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The Evaluation Index System and Synergistic Development Pathways for AI-Empowered Professional Ethics among Primary and Secondary School Teachers

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Abstract

In the process of empowering teacher professional development with intelligent technology, professional ethics of teachers are facing new demands for high-quality development. Currently, the cultivation of professional ethics among primary and secondary school teachers confronts three core challenges: a deviation between policy orientation and practical implementation, weakening of objective evaluation and diagnostic function, and lag in the expansion of intelligent application and ethical regulation. To address these issues, this research applies synergy theory, aiming to reveal how intelligent technology, as a control parameter, facilitates the synergistic evolution of the teacher professional ethics governance system. The specific research objectives are to: (1) systematically observe the states of subsystems, (2) establishing evaluation indicators for teachers in the era of AI , and (3) confirm the upgrade to the collaborative path. Methodologically, this study is based on the analysis of 18 teacher ethics policy texts and related literature. It adopts a mixed-method approach, such as grounded theory, Analytic Hierarchy Process (AHP), Fuzzy Comprehensive Evaluation, and questionnaire surveys. Through this approach, we construct an index system for teacher ethics development, consisting of 4 first-level Indicators (thought, behaviour, competency, institution) and 13 second-level indicators. This study seeks to resolve the synergistic dilemma of teacher ethics evaluation in educational digitalization and provide theoretical support and practical basis for the cultivation of ecological governance system.

Keywords

Artificial Intelligence; Teachers' Professional Ethics; Synergistic Paths; Evaluation Index System.

1. Introduction

In this era of profound social transformation and sweeping information technology revolution, the traditional model of teacher professional ethics cultivation is facing unprecedented challenges(Tagare et al., 2025). On one hand, societal expectations continue to rise, and various sectors have put forward unprecedented multidimensional requirements for the role of teachers: Teachers not only need to possess extensive professional knowledge and proficient teaching skills, but are also expected to have high moral integrity as well as substantial educational sentiments(Azevedo & Duarte, 2018; Tabassum & Alam, 2024). On the other hand, technological change, particularly artificial intelligence, is fundamentally reshaping the educational ecosystem. It is reconfiguring teaching environments, renewing pedagogical concepts, and expanding learning boundaries(Li et al., 2024; Song, 2024). In the face of this convergence of opportunities and challenges, the cultivation of teacher ethics can no longer rely solely on the dissemination of concepts, the imposition of regulations, or experience-based

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management. It urgently needs to be integrated into the wave of intelligence, and empowering with intelligent technology should be regarded as a key breakthrough and core driving force to solve deep-seated contradictions and enhance governance efficacy.

Currently, some schools leverage the powerful data processing, pattern recognition, process tracking and intelligent decision-making capabilities of artificial intelligence to integrate multiple sources of data such as teaching behaviours, teacher-student interactions, and parent feedback, enabling the dynamic monitoring of teachers' professional conduct. This can precisely match the core demands of the current upgrade of teacher ethics cultivation. However, the integration of artificial intelligence technology with teacher ethics cultivation is still in the exploratory stage, and in practice, it faces several risks: concerns over data privacy (Chaudhry & Kazim, 2022; Hwang & Chen, 2023), over-reliance on artificial intelligence (Nguyen & Truong, 2025), and algorithmic bias that undermines humanistic care (Fukuda-Parr & Gibbons, 2021; Nguyen et al., 2023). Addressing these challenges, this study adopts a dual perspective of policy orientation and technological empowerment, systematically constructs a multi-level evaluation index system for applying artificial intelligence to enhance the moral education of primary and secondary school teachers, and conducts empirical research to verify the feasibility and effectiveness of the application. It elucidates the intrinsic mechanisms through which intelligent technologies drive paradigm shifts in teacher ethics development, facilitating a transition from an empirically guided, ambiguous form to a data-driven, standardised, and dynamically iterative system of governance. The research aims to establish a evaluation index system and practical pathways for AI-empowered teacher ethics governance, thereby providing theoretical underpinnings and practical paradigms for the digital transformation of teacher ethics development in the new era.

2. Literature Review

2.1. What is teachers' professional ethics

Teachers' professional ethics have consistently been a focal point within the primary and secondary education sector, referring to the composite of relatively stable moral concepts, behavioural norms, and ethical qualities formed by educators in the course of their educational activities (Fang et al., 2002). In 2004, Education International published Declaration on Professional Ethics (EI, 2004). It advocates that teachers' unions should eliminate prejudice in education, while also setting out requirements for teachers regarding lifelong learning, professional commitment, and statutory rights concerning dedication to students, colleagues and parents. Subsequently, The Model Code of Ethics for Educators introduced by the United States in 2015 incorporated new provisions on technological ethical responsibilities and refined prohibitions on conduct. This marked a shift from the NEA's idealistic declarations towards the MCEE's operational prohibitions, establishing technological ethics as a new dimension of professional conduct for educators (NASDTEC, 2015). In China, the promulgation of the 'Ten Guidelines for the Professional Conduct of Primary and Secondary School Teachers in the New Era' (Ministry of Education of the People's Republic of China, 2018) systematically regulates teachers' professional behaviour. It provides more precise guidance and stronger safeguards through directives on stabilizing political orientation, disseminating excellent culture, and caring for students. Therefore, in the new era, the cultivation of teacher ethics must consider the motivation of teacher ethics cultivation from its root, and shift from the external driving logic to the internal driving logic. (Tan & Yao, 2022). From the above, it can be seen that teacher ethics possess the unity of historicity and inheritance, the unity of temporality and development, and the unity of exemplary nature and professionalism. Consequently, in different eras, the cultivation of teacher ethics also has different requirements for the times. Especially since the continuous update and iteration of digital intelligent technologies, the

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cultivation of teacher ethics and conduct for primary and secondary school teachers has continuously expanded in breadth and deepened in depth, exhibiting a multi-dimensional development trend.

