

A Study on the Well-being of English Majors in the Age of Artificial Intelligence — The Application of DeepSeek from the Perspective of PSHACME

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Abstract. With the application of generative artificial intelligence in educational and teaching activities, although learning efficiency has been improved, it has also caused an imbalance in learners' emotional experience and well-being. This paper adopts a longitudinal case tracking method, selecting four university English majors as participants. From 2021 to 2024, a mock training for the Test for English Majors-Band 4 (TEM-4), learning journals and feedback provided by AI (DeepSeek) were conducted every year to analyze the changes in their learning effects and well-being. Based on the EMPATHICS well-being theory of positive psychology, this paper proposes a three-stage development process of "Psychological Support - Human-Computer Collaboration - Metacognitive Empowerment", namely the PSHACME model. The first stage guides students' learning based on Rebecca L. Oxford's EMPATHICS model to meet their basic psychological needs; the second stage uses human-computer collaboration to help students overcome learning anxiety and improve their information technology skills; the third stage develops students' metacognitive abilities and sense of learning control by marking their errors, recording data and displaying trends. In this process, students' well-being has been greatly enhanced, that is, they have gained more psychological support, a lower level of learning anxiety and a stronger sense of learning control, thus promoting their language acquisition and the increase of well-being as a whole. This paper introduces the positive effects of generative artificial intelligence represented by DeepSeek on language learning, as well as its guiding significance for English learners in choosing personalized development paths and improving well-being.

Keywords: Generative Artificial Intelligence, PSHACME Model, English Majors, Well-being, DeepSeek

1. Introduction

AI represented by DeepSeek has developed rapidly since its launch, and it is an irresistible trend for AI to promote educational reform [1], playing a significant role in foreign language teaching. For English majors, their well-being has attracted increasing attention due to academic pressure, academic competition and employment anxiety. However, there is still a lack of sufficient and systematic empirical research on how to improve learners' well-being with the help of AI.

Domestic research on the well-being of English learners mostly focuses on psychological and social support. Positive emotions and good teacher-student and peer interactions are conducive to improving the well-being and learning enthusiasm of English learners [2,3]. From the perspective of the application of generative AI, the more popular topics in the field of education include personalized guidance for students' writing by ChatGPT [4], AI's simulated communication and interaction for students' oral English and reading [5,6], and intelligent systems such as EduAITutor helping students customize personalized plans [7]. In addition, some experts point out that teachers lack necessary AI knowledge, have over-reliance on technology and the various problems arising therefrom [8,9]. In general, domestic scholars have noticed the possibility of generative AI improving learning efficiency and well-being, but its long-term impacts and adaptability to Chinese culture need further discussion.

Foreign scholars' research on the application of generative artificial intelligence in education involves multiple perspectives, such as providing educational support for different groups [10] and designing personalized learning programs for the adult development of college students [11]. In addition, policies and teachers' AI literacy are also the focus of attention [12,13]. In the research on well-being, Dewaele [14] holds that students' emotions and teacher-student communication in foreign language classrooms (such as whether teachers give timely feedback to students and whether students can cooperate effectively with each other) have a great impact on students' willingness to communicate in a foreign language. Moreover, teachers' personality traits, non-judgmental evaluation methods and the use of AI-assisted learning can greatly improve students' well-being [15,16]. On the whole, foreign research attaches importance to the combination of theory and practice, and studies the changing process of well-being under the influence of cross-cultural contexts and information technology.

At present, relevant studies at home and abroad have explored the application of generative artificial intelligence in education and its impact on the well-being of English learners, but most of these studies are carried out independently, lacking research combining AI technology with learners' well-being. Furthermore, existing studies mostly focus on teaching effects or psychological mechanisms, while ignoring the lasting impacts of AI on alleviating anxiety, stimulating motivation and improving well-being, as well as their internal causes.

A highlight of this paper is the systematic combination of generative artificial intelligence technology with the well-being of English learners in the research. By adopting the longitudinal case tracking method and combining the concepts of positive psychology and human-computer interaction, it proposes a three-stage PSHACME model. The study finds that artificial intelligence can effectively reduce anxiety, increase the sense of control and well-being, and also provides insights into how to better design personalized learning programs to improve students' well-being.

