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A Comparative Study on AI Education Models for Young People in Singapore and the Greater Bay Area - Based on Curriculum System and Teaching Methods

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Abstract: This study examines the similarities and differences in AI education models for young people in the Greater Bay Area and Singapore from both curriculum systems and teaching methods. The study finds that the Greater Bay Area adopts a 'state-led, tiered progression' curriculum framework, emphasizing the completeness of the knowledge system and value guidance, with a teacher-centered approach to teaching. In contrast, Singapore has developed an 'application-oriented, flexible autonomy' curriculum structure, focusing on practical skills development and implementing problem-based learning strategies. These differences stem from the deep-seated influences of educational traditions and social cultures: the Greater Bay Area emphasizes systematic inheritance and collectivism, while Singapore integrates multiculturalism and innovation. The study provides theoretical references for the localization of AI education practices and international learning.

Keywords: Artificial Intelligence Education; China-Singapore Comparison; Curriculum System; Teaching Method; Cultural Influence

1. Introduction

With the rapid advancement of artificial intelligence technology, AI education for young people has become a focal point in global educational reform. The Greater Bay Area and Singapore, as representatives of the Asian education system, exhibit distinct differences and unique characteristics in their AI education curricula and teaching methods. This paper aims to compare the models of AI education for young people in these two regions, analyzing the similarities and differences in curriculum design, teaching implementation, and evaluation mechanisms. It seeks to reveal how different educational philosophies and social-cultural backgrounds influence the development of AI education. The study not only deepens our understanding of the educational models in both countries but also provides theoretical insights and practical guidance for optimizing China's AI education system.

2. Comparison of Curriculum Systems

2.1 Framework and Characteristics of AI Courses in Greater Bay Area

The AI curriculum for young people in the Greater Bay Area is characterized by 'national leadership, tiered progression, and interdisciplinary integration.' The Ministry of Education has established an integrated K-12 curriculum framework through the 'General Senior High School Information Technology Curriculum Standards (2017 Edition)' and the 'Compulsory Education Information Technology Curriculum Standards (2022 Edition),' forming a three-stage training path: 'cognitive enlightenment-basic skills-professional deepening.' The curriculum design emphasizes a balance between theoretical knowledge and practical skills. In primary school, students develop computational thinking through graphical programming and smart hardware experiences. In junior high school, Python programming and basic algorithm concepts are introduced. In senior high school, systematic instruction in machine learning, computer vision, and other professional knowledge is provided, with discussions on data security and ethics integrated into the curriculum. This vertically integrated curriculum structure reflects the Greater Bay Area's commitment to a comprehensive knowledge system, with a notable feature being the deep integration of AI education with traditional subjects like mathematics and physics, fostering students' comprehensive application skills through interdisciplinary projects[2]. The curriculum implementation follows a dual-track model of 'national curriculum + local characteristics,' ensuring the uniformity of basic teaching content while allowing developed regions to conduct robotics competitions, maker education, and other extension activities. Notably, the curriculum places a strong emphasis on technical ethics education, guiding students to reflect on the social impact of AI through specialized modules, reflecting the value orientation of 'technology for good.' However, the system also faces structural challenges such as outdated content and uneven regional development, prompting the education department to explore dynamic adjustment mechanisms.