2.2. The Role and Risks of Artificial Intelligence in the Development of Teachers' Professional Ethics

As intelligent technologies are increasingly integrated into the educational ecosystem, their role exhibits a distinct "double-edged sword" characteristic. On the one hand, technological empowerment frees teachers from repetitive tasks by optimizing resource allocation and reorganizing work processes, allowing them to focus more on their core and irreplaceable role as educators. From the formulation of the "*Guidelines for the Use of Generative AI Tools*" (MIT, 2024) to the introduction of intelligent analysis in curriculum design and assessment to facilitate technological integration (Shen et al., 2024), signals that intelligent technologies are becoming a key lever for redefining teaching concepts and practices. In the dimensions of assessment and data analysis, intelligent analysis technology has brought about a paradigm shift in teaching assessment. Through continuous collection and analysis of learning process data, teachers can assess micro-level evidence about students' cognitive processes, engagement, and conceptual understanding that was previously difficult to capture (Lin et al., 2024; Tempelaar et al., 2024). This enables the visualization of teaching outcomes.

On the other hand, this deep integration has also given rise to multi-dimensional ethical risks and systemic challenges. At the macro level, AI may lead to the weakening of algorithmic accountability and the exacerbation of the digital divide (Crawford & Calo, 2016; Guo & Rong, 2025). At the micro-level of interaction, educational relationships are evolving from a simple teacher-student relationship to a human-machine collaborative symbiosis. While this helps to pool collective wisdom and enhance teaching and cognitive abilities (Lu & Tang, 2025), it also gives rise to specific issues such as the exacerbation of educational inequality due to data bias, excessive collection of non-teaching sensitive data, privacy security, algorithm discrimination, and disputes over data ownership (Alfiras et al.,2025; Bai, 2024; Tripathi & Kumar, 2025;Yao & Wang, 2025). Introducing intelligent technologies at the basic education stage has further magnified the complexity of potential uncertainties and ethical challenges (Wu & Guo, 2024).

The current core issue lies in the fact that although intelligent technologies have provided new impetus for the digital transformation of teachers' professional ethics, the existing research still exhibit significant gaps in how to systematically identify, accurately classify, and effectively manage the intertwined risk networks mentioned above. Therefore, the cultivation of a new evaluation system that can proactively identify risks and ensure the symbiotic cooperation between humans and machines has become a core issue that urgently needs to be addressed in order to promote the cultivation of teachers' professional ethics.

2.3. The synergistic mechanism of AI-empowering the development of teachers' professional ethics

Teacher ethics development is a systematic endeavour, and it requires a comprehensive mechanism to ensure its smooth implementation (Barrett et al., 2006). Given the complexity of the interactions involving multiple levels and types of entities, clarifying the relationships among the stakeholders involved, that is, the collaborative mechanism of multiple entities, has become a key entry point for optimizing teacher ethics evaluation. The Synergistics provides a profound theoretical perspective for understanding the evolution of such complex systems. (Fan & Li, 2024). This theory reveals that the evolution of an open system from disorder to order is not simply the simple superposition of its subsystems, but rather a process of self-organization and synergy led by order parameters and achieved through nonlinear interactions (Haken, 1987). This means that an effective evaluation of teachers' ethics should not merely

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rely on mechanical control of a single factor, but should aim to identify and cultivate the key order parameters that can guide the entire system towards a more orderly state of development.

Technology empowerment in the cultivation of teachers' professional ethics in primary and secondary schools highlights the feature of synergy governance. It emphasizes the integrated coordination of various resources and multiple systems. The cultivation of teachers' ethics has three characteristics: First, it is dynamic and evolving. The cultivation of teachers' ethics in primary and secondary schools is a complex system that evolves dynamically and is interrelated. All kinds of cultivation environments, cultivation subjects, and cultivation contents are subsystems with openness and complexity. Second, it has nonlinear coordination. Technology empowerment has broken the one-way indoctrination structure in traditional teachers' ethics cultivation and constructed a collaborative interaction network of multiple subjects such as individual teachers, teacher communities, educational administrators, technology developers, parents, and the public. Third, it has an order-state transition. In the collaborative system empowered by technology, minor innovations in ethical teaching practices may be amplified by the technology platform and transmitted to the whole system, becoming the key force triggering the system to transition to a higher ordered state, as shown in **Figure 1**.

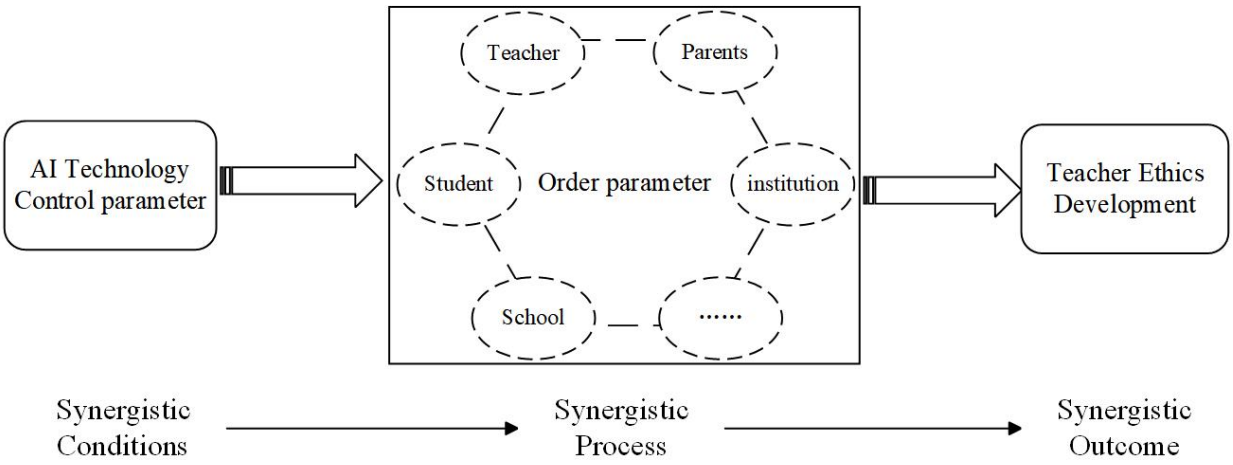

Figure 1. Synergistic theory model

2.4. A Governance Framework for the Synergistic Development of Teachers' Professional Ethics through Technological Empowerment

