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Model Construction and Practice of Cultivating Academic Writing Skills in Business with the Empowerment of Artificial Intelligence

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SUMMARY: *Based on elaborating the positive impact of AI technology on academic writing, this paper analyzes the trend of academic ecological reform under the empowerment of AI and establishes a model for the cultivation of academic writing ability in business. Then based on Seq2Seq model, BiGRU model and Luong attention mechanism are introduced to establish the intelligent error correction model of business academic writing based on fixed-length Seq2Seq network. And based on the model of academic writing ability cultivation in business class, the teaching practice research is carried out with the students of a university as the research object. The results show that the F0.5 value of the intelligent error correction model reaches 38.81%, which is 5.18 percentage points higher than that of the sub-optimal Seq2Seq+BiGRU model, and the students' academic writing ability under the business academic writing ability cultivation model improves by 11.68 points compared to the preexperimentation period, which is a highly significant difference (t=9.586, P=0.000< 0.01). Therefore, based on artificial intelligence technology can promote the academic writing ability of business students significantly and improve the quality of academic writing in business.*

KEYWORDS: *ai technology; Seq2Seq model; BiGRU model; attention mechanism; academic writing skills*

1 Introduction

With the rapid development of science and technology, industrial restructuring and business model innovation have put forward new requirements on the connotation and development ideas of business education in the new era [1]. Among them, business academic writing ability, as the focus of business management, is highly concerned about the training of business talents in colleges and universities. Academic writing ability is a direct reflection of its scientific research and innovation ability, and in the process of literature review, classroom report, academic communication, writing the opening report, publishing academic papers and finally writing the dissertation, the writing level and writing ability directly affect the effect of the above academic activities [2]. It can be said that the level of writing ability directly affects the progress and level of their research, as well as the expression and output of their academic ideas, and therefore plays a pivotal role for students [3]. However, in the actual training of business students, they often focus on the cultivation of their professional knowledge and scientific research ability, but pay insufficient attention to the cultivation of the basic ability of students' academic writing. The lack of logic in business students' academic papers, irrational structure of the paper, frequent occurrence of sick sentences, poor generalization, inability to accurately

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express ideas, insufficient data analysis and other issues, greatly affecting the quality of training of talents, and even the lack of academic writing ability will affect the students' career development prospects, and become the short board of talent training [4-8]. In addition, teachers have limited time for academic writing instruction, and it is difficult to realize personalized instruction, so it is necessary to introduce new methods to improve the academic writing ability of business students [9].

With the development of information technology, artificial intelligence (AI) technology is widely used in the field of education. Literature [10] found that implicit and explicit instruction on AI platforms can effectively promote the development of learners' writing skills, and the interview results also confirmed that learners have positive attitudes toward them, which provides practical insights for AI-assisted foreign language writing teaching. Literature [11] shows that AI writing tools have significant advantages in improving academic writing fluency and providing personalized tutoring, as well as helping to enhance learning autonomy. Literature [12] reveals that AI tools are effective in assisting the conceptualization, grammatical improvement, and efficiency of academic writing, and are generally viewed by students as a useful supplement rather than a substitute for critical thinking. Literature [13] found a significant positive correlation between the adoption of AI technology and the quality of academic writing through a survey of 376 Lebanese business students, and regression analyses further confirmed that AI is effective in improving academic writing in business. Literature [14] builds an AI-supported academic writing feedback model with the help of natural language processing technology for automatic assessment of academic writing texts and provision of personalized feedback to deepen the understanding of how writing skills are developed in the age of AI. Literature [15] evaluated the effect of ChatGPT-based academic writing revision method on the improvement of students' writing skills, and the questionnaire feedback was positive, indicating the potential of AI big language modeling in assisting students' writing and educational assessment. In addition, literature [16] summarized the application of AI in academic writing since 2019, covering the assistive role in six core areas: idea generation, structure optimization, literature review, data analysis, editing and publishing, and ethical compliance, and the potential of AI tools represented by ChatGPT is significant, but the relationship between its application and academic integrity and human insight needs to be balanced, and ethical training and transparency should be strengthened in the future Integration. Literature [17] argues that although AI can assist in grammar and style improvement, it cannot replace the cultivation of critical thinking, research ethics and other core competencies in the curriculum, and emphasizes the need to balance the use of AI tools with traditional teaching in order to effectively cultivate students' comprehensive writing skills. Literature [18] points out that while AI improves the efficiency and quality of academic writing, it also raises ethical issues such as content copyright, creativity retention, and academic integrity. In view of the assistive effect of AI technology in students' academic writing, as well as the balance between academic writing teaching and AI application, the construction of an AI-enabled model for the development of academic writing skills in business can improve students' academic writing skills and effectively avoid ethical issues and integrity problems in the application of AI tools.

The rapid development of AI modeling and its application in academic writing has triggered widespread attention worldwide. To this end, this paper designs a model for the cultivation of academic writing ability in business class empowered by AI technology and establishes an intelligent error correction model for academic writing in combination with a fixed-length Seq2Seq network. The model in this paper can understand the possible errors of business students in the process of academic writing, and combined with the cultivation model can significantly enhance the academic writing ability of business students, and promote the creative thinking ability and academic research ability of business students.

