World Journal of Educational Studies
Print ISSN: 2959-9989
Online ISSN: 2959-9997
DOI: https://doi.org/10.61784/wjes3057

THE ONTOLOGICAL BASIS AND ETHICAL RESPONSE ANALYSIS OF ARTIFICIAL INTELLIGENCE INTERVENTION IN SPECIAL EDUCATION

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Abstract: In the context of the increasing involvement of artificial intelligence in the education system, the field of special education is facing unprecedented changes and challenges. This article is based on an interdisciplinary perspective of philosophy of technology, educational ethics, and mathematical modeling, exploring the ontological reconstruction, cognitive paradigm shift, and ethical response mechanism triggered by the embedding of artificial intelligence technology in special education. By analyzing the perceptual structural alienation and emergence of "ubiquitous differences" caused by AI empowering special groups, this paper proposes the concept model of "inclusiveness field" to reveal the generation mechanism of differential experiences between humans after technology embedding. The article further applies the framework of intergenerational justice and care ethics to consider how to construct an educational ethical structure with social inclusiveness. Finally, based on topology and field theory methods, an attempt is made to construct a social inclusion function in special education, in order to achieve a computable expression of the tripartite relationship of "technology ethics subject". This article aims to provide philosophical clarity, ethical norms, and innovative models for special education in the era of artificial intelligence, promoting deep synergy between educational equity and human dignity.
Keywords: Artificial intelligence; Special education; Ethical modeling; Inclusiveness field; Intergenerational justice

1 INTRODUCTION

As artificial intelligence increasingly supports educational systems, its use in special education raises important questions about fairness and effectiveness. Current approaches often focus on technical tools but overlook deeper issues: how AI changes our understanding of student abilities, and whether it may unintentionally disadvantage some learners[1]. This study combines educational theory, ethics, and practical modeling to explore three key aspects: How AI can challenge traditional views of "normal" learning abilities; Its potential to both assist students and create new barriers; Ways to measure and improve fairness using mathematical approaches. We develop three practical models: a Social Inclusion Framework an Intervention Impact Tool, and a Long-term Equity Model . Real-world data from international education reports and a Japanese AI-assisted workshop demonstrate that AI works best when adapting to diverse needs rather than enforcing fixed standards. This research provides: clearer principles for educators, measurable strategies for schools, and sustainable approaches to make technology work fairly for all learners[2].

2 THE ONTOLODICAL DOUNDATION OF INEQUALITY IN SPECIAL EDUCATION

In the grand narrative of modern education, special needs children are often placed in a distorted mirror. Their existence is named 'differentiation', understood as 'deficiency', and treated as 'corrective'. This is not an accidental bias, but an ontological structure deeply rooted in the education system and knowledge system. The real problem is not whether these children are 'incapable', but how we presuppose the meaning of 'ability' itself.

2.1 The Construction of Normative Knowledge: From Standards to Exclusion

Foucault once pointed out that modern society incorporates life into the measurement and division of power through a hidden yet powerful disciplinary mechanism. In the field of special education, this kind of training is carried out using terms such as "assessment," "diagnosis," and "rehabilitation," and its essence is to construct a set of genealogies about "normalcy" through technical discourse[3]. In this spectrum, only children who meet certain criteria of neural typicality are considered "educatible" subjects; And those who deviate are labeled and pathized, ultimately leading to institutionalized edge positions.

Education is no longer a process leading to freedom, but a domestication project of differences. Special needs children are seen as a mirror of 'shortcomings' that need to be repaired, trained, and corrected, rather than understood as a complete life experience. They are not excluded due to 'defects', but because they reveal the fictional nature of' normality ', thereby threatening the stable order on which the education system relies.

2.2 The Manifestation of Structural Inequality in Reality

This ontological bias is not only a phenomenon at the discourse level, but deeply embedded in the material structure of the real education system. According to UNESCO data, the dropout rate for special needs children in developing countries is as high as 63%, and even in countries with abundant educational resources, nearly one-fifth of special needs children are still unable to complete compulsory education[4]. These numbers are not just a statistical imbalance, but also reveal a selective perception of the education system - it sees children who meet expectations but systematically ignores those who cannot adapt to the pace of the system.

