Application of WPS AI Digital Intelligence Technology in the Teaching of Fundamentals of Electrical Engineering

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Abstract Fundamentals of Electrical Engineering is a core foundational course for electrical majors, which includes a large amount of abstract circuit principles, complex formula calculations, circuit analysis, and practical content. Students are prone to teaching pain points such as difficulty in understanding concepts, weak mastery of formulas, and a disconnect between theory and practice. Relying on big language models, intelligent document processing, data visualization, intelligent forms, collaborative office and other digital intelligence capabilities, WPS AI can deeply integrate into the entire teaching chain of Fundamentals of Electrical Engineering: pre class preparation, classroom teaching, post class consolidation, and learning evaluation, reducing the burden of teacher preparation, visualizing abstract electrical knowledge, achieving hierarchical teaching and process evaluation, and promoting the transformation of traditional electrical engineering classrooms to a smart teaching mode of human - machine collaboration.

Key words WPS AI; Numerical technology; Fundamentals of Electrical Engineering; Smart teaching

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The application of artificial intelligence in electrical and circuit engineering education started earlier in foreign countries, and the research is mainly divided into two stages: traditional intelligent tutoring system stage and generative large model teaching application. However, there is almost no specialized research on domestic office large models such as WPS AI, and the research objects mainly focus on general large models and customized circuit intelligent teaching Agent.

Research stage of traditional intelligent teaching system. Early foreign research focused on circuit simulation and the development of intelligent Q&A systems, and relied on machine learning and expert systems to build a circuit intelligent tutoring platform. The research focused on circuit fault diagnosis, automatic correction of circuit exercises, and development of virtual simulation experiment systems, with a particular emphasis on building independent professional teaching software. Part of the research developed circuit analysis intelligent Q&A systems, which can identify basic circuit topologies and complete simple circuit calculation Q&A. However, such systems have high development costs and complex deployment, making it difficult for ordinary teachers to develop them again and limiting their promotion. They are mostly used in university laboratory teaching scenarios and difficult to popularize arXiv on a large scale for basic classrooms of electrical engineering[1-3].

Research on generative large models in electrical and electronic education (2023 - 2026). After the outbreak of generative AI, a large number of empirical studies have been conducted in the field of engineering education abroad on the teaching of LLM large models in electrical circuit courses. The research directions mainly include four aspects: first, the ability assessment of large models to solve electrical circuit problems. Multiple literature uses classic circuit textbook exercises as a test set to evaluate the accuracy of mainstream large-scale models in solving DC circuits, AC RLC circuits, and Kirchhoff's law exercises. Research has shown that large models are prone to circuit calculation errors and professional knowledge illusions. Even mainstream large models still have obvious errors when facing complex circuit calculation problems. It is necessary to manually verify the output results of large models and not directly use them as standard answers[4-5]. Second, the development of customized circuit teaching intelligent agents. Foreign scholars have constructed a specialized lightweight large model teaching assistant for electrical engineering courses through RAG retrieval enhancement and fine tuning of domain datasets. There is research on fine-tuning small parameters and large models based on circuit professional datasets, achieving circuit principle explanations, exercise questions, and error analysis. Ordinary hardware can be deployed as an auxiliary learning tool for students after class. There are also research of developing Agent intelligent mentors that use Socratic dialogue to guide students to independently deduce circuit problems, avoiding direct output of answers and causing students to overly rely on AI tools[6-7]. Third, research on generative AI teaching mode and strategies. Foreign teaching practice research integrates large models into the pre class preview, pre experiment preparation, post experiment data analysis, and auxiliary writing of experimental reports in electrical engineering courses. It clearly states the positioning: AI as a learning aid tool, students are prohibited from directly copying AI generated reports; it focuses on using AI to conduct experimental error analysis, compare circuit schemes, and train students' engineering thinking. At the same time, compara-

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tive teaching experiments are conducted, with the experimental group using generative AI assisted learning and the control group using traditional teaching. It is verified that the reasonable use of AI can improve students' understanding of circuit principles, but there is a potential risk to students' independent problem-solving ability, and supporting teaching standards are needed to constrain students' usage behavior[8-11]. Fourth, risk and ethical research. The foreign academic community is highly concerned about the problems of big model illusion, student homework cheating, and thinking inertia in engineering classrooms. A large amount of literature discusses the reform of assessment methods, and proposes to increase practical assessment and process evaluation, reduce the weight of written homework, to avoid the academic integrity risks brought by big models.

