



Research on Data Ethics of Digital Portrait Technology Empowering English Teaching

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Abstract. Digital portrait technology, by integrating and analyzing data generated by students in the context of college English learning environments, supports personalized teaching but also poses data ethical risks such as invasion of data privacy, algorithmic bias, and infringement upon student autonomy. Drawing upon theories of information privacy, justice, autonomy, and technological determinism, this study delves into the application of digital portrait technology in college English instruction and the associated data ethics issues. A multidimensional ethical governance framework is proposed, emphasizing privacy protection in the collection and processing of personal information, overcoming data biases to ensure fairness, respecting student choice rights, and leveraging technology to enhance educational quality, thereby realizing the governance concept of "joint construction, joint governance, and shared benefits." Combining empirical analysis of the ethical application of digital portraits in English classrooms, this paper specifically elucidates the implementation pathways to avoid ethical risks in specific contexts, ensuring that the application of digital portrait technology promotes educational equity and high-quality development.

Keywords: Digital Portrait Technology; Data Ethics; College English Classroom; Personalized Teaching; Data Privacy and Governance

1 Introduction

In the knowledge economy era of the 21st century, the field of education is undergoing a transformation driven by intelligent technologies. The convergence and application of artificial intelligence, big data, and cloud computing are reshaping traditional educational models and learning methods. Intelligent technologies significantly enrich teaching methods and learning experiences by providing personalized learning resources, real-time feedback, and flexible learning environments. [1] Against this backdrop, student digital portraits have emerged as a bridge connecting technology and educational practice. Digital portrait technology is an educational technology application

that integrates and analyzes various data generated by students in digital learning environments, aiming to construct a comprehensive and dynamic learner model, including academic performance, ability levels, as well as non-cognitive factors such as learning styles and interest preferences. [2] This technology supports educators in gaining a deep understanding of student characteristics and needs through personalized learning resources and teaching strategies, achieving personalized and precisely tailored teaching activities, thereby enhancing teaching quality and the comprehensive development of students. It also provides data support for educational decision-making, optimizing resource allocation and teaching strategies.

Digital portrait technology offers robust support for teachers, enabling them to personalize teaching plans through the analysis of students' learning data, monitor academic progress, optimize classroom management, make data-driven educational decisions, and communicate effectively with students and parents. [3] Additionally, the technology helps teachers reduce assessment bias, improve work efficiency, and promptly identify students' learning obstacles, providing necessary support. Overall, digital portrait technology enhances teachers' professional capabilities, allowing them to more effectively meet students' personalized learning needs and improve teaching quality. [4]

The application of digital portrait technology in English teaching is mainly reflected in personalized teaching and the enhancement of learning outcomes. By collecting data such as students' online learning behaviors, classroom interactions, homework submissions, and test scores, a learner model is constructed for each student. These data help teachers gain a deep understanding of students' learning habits, preferences, and abilities, thereby designing teaching activities and materials that align with students' personalities. For instance, for visual learners, teachers can design teaching content that includes rich diagrams and color coding; for auditory learners, audio lectures and language learning podcasts are provided. Moreover, digital portrait technology can monitor students' academic progress and comprehension in real-time, allowing teachers to dynamically adjust teaching plans and resources according to individual differences, ensuring that every student progresses at their own pace. In this way, digital portrait technology not only optimizes learning conditions but also cultivates students' personalized learning abilities, laying the foundation for continuous learning and growth.

The study of student digital portraits holds immense potential value but also faces a series of challenges. From a value perspective, this research contributes to promoting personalization and precision in education, enhancing educational equity and quality. [5] It provides educators with a deeper understanding of students and offers learning resources that better meet their needs, thus promoting the comprehensive development of students. However, this research also confronts challenges such as data privacy protection, algorithmic bias, and technological ethics. Ensuring the security and privacy of student data, avoiding the adverse effects of algorithmic bias on students, and ensuring the ethics and fairness of technology are all issues that need to be carefully considered and addressed in the study of student digital portraits.[6] Therefore, this research requires interdisciplinary collaboration and a multidimensional perspective to ensure that the application of technology truly serves the long-term development of education and the well-being of students.

2 Constructing an Ethical Framework for Digital Portrait Technology

Data Ethics, as a significant branch of Information Ethics, primarily focuses on the moral issues and principles in the processing and management of data. It encompasses the handling of personal data, commercial data, and other types of information, including aspects such as privacy protection, data security, data quality, data ownership, and control. [7] Additionally, Data Ethics is concerned with transparency, responsibility and accountability, fairness and non-discrimination, as well as the sustainable use of data. These principles together form the core objectives of Data Ethics, which are to ensure that the collection and use of data not only adhere to ethical standards but also respect individual rights and promote the responsible use of data. Such goals aim to achieve the overall well-being of society.