2.2 Architecture and Advantages of AI Courses in SINGAPORE

Singapore's AI education adopts a flexible framework of' government guidance, school autonomy, and industry-education collaboration. 'The curriculum design emphasizes' application-oriented, competency-based, and lifelong learning. 'As a key component of the' Smart Nation 'strategy, the Ministry of Education integrates AI education into the primary and secondary school curriculum through the' Computational Thinking Framework, 'without setting a unified curriculum standard. Instead, it encourages schools to develop their own teaching plans based on the' Less Teaching, More Learning 'philosophy[1]. In primary school,' fun programming 'activities are used to cultivate basic computational thinking. In secondary school, AI elective modules are included in the' O-Level 'and' A-Level 'exams, focusing on problem-solving and project practice. The course's greatest strength is its modular design, allowing students to choose from different directions such as machine learning, data analysis, or robotics engineering based on their interests. They also engage in 'Applied Learning Projects' (ALPs) to solve real-world problems in collaboration with companies. This 'learning by doing' approach effectively fosters students 'innovation and practical skills. Singapore's curriculum also places a strong emphasis on 'digital citizenship' education, integrating ethical considerations into each technical module to foster students 'responsible use of technology. A key to its success is the establishment of a comprehensive teacher professional development system, with continuous training provided by the' National Institute of Education,' a direct affiliate of the Ministry of Education, ensuring that teachers can keep up with rapidly evolving technological content[4]. This flexible curriculum structure maintains consistency in core competencies while providing ample space for school innovation.

2.3 Analysis of Commonalities and Differences between the Two Countries' Curriculum Systems

The AI curriculum systems of China and Singapore share deep commonalities in value orientation and structural design, yet they also exhibit significant differences. Both countries view AI education as a key element of national competitiveness, adopting a progressive curriculum framework across different educational stages and emphasizing technical ethics education. The curriculum content covers core areas such as programming fundamentals, algorithmic thinking, and machine learning, and both aim to connect with traditional subjects[5]. However, in terms of implementation, the Greater Bay Area emphasizes the uniformity of national curriculum standards, ensuring balanced basic education through required courses, while Singapore adopts a guiding framework, granting schools greater curriculum autonomy. In teaching methods, the Greater Bay Area focuses on systematic knowledge transmission, with a rigorous course structure; Singapore, on the other hand, favors project-based learning, emphasizing problem-solving skills in real-world contexts. The evaluation mechanisms differ significantly: the Greater Bay Area relies on standardized exams to assess learning outcomes, while Singapore uses a variety of assessment methods, including portfolios and project presentations for formative evaluation. These differences are rooted in distinct educational traditions- The Greater Bay Area follows the mainland-style education model that emphasizes 'solid foundations and a strong system,' while Singapore integrates British and American educational philosophies, placing greater emphasis on personalization and practical skills. Notably, both curricula face the challenge of teacher professional development lagging behind technological advancements, but they have adopted different strategies: the Greater Bay Area enhances overall quality through a national teacher training program, while Singapore promotes knowledge updates through school-enterprise collaboration. These comparisons offer valuable insights into balancing the localization and internationalization of AI education.

3. Comparison of Teaching Methods

3.1 Main Modes of AI Teaching in the Greater Bay Area

The teaching of artificial intelligence in the Greater Bay Area follows a three-dimensional model: 'theoretical foundation-practical reinforcement-ideological and political integration.' This model emphasizes the systematic construction of knowledge systems and the dual goals of value guidance. In classroom settings, the traditional 'lecture-demonstration-practice' approach is commonly used. Teachers explain algorithm principles and programming syntax through structured lectures, complemented by multimedia courseware that showcases technical applications. Students then complete pre-set programming tasks or hardware assembly activities. This method efficiently conveys systematic knowledge, ensuring students accurately understand basic concepts, making it particularly suitable for large-class teaching environments. In recent years, project-based learning (PBL) has gained popularity in experimental schools, where students work in groups on comprehensive projects like smart home design and image recognition system development. However, these activities are typically supplementary to regular teaching rather than replacing it [6]. Notably, the deep integration of 'ideological and political education' elements is noteworthy. Teachers use cases such as facial recognition and autonomous driving to guide discussions on technology ethics and social responsibility, reflecting the educational goal of 'moral and intellectual development.' For extracurricular activities, robotics competitions and creative programming contests are organized through youth palaces and science museums, creating an integrated training mechanism between in-class and out-of-class activities. However, this model also has limitations: standardized teaching processes restrict students' personalized development, and evaluations heavily rely on written tests and the completion of preset works, which fail to truly reflect innovative capabilities. In order to break through these limitations, some developed regions began to try "double-teacher classroom", inviting enterprise engineers to participate in teaching, but on the whole, they still failed to break through the traditional paradigm of teacher-centered.