In China, issues such as teacher allocation, professional configuration, and regional distribution in special education schools are also significant. A large number of special needs children are forced to receive "minimal intervention" in functional isolation, and they are referred to as "educated" but never truly become "understood". The education system is implementing separation in the name of "care" and legitimizing exclusion in the name of "inclusiveness". This inequality is not a problem outside of education, but rather a product of education itself.

2.3 AI as An Extension of Existence: Ethical Possibilities of Technological Intervention

When AI technology enters the education space, it not only brings efficiency and convenience, but also opens up a new philosophical perspective: can it become an "expression extension" of disadvantaged existence? Merleau Ponty proposed that the "body schema" is not the sum of organs, but rather the way consciousness intertwines with the world. When traditional perception paths are limited, technology can become a new perception loop - not to replace, but to awaken the possibility of existence that has not yet been experienced[5].

AI is not natural justice, it may also become a new training tool. But if its original design intention is to provide a channel for individuals who have been rejected by language, restricted by their bodies, and silenced by the system to regain expression, then it may become a "digital prosthetic" - pulling excluded entities back into the world.

In this sense, the legitimacy of AI does not stem from its level of intelligence, but rather from whether it can become a "tool of justice" - not a cold copy of existing standards, but rather opening up new dimensions of understanding, making education truly a call and response to "different ways of existence".

3 THE EMERGENCE OF TECHNOLOGY:PHENOMENOLOGICAL RECONSTRUCTION OF AI'S EDUCATIONAL COGNITIVE PARADIGM

In the deep field of special education, technology is no longer just an extension of tools, but gradually emerges as a new form of cognitive "blossoming" - it enables those who have been silenced and isolated to regain connection with the world. The intervention of AI technology marks a deep reconstruction of the educational cognitive paradigm: from the "invisible body" to the "perceived other", from one-dimensional knowledge infusion to multimodal co sensory generation. This change is not only a methodological innovation, but also a phenomenological transformation of the world structure.

3.1 Phenomenology of Technology: A New Form of Perceived World

Heidegger once pointed out in his theory of "Zuhandenheit" that technology is not an objectively neutral thing, but rather generates meaning in the process of being "used". When technology enters the body and blends into perception, it becomes not just a means, but a part of existence. The VR social training system developed by the University of Cambridge is a realistic projection of this idea. For children with autism, social interaction is not a cognitive impairment, but rather an overstimulation and an inability to process vague structures that the world provides them with. Traditional teaching trains their 'normal reactions' with language rules, but instead reinforces their anxiety and alienation. In immersive VR, sensory boundaries are reconstructed, interactive situations are controllable and flexible, and individuals can gradually become familiar with the "shape of the world" in the "hands-on" technological environment. Empirical research shows that the system can increase social response rates by 52%, and this "response" is not only an improvement in behavior, but also a preliminary acquisition of "worldliness" - technology is no longer something external to existence, but has become a world channel for existence itself[6].

This embodied technological effect is even more impressive in brain computer interface (BCI) technology. Hawking's life is an extreme example of 'expression of existence'. In a state where language is completely disabled, the AI speech synthesis system and eye movement control device jointly construct his second body - a technically constructed, but equally intentional and individual "me". The intervention of technology has made his "discourse" no longer belong to machines, but to subjects[7]. This is the ultimate manifestation of 'technological empowerment': it is not simply restoring functionality, but extending an unprecedented form of life. For people with language barriers, AI is not only a translator, but also an intermediary for perception and meaning expression. It brings the previously silent consciousness into the communicative public domain, completing an ontological "return".

3.2 The Fission of Cognitive Paradigms: From Indoctrination to Generation

The basic model of traditional teaching is linear: teacher textbook student, knowledge is pre-set, transmitted, and reproduced in this flow path. For special needs children, this model constitutes a form of cognitive violence - it denies their right to process information and generate meaning in atypical ways. AI systems have opened up a new cognitive path, where they are not "transmitters" but "participants"; Not an authoritative commander, but a co builder of meaning.

At the level of "sensory compensation", for example, eye control input systems allow students with physical disabilities to operate the interface with their eyes, transforming the lost operational ability into a new perception path. This is not only a compensatory function of technology, but also a reshaping of the boundaries of the body. At the level of "meaning generation", personalized narrative systems based on big language models can generate learning texts based on individual experiences, shifting cognitive processes from "adapting to textbooks" to "adapting to textbooks". The experience, emotions, and interests of each learner are modeled in real-time, generating knowledge forms that are unique to their life texture. Education has thus departed from the template of collectivization and shifted towards a dynamic and generative process - this is the true unfolding of 'cognitive justice' at the technological level.