With the rapid development of big data and artificial intelligence technologies, the importance of Data Ethics is increasingly highlighted. It is no longer confined to the technical level but extends to legal, social, and cultural dimensions. The practice of Data Ethics requires us to consider the formulation of laws and regulations, the construction of social ethics, and the inheritance of cultural values alongside technological development. Therefore, Data Ethics has become a multidimensional, interdisciplinary field, which is of great significance for promoting the healthy development of information technology and ensuring social justice. [8] The educational application of digital portrait technology also brings challenges such as data privacy protection, algorithmic bias, and ethical issues, necessitating the strengthening of ethical norms and legal regulation alongside technological development.

2.1 Theoretical Foundations

In constructing ethical norms and an ethical analysis framework for digital portraits, Information Privacy Theory provides an important theoretical foundation. This theory focuses on the individual's right to control their personal information, emphasizing the moral and legal standards that should be followed when collecting, processing, and disseminating personal information to protect individual privacy and prevent the misuse of information. Scholars such as Heinz Klein have emphasized the individual's right to control their information, which is particularly important in the context of data privacy and protection in digital portraits.

Issues of data bias and fairness can be theoretically supported by theories of justice, particularly John Rawls' theory of justice. Rawls' theory advocates that the basic structure of society should be designed to minimize inequality and ensure the greatest benefit for the most disadvantaged groups. [9] In the context of digital portraits, this means that algorithms and data analysis should promote educational equity, avoid exacerbating existing inequalities, and ensure that all students have fair educational opportunities.

Ethical norms regarding student autonomy and choice can be derived from Autonomy Theory. This theory emphasizes an individual's right to self-determination and self-management, asserting that individuals should have the right to make choices based

on their values and goals.[10] In the field of education, respecting students' personal choices and learning paths is crucial, which requires the application of digital portrait technology to support students' personalized development rather than restricting their creativity and individuality.

Finally, issues of technological dependence and educational quality can be theorized through critical perspectives on technological determinism. Scholars such as Jacques Ellul have critically reflected on the role of technology in society and culture, opposing the view that technological development inevitably leads to social change.[11] In the field of education, this involves critical thinking about the application of technology and how to balance the relationship between technology and educational quality, ensuring that the application of technology can improve educational quality rather than replacing interpersonal interactions and professional judgment in education. These theories provide a solid theoretical foundation for constructing ethical norms and an ethical analysis framework for digital portraits, ensuring that the application of technology can enhance educational quality and efficiency while respecting individual rights, promoting fairness, protecting autonomy, and critically assessing the impact of technology.

2.2 Constructing the Ethical Framework

In this study, a suite of philosophical analysis methods will be employed to explore the ethical and value issues of student digital portraits within the purview of intelligent technology. Initially, phenomenological methods will be utilized to describe and analyze the direct experiences of students, teachers, and their interactions with digital portraits, revealing the impact of digital portraits on educational practices. Subsequently, ethical analyses, particularly focusing on the moral responsibilities and privacy issues in the handling of student data by digital portraits, will be conducted. Additionally, a critical theory perspective will be adopted to scrutinize the potential exacerbation of educational inequalities and social structural issues by digital portraits. The integrated application of these methods aims to delve into the philosophical significance and potential impacts of digital portraits from various angles.

Accordingly, a theoretical framework has been constructed (as shown in Figure 1), which will be built at the intersection of educational philosophy, information ethics, and philosophy of technology. In general terms, they focus on axiology, impact theory, and technology theory, respectively. Educational philosophy provides a profound understanding of the purposes of education, learning processes, and the role of teachers, offering a theoretical foundation for assessing the educational value of digital portraits. Information ethics is concerned with the impact of information technology on individual rights and social values, providing analytical tools for examining the ethical issues of digital portraits. Philosophy of technology explores the nature and developmental patterns of technology, offering theoretical perspectives for understanding the technological characteristics and social impacts of digital portraits. The convergence of these three theoretical domains provides robust theoretical support for a comprehensive examination of digital portraits.

Constructing an ethical analysis framework for the educational application of digital portraits requires a comprehensive approach that addresses several key ethical considerations. Firstly, data privacy and protection stand at the forefront of these concerns. The creation and utilization of digital portraits must ensure the privacy and security of student data. Ethical standards demand that educational institutions and technology developers adhere to stringent data management and privacy protection policies, in line with international and local regulations such as the European Union's GDPR. This encompasses encrypted data storage, controlled access permissions, transparent data processing policies, and obtaining informed consent from students and parents. Data privacy and protection are paramount, and any data collection and analysis must respect students' privacy rights.

