525)		
Students' knowledge of picture books					
Have it all	33(66)	21(67.74)	12(63.16)	0.0796	0.9636
Partial mastery	17(34)	10(32.26)	7(36.84)		

## 2) Satisfaction situation

Table 2 reveals the students' contentment with the Picture Book of Idioms. The results show that 94.4% of the students were more satisfied with the overall evaluation of this elementary school language teaching based on the Picture Book of Idioms and the ratings of nine items, including the story content, the color of the illustrations, the paper of the Picture Book, the content of knowledge of Idioms, the storyline, the quality of the illustrations, the expression of the text, the educational value as well as the design and production, are all over 9 points. With a satisfaction rate of 98%, the content of knowledge of idioms was rated 9.458 among them.

**Table 2.** Students' satisfaction with the picture book "Picture Idioms"

Item	Satisfaction score ( $\bar{x} \pm s$ )	Satisfaction [n(%)]	
		Undersatisfaction ( $\leq 8$ points)	Satisfaction (9~10point)
Story content	9.454±1.265	4(8)	46(92)
Illustration color	9.348±1.482	6(12)	44(88)
Picture book paper	9.014±1.154	5(10)	45(90)
Idiom knowledge content	9.458±1.356	1(2)	49(98)
Storyline	9.014±1.265	2(4)	48(96)
Illustration quality	9.265±1.144	2(4)	48(96)
Literal expression	9.148±1.014	1(2)	49(98)
Educational Value	9.265±1.265	3(6)	47(94)
Design and manufacture	9.354±1.078	1(2)	49(98)

## 4.3 Evaluation of the Teaching Effectiveness of "Diagramming Idioms"

### 1) Data collection and analysis

In the next analysis, Class B in Grade 4 of T Primary School was added as the control group of the experiment. Class B adopts the traditional language learning method, and the number of students is 52. Class A adopts the Picture Idioms Picture Book Aid for elementary school language teaching, and both classes have the same length of teaching for one semester.

The independent samples t-test for the pre and post-test scores of class A and class B is shown in Table 3. In class A and class B, 50 and 52 students took part in the test before the experiment began. The pre-test scores of class A and class B were  $25.154 \pm 2.7885$  and  $26.014 \pm 2.4584$ , respectively. According to the data, there was a slight discrepancy between the levels of both classes and class B had higher pre-test scores than class A. In order to determine whether the two classes can be experimented as parallel classes, an independent samples t-test was conducted on the pre-test scores, and the significance (two-tailed) value was 0.9488, which is greater than 0.05, indicating that there is no significant difference between the scores of the two classes, i.e., the two classes, Class A and Class B, can be experimented as parallel classes.

The mean values of the post-test scores of the two classes were 39.458 and 32.488, with a standard deviation of 2.7859 and 2.6488, respectively. The data was further analyzed, and the independent samples t-test resulted in a significance (two-tailed) value of 0, which is less than 0.05, showing that there is a significant difference between the post-test scores of Class A and Class B.

**Table 3.** Independent sample T-test of the scores of Class A and Class B before and after testing

Pretest					
Group	N	Mean	SD	T	Sig.
A	50	25.154	2.7885	0.0798	0.9488
B	52	26.014	2.4584		
Post-test					
Group	N	Mean	SD	T	Sig.
A	50	39.458	2.7859	5.4266	0.000
B	52	32.488	2.6488		

2) Comparison of pre and post-test data

The correlation coefficients and paired samples t-test results for the pre-and post-tests of Classes A and B are displayed in Table 4. It can be seen that the two parallel classes have improved their knowledge mastery level compared to the pre-test. The correlation coefficients of "Pair Group 1" (A class pre-test scores & A class post-test scores) and "Pair Group 2" (B class pre-test scores & B class post-test scores) are both higher, "Pair Group 1" The correlation coefficient is 0.9455 and the Sig value is less than 0.05, i.e., class A pre-test and post-test scores are significantly correlated. The correlation coefficient of "Pair 2" is 0.8154, and the Sig value is less than 0.05, which means that the pre-test and post-test scores of class B are significantly correlated. The pre and post-test scores of both classes have a linear relationship, and paired samples can be made.

From the table, we can see that the two-sided t-test of "Pair Group 1" (pre-test scores of class A and post-test scores of class A) and the Sig value of the probability of significance of "Pair Group 2" (pre-test and post-test scores of class B) are both 0, which is less than 0.05, which means that there is a significant difference between the pre-test and post-test scores of class A and class B. The results of classes A and B are significantly different from each other. Posttest scores, combined with the correlation coefficient, indicate that the language teaching strategy of Class A is better than that of Class B.

**Table 4.** The correlation coefficient and paired sample T-test before and after class A and class B

		Mean	N	SD	Correlation coefficient	Sig.	
Pair 1	Class A pre-test	25.154	50	2.7885	0.9455	0.000	/
	class A Post-test	39.458	50	2.7859			
Pair 2	Class B pre-test	26.014	52	2.4584	0.8154	0.000	
	ClassB Post-test	32.488	52	2.6488			
		Paired difference			T	df	Sig.(double side)
		Mean	SD	SEM			
Pair 1	Class A pre-test & post-test	-14.304	0.8452	0.1356	-98.5644	49	0.000
Pair 2	Class B pre-test & post-test	-6.474	1.7854	0.2648	-36.4524	51	0.000

5 Conclusion

This paper combines an LSTM neural network and a diffusion model to extract and generate idiom illustrations. By using Pictures of Idioms as a case study, a design strategy is proposed for the

illustrations of idiom series that accompany elementary school language texts. The impact of practical application is evaluated through the application of the models and strategies proposed in this paper in elementary school language teaching.

- 1) The illustrations of Intelligent “Pictures of Idioms” use blue and blue-gray tones with fuller contrast in the design of color styles, and analyze the color design effect of the illustrations of “Pictures of Idioms” in terms of students’ preference for colors. Students ranked blue-gray and blue first and second in the order of their preference for colors, with the mean preference scores being 4.9 and 4.6, respectively. The color style of the illustrations of “Pictures of Idioms” is in line with students’ color preferences.
- 2) In the basic reading situation of “Picture Talking about Chinese Idioms”, 52% of the students read mainly by the picture reading method, 66% of the students read for more than 15 minutes a day, and 66% of the students who had all the knowledge of the idioms in “Picture Talking about Chinese Idioms”. The knowledge content of idioms was rated at 9.458 points, with a satisfaction rate of 98%.
- 3) The independent samples t-test on the post-test language achievement of classes A and B shows that the post-test means of the language achievement of the two classes are 39.458 and 32.488 points, respectively, with a significance value of 0.000, which is less than 0.05, and there is a significant difference between the two classes. It shows that the supplementary teaching of language through the book “Picture Idioms” can significantly improve the language achievement of primary school students.

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