Foreign research has fully validated the potential application of generative AI in electrical engineering courses, while revealing core risks such as computational illusions in large model majors and student tool dependence. However, most foreign research is based on overseas large-scale model products, focusing on customized development of professional teaching systems. The threshold for system development is high, and there is a lack of relevant research on low-cost teaching reform aimed at ordinary teachers and relying on general office AI tools. Its educational model is adapted to the higher engineering education system in Europe and America, but not fully adapted to the learning situation and teaching conditions of the course of Fundamentals of Electrical Engineering in China, and cannot be directly applied to domestic classrooms.

Domestic research is divided into two main areas: one is the teaching research on Fundamentals of Electrical Engineering/electrical and electronic courses empowered by artificial intelligence and large models; the other is the application research of WPS AI digital intelligence tool in the field of education and teaching.

Research on empowering the course of Fundamentals of Electrical Engineering with artificial intelligence in China. Driven by the national policies of education digitization and vocational education quality improvement, research on AI enabled basic courses of electrical engineering in China has been increasing year by year, covering undergraduate, vocational, and secondary vocational levels[12]. Research on digital smart classrooms and blended learning models. Many scholars analyze the pain points of traditional teaching of Fundamentals of Electrical Engineering: abstract knowledge, multiple formulas, disconnection between theory and practice, and lagging feedback on learning situation. It proposes to build an electrical smart classroom based on digital platforms, virtual simulation, and big data, reconstruct the closed-loop teaching process before, during, and after class, use digital resources to reduce the difficulty of understanding circuit principles, and achieve blended learning reform. This stage mainly focuses on virtual simulation platforms and smart teaching platforms, with less involvement of generative large model office tools[13].

Research on the integration of generative large models into the teaching mode of electrical engineering courses. From 2024 to 2026, an increasing number of studies in China are exploring the application of big language models in electrical and electronic education. Many scholars have proposed using large models for lesson plan and courseware generation, exercise preparation, personalized Q&A, and experimental teaching assistance, to construct a human – machine collaborative teaching model[14-17]. Some universities are attempting to build course specific AI agents, importing electrical engineering course textbooks and experimental resources, to achieve knowledge point answering and error analysis. Research generally suggests that large models can reduce teachers' repetitive work and support hierarchical teaching. At the same time, it is pointed out that there are problems with formula calculation errors and circuit analysis illusions in the large model. Teachers must manually review the AI output content, strictly control students' usage behavior, and prevent to directly copy AI homework answers. Some frontline teaching papers have proposed a framework for the reform of AI enabled basic courses of electrical engineering, proposing reform paths from teaching resources, classroom activities, practical training, and evaluation systems. However, most research remains at the theoretical conceptual level, with a small number of empirical teaching pilot samples and a lack of complete and replicable classroom practice cases[18].

The limitations of AI application research in current domestic electrical engineering courses. Most of the research objects are professional intelligent teaching platforms, virtual simulation software, and self built AI intelligent agents. These platforms often require funding for procurement and secondary development, making it difficult for ordinary frontline teachers to deploy independently. There is a lack of systematic research on the complete teaching process of WPS AI in the course of Fundamentals of Electrical Engineering.

WPS AI is a domestically produced generative office AI launched by Kingsoft Office, relying on text PPT, tables, forms, and cloud collaboration to achieve document generation, intelligent formulas, data processing, online evaluation, and other functions. Relevant research in China gradually emerged from 2025, and overall research is still in its infancy. The existing literature mainly focuses on courses such as computer fundamentals in universities, computer applications in vocational schools, and secretarial accounting. Research has confirmed that WPS AI can assist teachers in quickly generating lesson plans, courseware, and assignments, using form AI to complete data processing, intelligent forms for in class evaluation, and cloud documents for collaborative lesson preparation and group collaboration. The study also identified practical problems in teaching, such as errors in AI generated content, excessive dependence of students on AI, and insufficient AI application ability of teachers, and provided corresponding teaching strategies[19-21].

The current research status of WPS AI in professional courses of science and engineering. The number of literature specifically studying the application of WPS AI in Fundamentals of Electrical Engineering and circuit courses is extremely small when searching existing journals and dissertations. Only a small number of theses and projects mention that office AI can assist science and engi-

neering teachers in writing lesson plans, inputting complex formulas, and processing experimental data. There is no complete construction of a full process teaching mode before, during, and after class, and there is also a lack of empirical data support for teaching practice, which belongs to the research gap of this study.

The value of generative AI in the transformation of electrical engineering curriculum teaching has been fully recognized domestically, and the feasibility of WPS AI education application has also been verified by general education curriculum research. However, there are obvious gaps in existing research: AI research in electrical engineering courses tends to focus on professional teaching platforms; the research on WPS AI focuses on general education courses of computer science and secretarial studies, and there is a scarcity of interdisciplinary research results. There is a lack of systematic research on teaching reform that fully utilizes the multi-module capabilities of WPS AI for the course of Fundamentals of Electrical Engineering.