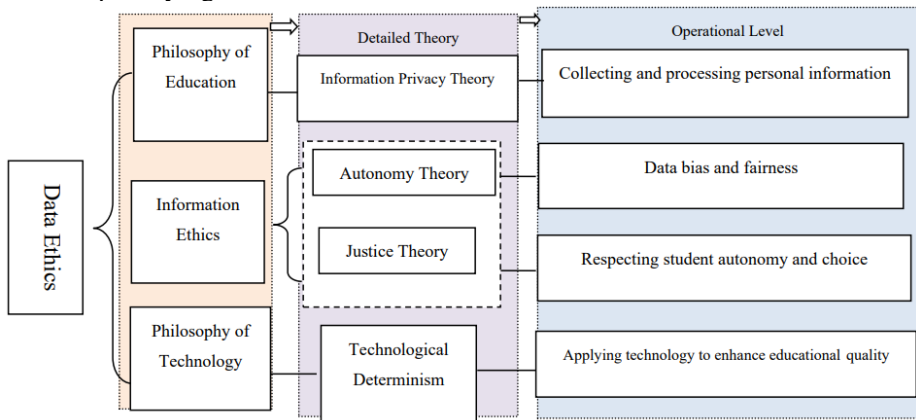


Fig. 1. Theoretical Framework Construction

Building on the foundation of privacy, the issue of data bias and fairness comes into play. Ethical guidelines for digital portraits must also address potential biases in data and strive for fairness. The design of algorithms and the analysis of data should circumvent unfair treatment of certain student groups that may arise from the limitations of historical data. Within the ethical analysis framework, it is crucial to include reviews of datasets and algorithms to guarantee they do not perpetuate educational disparities but instead foster equitable educational opportunities for all students. Moreover, regular audits and updates of algorithms are necessary to identify and rectify any potential biases.

Furthermore, the construction of digital portraits should not infringe upon students' autonomy and choice. Ethical standards should safeguard students' autonomy in their learning paths and content, steering clear of over-categorization and labeling. The ethical analysis framework should assess the impact of digital portraits on student autonomy, ensuring that technological applications support personalized student development rather than stifling creativity and individuality.

Additionally, as digital portrait technology becomes more prevalent, there is a need to prevent over-reliance by both students and teachers. Ethical standards should encour-

age a balance between technological applications and traditional teaching methods, nurturing students' independent learning capabilities and enhancing teachers' professional judgment. The ethical analysis framework should include an assessment of technological dependence to ensure that the development and application of digital portrait technology enhance educational quality without replacing the essential interpersonal interactions and professional judgments in education.

In conclusion, the ethical analysis framework for digital portraits should integrate four critical areas: data privacy and protection, data bias and fairness, student autonomy and choice, and technological dependence and educational quality. By addressing these areas, the application of technology can be guided to respect student rights, promote educational equity, and improve the quality and efficiency of education. This comprehensive approach ensures that the benefits of digital portrait technology are realized in a manner that is ethically responsible and pedagogically sound.

3 Ethical Empirical Analysis of Digital Portrait Application in English Classrooms

Applying digital portrait technology in English classrooms to enhance the quality of English education is a multidimensional task that involves not only respecting student privacy but also addressing data bias and fairness issues, as well as respecting student choice rights. Respecting privacy is the cornerstone of technological application. When collecting personal information such as students' online learning behaviors, classroom interactions, homework submissions, and test scores, educational institutions and technology providers must adhere to strict data management and privacy protection policies.

This includes ensuring that the purpose of data collection is clear and lawful, collecting only the minimum amount of data necessary to achieve educational objectives; ensuring the security of data by taking measures such as encrypted storage and access control to prevent data breaches; upholding the principle of transparency by clearly explaining to students and parents how data will be collected, used, and processed; and obtaining informed consent from students and their parents. Additionally, students should have the right to access and correct their own data and be able to withdraw consent when necessary.