To effectively enhance the professional ethics of primary and secondary school teachers, it is necessary to recognize that this is a complex systemic issue involving multiple factors and cannot be resolved by a single approach. This requires us to fully understand the collaborative, dynamic and evolving nature of teacher ethics cultivation itself (Ansell & Gash, 2008). In this context, synergetics provides us with a powerful analytical framework. (See **Figure 2** for the framework)

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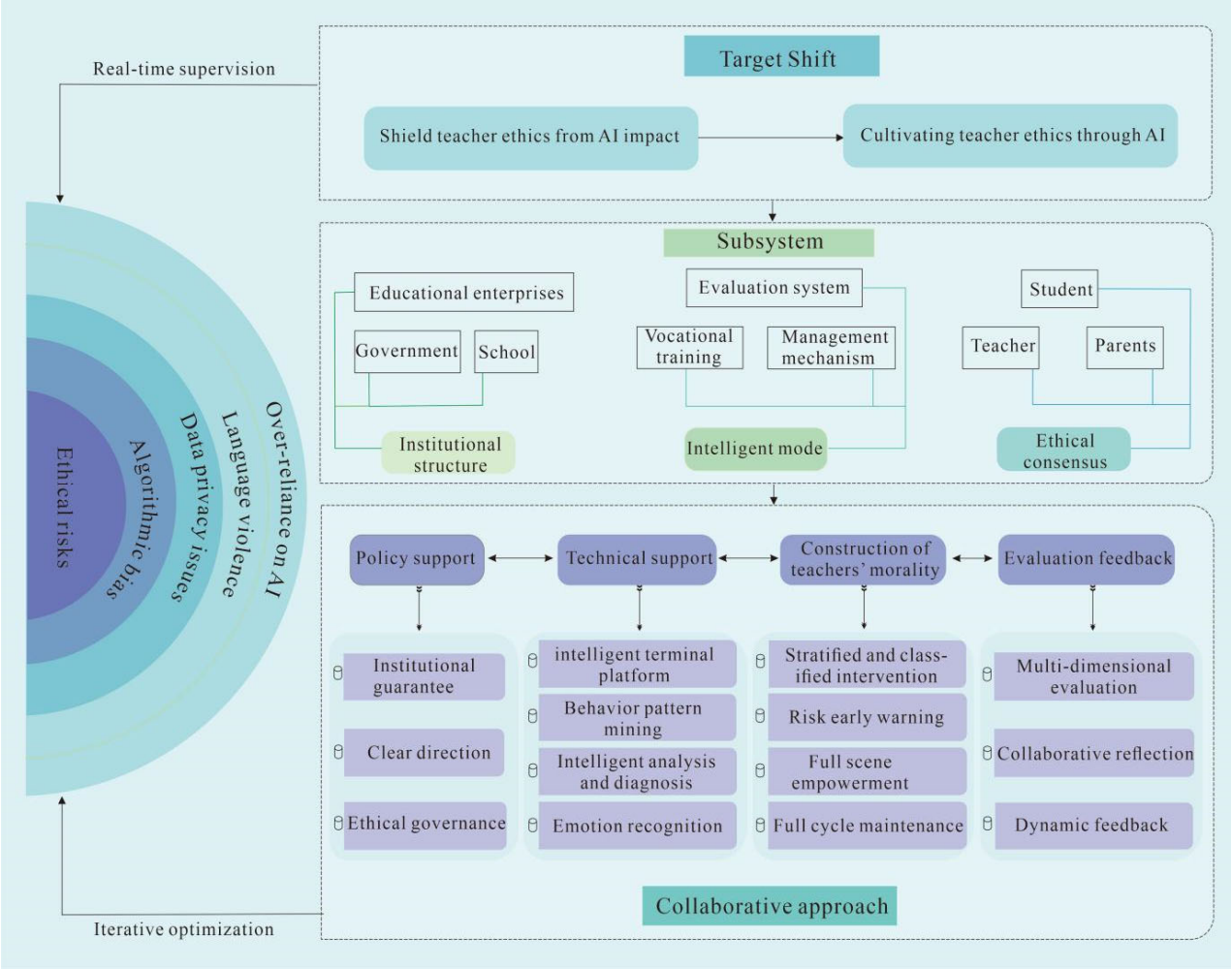

Figure 2. The collaborative framework for empowering teachers' professional ethics through artificial intelligence

Under this theoretical framework, we regard artificial intelligence as a control parameter. It exerts external influences, driving the reconfiguration of the internal interaction relationships within the system, thereby creating conditions for the system to evolve towards a higher-order ordered state.

During this process, the interactions among the various subsystems will give rise to an order parameter for one or a few dominant modes (for example, a set of unified evaluation criteria that integrate scientific, ethical and educational values). This order parameter governs the behaviours of all subsystems via the 'slaving principle', directing them to adapt their internal structures and behavioural patterns in order to sustain the macroscopic ordered state of the overall system. Based on this understanding, the cultivation of teacher ethics hinges on fully utilizing the potential of technological empowerment for mechanism innovation and process optimization—under the premise of respecting educational ethics and pedagogical principles—to construct a sustainable, resilient, and evolvable path for the systematic development of teachers' professional ethics.