This paper adopts the PSHACME model for research, which is conducive to a comprehensive discussion of the impact of AI on learners' well-being. The first part of the PSHACME model is "Psychological Support", which is based on the EMPATHICS well-being framework proposed by Oxford, including empathy, positive emotions, motivation, self-regulation and other aspects, providing students with emotional and cognitive support in the process of English learning. This part focuses on solving learners' basic psychological problems, enabling them to have a sense of security and good expectations in learning. The second part is Human-Computer Collaboration, which adds generative AI on the basis of psychological support, such as the timely feedback and rich learning materials provided by DeepSeek. The application of AI can not only guide students to find and correct their own language errors, but also alleviate the pressure caused by uncertainty and lack of relevant knowledge, allowing students to improve their technical abilities while acquiring

knowledge. The third part is "Metacognitive Empowerment", that is, using AI to classify and summarize students' errors, count their frequencies and put forward corresponding suggestions, so that students can reflect on their learning process, identify their strengths and weaknesses and thus make improvements. This enhances students' sense of control and self-confidence in learning, enabling them to independently adjust their emotions and learning methods, thereby greatly improving their well-being.

This paper adopts a longitudinal case study method, selecting four English majors from universities (marked as A, B, C and D respectively) as participants, and conducting analysis on the basis of doing real test papers of TEM-4, keeping learning journals and receiving feedback from DeepSeek. A total of four students participated in this experiment, and each student was required to complete three sets of real TEM-4 test papers of the past three years in a row. Afterwards, researchers used DeepSeek to grade the students' test papers and put forward suggestions. This process of "independent completion of test questions - DeepSeek intervention" was used to observe the changes in the participants' listening, reading and writing abilities and record their experiences. Then a phased test was conducted with the 2024 TEM-4 real test papers, which were completed independently by students and evaluated by AI to test the effect of the previous stage. In the repeated process of "examination - feedback - reflection", the study demonstrates the promoting effects of psychological support, human-computer collaboration and metacognition step by step, and finally draws conclusions on the impact of AI participation on the well-being of English majors and the enlightenment for education.

2. Psychological support

EMPATHICS is a concept put forward by Rebecca L. Oxford, an American expert in language education, which illustrates the main psychological elements in the process of supporting learners to achieve good well-being, accelerate learning speed, improve language ability and enjoy learning. This model holds that language learning is a cognitive process as well as a result of the combined action of emotional responses, motivation, social influences and other factors. By paying attention to learners' emotions, helping them develop good habits and learn self-control, both teachers and students can better promote language learning and increase students' well-being and enthusiasm for learning. Each letter in the EMPATHICS model represents the following key components: E: Emotion and Empathy; M: Meaning and Motivation; P: Perseverance, which includes resilience, hope and optimism; A: Agency and Autonomy; T: Time; H: Hardiness and Mental Habits; I: Intelligences; C: Character Strengths; S: Self Factors.

"Emotion" refers to personal feelings in the learning process, including positive and negative emotions, and "Empathy" means the ability to understand others' feelings and thoughts and resonate with them in language learning. For English majors, if the classroom and learning atmosphere can bring positive emotions, they will be more willing to learn and feel happy; if they can establish connections with peers, teachers or people from different cultural backgrounds through empathy in the learning process, they will have a stronger sense of belonging and being supported, and thus feel happier. The concept of meaning is significant because those individuals that feel that they have a sense of meaning or purpose in their lives are happier, better off, and more satisfied with life, and are more involved in their work [17]. Motivation is that which we are aware of as a cumulative arousal, or want... meaning cannot be separated from motivation because the aim has to be meaningful to the person to motivate him/her [17]. When English-major students perceive studying English as highly relevant to their future prospects or personal objectives, they are more likely to find learning more motivating and satisfying. Intrinsic motivation is generally more associated with