1 Existing problems in traditional teaching of Fundamentals of Electrical Engineering

1.1 Abstract knowledge, high understanding threshold, and heavy preparation workload Ohm's Law, Kirchhoff's Law, AC circuits, series parallel resonance, and other content cannot be seen or touched. Relying solely on static PPT and textbook text, students are difficult to establish intuitive cognition on circuit models and phase relationships. Teachers need to manually write lesson plans, draw circuit schematics, prepare calculation questions, organize experimental task lists, and input formulas and practice exercises, which consume a lot of time.

1.2 Bag between exercises and learning feedback, disconnection between theory and practice, and fragmentation of resources Traditional paper assignments and classroom questioning make it difficult to timely grasp each student's mastery of circuit calculation and fault analysis, and it is difficult to carry out hierarchical training. The connection between classroom theoretical explanation and post class experimental training is insufficient, lack of lightweight preview and consolidation tools. The preview before practical training is inadequate, which increases safety hazards in practical operation. The scattered storage of lesson plans, example problems, experimental report templates, and test papers makes it difficult to share and reuse collective lesson preparation resources.

2 Core ability of WPS AI digital intelligence technology to adapt to the teaching of Fundamentals of Electrical Engineering

As a lightweight, domestically produced, and highly adaptable digital intelligence teaching aid tool, WPS AI deeply integrates five functional modules: WPS text, PPT presentation, data tables, intelligent forms, and cloud collaboration. It does not require the deployment of professional simulation software or large-scale teaching platforms, and is compatible with undergraduate conventional teaching equipment and environments. It can fully adapt to the entire teaching process of undergraduate course of Fundamentals of Electrical Engineering, including theoretical lectures, circuit analysis, experimental training, learning situation diagnosis, and innovative teaching and research. Compared to vocational colleges that focus on practical skills training, undergraduate teaching of Fundamentals of Electrical Engineering emphasizes more on principle derivation, circuit modeling, comprehensive analysis, engineering thinking, and research foundation ability cultivation. The curriculum knowledge system is rigorous, the theoretical depth is stronger, and the comprehensive question type is more difficult. With its digital intelligence characteristics of zero threshold, easy to operate, and end-to-end empowerment, WPS AI can accurately adapt to the teaching needs of undergraduate courses that focus on logic, deduction, data analysis, and ability expansion. It effectively compensates for the problems of traditional undergraduate electrical engineering courses, such as single teaching methods, abstract theory, tedious data analysis, and lack of personalized teaching. Its core digital intelligence capabilities for adapting to undergraduate teaching of Fundamentals of Electrical Engineering are as follows:

2.1 Capability of intelligent content generation, which is suitable for the research and development needs of advanced undergraduate teaching resources The undergraduate course Fundamentals of Electrical Engineering emphasizes the completeness of the theoretical system, the rigor of circuit models, and the comprehensiveness of exercises, including complex AC/DC circuits, superposition theorem, Thevenin's theorem, three-phase AC circuits, dynamic circuit time-domain analysis, and other key and difficult content. The compilation of teaching resources is highly specialized, the amount of formula derivation is large, and the difficulty of lesson preparation is high. WPS AI can intelligently generate a complete and logically rigorous refined lesson plans, chapter teaching courseware, deduction lecture notes of key and difficult points, comprehensive circuit examples, and course experiment guides based on undergraduate course syllabi and talent cultivation requirements, effectively replacing traditional manual tedious text compilation and content organization work. WPS AI can accurately and standardly generate professional formula formats for a large number of differential formulas, circuit equation systems, impedance operation formulas, and phasor operation formulas in undergraduate teaching, solving the problems of traditional teaching formula layout confusion and non-standard derivation steps. At the same time, logical reconstruction, expansion of knowledge points, annotation of key and difficult points, and content correction of existing teaching content can be conducted, to adapt to the teaching standards of undergraduate education that focus on principle deduction, system construction, and academic norms, and greatly improve the efficiency of undergraduate teachers' lesson preparation and the quality of teaching resources.