However, the existing research has significant deficiencies in the aspect of teachers' professional ethics: Firstly, the theoretical analysis is weak. The collaborative theory was not effectively utilized to clarify the internal logic of the evaluation mechanism, resulting in a blurred relationship of responsibilities and authorities in the evaluation process. Secondly, the response to practice was sluggish, and it failed to proactively establish integrated evaluation standards that could adapt to the intelligent era and integrate technological rationality with

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educational values. As a result, the empowerment of AI technology and professional development were disconnected from each other.

Based on this, this study focuses on answering the following three questions:

(1) What factors are included in the evaluation index system of teachers' professional ethics in the era of artificial intelligence?

(2) Why is the development of teacher ethics important?

(3) What methods can enable the synergistic development of teachers' professional ethics?

3. Materials and Methods

This study adopts a mixed-methods approach, integrating both qualitative and quantitative research paradigms. First, grounded theory was applied. The research began with actual observation, original data were summarized and generalized to build substantive theories from the bottom up. Subsequently, the Analytic Hierarchy Process (AHP) was employed to quantify and assign weights to the theoretical framework. This approach facilitated the establishment of a scientific and comprehensive evaluation index system for assessing teachers' ethics in primary and secondary schools. Finally, empirical tests were conducted utilizing questionnaire surveys alongside the fuzzy comprehensive evaluation method.

3.1. Grounded Theory Methodology

This study employed a procedural grounded theory approach to identify the factors influencing professional ethics of primary and secondary school teachers with open coding, axial coding, and selective coding. We conducted a search of policy documents and academic literature related to the professional ethics cultivation of primary and secondary school teachers. Then, we screened and organized the retrieved documents, eliminating those with relatively low relevance to the key terms. Finally, 18 policy documents and 4 journal articles were selected as the research basis. Coding was independently verified by two researchers, and discrepancies were resolved through consensus.

3.1.1. Open coding: refining concepts and categories

Open coding involves attaching labels to the original data in a bottom-up manner, analysing sentence by sentence and extracting concepts, then merging similar items and eliminating duplicate concepts. To reduce bias, the data must be processed without preconceived notions. In this study, each keyword and sentence of the relevant cases was labelled and irrelevant content was identified. Initially, 230 valid original statements were extracted. Subsequently, they were classified and summarized to initially obtain 78 initial categories. The connotations of these concepts were explained to become the target objects for the next level of coding, and ultimately, 21 initial categories were obtained.

3.1.2. Axial coding: establishing the core categories

The categories derived from open coding are often quite dispersed. Following the extraction of initial categories, axial coding becomes necessary. This step is a critical step for researchers to delineate the nature and dimensions of these categories while uncovering their underlying logical connections. Subsequently, the initially extracted concepts undergo axial coding. Through comparison, induction, and abstraction of these initial concepts, four core categories emerge. (Please refer to **Table 1**)

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Table 1. Axial coding

Core category	Initial category	category connotations
Thought	Patriotic	Love one's country, abide by the law, and discharge teaching duties accordingly.
	Devote to work	Teachers must be loyal to the cause of education.
	Morality	Teachers shall steadfastly uphold the ideal of serving the greater good, cultivating their moral character and ethical stance.
Behaviour	Nurture students	Teachers bear the weighty responsibility of shaping souls, shaping lives, and shaping individuals in this era.
	Example	Teachers should uphold the commendable practice of leading by example and maintain a professional demeanour.
	Care for students	Care for and cherish students, effectively safeguard their right to education, and respect them.
	cooperation	Teachers should foster unity among colleagues and parents, and manage interpersonal relationships appropriately.
Competency	Self-improvement	Cultivating professional competence and subject expertise to enhance teachers' practical capabilities
	lifelong learning	Upholding the educational philosophy of fostering virtue, promoting all-round development, and encouraging lifelong learning
	Innovate	Adhering to a diligent approach of seeking truth and fostering innovation, we shall build a high-calibre, innovative teaching faculty.
Institution	Resource	Strengthen the cultivation and supply of high-calibre teachers, and optimise the allocation of teaching resources.
	Management	Establish a leadership accountability system for professional ethics development, deepen institutional reform, and foster institutional innovation.
	Surroundings	Strengthen the promotion of professional ethics among teachers to foster a campus atmosphere that honours educators and values education.

3.1.3. Selective coding: framework integration

Selective coding involves organising core categories according to the narrative thread describing the research question, thereby synthesising and refining concepts to ultimately construct a theoretical framework. The central phenomenon of this research is the development of professional ethics among primary and secondary school teachers, analysed by identifying intrinsic logical connections and commonalities across distinct categories. Corresponding narrative threads include: Thought that guides teachers to establish sound values, defining both purpose and methodology of teaching. Behaviour that translates principles into practice. Competency that enhances teaching effectiveness. Institutions that foster a synergistic environment for teachers and students. This forms a logical loop for teacher ethics, collectively advancing its development, as shown in **Figure 3**.