2 AI-enabled model for developing academic writing skills in business disciplines

Academic paper writing ability training aims to systematically train students' academic research ability, and exercise their independent analysis and problem solving ability through mastering research methods and academic writing standards. Under the rapid development trend of artificial intelligence technology, this paper establishes an academic writing competence cultivation model for business, aiming to further cultivate students' spirit of scientific research and innovation and academic ethics, and laying a foundation for the successful completion of graduation thesis and future academic development.

2.1 AI's facilitation of academic writing

Academic writing in business is an art that requires specific skills to provide a comprehensive description of research methods and results in a summary report. Typically, students use a combination of reporting guidelines and other tools (e.g., journal guidelines) to optimize their reports. Clarity, completeness, and transparency in writing are cornerstones of academia that facilitate knowledge dissemination and professional advancement. In recent years, with the advent of Artificial Intelligence (AI), these AI tools are becoming another ‘tool’ for students, and the disruptive technologies they embody offer exciting opportunities to improve student productivity and the quality of scientific output. These AI tools have a number of advantages that greatly appeal to students and enhance their academic writing skills to a certain extent. Moreover, their ability to provide personalized feedback and guide students and other educated individuals in their writing progress better develops students' academic writing skills.

In recent years, the explosive growth of AI technology has triggered a multifaceted change in the field of information and academic writing, and AI not only provides efficient and convenient content creation tools for professional information producers and ordinary users, but also creates a new type of information production mode of “artificial+intelligent”. In addition to academic writing in the general sense, AI is also widely used in various academic summaries, report writing, and even copywriting. With strong intelligence and low cost, AI technology has rapidly penetrated into various fields, and academic writing and other textual and academic information creation has become one of the main application scenarios.

2.2 Academic ecological reform empowered by AI

In a sense, academic production is also a process of content creation, and it is naturally affected by AI technology. Academic ecology provides a perspective for understanding this impact. In a broad sense, academic ecology refers to the social ecology, natural ecology, cultural tradition and many other elements related to academics. In a narrower sense, academic ecology refers to the ecosystem of intellectuals as the main body of activities such as complex academic inquiry and scientific experimentation to achieve academic innovation.

Figure 1 illustrates the change of academic ecology from the perspective of “human-machine” relationship. Firstly, AI technology has the ability to output ideas similar to those of researchers, and can become a participant in collaborative production, academic search, and collision of ideas. Second, AI has unprecedented research capabilities. Through the Internet, AI calls on far more knowledge than humans and has an advantage in data collection and writing programs. Finally, AI has the possibility of deep intervention. The use of AI technology is not only limited to academic production, but its use in academic evaluation and academic dissemination can also collect information and capture literature.

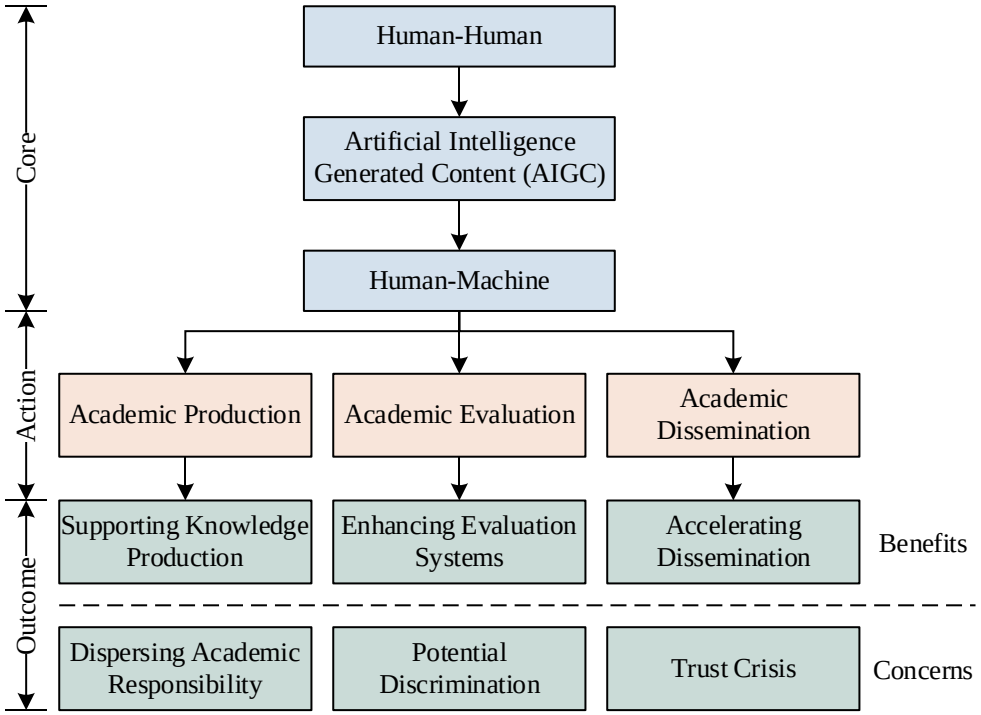

Figure 1: Academic ecosystem reform empowered by AI

In short, the powerful ability of AI provides the possibility for the original academic kernel of "human-human" relationship to "human-machine" relationship, and the change of the kernel relationship brings the change of the action level. From the action level, the impact of AI is mainly focused on academic production, academic evaluation and academic communication, which are the key links in the academic ecology, so the introduction of AI will have an important impact on the academic ecology. Changes at the action level will bring different consequences, which can be divided into two aspects, on the one hand, it is helpful, mainly assisting the production of knowledge, assisting the evaluation system, and accelerating the dissemination. On the other hand, there are concerns, mainly the fragmentation of academic responsibility, potential discrimination, and a crisis of trust.