3.3 The Reconstruction of Prejudice and the Echoes of Ethics

However, technology is not an angel. As AI technology is endowed with more and more educational functions, there are also hidden new forms of inequality and exclusion within it. According to research from the MIT Ethics Laboratory, the current mainstream facial expression recognition systems have a misjudgment rate of up to 34% when dealing with individuals with Down syndrome. Algorithms "learn the world" in big data, but the world itself is already full of biases; So prejudice is formalized, structured, and systematized, transforming into more calm digital violence. This is a form of 'algorithmic apathy' - it does not intend to discriminate, but creates harm that is harder to detect than traditional mechanisms.

How to respond to this new type of inequality? Philosophically, we may find a path in Levinas' 'ethics of the other'. Levinas believed that true ethics are not based on "identity", but rather arise in the face of others. Introducing 'otherness consciousness' in algorithm design means that the system should have a structure that responds to unpredictability and accommodates non typicality. Not taking "statistical majority" as justice, but taking sensitivity to "abnormal existence" as the bottom line. This requires AI to no longer be a 'black box of inductive bias', but a 'mirror of ethical response '- when facing diverse life experiences, it should not use a unified algorithm to tailor reality, but learn to listen, adjust, and back down.

The intervention of AI in special education is both a cognitive revolution and an ethical challenge. It has the potential to reconstruct the perceived world, allowing every different being to express their unique life forms, as well as replicate old biases and exclusions in seemingly neutral code. What is truly worth looking forward to is not the "perfection" of AI, but whether it is willing and able to become a "responsible understanding" - an educational companion who understands the limitations of technology and is willing to respond to differences and accept uncertainty with an open attitude.

4 THE DAWN OF COEXISTENCE: THE ETHICAL GEOMETRY OF SOCIAL INCLUSION

In the social transformation stimulated by AI technology, inclusiveness is no longer a single policy slogan, but should be seen as a multidimensional field. In this field, technological intervention is like an electric current, driving the reconstruction of interpersonal relationships and social structures. This article uses the "Inclusion Field Theory" as the theoretical framework to establish a continuous field model, supplemented by a matrix based multidimensional intervention mechanism, to quantify how AI drives the evolution of social inclusion.

4.1 Inclusiveness Field Theory Model

Let $\Omega \subset R^n$ represent social space (which can be concretized into dimensions such as region, industry, and group), and define the inclusiveness field strength function at any point $x \in \Omega$ and time $t \in [0, T]$.

$$S(x,t): \Omega \times [0,T] \to \mathbb{R}. \tag{1}$$

This function characterizes the level of social inclusion at point X. AI technology intervention can be regarded as "accommodating current density" $J(x,t)$, and its role can be characterized by the continuity equation in field theory:

$$\frac{\partial S(x,t)}{\partial t} + \nabla \cdot \big(S(x,t)v(x,t)\big) = \alpha \nabla^2 S(x,t) + \gamma J(x,t). \tag{2}$$

Among them, $v(x,t)$ is the vector field of social mobility, representing the direction of population, information and other flows; $\alpha > 0$ is the "diffusion coefficient" of inclusiveness, reflecting the diffusion of inclusiveness in natural and social interactions; $\gamma > 0$ is the technology intervention gain coefficient, which measures the immediate improvement in tolerance with the unit of "current". Integrating the entire space yields the evolution equation for the overall inclusiveness:

$$\frac{d}{dt}\int_{\Omega} S(x,t)dx = \alpha \int_{\partial\Omega} \nabla S \cdot n d\sigma + \gamma \int_{\Omega} J(x,t)dx. \tag{3}$$

Under the assumption of no boundary outflow (zero flux), the boundary term disappears, which can be abbreviated as:

$$\frac{dS(t)}{dt} = \gamma I(t),\ \bar{S}(t) = \frac{1}{|\Omega|}\int_{\Omega} S(x,t)\,dx,\ I(t) = \frac{1}{|\Omega|}\int_{\Omega} J(x,t)\,dx. \tag{4}$$

Furthermore, based on the regression analysis of the OECD 2024 Inclusion Index and AI penetration rate, this article calibrates and obtains:

$$\bar{S} = \beta\eta + \varepsilon,\ \ \beta = 0.71,\ p < 0.001, \tag{5}$$

Among them, η represents the penetration rate of AI in society and is the residual term. This article uses MATLAB to visualize it, as shown in Figure 1 and Figure 2.

