A Study on the Impact of English Teachers' AI Literacy on Classroom Teaching Effectiveness

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Abstract: *With the spread of artificial intelligence in foreign language education around the world, English teachers need to learn how to use it effectively to improve the quality of teaching. Systematically explore the effect of AI literacy on the efficiency of classroom teaching in this paper; reconstruct the combined index for the effectiveness of classroom teaching to include AI literacy and intelligent interactive characteristics; find an irregular coupling relationship between the two, and, through the three channels of intelligent tool operation ability, algorithm understanding level and data interpretation literacy, examine the corresponding effects on resource adaptation, dynamism of decision-making adjustment and accuracy of learning diagnosis; finally, build an effectiveness optimisation model with an organised adaptation framework, a bidirectional gain logic and a closed-loop regulation system. First, we need to know what AI literacy is and how it will affect the quality of teaching.*

Keywords: *AI Literacy of English Teachers, Effectiveness of Classroom Teaching, Intelligent Tool Operation Ability, Level of Algorithm Understanding, Data Interpretation Literacy, Human-Machine Collaboration*

Introduction

With the spread of artificial intelligence in the creation of teaching materials, learning behaviour analysis and personalised feedback, the structure of professional competence for foreign language teachers is changing. Teaching in English classrooms is changing from the traditional teacher-student model to a new cooperative mode of teachers, artificial intelligence and students, and with this change, new demands have arisen for teachers' AI literacy. Most of the current research on the effect of AI literacy on teaching effectiveness is still at the macro level, and the specific reasons for this have not been well understood. The problem that has not been organised is: What is the impact of intelligent tool operation ability on the efficiency of resource adaptation? How Does the Scope of Algorithm Knowledge Affect Classroom Decision-Making? How does Data Interpretation Literacy Affect the Accuracy of Learning Diagnosis? Therefore, the following theoretical contributions will be made by this paper: First, it will help to clarify the causal logic and transmission path of the various dimensions of AI literacy and classroom teaching effectiveness; Second, it will provide theoretical support for the development of strategies to improve classroom teaching effectiveness in intelligent educational environments. The three stages of conceptual reconstruction, mechanism analysis and model construction will be employed in this paper to present an organised system of explanations for how English teachers' AI literacy affects the effectiveness of classroom teaching.

1. Conceptual Reconstruction of English Teachers' AI Literacy and Classroom Teaching Effectiveness

1.1 Composite Dimensions and Characteristics of Technological Embedding in English Teachers' AI Literacy

The AI literacy of English teachers has taken many forms and can be divided into four general categories: understanding algorithms, recognising data, operating intelligent tools, and adapting to all kinds of teaching situations. The scale of algorithm understanding refers to how well teachers have grasped the basic ideas of natural language processing and learner profile generation; the dimension of data identification is the collection, cleaning and analysis of classroom behaviour data; the dimension

of intelligent tool operation is the ability to use specific applications, such as speech synthesis, automatic grading and adaptive learning systems; and adaptive integration in teaching scenarios refers to the dynamic organisation and combination of all the above dimensions in actual teaching situations. Teachers' views on the shortcomings of technology and their teaching goals have changed; thus, the development of AI tools has also shifted, and now AI tools are no longer merely additions to the old materials but can present this material in various forms and even participate in teaching decisions.

1.2 Connotative Extension and Intelligent Interactive Attributes of Classroom Teaching Effectiveness

With the development of foreign language educational technology in recent years, the scope of classroom teaching has expanded, and new indicators of teaching effectiveness have begun to emerge, such as the quality of intelligent interaction, the timeliness and personalisation of feedback, and adaptation in learning paths. The three main features of intelligent interactivity are: first, human-machine cooperation; that is to say, teachers and artificial intelligence systems work together to lead the direction of class discussion and produce responses; second, data-driven real-time interaction; that is to say, based on the analysis of real-time learning data, teaching strategies can be continuously improved and adjusted; and third, cross-modal interaction; that is to say, semantic alignment and information supplementation are achieved in all kinds of forms, such as speech, text, pictures, etc. As shown in the attributes above, the success of teaching can no longer be attributed to the efforts of individual teachers; rather, it is the result of all-encompassing changes in the system, including teachers, artificial intelligence and students[1].