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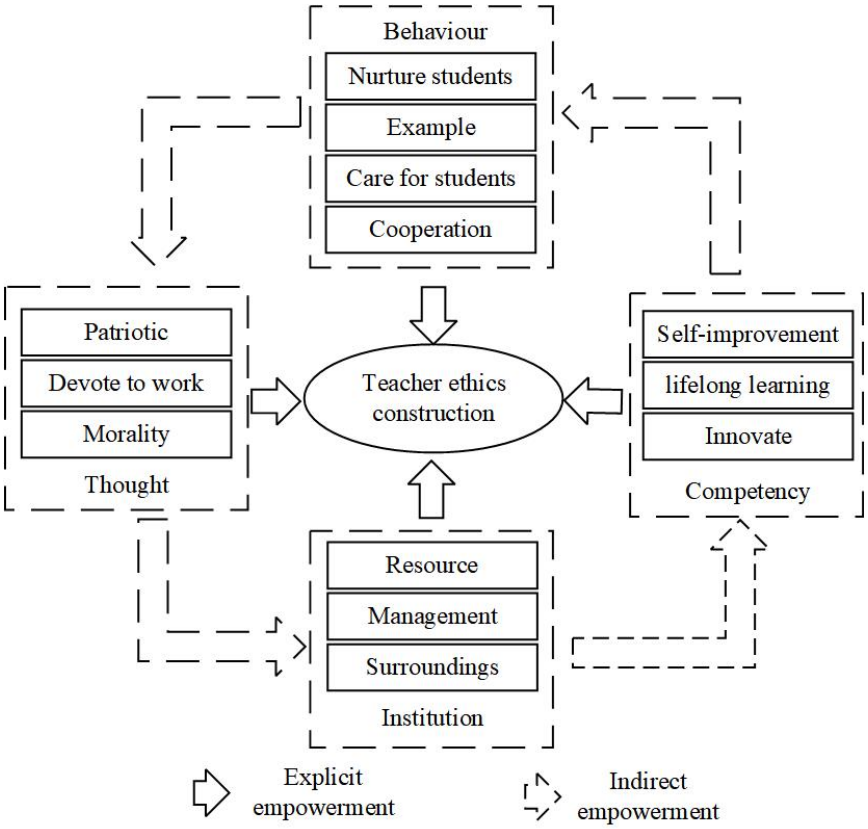

Figure 3. Model of Constituent Factors in the Development of Professional Ethics for Primary and Secondary School Teachers

3.1.4. Theoretical saturation testing

This research employed coding of the first 20 documents, with the remaining two policy documents used for theoretical saturation testing. Upon examination, it was determined that the additional sample materials did not yield any new categories, primary categories, or typical relationships. This indicates that the evaluation indicators have reached a state of saturation, thereby confirming that the theoretical model of this research exhibits a high degree of theoretical saturation.

3.2. Analytic Hierarchy Process for Determining Indicator Weights

3.2.1. Constructing hierarchical models and judgment matrix

Based on the aforementioned evaluation indicator system, a three-tier hierarchical model comprising objective-criteria-indicator has been established. The objective is to enhance the professional ethics of primary and secondary school teachers through artificial intelligence. The criteria level comprises four core categories: thought, behaviour, competency, and institution. The indicator level consists of 13 initial indicators. To objectively determine the weights of the indicators, the Analytic Hierarchy Process (AHP) was employed. In this study, a questionnaire survey was conducted among 10 experts. For each level of indicators or factors, a pairwise comparison was made based on the '1-9' importance rating scale proposed by Saaty (1977), and the importance was quantified using numerical values, thereby constructing the judgment matrix. The score given by an expert can be used to construct a judgment matrix at each level structure. **Table 2** shows the judgment matrix of Expert 1. The calculation steps for the scores of the secondary indicators are basically the same as those for the primary indicators, so they are omitted for brevity.

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Table 2. Expert 1's O-P Judgement Matrix

	P1	P2	P3	P4	Wi	λmax	CR
P1	1	3	5	7	0.5579	4.118	0.044
P2	1/3	1	3	5	0.2633		
P3	1/5	1/3	1	3	0.1219		
P4	1/7	1/5	1/3	1	0.0569		

The maximum eigenvalue(λ_{max})is computed using Equation (1), The Consistency Index(CI) values are computed using Equation (2), Subsequently, a consistency test was performed using Equation (3) to obtain the Consistency Ratio (CR). From the formula, it can be seen that Expert 1's judgement matrix satisfies the consistency test. Similarly, the weights for the other nine experts can be calculated. From the weighting table for core category, the consistency ratio of the matrix is less than 0.1, indicating that the matrix has passed the test. Consequently, the indicator weights can be derived using Equation (4). W_i denotes the final weighting of each indicator, n represents the number of experts, and consistency tests were conducted for the corresponding four core categories. The results are presented in **Table 3**.

Table 3. Results of consistency test of judgment matrix

Core category	λmax	CI	RI	CR	Consistency test results
Thought	3.001	0.001	0.520	0.001	PASS
Behaviour	4.014	0.005	0.890	0.005	PASS
Competency	3.000	0.000	0.520	0.000	PASS
Institution	3.002	0.001	0.520	0.002	PASS

$$\lambda_{max}=\sum_{i=1}^{n}\frac{(AW)_i}{nW_i} \quad (1)$$

$$CI=\frac{\lambda_{max}-n}{n-1} \quad (2)$$

$$CR=\frac{CI}{RI} \quad (3)$$

$$W_i=\frac{w_{i1}+w_{i2}+\cdots+w_{in}}{n} \quad (4)$$

3.2.2. Assignment of weights to each indicator

Finally, after confirming that all judgement matrices meet the consistency criteria, the weights for the core categories were determined as follows: (Thought, Behaviour, Competency, Institution) = (0.3508, 0.3699, 0.1547, 0.1246). It can be observed that among the core categories, thought and behaviour exert a greater influence on teachers' professional ethics, whereas most experts consider the Institution indicator to have a relatively minor impact on the development of teachers' professional ethics, as shown in **Table 4**.