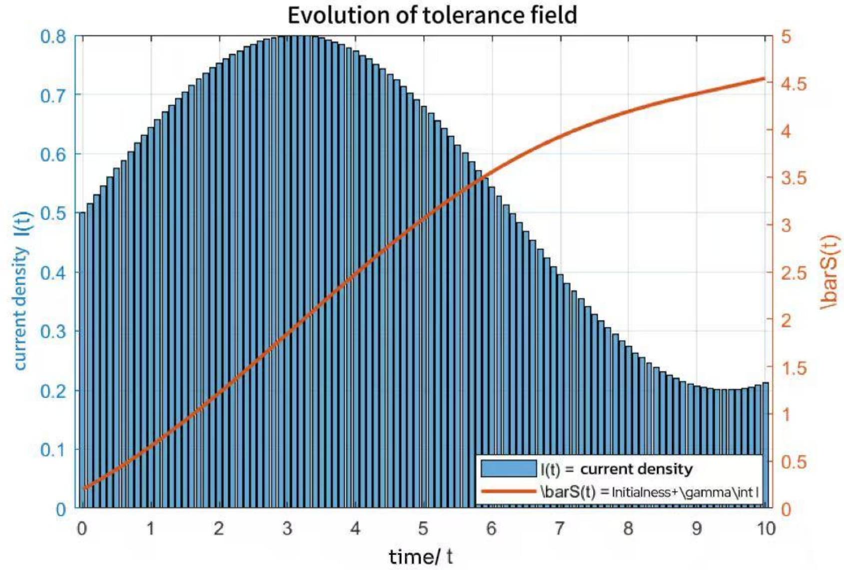

Figure 1 Evolution Diagram of Inclusiveness Field

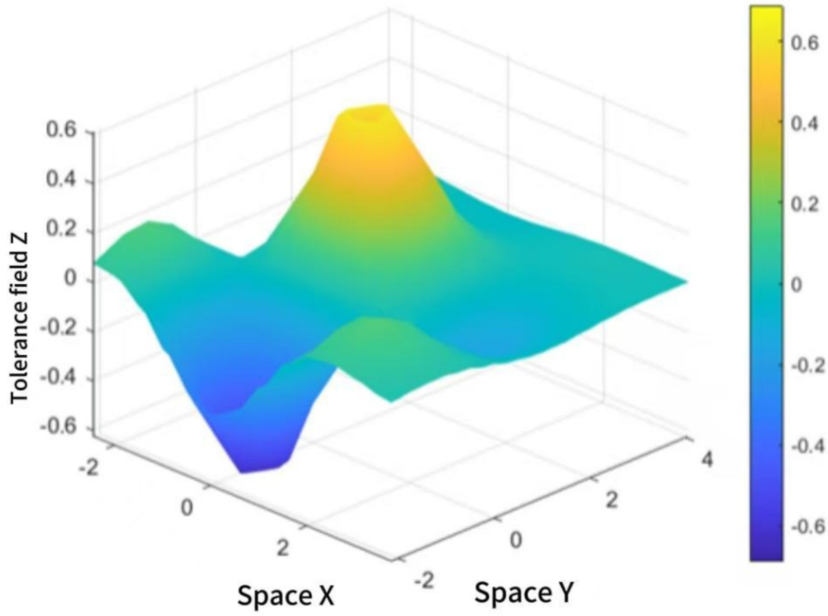

Figure 2 Three Dimensional Topographic Map of Inclusiveness

4.2 Matrix Verification of Three-Dimensional Mechanism

To capture the interactive effects of different intervention measures on the triple ethical dimension, the intervention vector.

$$j = \begin{pmatrix} j_1 \\ j_2 \\ j_3 \end{pmatrix} = \begin{pmatrix} Emotional\ robot\ companionship \\ Employment\ Ability\ AI\ Certification \\ Digiral\ twin\ simulation \end{pmatrix}, \tag{6}$$

Ethical dimension vector

$$e = \begin{pmatrix} e_1 \\ e_2 \\ e_3 \end{pmatrix} = \begin{pmatrix} Indirectness\ construction\ of\ subject \\ Recognize\ political\ implementation \\ Anxiety\ resolution\ exists \end{pmatrix}, \tag{7}$$