1.3 Theoretical Linkage of AI Literacy and Classroom Teaching Effectiveness

AI literacy and the effectiveness of classroom teaching are in opposition, and the foundation for this is the logic of task-tool matching via technology. If some of the English teachers have some AI literacy, then smart tools can be used as auxiliary devices to improve teaching efficiency; that is to say, some routine work can be offloaded from the teachers and timely help can be provided for students who are having difficulty learning. Conversely, if the people are illiterate, they will not know how to use the technology properly or operate it. First, the teacher will check the results produced by artificial intelligence; second, they will be aware of any algorithmic bias; finally, if there are any problems with the technology, other measures will be taken. The three reasons above will work together to determine how much the AI literacy of teachers has increased and form a virtuous cycle of "literacy - application - feedback - re-literacy".

2. Pathways of Influence for English Teachers' AI Literacy on Classroom Teaching Effectiveness

2.1 Transmission Effect of Intelligent Tool Operation Capability on the Efficiency of Teaching Resource Adaptation

2.1.1 Compression Mechanism of Operational Fluency on the Time Consumption of Resource Selection

Operational fluency is the ability of a person to carry out a series of operations, such as starting a tool, entering a command, modifying parameters, etc. Fluency in the preparation stage of English classroom teaching will determine how long it takes to obtain suitable materials from corpora or other platforms. Quick retrieval of information can be achieved by using shortcut keys or batch processing, but more time is still required for review of the content and adjustment of the difficulty of the problems in a single teaching period; otherwise, there will be repeated interruptions to the operation, students will waste cognitive resources on these operations, and the accuracy of matching problems with their current language abilities may be reduced.

2.1.2 The Promoting Effect of Deep Invocation of Tool Functions on the Degree of Resource Personalization

Teachers will only be able to use the advanced functions of the intelligent tools, such as stratified retrieval, self-adjusting difficulty and semantic similarity ranking, if they can tune the parameters of these tools. Teachers who can use the above functions can set resource filtering thresholds according to the distribution of class language proficiency; for example, they can adjust the text complexity to be in the range of i+1 to i+2 or prioritise targeted exercises based on the frequency of grammatical errors.

Given the deep invocation behaviour, many sets of teaching materials can be prepared for different classes or groups to avoid the problem of uniform resources and reduced teaching efficiency.

2.1.3 The Mitigating Effect of Operational Strategy Repertoire on Tool Function Redundancy

Redundancy in the function of tools refers to modules that do not meet the actual teaching needs in practice; the repertoire of the operational strategy system is a teacher's ability to choose suitable operational paths for all kinds of problems, and it includes determining the main and minor functions, deciding whether to use a combination of functions, and maintaining interface orientation. Teachers who have many strategies can skip some of the redundant modules early in the process and focus their attention on the functions that directly support the learning goals; thus, they reduce cognitive load and improve the accuracy of resource selection. At the same time, teachers who do not have many strategies are often led by the interface to take a long way around, and resource selection may be off-target and transmission efficiency will be reduced.

2.2 The Moderating Effect of Algorithm Understanding Level on Dynamic Generative Decision-Making in the Classroom

2.2.1 Calibration of the Decision Adoption Threshold Based on Recognition of Algorithm Output Confidence

Another index of the level of understanding of algorithms is the confidence teachers have in the results of AI. Most intelligent teaching systems express the confidence scores or probability distributions of the teaching indirectly. English teachers aware of the problems may find that the output has low confidence (e.g., the boundary of the syntactic analysis result is ambiguous) and thus increase the threshold for requiring a review or rejection. A calibration device can help to avoid teaching errors caused by the automatic introduction of technology, and the decisions made in the classroom will be based on accurate technical data[2].