2.3 Model of academic writing skills development

In order to enhance the academic writing level of business students and better cultivate their academic writing ability, this paper designs an academic writing ability cultivation model that integrates teachers, students and AI, and its specific framework is shown in Figure 2. Under this cultivation model, teachers, students and AI integrate with each other to complete the teaching tasks and achieve the teaching goals, the significance of which is to give full play to the advantages of each participant to optimize the classroom teaching effect.

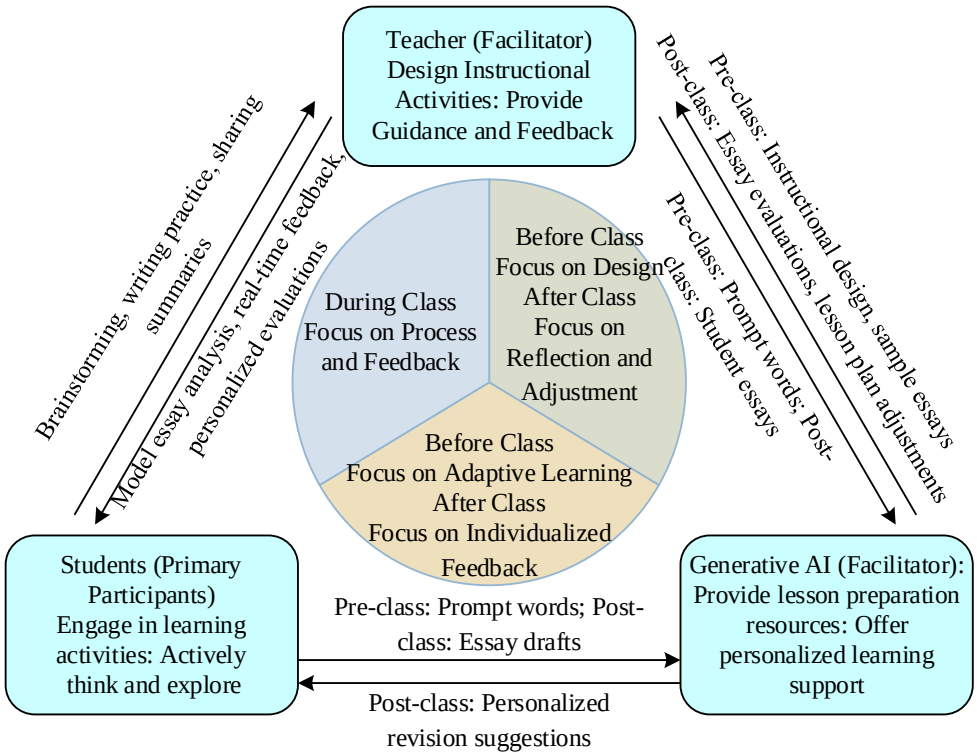

Figure 2: Model for cultivating academic writing skills

In the communion model, the teacher is no longer a knowledge transmitter in the traditional sense, but plays the role of a designer, guide and motivator. Teachers design open-ended writing tasks, gradually guide students' writing, and provide real-time feedback and personalized guidance. In addition, teachers cultivate students' sense of academic integrity by helping them understand the principles and use of AI tools, and explore more fair and objective evaluation methods in order to improve students' learning motivation and promote their writing ability. Under the guidance of the teacher, students learn independently, think independently, and take the initiative to participate in group cooperation and discussion, actively accumulate vocabulary and materials, and carry out writing independently. Students should understand the working principle of AI and make full and reasonable use of the resources it provides to help improve their academic writing ability.AI plays an auxiliary and supportive role, which can not only provide teachers with rich teaching materials, teaching cases and teaching methods, but also provide students with relevant writing materials and references, help students solve the problems in writing, and provide personalized feedback and suggestions. It can also provide students with relevant writing materials and references, help them solve their writing problems, and provide personalized feedback and suggestions.

3 Seq2Seq network-based error correction model for academic writing

Artificial intelligence-driven academic writing aids have been widely used in the academic field in recent years, and with their advanced natural language processing technology, they are able to provide learners with real-time feedback such as grammatical error correction and vocabulary optimization, and even generate content to help them improve their writing efficiency and quality. To this end, this chapter mainly designs a business academic writing error correction model based on fixed-length Seq2Seq networks, aiming to help students correct possible errors

in the academic writing process, so as to improve the academic writing ability of business students.

3.1 Seq2Seq model with BiGRU

3.1.1 Seq2Seq network architecture

The Seq2Seq model is an Encoder-Decoder structured network model for mapping one sequence to another.The learning approach of the Seq2Seq model involves two main processes, firstly, a variable length input signal sequence is converted into a fixed length vector expression in the Encoder, and secondly, a signal sequence of variable length target is generated from this fixed length vector expression in the Decoder. vector expression of fixed length, and secondly in the Decoder, this vector expression is used to generate a signal sequence of variable length for the target.

An Encoder is usually an RNNs that reads each character in the input sequence $X\left(x_1, x_2, \cdots, x_t, \cdots\right)$ in order. As each symbol is read, the hidden state of the RNNs changes according to equation (1). Eventually, after reading to the end of the sequence, the hidden state of the RNNs represents the feature information of the whole input sequence C. i.e:

$$h_t = f\left(h_{t-1}, x_t\right) \tag{1}$$

where h_t represents the hidden state of the RNNs at the current time step t and f is a nonlinear activation function.