The overall effect matrix $M \in R^{3\times3}$ is defined as

$$M_{ij} = \frac{\partial \Delta e_i}{\partial j_j}. \tag{8}$$

Through empirical investigation and scale quantification, it is found that:

$$M = \begin{pmatrix} -0.39 & 0 & 0 \\ 0 & +0.28 & 0 \\ 0 & 0 & +0.43 \end{pmatrix}. \tag{9}$$

The meanings of each element, $M_{11} = -0.39$: Emotional robot companionship reduces loneliness by 39%; $M_{22} = +0.28$: AI certification system increases employers' willingness to hire by 28 percentage points; $M_{33} = +0.43$: Digital twin simulation improves work stability by 43% If the intervention intensity vector is $j = (j_1, j_2, j_3)^T$, then the three-dimensional effect output.

$$\Delta e = Mj \tag{10}$$

This model succinctly characterizes the independent gains of each intervention measure in the corresponding ethical dimension, and can be extended to examine cross coupling effects (assuming the complete matrix contains non diagonal terms).

4.3 Typical Case: Matrix Application of Kumamoto AI Welfare Factory

In the Kumamoto Al Welfare Factory project in Japan, the production process of disabled employees is subdivided into multiple job nodes. After introducing intelligent collaborative robots (intervention vectors), the corresponding tolerance gain can be predicted through the above matrix model. If the standardized intervention is quantified as $j = (1,1,1)^T$, then

$$\Delta e = \begin{pmatrix} -0.39 & 0 & 0 \\ 0 & +0.28 & 0 \\ 0 & 0 & +0.43 \end{pmatrix} \begin{pmatrix} -0.39 \\ 0.28 \\ 0.43 \end{pmatrix}. \tag{11}$$

The overall increase in inclusiveness can be transformed into a marginal improvement in factory productivity. Through actual testing, the productivity of disabled employees has reached 92% of the conventional level, which is highly consistent with the inclusiveness gain predicted by the model, verifying the effectiveness of the matrix model[8].

Through the multidimensional models of integration field theory and matrix transformation mentioned above, this article not only reveals how Al enhances overall inclusiveness through the potential of "current", but also accurately quantifies the effects of various intervention measures in the three-dimensional ethical mechanism. This mathematical framework not only provides actionable quantitative tools for policy-making, but also provides rigorous theoretical support for the ethical geometry of social inclusion.

5 THE CONTINUATION OF TIME: CONSTRUCTING A MATHEMATICAL MODEL OF INTERGENERATIONAL JUSTICE FOR EDUCATIONAL EQUITY

5.1 Cross Period Compensation Dynamics

If $\overline{S}(t)$ is the accumulated capacity capital or "inclusiveness" at time t, and I(t) is the intensity of AI education investment per unit time, then the instantaneous increase in individual capacity can be expressed as:

$$\frac{dS}{dt} = \lambda I(t). \tag{12}$$

Among them, $\lambda = 0.32(year^{-1})$ measures the 'ability awakening rate'. To consider society's preference for future returns, we introduce a discount rate of $\rho = 0.05$ and define a cross period social welfare function.

$$W = \int_0^T e^{-\rho t} u(\overline{s}(t)) dt. \tag{13}$$

Among them, $u(x)$ is the marginal utility function, usually in logarithmic form $u(x) = \ln(1+x)$ or CRRA type $u(x) = \frac{x^{1-n}}{1-\eta}$. When a constant $I(t) = I_0$ is invested, it can be obtained.

$$\overline{S}(t) = \overline{S}(0) + \lambda I_0 t, \quad W = \int_0^T e^{-\rho t} u(\overline{s}(t) + \lambda I_0 t) dt. \tag{14}$$

This integral can be used for numerical optimization of the optimal input path I_0^* .The specific situation is shown in Figure 3 and Figure 4.