3.2 Typical Strategies of AI Teaching in Singapore

Singapore's AI education adopts an innovative strategy of' problem-oriented, self-inquiry, and social collaboration, 'which exemplifies the localization of constructivist learning theory. The classroom typically employs the' 5E teaching model '(Engage, Explore, Explain, Elaborate, Evaluate). Teachers start by posing real-world problems, such as predicting traffic congestion or analyzing medical images. Students collaborate in groups to collect data and test various algorithm solutions, ultimately presenting and refining their findings. This approach transforms knowledge transmission into a problem-solving process, significantly enhancing students' metacognitive skills and innovative thinking. Key practices include the full implementation of 'flipped classrooms,' where students learn foundational concepts through an interactive learning platform developed by the government before class, with class time focused on project discussions and prototype development. A notable feature is the 'school-enterprise joint laboratory' mechanism, where schools and tech companies collaborate to create teaching spaces where students can access industry-level tools and real datasets. This integration of industry and education effectively bridges the gap between education and the workforce. In terms of differentiated instruction, Singapore implements a 'tiered task sheet' system, offering projects of varying complexity within the same class to meet individual needs while ensuring basic requirements. The evaluation system uses a 'continuous assessment portfolio,' which includes programming logs, project iteration records, and peer reviews, providing a comprehensive reflection of student growth. The success of this strategy is due to a fundamental shift in the role of teachers - teachers as more facilitators of learning than knowledge transmitters, which is based on five hours of professional development activities per week to ensure that educators remain technologically sensitive and innovative in teaching.

3.3 Cultural and Institutional Roots of Differences in Teaching Methods

The significant differences in artificial intelligence teaching methods between China and Singapore are fundamentally the result of different educational traditions and social cultural structures [3]. Culturally, the Greater Bay Area continues the Confucian emphasis on 'respecting teachers and valuing the path' and 'systematic inheritance,' with a focus on accurate knowledge transmission and standardized learning, as seen in teacher-led classrooms and standardized evaluation systems; in contrast, Singapore, influenced by British and American progressive education, emphasizes 'critical thinking' and 'individual expression,' forming a student-centered teaching model [7]. In terms of institutional design, the highly unified education management system in the Greater Bay Area leads to a homogenization of teaching methods, with centralized models for curriculum standards, textbook reviews, and teacher evaluations that ensure basic quality but stifle grassroots innovation; in comparison, Singapore's' independent school 'system grants principals curriculum leadership, with the Ministry of Education providing macro guidance through the' Education Technology Framework, 'offering institutional support for teaching innovation. Social cognitive differences are also crucial: parents in the Greater Bay Area generally expect' success in exams, 'which forces teaching methods to balance knowledge density and exam demands; in Singapore, society more strongly embraces the concept of' competency-based education,' leading to widespread support for project-based learning. A deeper difference lies in the professional autonomy of teachers -: teachers in the Greater Bay Area must strictly adhere to the teaching schedule, while Singaporean teachers have 80% decision-making power over the curriculum, which directly impacts the possibility of teaching innovation [8]. It is worth noting that the differences between the two countries are producing new complementary trends: the Greater Bay Area has begun to absorb elements of constructivist teaching, while Singapore has learned from the advantages of systematic training in the Greater Bay Area. This two-way adjustment reflects the integration trend of global education reform.