positive emotions and lasting well-being because students can derive pleasure from the learning process. "Perseverance" is defined as the act of continuing to do something or accomplish something despite difficulties, failures or opposition [17]. "Perseverance" enables English majors to actively participate in learning despite employment pressure and language barriers, and gain more learning well-being in the process of solving these problems. "Agency" means that learners independently participate in their own learning and can control and influence their learning. "Autonomy" refers to learners making choices according to their own interests and needs in learning, and being able to conduct self-regulation and self-management. This makes students feel that learning English is a free choice, thus helping to stimulate their motivation, giving them a sense of control and further improving the pleasure of learning. "Time" refers to the time spent on learning, the mastery and patience of time. It requires long-term learning and reasonable arrangement rather than achieving success overnight. Proper time management and long-term efforts enable English majors to continuously improve their English proficiency while maintaining a good balance between work and life, thus feeling happy. Hardiness refers to the psychological resilience and the ability to withstand setbacks in the face of difficulties, pressure and challenges. "A 'Habit of Mind' is a composite of many skills, attitudes, cues, past experiences, and proclivities [17]." English majors will encounter various problems in the process of learning English, and hardiness and a positive way of thinking can make them regard problems as an opportunity for development rather than an obstacle, constantly find a sense of achievement and pleasure in learning, and thus improve their satisfaction. "Intelligences" refers to the different types of intelligence demonstrated by learners in the learning process, not just linguistic intelligence. "Intelligences" enables English majors to participate in learning in different ways, give play to their respective strengths, improve their self-confidence and learning enthusiasm, and thus increase their well-being. In the part of "Character Strengths", "Language learners with high well-being possess various 'character strengths' which assist them both academically and personally [17]." The well-being of English majors is not only a matter of academic performance, but also related to personality. When they show qualities such as perseverance, curiosity and self-discipline, they can learn better and have more positive emotions, good interpersonal relationships and personal a sense of achievement. In the part of "Self Factors", "Language learners with high well-being have self-efficacy, positive self-concept, and high self-esteem, and use self-verification positively [17]." Self Factors mean that the well-being of English majors comes from their own inner world. A positive self-concept and a high sense of self-efficacy make them full of confidence and motivation in learning, thus feeling happier. On the contrary, self-denial or the inability to self-regulate may cause anxiety and a decline in well-being. Therefore, the nine aspects proposed by EMPATHICS have comprehensive guiding significance for understanding the well-being of English majors in universities, and the research experiment carried out on this basis also has a clear direction. Moreover, the psychological problems of these four students at the beginning of learning exactly correspond to the lack or imbalance of a certain aspect, thus facilitating follow-up tracking surveys and assistance.

The initial states of the four students are as follows: Student A was in an anxious state, experiencing a high level of anxiety before and after exams, worrying about poor grades, having unstable emotions, lacking self-confidence, often thinking that he was "incompetent" and suffering from serious damage to self-esteem; Student B was in a confused state, unclear about the purpose of learning and the meaning of learning English, and learning more out of external pressure; Student C was in an impulsive state, with great enthusiasm for learning but volatile emotions and difficulty in persevering. He occasionally had the idea of self-study but lacked executive ability, always making plans but failing to put them into practice; Student D was in a perfectionist state, with tense

emotions and fear of making mistakes. Even a small mistake would make her very upset. She could study, but was often exhausted due to the pursuit of perfection; her study plan was tight without proper relaxation, making her easy to feel tired; in addition, she had high expectations of herself, resulting in low self-confidence and wavering between perfectionism and self-denial.

Student A's problems were pre-exam anxiety, low self-efficacy and damaged self-esteem, which were related to "Emotion" and "Self Factors". Student A needed to adjust emotions and establish a correct self-concept to cope with the anxiety caused by TEM-4 pressure; in terms of "Perseverance" and "Hardiness", Student A needed to enhance frustration tolerance and perseverance, and overcome the fear of making mistakes by doing a large number of mock questions. Student B's problems were lack of a sense of purpose, externalization of goals and severe procrastination, related to "Meaning and Motivation". Student B should recognize the purpose of learning, regard TEM-4 as a ladder for academic progress and future career rather than just the expectation of the family. In terms of "Time", she needed to improve the concept of time and form the habit of arranging time reasonably. Student C's problems were willfulness, inconsistency in learning and lack of executive ability. In terms of "Perseverance" and "Time", Student C needed to develop a persistent and organized learning method in the preparation for TEM-4; in terms of "Agency and Autonomy", he needed to truly take the initiative to learn and turn "making plans" into "putting them into practice". As for Student D, her problems were being exhausted and anxious due to overemphasis on details. In terms of "Emotion" and "Hardiness", Student D needed to learn to accept failure and regard the errors in the TEM-4 real test papers as an opportunity for progress rather than a reason for "self-blame". In terms of "Time" and "Habits of Mind", she needed to reasonably plan review time, ensure sufficient rest while learning, form good learning and reflection habits to prevent overwork; in terms of "Meaning", she needed to re-examine the significance of TEM-4, regarding it not merely as a criterion for measuring perfection, but as an opportunity to improve her professional knowledge level. These points, corresponding to the psychological needs based on the EMPATHICS model, are the basic conditions for improving English majors' satisfaction with TEM-4 preparation. Only when their psychology is in a good state, with clear goals, a regular life and appropriate values, can they obtain a pleasant experience in the process of TEM-4 review, rather than distress, confusion or excessive pressure. In other words, the satisfaction of these psychological needs can improve learning efficiency, and enable students to make continuous progress and gain a sense of achievement in the process of "examination - feedback - reflection", thus increasing the pleasure of learning.