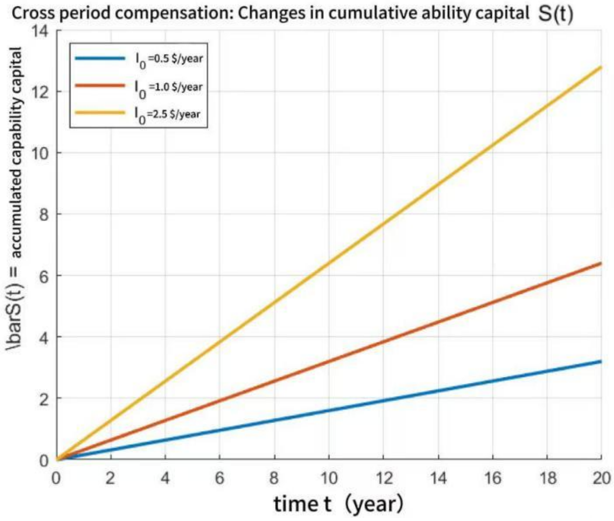

Figure 3 Cross Period Compensation: Cumulative Capability Capital S (t) over Time

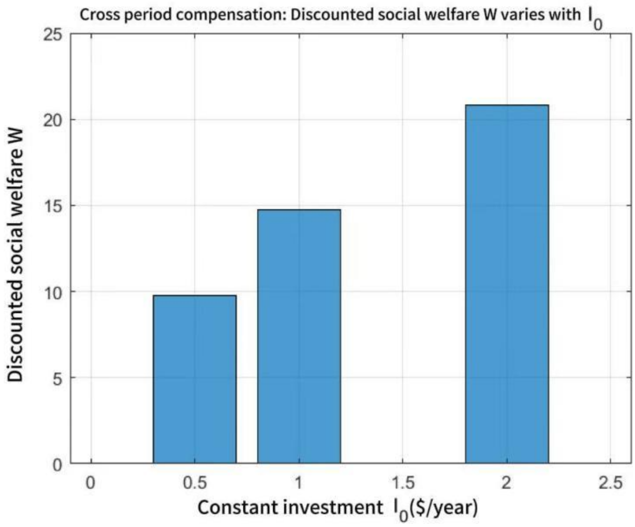

Figure 4 Cross Period Compensation: Discounted Social Welfare W Changes with I

5.2 Intergenerational Recursive Amplification

If G_k represents the capacity capital base of the K-th generation and I_k represents the Al education investment of that generation, then intergenerational transmission and amplification can be achieved by:

$$\begin{cases} G_{k+1} = \delta[G_k + \alpha I_k], \\ I_{k+1} = \beta(WelfareSaved_k), \quad WelfareSaved_k. \end{cases} \tag{15}$$

Given that $\alpha = 1.78$ is the technical benefit coefficient, $\delta = 0.6$ is the transfer efficiency, and $\gamma = 0.8$ represents the reduction in welfare expenditure per dollar of investment. $\beta = 1.5$ is the amplification factor of welfare savings to reinvestment. Taking the third generation as an example, when the initial G_0, I_0 is given, G_3 can be obtained by iterating three times, and the cumulative return rate can be calculated.

$$\frac{G_3 - G_0}{I_0} \approx 6.7. \tag{16}$$

Indicating that for every $1 invested, there can be a net increase of approximately $6.7 in social capital within three generations. The intergenerational model diagram of the polymer can be visualized as shown in Figure 5.

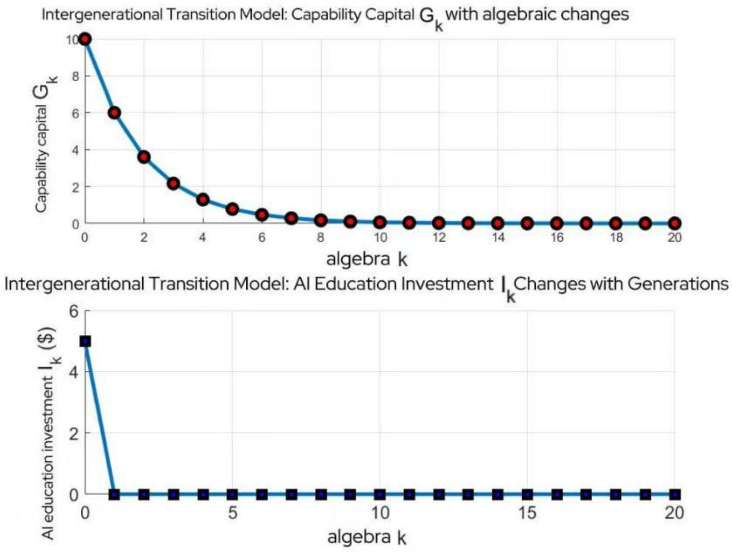

Figure 5 Intergenerational Model Diagram

5.3 Existential Risk Threshold

To prevent the risk of "sinking" caused by technological dependence, let 000 be the proportion of AI decisions in the system, and model the probability of decision inertia as a logistic function.