2.2 Ability to present multimodal visualization, which resolves the cognitive difficulties of abstract electrical knowledge In response to the teaching pain points of the electrical en-

gineering course, which involve numerous intangible electrical laws and abstract and difficult to understand concepts, WPS AI has the teaching adaptation ability of graphic and textual conversion and visual modeling. By relying on PPT intelligent mapping and SmartArt intelligent flowchart generation functions, circuit topology diagrams, current flow diagrams, circuit fault analysis flowcharts, and series parallel circuit structure comparison diagrams can be quickly generated, transforming current and voltage changes, phase shifts, and RLC series parallel resonance processes that cannot be observed by the naked eye into intuitive visual graphics. At the same time, combined with the AI function of the table, it can organize the measured parameters such as resistance, voltage, current, and power in circuit experiments, automatically generate data line charts, comparative analysis charts, and transform boring numerical data into intuitive change patterns, effectively helping students establish concrete circuit cognition and solve the problems of insufficient visualization and difficult understanding in traditional static teaching.

2.3 Intelligent question generation and form-based assessment capabilities, enabling real-time monitoring of learning situations in the classroom WPS AI can accurately generate fill-in-the-blank questions, multiple-choice questions, true/false questions, circuit calculation questions, and simple fault analysis questions that are suitable for the learning situation based on the core knowledge points of each chapter of Fundamentals of Electrical Engineering. It supports customization of multiple-gradient question types: basic consolidation, ability improvement, and expansion, without the need for teachers to manually generate test papers and set questions. Relying on intelligent form tools, it is possible to quickly create pre class preview checks, in class assessments, and post class consolidation practice questionnaires. Students can complete online answers by scanning the QR code on their mobile phones. The system automatically collects answer data, calculates overall accuracy, screens high-frequency incorrect questions, and quickly locates common knowledge gaps and individual weaknesses at the class level. This completely changes the drawbacks of traditional paper-based assessments, such as slow grading and feedback, and provides data support for real-time correction and layered training in the classroom.

2.4 AI intelligent data analysis capability, which supports precise process based teaching evaluation The WPS table is equipped with an AI data analysis assistant, which is suitable for the statistical analysis needs of assignments, tests, and training data in electrical engineering courses. Teachers do not need to master complex functions and data analysis skills, and can complete tasks such as grade sorting, error summary, loss point statistics, and analysis of knowledge point mastery rate through natural language instructions. The system can automatically integrate multi-stage learning situation data, generate class learning situation analysis reports, and accurately identify common problems and personalized shortcomings of students in modules such as circuit calculation, law application, fault analysis, and experimental data processing, thereby helping teachers dynamically grasp changes in learning situations, and timely adjust teaching difficulties and pace. It achieves the transformation from "experiential teaching" to "data-driven precision teaching", and improves the course process evaluation system.

2.5 Cloud based collaborative knowledge base capability, which helps to deposit teaching resources and share teaching and research Relying on the cloud collaboration function of WPS, an exclusive online resource knowledge base for the course Fundamentals of Electrical Engineering can be built, supporting real-time collaborative editing, modification, and optimization of teaching resources such as lesson plans, courseware, experimental report templates, exercise papers, *etc.* by multiple teachers in the teaching and research group, and breaking the limitations of traditional resource decentralized storage and independent editing. All teaching resources can be archived, classified, and iteratively updated in the cloud, achieving long-term accumulation and efficient reuse of high-quality teaching materials, classic examples, practical training plans, and error resources. It simultaneously supports online sharing of teaching resources and permission management, facilitating the inheritance of experience and collective lesson preparation and discussion among new and old teachers. It effectively solves the problems of fragmented, difficult to share, and low reuse rate of traditional teaching and research resources, and comprehensively improves the overall teaching and research efficiency of the electrical engineering course teaching and research group.

3 Application paths of WPS AI digital intelligence technology in various teaching aspects of Fundamentals of Electrical Engineering

3.1 Pre class session: AI assisted lesson preparation and preview, optimizing teaching design

3.1.1 Intelligent generation of teaching resources. When teachers input instructions, WPS AI can directly generate lesson plans and PPT courseware outlines for the course Fundamentals of Electrical Engineering. For example, when inputting "generate a teaching PPT for Kirchhoff's Current Law in vocational Fundamentals of Electrical Engineering, including introduction, principle explanation, circuit cases, example calculations, and classroom exercises", a first draft of the courseware is automatically generated. Teachers can then supplement circuit schematics and physical images, greatly reducing preparation time. In WPS text, AI assists in writing experimental manuals, such as Kirchhoff's Law verification experiment, series parallel circuit testing task sheets, and automatically generates experimental objectives, experimental principles, steps, data recording tables, and thinking questions. It could automatically generate complex electrical formulas such as Ohm's Law and three-phase AC power, solving the problem of tedious manual formula input.