The first stage uses the EMPATHICS model to solve the psychological problems of English majors in the process of TEM-4 review, alleviating their emotions, cognition of the meaning of learning, self-efficacy and time management to a certain extent, thus generating positive psychological support and learning motivation. Moreover, it also makes students feel an improvement in well-being in the learning process, and enter the next link with clearer goals, more stable emotions and higher self-efficacy, laying a good psychological and theoretical foundation for the subsequent development of "AI intervention and human-computer collaboration".

3. Human-computer collaboration

In the second stage of improving well-being, this paper attempts to add a learning method of "human-computer collaboration", integrating the AI tool DeepSeek into students' daily review. Its functions in students' TEM-4 learning are as follows: First, in terms of "error analysis of wrong answers", it can provide students with timely feedback, pointing out not only the wrong answers but also the reasons and problem-solving ideas, enabling students to master knowledge on the basis of

understanding; Second, in "text correction" and "writing improvement", DeepSeek can evaluate students' compositions from the aspects of grammatical correctness, textual fluency and idiomaticity and put forward suggestions. Third, in the "growth trajectory" during the learning process with DeepSeek, it can track students' performance in listening, speaking, reading and writing, mark the types and frequencies of errors, and display them to teachers in specific forms. On this basis, researchers can also visualize these contents to facilitate the observation of students' progress process. Such a method of "timely feedback - dynamic recording - continuous improvement" enables students to achieve a higher level of cooperation with human teachers with the help of artificial intelligence, while improving learning effects and alleviating to a certain extent the troubles and frustrations caused by low efficiency and lack of targeted training.

Student A's problems were mainly related to emotion and self-efficacy, especially in the TEM-4 listening test. He often felt anxious due to the fear of failure, which distracted him and affected his exam results. In the 2021 listening real test papers, in the Conversations section, Student A was so nervous during the listening that he could not remember important information. He had already decided that he would answer the questions wrong before seeing the options, and missed the frequency-related word "At least ten" mentioned in the listening script due to excessive anxiety, thus failing to correctly answer the first question "Has the woman had any interviews before?". Student A wrote in his learning journal:

When I did the listening real test for the first time, I was so nervous that my palms were sweaty, and I panicked as soon as I heard the recording, so I left half of the questions blank. But later, I listened to the recording without thinking about the exam, and I found that it was not that I could not understand, but that I was too nervous to concentrate.

With the auxiliary grading of DeepSeek, after he finished the listening questions every time, he could not only see whether the answers were right or wrong, but also get comparative feedback on the sentence-by-sentence listening script. For example, AI would mark the sentence where the correct answer was located and highlight the key words in it, which helped him understand which key information was ignored during the listening process. DeepSeek would summarize Student A's listening wrong questions and question types, and on this basis, Student A further analyzed his error patterns and gradually realized that he often lost concentration at the first sentence due to anxiety, thus leading to the disconnection of the whole paragraph of information. After several rounds of cyclic training, he began to regard listening errors as objective phenomena that could be tracked and corrected, rather than a negation of his own ability. After three rounds of real test training, Student A's psychological state changed significantly:

With the help of DeepSeek, I am much more relaxed in listening than before. I no longer feel nervous at the beginning, but focus on the content of the questions from the start. I will remind myself to pay attention to numbers, time and transition words even if I am nervous, so as not to ignore important parts.