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Table 4. Weighting of Evaluation Indicators for Professional Ethics of Primary and Secondary School Teachers

First-level Indicator	First-level Indicator relative to overall target weighting	Second-level Indicator	Second-level Indicator relative to primary indicator weightings	Second-level Indicator relative to overall target weighting
Thought	0.3508	Patriotic	0.5824	0.2043
		Devote to work	0.1938	0.0680
		Morality	0.2238	0.0785
Behaviour	0.3699	Nurture students	0.3667	0.1356
		Example	0.2761	0.1021
		Care for students	0.2253	0.0833
		cooperation	0.1319	0.0489
Competency	0.1547	Lifelong learning	0.3506	0.0542
		Self-improvement	0.4021	0.0622
		Innovate	0.2473	0.0383
Institution	0.1246	Resource	0.3482	0.0434
		Management	0.3112	0.0388
		Surroundings	0.3406	0.0424

4. Results

4.1. Fuzzy Comprehensive Evaluation

To validate the scientific rigor of the constructed evaluation index system, this study employs the fuzzy comprehensive evaluation method for empirical analysis. Fuzzy comprehensive evaluation is a holistic assessment methodology grounded in fuzzy mathematics, which converts qualitative evaluations into quantitative assessments based on membership theory. It is currently frequently combined with the Analytic Hierarchy Process to assess various types of non-deterministic problems (Qian et al.,2025; Zhou et al.,2025). The specific analytical procedure is as follows:

(1)First, establish a comprehensive set of evaluation factors denoted as U, $U=\{U_1,U_2,\cdots,U_n\}$, Each element U_n represents the nth factor influencing the evaluation subject. The previously determined evaluation indicators for the professional ethics development of primary and secondary school teachers shall serve as the set of evaluation factors.

(2) Subsequently, the set of evaluation comments V is defined, representing the m grades of evaluation outcomes. Assuming there are m possible evaluation results that the evaluator may assign to the subject, the set of evaluation grades is constructed as $V=\{V_1,V_2,\cdots,V_m\}$. This study adopts the grading scale {Very Good, Good, Average, Poor, Very Poor}.

(3) To enhance the scientific rigour of the evaluation outcomes, and recognising that non-specialist teachers may struggle to provide a comprehensive assessment of professional ethics development, this study employs an expert-led scoring approach for empirical evaluation. The panel comprises headteachers from primary and secondary schools, experienced frontline teaching staff, and specialists in primary and secondary education research. A total of 35 experts were invited to participate in the evaluation, with 30 valid expert evaluation data points

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ultimately retrieved. Based on the scoring results, the fuzzy evaluation matrix *R* was calculated. Referencing Equation (5), the membership degrees of the evaluation indicators for the evaluation lexicon were obtained.

$$R=\begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{bmatrix} \quad (5)$$

(4) Based on the evaluation indicator weights determined by the aforementioned Analytic Hierarchy Process, the weight vectors for each dimension's evaluation indicators are established, where A_n represents the weight corresponding to the nth evaluation indicator. A_n>=0 and satisfies Equation(6),The overall weight vector is A={0.3508, 0.3699, 0.1547, 0.1246}, with the weight vectors for each primary indicator being A_1={0.5824, 0.1938, 0.2238}; A_2={0.3667, 0.2761, 0.2253, 0.1319}; A_3={0.3506, 0.4021, 0.2473}; A_4={0.3482, 0.3112, 0.3406}. The indicator weight vector A and fuzzy relationship matrix R using Equation(7), the dimensional evaluation vectors for the five primary indicators can be derived. Following comprehensive calculation, the overall evaluation matrix is presented in **Table 5**.

Table 5. Fuzzy comprehensive evaluation results for core category

Fuzzy Comprehensive Evaluation Results for First-level Indicator	Very Good,	Good,	Average	Poor	Very Poor
Thought	0.487	0.407	0.092	0.014	0
Behaviour	0.427	0.425	0.099	0.049	0
Competency	0.360	0.319	0.205	0.116	0
Institution	0.399	0.354	0.179	0.068	0

$$\sum_{i=1}^{n} A_i = 1 \quad (6)$$

$$W_i = A_i * R_i \quad (7)$$

(5) Multiply the five primary indicator dimension evaluation vectors (W_1–W_5) by their corresponding evaluation grade scores (1–5) to obtain the comprehensive evaluation vector.

Thought=5*0.487+4*0.407+3*0.092+2*0.014+1*0=4.367;

Behaviour=5*0.427+4*0.425+3*0.099+2*0.049+1*0=4.23;

Competency=5*0.360+4*0.319+3*0.205+2*0.116+1*0=3.923;

Institution=5*0.399+4*0.354+3*0.179+2*0.068+1*0=4.084;

From the overall evaluation scores, Thought and Behaviour scored 4.367 and 4.23 respectively, indicating that the expert assessors were generally satisfied with the professional ethics effectiveness in these two dimensions, though room for improvement remains. Among the four core categories, Competency scored lowest while Thought scored highest. Multiplying the first-level indicator dimension evaluation vectors by the weight vector A yields the overall evaluation vector W_a={0.434,0.394,0.122,0.05,0} ,Subsequently, multiplying the overall evaluation vector W_a by the corresponding scores for the five evaluation grades (1–5) yields the comprehensive evaluation score for professional ethics development:

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X=0.434*5+0.394*4+0.122*3+0.05*2+0*1=4.212，This indicates that, overall, the evaluation grade for professional ethics development is favourable.

4.2. Questionnaire investigation

This study developed an evaluation framework for teacher ethics development encompassing four dimensions—thought, behaviour, competency, and institution—based on the core provisions of regulations governing teacher ethics development in primary and secondary schools. Based on this framework, a questionnaire comprising 20 items was constructed. The items were derived from three sources: (1) the comprehension and interpretation of relevant concepts and theories; (2) the coding and extraction of policy texts; (3) the examination of pertinent literature (Gai & Li, 2020; Lin & Ping, 2021; Liu et al., 2022; Gao, 2023). These processes established items suitable for assessing the professional ethics development of primary and secondary school teachers in the era of artificial intelligence. This study conducted a small-scale trial among a sample of teachers in City A. A total of 230 questionnaires were distributed, and 203 valid questionnaires were retrieved, with an effective rate of 88.26%. The proportion of males was 39.9%, and the proportion of females was 60.1%. The total reliability of the questionnaire reached 0.875, indicating that the questionnaire has certain internal reliability. In the KMO and Bartlett's sphericity test, the KMO value was 0.852, the approximate chi-square value of Bartlett's sphericity test was 1124.068, the degrees of freedom were 153, and the significance was 0.000 < 0.001, indicating that the variables in this questionnaire have common factors and are suitable for factor analysis.