These measures collectively constitute respect for and protection of student privacy rights, aiming to ensure that the application of technology does not infringe upon students' personal privacy while promoting the healthy development of education. (As shown in Figure 2, Ethical Considerations of Digital Portrait Application in English Classrooms)

Furthermore, data bias and fairness are central issues in the application of technology. The limitations of algorithm design and datasets may lead to digital portraits failing to fully and accurately reflect the diversity and complexity of students, thereby neglecting the special needs of students from different cultural backgrounds or exacerbating existing educational inequalities. Additionally, there is the issue of fairness in educational opportunities, ensuring that the application of digital portrait technology does

not result in certain student groups receiving fewer educational resources or opportunities, and guaranteeing that all students have access to fair educational opportunities. Lastly, there is the issue of algorithm transparency and explainability, which involves ensuring that the algorithmic decision-making process is transparent, allowing students and educators to understand the logic behind the data portrait results, and avoiding distrust and potential bias due to opacity. These aspects together constitute the data bias and fairness issues that require special attention when applying digital portrait technology in the field of education.

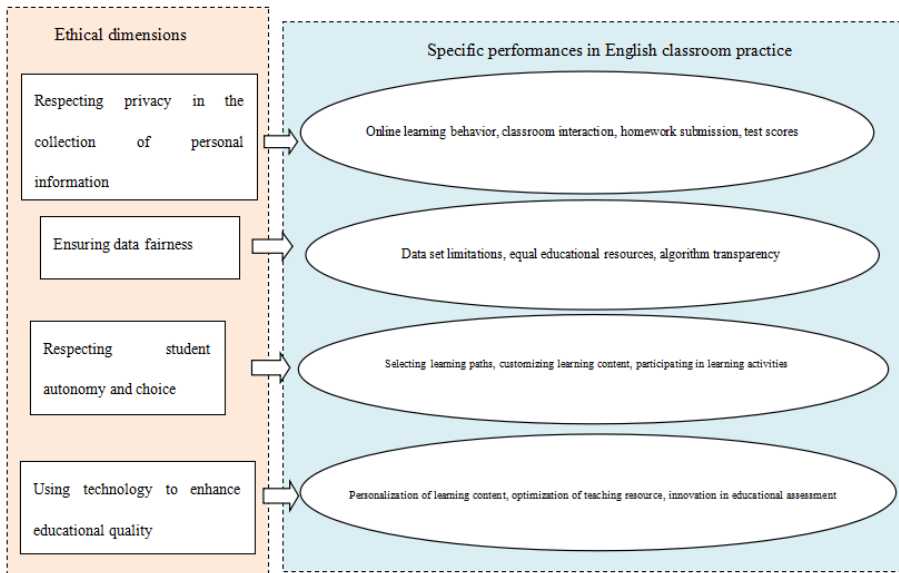


Fig. 2. Ethical Considerations of Digital Portrait Application in English Classrooms

Moreover, respecting student choice is crucial in the educational process. It means that students can make learning decisions autonomously based on personal interests, abilities, and goals. This is reflected in three aspects: First, students can choose learning paths that align with their learning styles and interests, such as selecting specific modules or units, and making choices among various teaching methods and resources, which helps to increase their motivation and efficiency. Second, students have the right to accept or reject personalized learning content recommended by educators based on digital portrait technology, and can even propose their own learning needs and preferences; this interactive process not only respects student choice but also enhances the relevance and effectiveness of learning content. Lastly, students have the right to choose to participate or not participate in certain learning activities, such as additional tutoring courses, study groups, or extracurricular projects; this freedom of choice helps students actively engage in beneficial learning activities without pressure, while also fostering self-management and self-regulation skills. Overall, respecting student choice is to ensure that students play a central role in their learning process, driving personal

learning development through autonomous choices, which is significant for achieving personalized education and promoting the comprehensive development of students.

Finally, applying technology to improve educational quality mainly refers to optimizing the teaching process and enhancing teaching effectiveness and learning experience through modern information technology means, such as artificial intelligence, big data, and cloud computing, to achieve an overall improvement in educational quality. This includes the realization of personalized teaching, where technology is used to construct student portraits based on learning behaviors, achievements, and interests, providing customized learning content and teaching strategies for each student, improving the targeting and effectiveness of teaching, and stimulating students' interest and motivation; the optimization of teaching resource allocation, where online learning platforms and remote education systems allow high-quality educational resources to transcend geographical limitations, be more widely shared and utilized, improve resource efficiency, narrow educational gaps, and promote educational equity; and the innovation of educational assessment and feedback, expanding educational assessment from traditional exams and quizzes to comprehensive and continuous learning analytics, tracking the learning process, collecting and analyzing learning behaviors, strategies, and outcomes, providing educators with rich feedback information for timely adjustment of teaching strategies, optimizing teaching content, and helping students reflect and self-regulate, promoting the enhancement of autonomous learning abilities. The comprehensive application of these aspects leads to an overall improvement of educational quality.