Student B's main problems were lack of a sense of meaning, externalization of motivation and poor time management ability, often being perfunctory in learning due to procrastination. She was prone to feel irritable when doing TEM-4 reading exercises. In the three multiple-choice reading comprehension questions in the Reading Comprehension section, she wanted to give up after reading one or two sentences, thinking that it was unnecessary to read carefully. For Question 42 in the 2022 reading section, "Which of the following does NOT fit the description of the family's dream house?", Student B only skimmed the superficial content of the article impatiently and failed to carefully find the information points required by the question; moreover, she often thought that "doing the questions is just a formality", quickly lost interest and ignored important information, and

finally chose an option that "fits the description of the family's dream house". After the participation of DeepSeek, Student B's reading attitude changed: after finishing each reading question, AI would provide the answer and tell the relationship between the article and academics, culture or life, which made Student B realize that learning English is valuable. Instead of glancing at the article hastily as before, she now reads the whole article first, then finds the corresponding position according to the question and marks the important sentences and conjunctions with a pen. For the content she is not familiar with, she will think about the impact of this content on real life. For example, when reading an article about environmental protection, she would think about the current global warming problem and consult relevant reports and materials. With the formation of this habit, she has changed from reading for "completing tasks" to reading for "exploring meaning", gaining more initiative and a sense of achievement in the process of TEM-4 practice. In the 2023 real test practice, Question 46 in the reading section was the same type of question as in 2022: "Which of the following is NOT mentioned as a requirement for a wildlife photographer?". After several times of AI guidance, Student B was no longer so careless in reading, could read each paragraph carefully and accurately find the position of the answer, and then rarely made mistakes when encountering similar questions. She no longer regards TEM-4 as an external requirement, but as a challenging task with a sense of satisfaction and well-being.

Student C's main problems were lack of perseverance and difficulty in implementing self-planning. He had high learning enthusiasm but was often unable to persist for a long time, prone to inconsistency in learning and eager for quick success. He always made plans but failed to put them into practice. This problem was particularly prominent in the writing practice of TEM-4:

I would stop writing halfway, feeling that there was no need to check or add anything, and sometimes I was unwilling to revise even if I finished writing at one time. I often get stuck on words when writing a composition. Although I have ideas, I don't know how to express them, and the more I write, the more I feel that my words fail to convey my meaning. After a long time, I hate writing and like to escape, and I don't even want to start writing when I see the topic.

For the 2022 composition topic, which required candidates to write about ways to enhance people's environmental awareness with no less than 200 words, Student C only put forward one method: "Giving lectures on how harmful plastic bags are" and stopped after writing 153 words. Due to lack of perseverance, he got low scores in the writing section, usually only about 10 points (out of 20). After using DeepSeek, Student C had to submit a complete first draft of the article meeting the word count requirement before writing the assignment. On this basis, AI would grade the article from multiple angles, such as spelling and phrase collocation errors, the logical fluency of textual coherence and argument development, the rationality of the overall structure of "beginning - body - conclusion", and highlight the areas needing improvement in bold. When Student C did the formal exam questions for the first time, he felt disappointed with the grading with the help of AI, but when AI put forward specific suggestions, he realized that the revised article was more clear and organized. After many repetitions, he looked forward to the AI grading part more and more. During the 2024 real exam test, student C put forward four complete methods of protecting the indigenous language as follows: legal protection and policy support, integration into education, use of modern technology, community-based empowerment and cultural revival, and finally DeepSeek gave him a high score of 17 points. It can be seen that with the help of AI grading, the student's perseverance has been improved. He began to regard "completing" and "revising" as an essential process of writing an article rather than something to do on an impulse. There is a sentence in his journal: "It turns out that I can persevere, and an article can become better." This is his recognition of the achievements gained through his perseverance.