4.3. Correlation Analysis

To deeply explore the correlations related to teacher ethics cultivation, this study performed a Pearson correlation analysis on all pairs of secondary indicators. The results revealed that there was a significant correlation among these secondary indicators, and they mutually influenced each other. Therefore, we must attach great importance to and strive to enhance every aspect of teachers' ethics, comprehensively improving the teacher ethics level of primary and secondary school teachers from all dimensions, in order to achieve their all-round development. Refer to **Figure 4**, where A1-A3 correspond to the Thought dimension, B1-B4 to Behavior, C1-C3 to Competency, and D1-D3 to Institution.

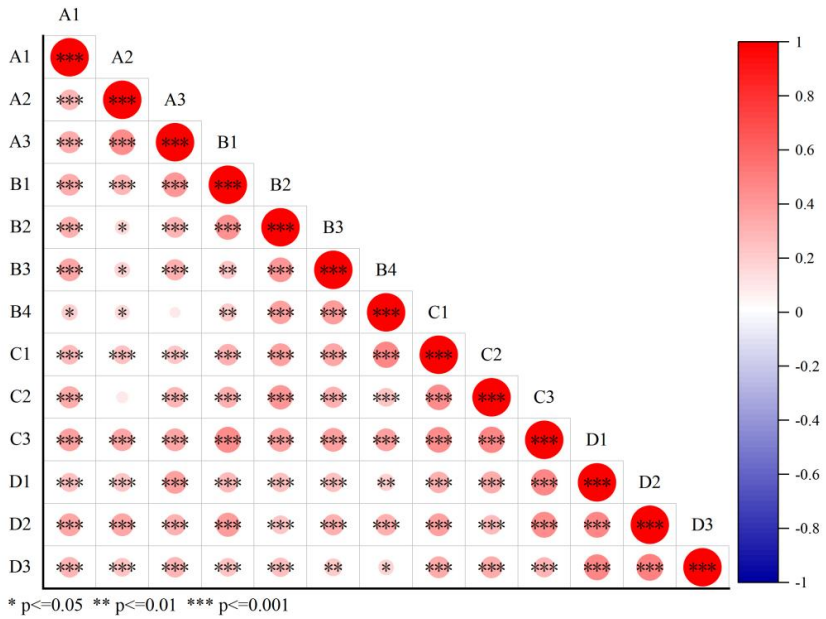

Figure 4. Heatmap of Correlation Analysis Across Dimensions

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4.4. Differential Analysis

This study conducted a differential analysis of the scores achieved by different groups, including those of varying genders and years of teaching experience, on the core category of teacher ethics development. First, an independent samples t-test was conducted to analyse gender differences. A significant difference was found only in the Competency dimension ($p = .007$), with male teachers scoring higher than female teachers on measures of professional ambition. No significant gender differences were observed in the Thought, Behaviour, or Institution dimensions.

Teachers were categorized into five groups based on years of service (1–3, 4–6, 7–14, 15–20, and 20+ years). A one-way ANOVA revealed significant differences across groups in the Behaviour ($p = .006$), Competency ($p = .018$), and Institution ($p = .006$) dimensions. The difference in the Thought dimension approached but did not reach significance ($p = .054$).

It can be seen that teachers at different stages have differences. Teachers with 1-3 years of teaching experience are relatively more passionate than teachers at other stages. The group of expert teachers with over 15 years of teaching experience exhibit mature and stable psychological characteristics of a profession. The accumulation of long-term educational practice has enabled them to form a profound professional identity, allowing them to better focus on educational and teaching work. They have a relatively sufficient understanding and insight into emotional expression and control. See **Figure 5** for details.

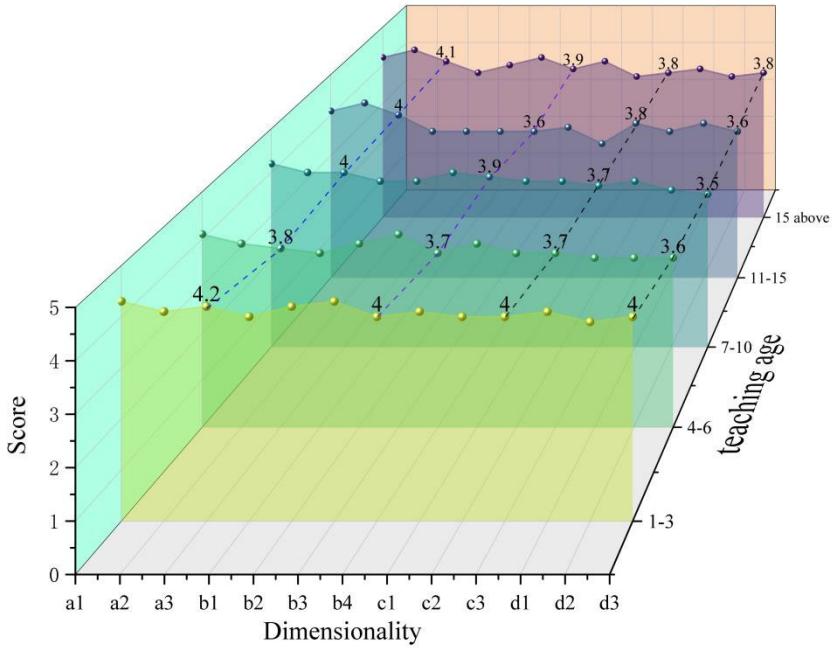

Figure 5. Waterfall Chart for Analysis of Teaching Experience Variability

According to the empirical test results, all dimensions of teacher ethics cultivation show a mutually reinforcing phenomenon. The professional ethics of primary and secondary school teachers are relatively good, but there is still room for improvement. Specifically, this generational difference in our context is manifested as follows: new teachers with 1-3 years of teaching experience are full of enthusiasm for the future education cause, professional teachers with 15 years or more of teaching experience can reconstruct their professional values through reflection, while middle-aged and young teachers (with 4-14 years of teaching experience) are in the high-risk stage of 'plateau burnout', and as their emotional exhaustion deepens, their professional cognitive framework gradually deviates - specifically manifested as superficial