In summary, the ethical considerations and enhancement of educational quality in the practice of applying technology in English classrooms is a complex and comprehensive process. It requires us to focus on data bias and fairness issues while respecting student privacy, respecting student choice rights, and optimizing the teaching process using modern information technology means. The implementation of these measures not only improves teaching effectiveness but also protects student rights, achieving educational equity and quality improvement, thus promoting the healthy development of education.

4 Conclusion

This study has conducted a comprehensive exploration into the application of digital portrait technology in college English teaching, with a particular emphasis on its potential to enhance educational quality amidst critical data ethics issues. By synthesizing theories of information privacy, justice, autonomy, and technological determinism, we have developed a multidimensional ethical governance framework to guide the responsible utilization of digital portraits within educational environments. The research findings underscore the importance of maintaining a delicate balance between technological innovation and ethical considerations, ensuring both educational equity and quality.

The study brings to light the transformative potential of digital portrait technology in personalizing learning experiences and optimizing educational outcomes. By meticulously analyzing students' learning behaviors, preferences, and achievements, digital

portraits provide educators with invaluable insights that enable them to tailor teaching strategies and resources, thereby significantly enhancing the effectiveness of English language instruction. However, the study also identifies several pivotal ethical challenges, including concerns over data privacy, algorithmic biases, potential infringements on student autonomy, and the risk of over-reliance on technology. To mitigate these adverse effects and ensure that technological applications harmonize with educational values, robust ethical guidelines and regulatory frameworks are imperative.

Despite the comprehensive scope of this study, several limitations merit further investigation. Firstly, the empirical analysis predominantly relies on qualitative insights; thus, future research should incorporate quantitative data to validate the efficacy of digital portrait technology across diverse educational contexts. Secondly, the study's focus on college English classrooms restricts its generalizability to other disciplines or educational levels. A broader research scope could potentially uncover additional ethical nuances and implementation strategies. Lastly, while the proposed ethical framework addresses key concerns, its practical applicability and adaptability across different cultural and institutional contexts necessitate empirical validation.

In summary, the application of digital portrait technology in education holds immense promise for advancing personalized learning and improving educational quality. However, the successful implementation of this technology hinges on a nuanced understanding of its ethical implications and the development of governance mechanisms tailored to specific scenarios. To address these limitations, future research should engage in cross-disciplinary and cross-cultural studies, integrate quantitative methodologies, and delve into the long-term impact of digital portraits on student development and educational equity. By doing so, we can ensure that technological advancements in education not only adhere to ethical standards but also deliver pedagogical effectiveness, ultimately contributing to the holistic development of learners in the digital era.

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References

1. Xu Fenghua & Hu Xianjin. Empowering personalized learning with artificial intelligence technology: Implications, mechanisms, and pathways [J]. *Journal of Guangxi Normal University (Philosophy and Social Sciences Edition)*, 2023, 59(04): 68-79.
2. Cui Jiafeng & Que Yuehong. Student digital portraits under the support of intelligent technology: Dilemmas and breakthroughs [J]. *Contemporary Educational Science*, 2020, (11): 88-95.
3. He Liping. Exploration and practice of educational data science in personalized teaching [J]. *Educational Progress*, 2024, 14(8): 898-907.

4. Zhang Xuebo, Lin Shubing, & Sun Yuanxiang. From data to knowledge: The theoretical model and capability enhancement of data-driven teaching decisions [J]. *Research on Distance Education*, 2021, 42(12): 41-47, 54.
5. Xing Wenming & Liu Wo. Research on the influencing factors of college students' digital literacy in the context of full-element digital transformation [J]. *Forum on Digital Libraries*, 2023, 19(10): 79-90.
6. Zhang Zhi, et al. *Digital Portraits: A New Paradigm for Comprehensive Quality Evaluation in the Intelligent Era* [M]. Shanghai: East China Normal University Press, 2023.
7. Tian Weilin. Research on big data ethics awareness and its cultivation [D]. University of Science and Technology Beijing, 2020.
8. Jin Fenglin & Shao Yan. The basis, content, and responsibilities of internet ethics [J]. *Journal of Hebei University (Philosophy and Social Sciences Edition)*, 2001, (2): 67-71.
9. Wang Xukun & Chang Dongxu. Three issues in science and technology ethics [J]. *Journal of Dalian University of Technology (Social Sciences Edition)*, 2007, 28(3): 39-43.
10. Chen Aihua. The ethical risks of high technology and their responses [J]. *Studies in Ethics*, 2006, (4): 95-99.
11. Zhao Yi. Research on ethical issues in big data applications [D]. Dalian University of Technology, 2021.

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