Student D's main problems were excessive pursuit of perfection and exhaustion, being prone to care too much about some small mistakes in the review process. For example, she would think she was poor if she made a mistake in one question; in the Reading Comprehension section, she would spend a lot of time and energy on translating or thinking about a certain detail, resulting in low overall efficiency and a state of great tension. In the first reading article of the 2021 real test, Student D pondered the meaning of the word "rigged up" repeatedly. The original text says: At first I used to come home and sit in front of the TV during dinner time. Later on, I transferred the TV in such a way that I could watch it lying in bed. I also installed a switch whereby I could switch off the TV without having to get off my bed. In fact, even without knowing the specific meaning of this phrase, there is no obstacle to understanding the overall content of the article and answering the questions correctly. She spent too much time on the first reading article, so that she had no time to finish the subsequent questions and got poor grades. At the same time, she felt upset about a small question she was not sure about, which affected her attention and made her unable to concentrate on the next question. After the application of artificial intelligence, DeepSeek not only gave the right or wrong result for each question, but also added an "error tolerance suggestion" after the error, explaining whether the error of the question had an impact on the understanding of the whole article, and distinguishing it with "low-risk error/high-risk error". This made Student D begin to understand that not all small mistakes would lead to a total failure. For example, in a reading article, she made a mistake due to careless misuse of conjunctions, but DeepSeek marked it as a "low-risk error", making her understand that her overall understanding of the article was correct. The evaluation of the risk level of such errors made her less anxious. At the same time, Student D recorded the start and end time of each question by herself during the exam, and input the time spent into AI after the exam. DeepSeek told her that she spent 25 minutes on a certain article, far exceeding the normal exam time, and she should reflect on her learning methods and improve her overall learning efficiency. After a period of learning, Student D also learned to accept small mistakes first and then correct them, without being too hard on herself. This made her get out of the shadow of perfectionism, form a good learning attitude, and enjoy life in a relatively relaxed state.

The human-computer collaboration in the second stage not only provides students with timely feedback and support in the learning process, but also imperceptibly turns the psychological foundation established in the first stage into visible progress. Under the error explanation, composition grading and personalized suggestions, students feel the sense of control and success brought by the improvement of their abilities, and also learn how to use these AI tools in practice, improving their human-computer collaboration abilities. AI is not only an external helper, but also a learning partner that can be actively mobilized.

4. Metacognitive empowerment

Metacognition generally refers to people's ability to cognize, control and manage their own cognitive activities [18]. It not only refers to the cognition of learning content (such as understanding one's own strengths and weaknesses and the requirements of tasks), but also includes the effective guidance of the learning process (such as planning, checking, reflecting and improving). Based on online micro-lectures, Yang Chunlei et al. [19] analyzed the learning and evaluation methods of metacognition. They hold that if students can use the "plan-monitor-evaluate" method to learn, they can better master the learned content and apply it to real life, and their autonomy and enthusiasm will be improved. From the perspective of information literacy education, Feng Wei et al. [20] attach importance to the use of metacognition to promote the cultivation of college students' abilities of information searching, screening and reflection in the digital

intelligence era. Studies have shown that the "plan-monitor-evaluate" teaching model can effectively improve students' critical and self-directed learning abilities. It is also shown through research that metacognitive instruction has an effect on certain language skills. Bozorgian [21] discusses the effect of metacognitive strategies on EFL learners' listening abilities, and he finds that focusing on metacognitive knowledge can be highly effective in enhancing listening comprehension with high-intermediate learners. In the area of writing, Wilson [22] studies the notion of metacognition in Hebrew as a second language and points out some of the important features of the metacognitive process of writing and its significance in language development. For English majors preparing for the TEM-4, improving their metacognitive level helps them to more consciously find their own problems, learn lessons and improve methods, and experience a sense of satisfaction and achievement while making continuous progress, which is an important reason for the generation of learning well-being.

Due to the differences in their own emotional states, motivation levels and learning methods, different individuals show different metacognitive performances in actual learning. This study selected four English majors and conducted a one-year follow-up survey on their TEM-4 preparation process. They were asked to do three sets of real test papers from 2021 to 2023 in turn, get help from AI to provide feedback and make corrections, and then take a test with the 2024 test papers on this basis, so as to explore the effect of metacognitive empowerment on improving students' listening, reading and writing abilities. Next, we will respectively introduce the metacognitive progress of the four students after four rounds of training and the changes in their learning well-being brought about by these progresses.