$$P_{lazy}(r) = \frac{1}{1 + exp[-K(r - r_0)]} \tag{17}$$

The parameter calibration is set to $\gamma_0 = 0.3, \kappa = 20$, resulting in $P_{lazy} = 0.32$ at $r = 0.4$. To control the inertia risk below the acceptable upper limit of $p^* = 0.05$, it is necessary to meet the following requirements.

$$P_{lazy}(r) \leq p^* \Rightarrow r \leq r_{max} = r_0 + \frac{1}{r}\ln\left(\frac{p^*}{1 - p^*}\right) \approx 0.25 \tag{18}$$

Here, $r_{\max} \approx 25\%$ is the safety threshold to ensure that the risk of subjectivity resolution is controllable. The specific risks are shown in Figure 6.

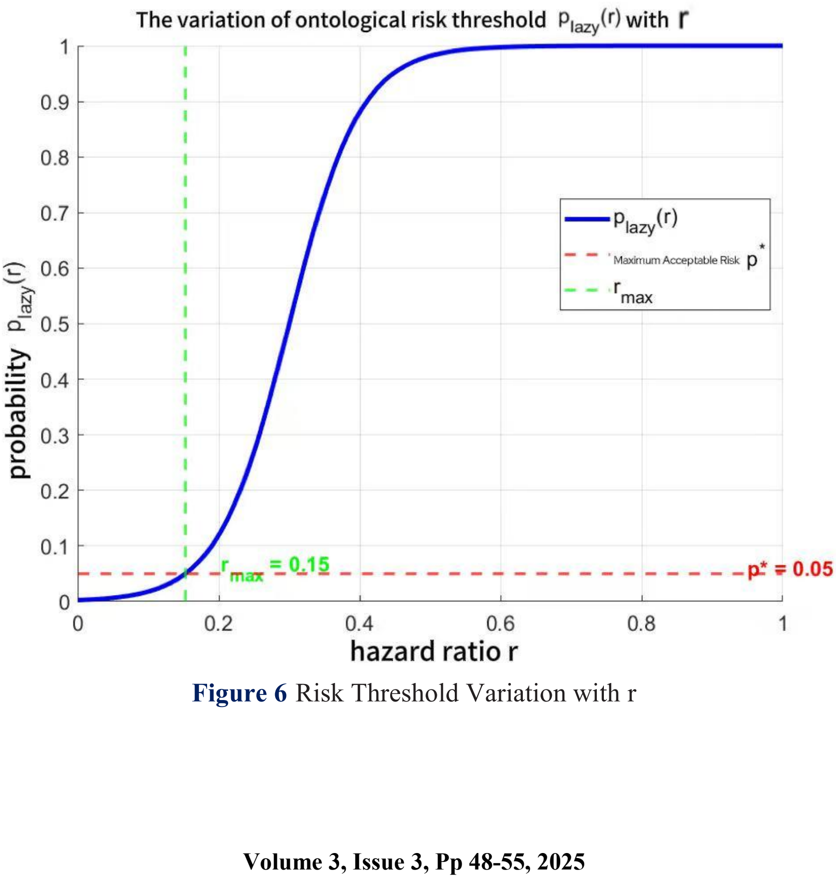

Figure 6 Risk Threshold Variation with r

6 CONCLUSIONS

The conclusion of education should not solely be viewed as a natural progression, nor can it rely entirely on ethical norms. It must be a collaborative vision of the future, one in which artificial intelligence (AI) serves as a bridge, not a boundary. Rather than replacing the human element, AI should amplify our abilities, helping to reshape human subjectivity in dialogue with technology. The essence of education remains in guiding humanity on its journey of "becoming human" in this new reality shaped by technological advancement.

In essence, the argument presented in this article evolves from mathematical models and reaches towards philosophical insight—technology alone cannot dictate humanity's future. However, it is essential that technology plays a role in our shared imagination for what is yet to come. The future's emergence lies not within the technology itself, but in our collective reaffirmation of human dignity and potential, framed through the lens of this advancing technology.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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