The Decoder in the Seq2Seq model is usually also an RNNs, which generates the next character according to the hidden state h_t given by the Encoder, and thus obtains the output sequence. Unlike the Encoder's hidden state update mechanism, the update of h'_m in the Decoder requires not only h'_{m-1} but also relates to y_{t-1} and C with the following update formula:

$$h'_m = f\left(h'_{m-1}, y_{t-1}, C\right) \tag{2}$$

As a result, the hidden state h'_m of the decoder is obtained, and again from the GRU structure, the conditional distribution of the next character can be computed in three parts, h'_m, y_{t-1} and C, viz:

$$P\left(y_m \middle| y_{m-1}, y_{m-2}, \cdots, y_0; C\right) = g\left(h'_m, y_{m-1}, C\right) \tag{3}$$

3.1.2 BiGRU recurrent neural network

The gated recurrent neural network (GRU) uniformly replaces the forgetting gate and input gate of the long and short-term memory neural network (LSTM) with the updating gate, and merges the cell state with the hidden state. In the network structure of GRU model, x_t is the input at the current moment (i.e., moment t), h_{t-1} and h_t are the state outputs of GRU at the previous moment (i.e., moment $t-1$) and the current moment, respectively, $\tilde{h}_t$ is the candidate state at the current moment, and r_t and z_t are the outputs of the reset gate and the update gate at the current moment, respectively.The output of the GRU is computed by the formula:

$$\begin{cases} r_t = \sigma\left(W_r\left[h_{t-1}, x_t\right] + b_r\right) \\ z_t = \sigma\left(W_z\left[h_{t-1}, x_t\right] + b_z\right) \\ \tilde{h}_t = \tanh\left(W_d\left[r_t h_{t-1}, x_t\right] + b_d\right) \\ h_t = (1 - z_t)h_{t-1} + z_t\tilde{h}_t \end{cases} \tag{4}$$

$$\tanh\left(x\right) = \left(e^x - e^{-x}\right)\Big/\left(e^x + e^{-x}\right) \tag{5}$$

where W_r and b_r are the weights and bias of the reset gate, W_z and b_z are the weights and bias of the update gate, W_d and b_d are the weights and bias of the gating unit, and $\sigma(\cdot)$ and $\tanh(\cdot)$ are the sigmoid function and hyperbolic tangent activation function, respectively.

BiGRU overcomes the defect that unidirectional GRU can only process historical state information but cannot combine future information, and strengthens the effect of extracting the original sequence information and improves the accuracy of the model output results by performing forward and backward computation on the time series at the same time.BiGRU consists of a combination of 2 GRUs, and their states together determine the network output. In the BiGRU model structure, the bottom and top nodes represent inputs and outputs, respectively, and in the middle is a 3-layer hidden layer with BiGRU structure.

In the back propagation process, there are $W_1 - W_6$ these 6 sets of weight matrices that need to be constantly updated numerically, of which W_1, W_3 are the weight matrices of the inputs to the forward and backward GRU hidden layers, W_2, W_5 are the weight matrices between the forward and backward GRU hidden layers, and W_4, W_6 are the weight matrices from the forward and backward GRU hidden layers to the output layer, respectively. It can be seen that at each moment, the output of the current unit is obtained by the joint computation of the forward GRU and the backward GRU. Namely:

$$\begin{cases} h_t = f\left(W_1 x_t + W_2 h_{t-1} + b\right) \\ h_t' = f\left(W_3 x_t + W_5 h_{t+1}' + b'\right) \\ o_t = g\left(W_4 h_t + W_6 h_t' + p_o\right) \end{cases} \tag{6}$$

where h_t' is the output of the backward GRU hidden layer at moment t, b, b' and p_o are the biases, o_t is the neuron output at moment t, $f(\cdot)$ and $g(\cdot)$ are the activation functions, and in this paper, we choose the hyperbolic tangent function and the SoftMax function, respectively, and the SoftMax function can be expressed as:

$$g(x) = \frac{e^{x_d}}{\sum_{d=1}^{N} e^{x_d}} \tag{7}$$

where x_d is the d th element of the N -dimensional vector x.

3.2 Intelligent Error Correction Model for Academic Writing

3.2.1 Luong Attention Mechanism

Attention mechanism is used to pay attention to what important information in the output sequence at the current moment, and then calculate the contextual semantic vector at that moment based on the important information.Luong Attention mechanism is an improved mechanism based on Bahdanau Attention, which is more reasonable in the calculation of the alignment function, and provides a variety of alignment functions. By adding Luong Attention mechanism to solve the problem that traditional Seq2Seq model is difficult to accurately capture the important information in long text sequences, the core logic of the mechanism is to focus the limited attention on the important information, and quickly capture the most critical information.