According to the learning summary of Student A provided by DeepSeek, the following conclusions can be drawn: in terms of listening, Student A's accuracy rate steadily increased from 50% in 2021 to 76% in the 2024 test. Based on the sentence-by-sentence script comparison and answer matching results provided by DeepSeek, the "key word recognition rate" can be calculated to have increased from 40% to 74%, which indicates that Student A gradually learned to focus his attention on core information rather than being disturbed by irrelevant details. At the beginning of the training, Student A often made mistakes in numeric questions due to excessive nervousness. AI's error marking function made him see this weak link repeatedly, and he gradually reduced similar errors in three rounds of training. At the same time, the systematic recording of progress data (accuracy rate, key word recognition rate, focus duration) provided him with an intuitive progress trend, making him change from "always thinking he is incompetent" to "being able to see his own progress". In this process, the phased feedback of AI also promoted reflection, and he gradually learned to adjust the pace of doing questions and regard wrong questions as an opportunity for improvement. Combining the system behavior log and the self-evaluation questionnaire, his anxiety level dropped from 8 points to 3 points, and the average focus duration increased from 8 minutes to 22 minutes. On the whole, AI assistance not only improved his human-computer collaboration skills, but also endowed him with a clear sense of control and lasting self-efficacy, thus significantly improving his learning well-being. Student A's journal is as follows:

At first, I got nervous as soon as I heard numeric questions in listening, but later I found that in most cases, I failed to hear the numbers or transition words, so I told myself "pay attention to this next time" and would intentionally notice those words when doing the questions. Now I can listen to the whole sentence and feel more able to grasp the speed than before.

According to the analysis of Student B's learning situation by DeepSeek: in terms of reading, Student B's score improved from 55% in 2021 to 78% in 2024. On the basis of the question-by-question explanation by DeepSeek, the "question stem positioning accuracy" also rose from 60% to

85%, indicating that she had learned how to find key points. In the 2021 real test papers, Student B got low scores in detail positioning questions due to impatience and perfunctory attitude; AI's marking of her wrong answers also pointed out this problem and warned her to be careful in similar questions all the time. After many practices, the progress data given by the system (improved accuracy rate and reduced time consumption) made her see her own changes and also increased her motivation to continue working hard. At the same time, the phased feedback given by AI not only provided her with answering skills, but also inspired her to think about the connection between articles and life, which helped her change from passive "external requirement" to active and positive "intrinsic drive". By the last round, her self-evaluation of reading interest increased from 3 points to 8 points, indicating that she had more initiative, a stronger sense of control and higher well-being. Student B excitedly wrote about her progress:

At first, I just did the questions to complete the task and always hoped to finish them as soon as possible. Then I paid attention to how I actually did the questions, and I found that many times I did not carefully find the content corresponding to the question stem. I will mark the source when answering questions and check whether I have found the correct position. After improving with DeepSeek, I found that the proportion of correct positioning is getting higher and higher. Now when I read an article, I will think about whether it is related to life and so on.

According to the summary of Student C's learning situation by DeepSeek: in terms of writing, the number of words written by Student C increased from 153 (required ≥ 200 words) in 2021 to 220 in the 2024 test. At the beginning, he often stopped writing halfway, and AI's marking of his wrong answers also made him realize his problems in word usage accuracy and argumentation, making him aware of his bad habit of "giving up halfway". In the subsequent several rounds of practice, the data displayed by the system showed great progress in word count qualification rate, the number of spelling and grammar errors decreased from 12 to 4, and the score of logical coherence increased from 2 points to 4.5 points (out of 5), making him understand the effect of hard work and correction. The phased feedback of AI not only corrected his grammar and word usage problems, but also told him to enrich his argumentation and optimize the article structure. He gradually began to regard writing as "something that can be continuously improved and perfected" rather than "a one-time thing". In this process, he changed from initial resistance to being able to persist and revise repeatedly by himself, having the motivation to keep moving forward and a sense of control over learning, which further enhanced his pleasure in learning. Student C wrote in his reflection:

I used to stop writing a composition halfway, but later I found that it was actually because I gave up as soon as I encountered a word I didn't know. So I forced myself to write it all out first... After AI grading, I can know where I am prone to make mistakes, so I will intentionally pay attention to this point when writing next time. I think it is a normal process to revise after finishing writing. Now I can finish a composition, and I don't think writing is so terrible.