3.1.2 Generating preview tasks and pushing layered learning materials. WPS AI intelligent form is used to generate preview quizzes, and set preview questions around voltage, current, resistance, and basic circuit components, and students scan the code to

complete the preview answers. AI automatically summarizes preview data, calculates which concepts have high student error rates, and teachers adjust classroom teaching focus based on this, achieving learning based teaching. AI generates simplified knowledge point mind maps for students with weak foundations; for students with a good foundation, AI can generate extended thinking questions and achieve hierarchical preview.

3.2 In class session: empowering classroom teaching and solving abstract knowledge difficulties

3.2.1 Dynamic optimization of courseware to resolve abstract circuit knowledge difficulties. During the teaching process, WPS AI could be used to optimize the PPT content, displaying the workflow and phase changes of complex circuits through SmartArt diagrams and flowcharts. For example, in the AC RLC series circuits, the phase relationship between current and voltage can be transformed into a visual chart to compensate for the shortcomings of traditional static courseware. AI can be called up at any time in class to generate variable calculation problems on site, such as resistance series parallel calculation, Kirchhoff circuit calculation. The real-time screen mirroring explanation is conducted to enrich classroom examples.

3.2.2 Real-time classroom assessment and grasp of learning situation. Based on WPS intelligent forms, classroom exercises are pushed in class, including circuit true/false questions, parameter calculation questions, and fault analysis questions. Students scan the code on their mobile phones to answer questions, and the system automatically calculates the accuracy and marks high-frequency errors. For example, students generally confuse the rules of series voltage division and parallel current division, and teachers can immediately re explain this knowledge point and change the lagging mode of "testing after finishing" in traditional classroom.

3.2.3 Classroom collaboration and discussion. Using WPS cloud documents, group students work together online to complete circuit analysis and discussion tasks. Each group fills in the analysis results in real time, and teachers view each group's answers in real time. Classroom comments are conducted to enhance classroom interaction.

3.3 After class session: consolidation training, homework management, and laboratory report assistance

3.3.1 Layered homework and exercise generation. WPS AI generates gradient based post class exercises based on classroom knowledge points, including basic consolidation questions, circuit calculation questions, and extended application questions. Teachers can directly modify and filter, avoiding the repetitive labor of manually generating test papers. Targeting areas that are prone to errors, AI generates similar variant exercises to help students strengthen their weaknesses.

3.3.2 Assisting in writing and correcting experimental reports. There are a large number of experimental reports for the course Fundamentals of Electrical Engineering. Students use WPS AI to organize the experimental report framework and organize experimental data; teachers use AI to quickly review reports, identify common issues, and generate modification prompts. Attention: as an auxiliary tool only, it is necessary to strictly require students to independently complete data processing and analysis, and prevent direct AI generation of complete reports.

3.3.3 Table AI assistant processing circuit experiment data. After completing the practical experiment, students input the measured voltage and current data into the WPS table, and use the AI data assistant to calculate resistance and power, and draw the U – I relationship curve. The experimental data are visualized to intuitively verify circuit rules such as Ohm's Law, reducing the difficulty of data processing for students.

3.4 Teaching evaluation and research section: process evaluation, collaborative teaching and research

3.4.1 Intelligent analysis of learning situation. Combining WPS form with AI assistant, it can statistically analyze multiple homework and test data, automatically mark high-frequency wrong questions, analyze common weak knowledge points in the class, and output learning situation analysis, providing a basis for teachers to adjust teaching plans, and achieving process evaluation. It does not rely solely on a final exam paper to evaluate students.

3.4.2 Collaborative collective lesson preparation and resource accumulation. Relying on the cloud team knowledge base of WPS, multiple electrician teachers carry out online collaborative modification of lesson plans, courseware, and test papers. WPS AI can organize and summarize existing course resources, extract key and difficult points in teaching, and form a course resource library, achieving sharing of high-quality teaching resource, and improving the efficiency of teaching and research groups.

4 Conclusions

WPS AI digital intelligence technology provides a lightweight and low-cost intelligent teaching solution for the teaching of Fundamentals of Electrical Engineering, covering the entire process of pre class preparation, in class interaction, post class consolidation, and teaching and research evaluation. By intelligently generating teaching resources, visualizing abstract circuit knowledge, and providing real-time learning feedback, it can effectively alleviate teaching pain points of electrical engineering courses such as abstract and difficult to understand, tedious lesson preparation, and delayed feedback. In practical teaching, it should adhere to human – machine collaboration, with teachers leading the teaching process. It should use WPS AI as a teaching aid tool, and manually verify AI output content. Combining it with physical training, it could better improve the teaching quality of the course Fundamentals of Electrical Engineering.

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(From page 59)

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