This is done by making the semantic encoding c of the input sequence in the traditional Seq2Seq model become no longer fixed, but instead, a vector c_t is computed for the output at each moment, and this contextual semantic encoding vector represents the degree of importance between the output at the current t moment and the input word at position j, which is computed as the mathematical expression:

$$c_t = \sum_j a_{tj}^T h_j \tag{8}$$

The encoder part of the Seq2Seq model incorporating Luong's attention mechanism uses a bidirectional gated loop unit to compute the hidden layer state $h_1 \sim h_7$ of the encoder, where the hidden state at each position contains the before and after information for that position. At the decoding end a unidirectional homogeneous neural network is used, and for the output of the current moment t, the degree of correlation between the output of the decoded position i and the input of the position j is measured by calculating an alignment function $a_t(s)$, again as in Eq. a_{tj} above. computed as:

$$a_t(s) = align\left(h_t, \bar{h}_s\right) = \frac{e^{score(h_t, \bar{h}_s)}}{\sum_{s'} e^{score(h_t, \bar{h}_s)}} \tag{9}$$

The hidden state of decoder position i and the hidden state of encoder position j are needed for the computation. Eq. (10) demonstrates the three computations of alignment scores provided by Luong Attention, which are dot product computation dot, weighted dot product computation general, and sum computation concat, where general is more often applied in research.

$$score\left(h_t, \bar{h}_s\right) = \begin{cases} h_t^T \bar{h}_s \\ h_t^T W_a \bar{h}_s \\ v_a^T \tanh\left(W_a \left[h_t^T, \bar{h}_s\right]\right) \end{cases} \tag{10}$$

In fact, the most critical part of the attention mechanism is how to compute different semantic coding vectors for the inputs at each moment c_t, which is used to prompt the outputs at the current moment to pay attention to which important information in the input sequences,

and then generate the appropriate outputs based on the important inputs to pay attention to.

3.2.2 Intelligent Error Correction Modeling Framework

In order to better cope with the conditions of disorganization, grammatical errors, and missing words faced by the task of intelligent error correction for academic writing in business, the traditional variable-length Seq2Seq model is skillfully transformed, and a model of intelligent error correction for academic writing that incorporates a fixed-length Seq2Seq network is proposed, and its specific structure is shown in Fig. 3. The modified academic writing intelligent error correction model contains a total of core modules such as input, hybrid vector coding, encoder, attention weighting and vector computation, decoder and output. In order to ensure that the input sequences and output sequences of the whole Seq2Seq network are in a constant-length state, the lengths of the input sequences corresponding to different error types are skillfully and uniformly designed.

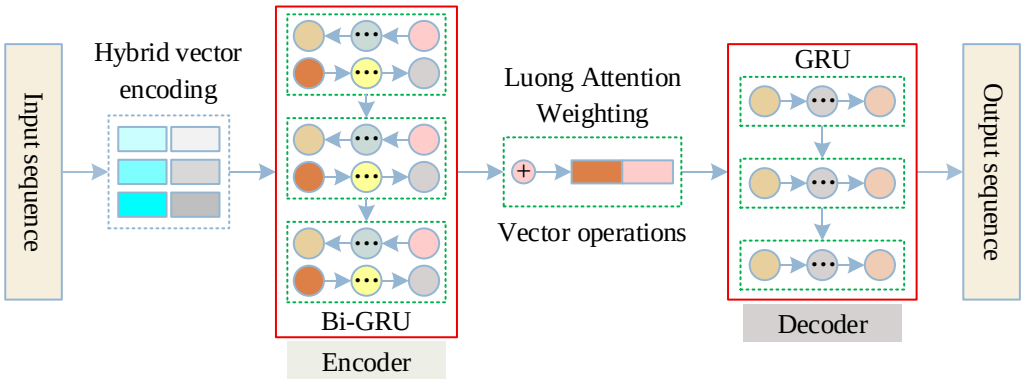

Figure 3: Intelligent error correction model framework

In the input and output modules, the length of the sequence is uniformly set to a constant length state of 6 characters. According to the different types of errors, considering that the input layer has four possible cases of disorder, grammatical error, missing word and correct, respectively, the model will automatically add the * sign to the position of the missing word to make up the length for the missing word when constructing the input sequences, so as to ensure the total length of all the input sequences. Then into the hybrid embedding layer, it should be noted that the input sequences may have disordered order, grammatical errors, missing words, and some of the sentence formulas will contain some correct words, which is significantly different from the traditional pre-training language model in which only the sentence text with completely correct order is used as input. The hybrid vector coding module will design a more effective hybrid embedding method of coexisting characters and words by combining the characteristics of the sentence form, and represent the input sequence into the corresponding vector form. Then, all the independent characters or words obtained after the input sequence is disambiguated are represented as corresponding numerical vectors using the bag-of-words model, thus completing the hybrid embedding representation of the whole feature. Then, these vectors are input into the encoder and the 3-layer BiGRU network is utilized to complete the vector encoding. Combined with Luong's attention weighting mechanism, the vectors are weighted and computed and then input to the decoder for decoding, in which a 3-layer unidirectional GRU network is used and combined with the Beam search strategy to generate the output sequence. Through the modified fixed-length Seq2Seq network academic writing intelligent error correction model can be compatible with different types of errors at the same time, and realize unified and efficient intelligent error correction.

4 Analysis of the application of error correction and developmental practices in business academic writing

Academic writing, as a carrier of knowledge output and dissemination, is a complex and challenging cognitive activity. How to better improve students' academic writing ability is an important research content to promote the development of scientific research. Based on this, this paper establishes an academic ability cultivation model integrating teachers, students and AI, and designs an intelligent error correction model for academic writing based on fixed-length Seq2Seq network to better enhance the academic writing ability of business students.