2.2.2 The Corrective Role of Algorithm Bias Sensitivity in Determining the Direction of Teaching Intervention

Algorithm bias is the problem that the distribution of the output in a system is uneven due to an uneven distribution of training data. The bias sensitivity of English teachers can be seen in their awareness that the system has repeatedly flagged certain non-standard expressions or has a low recognition rate for some spoken variations. Given the current situation and development conditions of the classroom, teachers can verify the accuracy of the results produced by artificial intelligence; if there are systematic flaws, they will adjust the direction of intervention accordingly, add explanations about the limitations of algorithms, or use non-automated teaching methods for a certain period. The higher the bias sensitivity, the lower the probability that algorithmic deficiencies will harm students in class, and the more practical and reasonable the teaching intervention.

2.2.3 Support for Algorithmic Logic Mapping of Decisions in Uncertain Situations

Dynamic generative decision-making in the classroom often takes place in very uncertain situations, such as unexpected pragmatic problems or cross-linguistic transfer errors. Algorithmic logic mapping is a teacher's ability to trace the abstract output back to the system's processing rules in reverse and to understand the generation logic of the conclusion. Teachers who have taken part in the training will be better able to learn how much to depend on the output of AI in uncertain situations more quickly, decide whether to adjust the parameters of the original framework or ignore the AI altogether, and then form their own conclusions. The teacher can continue to lead the collaboration of people and machines, and the class will not be too rigid because of the differences in technology.

2.3 The Mediating Effect of Data Interpretation Literacy on the Diagnostic Accuracy of Learning Behaviors

2.3.1 Hierarchical Impact of Selection of Data Granularity on Diagnostic Resolution

Behavioural data can be obtained at various levels of granularity, such as the task level (completion degree of an entire piece of work), the sentence level (number of changes in sentences), and the word level (dwelling time on retrieval of specific words). The first type of data interpretation literacy is to choose a suitable level of granularity according to the diagnostic purpose of the teacher; for a macro-level diagnosis, aggregated data at the task level are needed, and to identify specific problems for individuals, one must go down to the sentence or word level. A single level of division is too

general and lacks local information; a very fine division will be full of noise. Teachers should be able to change among the various levels of detail and combine them to make particular observations.

2.3.2 The Decisive Role of Attribution Judgment in the Diagnosis of Outliers

Outliers in the learning behaviour data, such as taking too long to answer easy questions or answering difficult questions too quickly, need to be explained; that is to say, we must determine whether they are caused by technical recording errors, situational factors or actual cognitive difficulties. Incorrect attribution directly affects the accuracy of diagnosis: Cognitive difficulties are mistaken for technical errors and no intervention is carried out; Technical errors are unnecessarily attributed to cognitive difficulties and corrected. Teachers who have achieved a certain level of interpretational literacy are more likely to use multiple sources to verify their understanding; that is to say, they will compare the abnormal response time with performance in other tasks or immediately ask follow-up questions to confirm the actual reasons for the outlier.

2.3.3 How the Method of Multi-source Data Fusion Improves the Actionability of Diagnostic Conclusions

The diagnostic information in one place is limited and may be due to a small reason. The goal of multi-source data fusion is to have teachers gather all kinds of data from different places, such as the correct-answer rate, response time, number of corrections and speaking fluency, etc., and then make an accurate diagnosis. Integrative interpretation can show that the different students used many different ways of thinking to reach the correct answer; for example, two students with the same correct rate may have used "rapid response without revision" and "correction after several attempts", respectively, and the former shows a high degree of automation in procedural knowledge, while the latter has activated metacognitive control but is inefficient in knowledge retrieval. Teaching instructions based on integrative diagnosis are more specific than those obtained from single-source diagnosis, and thus they can improve the efficiency of turning data into teaching activities[3].