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understanding of educational concepts, negative work attitude, and tool-based understanding of teaching nature, ultimately leading to the formal operation of teacher ethics practice. Therefore, technological empowerment of teacher ethics cultivation is particularly important.

5. Discussion

5.1. Policy Support for Multi-stakeholder Synergistic Enhancement in Teacher Ethics Development

While artificial intelligence technology assists teachers in assessment, it may also bring about new ethical risks: On one hand, it is prone to overlook non-quantifiable implicit educational behaviors such as emotional interaction, leading to a one-sided assessment(Brownlie, 2025); on the other hand, its algorithmic biases may reinforce standardized evaluation and squeeze the personalized space for teachers to teach according to individual needs(Henriksen et al., 2025; Hooshyar et al., 2025). To address these challenges, we cannot rely solely on the self-improvement of technology; instead, we must design policies and systems collaboratively to systematically guide and regulate.

Therefore, the policy should focus on establishing a clear and operational multi-party collaborative governance framework. The key lies in defining the rights boundaries, obligation lists and responsibility loops of various stakeholders (government, schools, enterprises, teachers, parents, and students) in data acquisition, algorithm training, and result application (Vineis et al., 2025). This requires the establishment of a classified and graded supervision and accountability mechanism to ensure that each subsystem (such as administration, schools, and technology providers) has equal rights and responsibilities in their interactions, thereby promoting positive and orderly collaboration (Dai & Zhu, 2024). It is necessary to take into account the characteristics of education itself, and formulate unified data collection standards, improve data processing norms and establish institutional standards (Yang&Chu, 2024).

The second is the trust crisis caused by the lack of algorithm transparency. The teacher assessment system should disclose the calculation method of data weights to teachers to prevent the emergence of doubts about “black box evaluation”, and enhancing algorithm transparency is not only the core path to break through the technical black box but also the key mechanism for building human-machine trust (Wu&Wu, 2024). At the same time, the synergy of policies and technology needs to break through single-scenario applications, use intelligent technology to establish a hierarchical capability framework, embed situational intelligent training, and improve teachers’ technical mastery and ethical sensitivity in real educational scenarios.

5.2. The Mechanism of Alleviating Teacher Burnout through Humanities-Based Empowerment

This study holds that the erosion of teachers’ professional ethics by job burnout is essentially a crisis of the alienation of educational subjectivity. Data analysis shows that there are differences in the professional ethics levels of teachers with different teaching experience, which suggests that burnout might be a gradual process. Senior teachers have more extensive work experience and better coping mechanisms, so their level of job burnout is lower, while young and middle-aged teachers have a higher degree of emotional exhaustion (Anastasiou & Belios, 2020). The key mechanism by which burnout erodes teachers’ professional ethics lies in gradually weakening the educational warmth through emotional exhaustion, ultimately undermining the foundation of values. Non-teaching administrative affairs with high frequency, such as inspections and checks, will generate more pressure (Li & Liang, 2025). When teachers are constantly exposed to high-intensity and high-standard working conditions for a long time, their value pursuits tend to be eroded, and the foundation of their professional ethics becomes

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unstable (Karakus, 2024; Oberg, 2025). The alleviation and prevention of teacher burnout should fully consider the constituent elements within each subsystem and the coordination among these elements (Gao et al., 2023). Therefore, the cultivation of teacher ethics must go beyond simple behavioural norms and evaluations, and shift its focus to the professional vitality and psychological experiences of teachers.

Secondly, the cultivation of teacher ethics should establish the principle of 'technology serving the essence of education', integrate AI tool design into teacher ethics care, understand the psychological burdens and difficulties of primary and secondary school teachers, enable intelligent technology to provide two-way care on both the teacher side and the student side. For instance: Utilize intelligent technologies to identify and eliminate the factors that cause job burnout (such as ineffective evaluations and repetitive tasks), and through humanistic care and growth-oriented evaluations, provide psychological support and professional development opportunities for teachers (Drew et al., 2024; Duan & Zhao, 2024). Ultimately, it leads to the restoration of the original purpose of teachers' professional ethics, making it a nourishment rather than a burden for teachers' growth, thereby rekindling the vitality of education and benefiting students' academic development.

6. Conclusion

Teachers play a pivotal role in the educational process and have a significant impact on students' academic and personal development. In the age of artificial intelligence, new avenues for establishing teachers' ethics have emerged: from a technological standpoint, AI has facilitated innovative practices in the ethical development of teachers within primary and secondary education as part of the digital transformation; from a values perspective, it offers a crucial breakthrough for fulfilling the fundamental objective of 'cultivating virtue through education.' Therefore, it is essential to establish a systematic evaluation framework for the development of teacher ethics in primary and secondary schools during this era of AI. However, this study is constrained by the current sample size and coverage, potentially limiting the generalisability of its empirical findings. Subsequent research aims to expand the diversity of sample collection and optimise sample structure to further validate the observability of the next-level evaluation indicators and conduct applied case studies. This will provide observable, easily implementable standards for teacher ethics development in primary and secondary schools, thereby enhancing its social dissemination value.

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8. Conflicts of Interests

No potential conflict of interest was reported by the authors.

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