4.1 Validation of the Academic Writing Error Correction Model

4.1.1 Model Error Correction Performance Comparison

In order to verify the effectiveness of the model in this paper, a series of experiments are conducted on the NLPCC 2018 dataset. Since the incorrect sentences in the dataset may contain multiple corresponding correct sentences, this paper first constructs a parallel corpus with one-to-one correspondence between the source utterances and individual correct utterances. A total of 30,000 sentences were obtained in this way, and then 8,000 sentences were randomly sampled from the training corpus as a validation set. The model uses positional coding information, the probability of dropout of the parameters during model training is 0.05, the Adam optimizer is used and the initial learning rate is set to 0.002.

In order to verify the effectiveness of the model, this paper adopts precision rate, recall rate and F0.5 value as evaluation indexes, selects multiple baseline models and combined models to carry out the verification, and obtains the experimental results of different models on the NLPCC 2018 dataset as shown in Figure 4. From the experimental results, it can be seen that the performance of the intelligent error correction model for academic writing designed in this paper is better than all the individual baseline models, and the model in this paper outperforms all the comparative models, achieving an $F_{0.5}$ value of 38.81%, which is an improvement of 8.83 percentage points compared to YouDao, and an improvement of 9.66 and 8.09 percentage points compared to the Seq2Seq model and the BiGRU model respectively and 5.18 percentage points compared with the Seq2Seq+BiGRU model. These experimental results validate the effectiveness of this paper's model based on fixed-length Seq2Seq networks on the task of intelligent error correction in academic writing grammar.

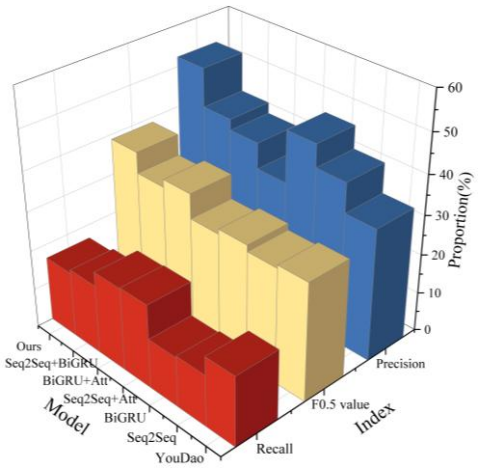

Figure 4: Experimental results of different models

In addition, validation is also carried out for the convergence speed of the model in this paper. For the convergence speed of the model, this paper chooses the perplexity level (PPL) as the evaluation index, which is an index used to measure the goodness of the model. Figure 5 shows the comparison results of the model convergence speed. As can be seen from the figure, the Seq2Seq+BiGRU model converges faster compared to the model in this paper, but the final training perplexity is slightly higher than the model in this paper. It is hypothesized that because of the lack of attention mechanism in the model, it is unable to effectively extract fine-grained error information in academic writing sentences, and although the convergence speed is faster, the overall error correction ability is significantly lower than that of this paper's model. Therefore, the model in this paper has a higher perplexity degree of error correction effect under the circumstance of ensuring a smaller variation of convergence speed, which can provide intelligent guidance for the cultivation of academic ability.

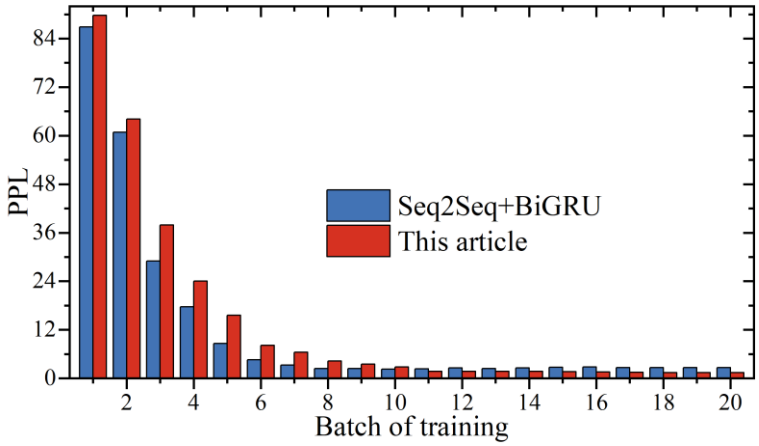

Figure 5: The comparison results of the convergence speeds of the models

4.1.2 Corrective Recall for Academic Writing

Based on the results of the model's academic writing error correction performance comparison in Section 4.1.1, this paper's model is further employed with the Seq2Seq+BiGRU model for type-by-type grammatical error correction on the NLPCC 2018 dataset. Table 1 shows the comparison results of error recall for type-by-type grammatical error correction during academic writing. As can be seen from the table, compared to the Seq2Seq+BiGRU model, the performance of this paper's intelligent error correction model for academic writing based on fixed-length Seq2Seq network is significantly more. Because the model designed in this paper is more accurate in the intelligent correction of academic writing, the model in this paper occupies a great advantage in the $F_{0.5}$ value index when compared with other models. The academic writing intelligent error correction model constructed by relying on intelligent technology can significantly find the errors existing in the process of students' academic writing, so as to help students optimize the content of academic writing and enhance their academic writing ability.