3. Optimization Model of Classroom Teaching Effectiveness Based on AI Literacy Enhancement

3.1 A Structured Adaptation Framework for AI Literacy in Teaching Scenarios

3.1.1 Classification of Teaching Scenarios and Mapping of AI Literacy Demands

Teaching Scenarios in English Classrooms can be divided according to the type of task and the degree of technology application, such as explicit knowledge presentation, skill training, pragmatic language application and classroom management. Teachers need to place all kinds of demands on students in all areas of AI literacy according to the actual conditions of the school; explicit knowledge instruction should focus on evaluating the reliability of algorithm-recommended materials, skill training requires proficiency in operating tools, pragmatic generation needs data interpretation literacy to find errors in language use, and classroom management demands the ability to handle abnormal situations in automated processes. Based on the demand-mapping relationship above, the foundation for organising competency units will be laid.

3.1.2 The Structured Organisation of Scenario-Sensitive Competency Units

All the modules of the structured adaptation framework are AI literacy, and they can be used alone or together to meet all the function requirements in different situations. The organisation of competency units is in line with the principles of horizontal independence and vertical nesting; that is to say, the competency units for different scenarios should be logically independent and not overlap, and higher-level scenario units should include the lower-level units as prerequisites. An organisation chart can help teachers find suitable places for their skills in light of changes in teaching circumstances more easily and promote the goal-oriented use of technology.

3.1.3 The Dynamic Calibration Mechanism of the Adaptation Framework

Teaching scenarios change all the time in the course of classroom teaching due to students' reactions and the stages of tasks, so an adaptation framework has been added that can dynamically modify the activation weights of competency units. There are two kinds of calibration: explicit signals (teachers manually change modes) and implicit signals (changes in the frequency of interaction or error rate noticed by the system). When the implicit signal indicates that the type of scenario has changed, the framework will automatically adjust the weights of the competency units; for example, it may decrease the weight given to operational proficiency and increase the weight given to the depth of data analysis

to avoid the problem of literacy frameworks being a fixed list[4].

3.2 Bidirectional Gain Logic of Classroom Effectiveness from the Perspective of Human-Machine Collaboration

3.2.1 Positive Support Path of AI Systems in Enhancing the Efficiency of Teachers' Decision-Making

The first step of the positive support path is to use AI to preprocess and organise the flow of classroom information. At the same time, the AI will also recognise what the students have said, point out any grammatical errors or problems in fluency, and then provide a diagnostic report to help the students organise their own study materials. Teachers no longer need to carry out the three functions of information collection, feature extraction and instructional decision-making simultaneously; thus, the time for decision-making has been reduced considerably. Teachers who do not have this support need to go through the four steps of observation, recording, analysis and judgment to adjust their teaching; with AI support, the first two steps, observation and recording, have been eliminated, and it is hoped that the efficiency of decision-making will be improved.

3.2.2 The Reverse Calibration Effect of Teacher Feedback on AI Model Output

Reverse calibration is employed to adjust the rules of the AI model according to teachers' evaluations of the teaching. When the teachers find that the organised differences in the suggestions provided by AI and the actual circumstances of teaching in the classroom are not in harmony, they will give explicit feedback (such as scores, notes, modifications) or implicit feedback (by ignoring some kinds of suggestions) to the system. According to the above feedback, adjust the parameters of the system accordingly, for example, modify the threshold for annotating grammatical errors or change the recommendation weights of corpora. Reverse calibration can be used to gradually adjust the AI model in line with the teaching style and language characteristics of a particular class at present, so it does not need to be based on a general model for special classroom conditions.