According to the analysis of Student D's learning situation by DeepSeek: in terms of intensive reading, Student D's score improved from 68% in 2021 to 82% in 2024, and the answer overtime rate also decreased significantly, from 45% to 12%. At first, encountering some unfamiliar phrases often led to spending a lot of time understanding a reading material, but AI's error marking identified these problems as "low-risk errors", making her realize that not every error has a great impact on reading. With the progress of training, the changing data recorded by the system such as improved accuracy rate and reduced overtime rate made her more clearly feel the effect of "ignoring small errors and grasping the overall situation". The phased feedback of AI continuously strengthened this awareness through error reminders of different levels, making her gradually understand what are insignificant small problems and what are really important ones. Finally, her acceptance of low-risk

errors increased from 2 points to 8 points, and her self-evaluation of tension level decreased from 9 points to 4 points. In this state of mind, she was no longer troubled by perfectionism and could read more easily, thus greatly increasing her happiness in learning. Student D also wrote about her changes in her diary:

I used to spend a long time thinking when I encountered a word I didn't know while reading, so that I couldn't finish an article. Later, I paid attention to where I was stuck, and found that many times the word did not hinder my understanding of the article, so I realized that I could skip it completely. So I told myself when doing the questions: if I encounter a word I don't know, I will ignore it for the time being and keep reading. Gradually, my speed has improved a lot. Now even if I can't understand all the words, I can still grasp the general meaning, and answering the questions is much easier than before.

It can be seen from the research that metacognitive empowerment is the highest level of the progressive improvement of students' learning well-being. Compared with psychological support and human-computer collaboration, metacognition enables students to actively perceive their own weaknesses, monitor the learning process, and achieve continuous optimization through strategic adjustment. Student A learned to regulate emotions and focus on key words, Student B found meaning and patience in reading, Student C improved executive ability through perseverance and revision, and Student D let go of perfectionism and grasped the overall understanding. They no longer rely on external evaluation, but form a self-driven learning model. This transformation from "passive acceptance" to "active control" enables students to gain a lasting sense of control and self-efficacy while improving their abilities, thus achieving an in-depth improvement of well-being.

5. Conclusion

Above, taking four English majors from different universities who did TEM-4 real test papers and received AI guidance from 2021 to 2024 as examples, this paper puts forward the PSHACME model and expounds the process of improving the learning well-being of English majors after the integration of generative AI. In the PSHACME model, students' well-being develops from "psychological stability - efficiency improvement - enhanced sense of mastery". The psychological support in the first stage meets students' needs in emotional management, motivation construction and self-confidence, enabling them to have a sense of security and full of hope during the review period; the human-computer collaboration in the second stage significantly improves students' learning effects through the timely feedback and error analysis of DeepSeek, and also makes students get rid of the pressure and sense of powerlessness brought by the previous review and preparation for exams; the metacognitive empowerment in the third stage makes students gradually realize their own learning situation and observe, reflect and adjust themselves, thus transforming from a controlled learner to an autonomous learner and gaining well-being in self-control and continuous growth.

Theoretically, the PSHACME model proposed in this paper is a new idea for analyzing the well-being of English learners. It enriches and improves the concept of language learners' well-being and its influencing factors from the perspective of positive psychology, especially pointing out how artificial intelligence is connected with psychological support and metacognitive growth and promotes the improvement of learners' well-being step by step; from a practical perspective, this paper also points out the direction for artificial intelligence to empower personalized learning, with "test - feedback - reflection" as its specific application. It provides learners with practical help in error explanation, composition grading and recording growth, enabling them to find their deficiencies and see their own progress, and then reflect on and manage their own emotions. This

human-computer cooperation method provides an effective way for teachers to carry out personalized guidance and cultivate students' well-being, and has reference significance for how to properly use artificial intelligence in college English courses in the future.

This study has two main limitations: first, the sample size is small, and the English scores and well-being of the four participants have all been greatly improved, which to a certain extent makes the conclusions of this study have certain limitations; second, the DeepSeek used in this study is an application program specially designed for a certain type of questions, which is affected to a certain extent by its own algorithm and question types. In the future, more samples can be added to the research, including students of different levels, and different AI tools and application scenarios can be used to test the generality and robustness of the PSHACME model; in addition, it is necessary to consider the impact of AI on students, such as technological dependence, ethical issues and cultural differences, and study how to use AI more effectively to help students obtain a better learning experience and well-being.

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