Table 1: Error correction recall comparison results

Error type	Seq2Seq+BiGRU	This article
Articles or determiners	223.41	45.68
Spelling, punctuation, capitalization, etc	16.59	25.17
Number of nouns	38.79	58.71
Noun possessive	12.06	23.28
Pronoun form	15.14	15.19
Reference to prepositional pronouns	2.49	8.92
Preposition	17.53	36.45
Redundancy	6.92	21.64
Sentence fragment	0.06	24.06
Hanging modifier	0.05	0.00
Similar	11.15	0.00
Connecting sentences, commas concatenated	0.07	0.00
Clause	5.74	4.51
Subject-verb agreement	36.83	56.72
Convert conjunctions/phrases	4.89	11.14
The meaning is not clear	0.05	0.00
Lack of verbs	17.81	38.34
Verb form	31.42	44.89
Verb modality	6.59	6.26
Verb tense	11.34	17.68
Acronym	0.06	0.00
Acronym Incorrect collocations/idioms	4.51	5.64
Word format	37.54	27.65
The order of adjectives/adverbs is incorrect	14.62	40.13
Word order error	2.87	7.83
Tone (formal/informal)	4.45	0.00
Other errors	1.64	0.00

4.2 Academic Writing Skills Development for Business

4.2.1 Subjects and research instruments

The subjects of this study were 60 students in a third-year English academic essay writing class for English majors at a university to clarify the changes in students' attitudes toward AI-assisted academic writing and their academic writing abilities before and after the use of different teaching models. This course was based on a previous English basic writing class, which was held twice a week for 45 minutes each time, and students were required to complete writing tasks independently outside of class every week.

On the first day of the course, students were informed that the course would be taught using an AI-based model of academic writing development, including the aspects of the previous design model. Students submitted weekly assignments based on their progress through the course, and the instructor corrected and provided feedback in the form of comments, questions, crosses, underlines, etc., which were then returned to the students for revisions, and in some cases, the feedback was presented verbally in class. Teachers sometimes use direct feedback and sometimes indirect feedback. When students did not understand the correct and appropriate form, content, or organization of language, the teacher explained it in class or asked students to discuss it with the teacher after class. Students then make revisions based on the feedback

provided by the instructor and submit the revisions to the instructor along with a previous draft, and the instructor checks the revisions made by the students in response to the corrective feedback. The course covers an overview of English academic essays, how to write an essay, and practice in writing essays in different styles, such as description, explanation, comparison **-** contrast, cause and effect, and argumentation. Final grading is based on the writing assignments students complete each week, including the final draft and all previously corrected drafts.

This study used a questionnaire to collect data, mainly including students' attitudes toward AI-assisted academic writing (including 10 survey items, i.e., Q1~Q10) and the number of people who used AI-assisted academic writing behaviors. The questionnaire passed the reliability test, and the questionnaire was quantified by a five-level Likert scale (L1~L5), and the questionnaire was distributed at the end of the teaching, and a total of 60 questionnaires were distributed this time, and 60 questionnaires were validly recovered, and statistically in order to make it clear the validity of the mode of cultivating the academic writing ability of business based on the assistance of AI.

4.2.2 AI-assisted academic writing attitudes

At the end of the teaching practice, a survey was conducted to investigate students' attitudes toward AI-assisted academic writing. Based on the data obtained from the questionnaire, the statistical results of students' attitudes toward AI-assisted academic writing were obtained as shown in Figure 6.

This study found that more than 93% of the students indicated that the AI technology-assisted academic writing training mode in business helps to improve the quality of academic writing. Specifically, more than 83% of students believed that it helped in business academic writing conceptualization, more than 86% believed that it helped in academic content writing, and more than 83% believed that it was helpful in refining academic language expression and revising academic research plans. Nearly 84% of students indicated that they enjoyed co-writing business academic articles with AI technology and that it was easier to co-write with AI technology than to write an academic plan alone. More than 80% of the students expressed their willingness to actively integrate into the business academic writing training model to better enhance their business academic writing skills, and more than 80% of the students were surprised by the performance of business academic writing supported by AI technology, and believed that the use of AI technology could promote their better grasp of academic writing to enhance their academic writing skills.

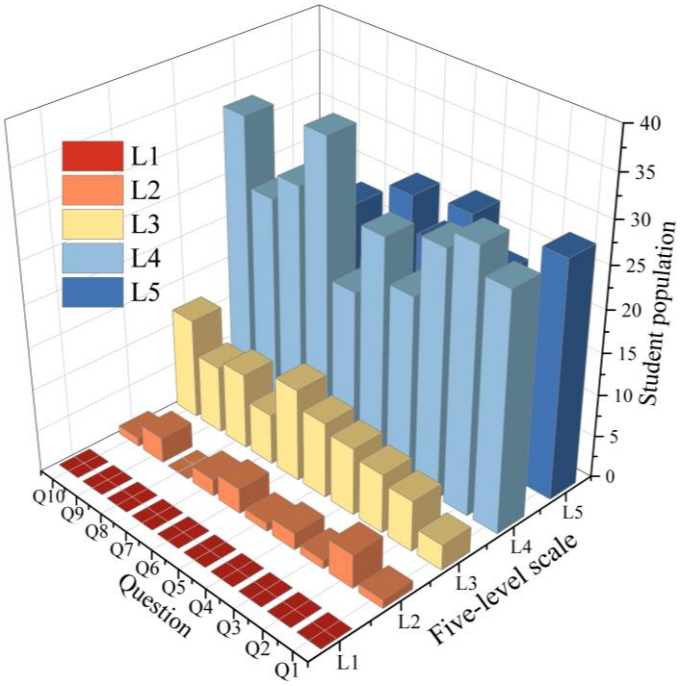

Figure 6: Ai-assisted academic writing attitude

4.2.3 Using AI to Assist Writing Behavior

After clarifying the students' attitudes towards the AI-enabled academic writing training model in business, this paper further analyzes the students' behaviors in using AI-assisted academic writing, and its specific results are shown in Table 2, where * and ** indicate P<0.05 and P<0.01, respectively.