3.2.3 Identification and Repair Mechanism for Interruption Nodes in Bidirectional Gain

There may be interruption nodes in the bidirectional gain; thus, continuous conflicts will occur between the AI's output and the teacher's judgment, system information will exceed the interpretation capacity of teachers, and feedback signals will be transmitted inefficiently. Based on the comparison of teachers' operation records and system response logs, it has been observed that suggestions are frequently ignored without any system adjustments at certain times. The three kinds of repair modes are path reset (to clear the accumulated bias), hierarchical reduction (to disable some AI functions), and manual takeover (to switch to teacher-led mode), and then collaboration can be resumed after the system has converged[5].

3.3 Closed-Loop Regulation System of Teaching Effectiveness Based on Dynamic Feedback

3.3.1 Real-time Perception of Teaching Conditions and Granularity of Data Collection

The first link of the closed-loop regulation system is the real-time observation of the teaching situation, and at the core of this is the selection of data collection granularity. Granularity is too large; therefore, a significant change in the signal will be considered noise and ignored. The hierarchy of granularity in the English classroom is as follows: At the change of tasks, this is recorded at the second level; during a stable period of execution, the quality of task completion is recorded; and in times of interaction, the sequence of responses is noted turn by turn. Based on how quickly the class is going, the amount of collected data will be adjusted, and teachers can set intervention thresholds.

3.3.2 Diagnosis of Effectiveness Deviation and Generation of Intervention Strategies

Compare the expected amount of data with the actual base and determine whether they differ and by how much. Diagnosis of the effectiveness deviation is to determine where the deviation occurs (that is, whether it is due to problems in the spread of knowledge, training of skills, management, etc.) and identify the reasons for the deviation (e.g., teacher factors, student factors, technological factors). Based on the above diagnosis, the next step is to develop an intervention plan, and according to the type of deviation, various strategies will be employed; for example, to address deviations in knowledge transmission, one can reduce the density of examples or lower the difficulty threshold of corpora; for deviations in skill training, the length of practice units can be shortened or the threshold for speech recognition lowered. To get a plan, one should choose one that meets the needs and has a small number

of modifications.

3.3.3 Control of Feedback Delay and Adaptive Adjustment of Step Size

Generally speaking, a closed-loop regulation system is good if both the feedback delay and the adjustment step size are small. Feedback delay is the time taken from perception to the start of intervention; if it is too long, there will be a phase lag. The diagnostic unit should be at the end of the control strategy, and corrective actions for typical deviations can be pre-calculated. Step size of adjustment is how much to change the parameter at one time; if it is too large, the system will oscillate; if it is too small, convergence will be slow. Change the step size of the adaptive adjustment algorithm according to the results of the previous intervention; that is, if the two consecutive interventions in the same direction show improvement, gradually increase the step size to speed up convergence, and if there is overshoot, immediately halve the step size and reduce the frequency of adjustment to ensure stable convergence of the regulation system at different teaching speeds.

Conclusion

The three levels of the impact of English teachers' AI literacy on the effectiveness of classroom teaching studied in this paper are conceptual reconstruction, pathway mechanism and optimisation model. Identify all the kinds of dimensions for AI literacy and the intelligent interactive features of effective classroom teaching in this paper; find that there are three different paths of influence for operational ability, algorithm understanding and data interpretation; finally, build an effectiveness optimisation model with an adaptation framework, a bidirectional gain logic and a closed-loop regulation system. The above theoretical work has extended the system of research on foreign language teaching in intelligent education environments.

First, the various structures of English teachers' AI literacy at different stages of education will be investigated; that is to say, teachers in primary school and senior secondary school will be included. Second, we will examine the correspondence problem of the iteration speed of AI systems and the development cycle of teachers' literacy. Thirdly, we will investigate how dependent the transfer of tacit knowledge in the classroom is on AI literacy and what deficiencies it has. Fourth, to reduce the cognitive load of technology for teachers, tools that promote the development of literacy through natural interaction interfaces will be developed. The development of the above directions will provide more theoretical support for the study of English teachers' AI literacy and its impact on teaching quality.

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