Further analysis of the sample of students who had used AI technology to assist with academic writing in business found that both male and female students chose “other research work (e.g., coursework)” as the highest percentage of text types for assisted writing, 85.96% and 65.97%, respectively, and the difference between the two was significant (Chi-square=9.276, P<0.05). In addition, the percentage of female students who chose “journal paper” (43.53%) was significantly higher than that of male students (21.67%), and the difference reached a highly significant level (Chi-square=34.638, P<0.01). This indicates that most of the students who use AI tools to assist their academic writing use them for research work other than journal papers and dissertations, and this is especially true for male students. Meanwhile, female students use it more than male students for journal paper writing.

In terms of the types of content for writing assistance, “translating/correcting the language presentation of the paper” and “searching for information related to the research topic” were the highest among both boys and girls, and the proportion of girls choosing “translating/correcting the language presentation of the paper” (83.42%) was higher than that of boys (65.38%) (Chi-square=10.694, P<0.01). The percentage of female students who chose “translate/correct the linguistic presentation of the paper” (83.42%) was higher than that of male students (65.38%), and the difference reached a significant level (Chi-square=10.694, P<0.01). In addition, a higher percentage of male students (38.15%) than female students (21.14%) chose “building a research framework”, and the difference also reached a significant level (Chi-square=9.835, P<0.01). This indicates that most of the students who use AI tools to assist business academic writing use them to translate/correct the text and search for information, while female students use them more than male students to translate/correct the text and male students use them more than female students to build a research framework.

Table 2: Use AI to assist in writing behavior

Variable		Male/%	Female/%	Chi-square test
Text type of writing	Degree thesis	18.45	12.18	1.541
	Journal article	21.67	43.53	34.638**
	Other scientific research work	85.96	65.97	9.276*
Content type of writing	Search for materials related to the research topic	53.27	46.06	2.173
	Build a research framework	38.15	21.14	9.835**
	Conduct research design	12.43	7.45	1.548
	Analyze data and write code	15.64	16.73	0.127
	Translate/Polish the language expression	65.38	83.42	10.694**

4.2.4 Changes in academic writing skills

For the change of academic writing ability of business students, this paper tests seven dimensions, including critical thinking ability, creative thinking ability, problem solving ability, self-regulation ability, human-computer collaboration ability, metacognitive ability and computational thinking ability. The tests were conducted before and after the teaching experiment, and the data were counted and then subjected to independent samples t-test, and their specific results are shown in Table 3.

As can be seen from the table, for the academic writing ability of business students, the total score of students' academic writing ability reached 28.16±0.39 points after the teaching practice, which increased by 11.68 points compared with that before the teaching practice, and the t-test of independent samples showed an extremely significant difference ($t=9.586$, $P=0.000<0.01$). Among them, the overall improvement of students' creative thinking ability was the greatest, and its score increased from 1.96±1.34 points before the teaching experiment to 4.31±0.83 points after the experiment, with an overall improvement of 119.90% and an extremely significant difference ($t=6.325$, $P=0.000<0.01$). Therefore, with the support of the business academic writing ability cultivation model empowered by AI technology, students' academic writing ability can be significantly enhanced, which further enhances students' inspiration in the academic writing process and promotes students to get stronger academic writing quality.

Table 3: The changes in academic writing ability

Dimension	Test	Score	*t*	*P*
Critical thinking ability	Before	2.27±0.75	2.982	0.015*
	After	3.05±0.28		
Creative thinking ability	Before	1.96±1.34	6.325	0.000**
	After	4.31±0.83		
Problem solving ability	Before	2.43±0.61	7.134	0.002**
	After	4.25±0.37		
Self-regulation ability	Before	2.58±0.95	2.158	0.024*
	After	3.39±0.42		
Man-machine ability	Before	2.12±0.71	8.487	0.001**
	After	4.17±0.35		
Metacognitive ability	Before	2.33±0.49	6.632	0.000**
	After	4.38±0.27		
Computational thinking ability	Before	2.79±0.72	7.493	0.002**
	After	4.61±0.45		
Total score	Before	16.48±0.86	9.586	0.000**
	After	28.16±0.39		

5 Conclusion

Based on the establishment of the AI-enabled business academic writing ability cultivation model, the article introduces an intelligent error correction model of academic writing with fixed-length Seq2Seq network, and carries out a validation analysis of the effectiveness of the model as well as the practical effect of the cultivation mode. The $F_{0.5}$ value of the intelligent error correction model reaches 38.81%, which is 5.18 percentage points higher than that of the suboptimal Seq2Seq+BiGRU model, and the students' academic writing ability is significantly improved under the business academic writing ability training model. Therefore, relying on AI technology can help business students better increase the level of grasping academic content, thus promoting the quality of students' academic writing.

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