4. The Influence of Educational Philosophy and Social Background

4.1 Adaptability of Education Goals in the Greater Bay Area to AI Education

The Greater Bay Area's educational system places a strong emphasis on artificial intelligence (AI) education, reflecting the dual goals of' serving national strategies and nurturing innovative talents. 'This alignment is characterized by a unique dialectical relationship in policy direction and implementation. At the national level, AI education has been integrated into the strategic frameworks of the' New Generation Artificial Intelligence Development Plan 'and' Education Modernization 2035, 'serving as a key driver for achieving technological self-reliance and strength. In terms of educational objectives, AI courses aim to both provide basic knowledge and select outstanding innovative talents, leading to a distinctive structure of' basic courses + competition expansion. 'The current educational system emphasizes the integration of AI with traditional subjects, with the curricula for mathematics, physics, and other foundational disciplines now including algorithmic thinking and computational modeling content. This curriculum reform reflects the strategic intent of the' Strong Foundation Program 'to cultivate versatile talents. Notably, the Greater Bay Area's unique 'five educations in parallel' philosophy extends to AI education, where technical ethics and social responsibility are core competencies, and students are taught correct technical values through 'technology for good' case studies. However, this alignment also faces practical challenges: under the influence of the college entrance examination, AI education risks becoming exam-oriented, with some schools reducing algorithm learning to problem-solving skills training. Regional disparities in educational resources lead to inconsistent course implementation quality, with maker spaces in economically developed areas contrasting sharply with traditional computer labs in less developed regions. These contradictions have prompted education policymakers to explore more flexible implementation mechanisms, such as the pilot "Artificial intelligence literacy level certification" in Beijing and Shanghai, to try to find a new balance between standardization and personalization.

4.2 The Guiding Role of Singapore's Education Policy on AI Teaching

The development trajectory of artificial intelligence education in Singapore clearly demonstrates a policy-driven model of 'national demand-educational response-social collaboration,' with its policy toolkit encompassing legislative safeguards, resource allocation, and evaluation reforms among other diverse levers[1]. As part of the 'Smart Nation 2025' strategy, the Ministry of Education has positioned artificial intelligence as a core element of 'digital literacy for all' through the 'Education Technology Master Plan,' ensuring policy coherence through this top-level design. The most distinctive feature is the integrated reform framework of 'teaching methods-technology-space': the 'ICT Teaching Syllabus' launched in 2019 not only outlines learning content but also provides detailed guidance on how teachers can use blended learning strategies to teach artificial intelligence. Additionally, special funds have been allocated to build 'future classrooms' equipped with programmable robots and cloud computing platforms. The precision of policy orientation is reflected in differentiated support strategies: schools with a focus on science and engineering are encouraged to develop advanced machine learning courses, while ordinary secondary schools are encouraged to strengthen basic programming skills. This categorized guidance ensures efficient resource allocation. The enterprise participation mechanism is a key support point for policy implementation, with the 'Applied Learning Project' (ALP) system requiring technology companies to deeply engage in curriculum development, allowing students to directly access industrial-grade development environments and real-world business problems. The synchronous reform of the evaluation system is particularly crucial, gradually replacing traditional exams with 'digital portfolios,' focusing on assessing students' computational thinking and innovation capabilities demonstrated in project practices. The effect of this policy combination is remarkable, but it also faces the implementation bottleneck that teacher professional development cannot keep up with. Therefore, the Ministry of Education launched the "Artificial Intelligence Educator Certification Program" in 2024 to systematically improve teachers' ability to integrate technology and teaching.

4.3 The Deep Mechanism of Social and Cultural Factors on the Shaping of Education Mode

The differences in AI education models between China and Singapore are fundamentally a manifestation of social and cultural genes in the educational domain, influencing through multiple pathways such as values, group psychology, and institutional traditions. The Greater Bay Area's tradition of valuing education and learning, along with its collectivist orientation, has shaped a teaching model that emphasizes systematic knowledge transmission and standard achievement. Parents' strong expectation of 'admission value' has led AI education to balance interest cultivation with exam preparation. The Confucian ethical norm of 'respecting teachers and valuing the Way' has reinforced a teacher-centered teaching model, even with the introduction of project-based learning, teacher-student interaction still maintains a clear authoritative structure. In contrast, Singapore's multicultural society has fostered a more flexible educational ecosystem. The British education tradition emphasizes critical thinking, the Chinese community values academic achievement, and Malay culture emphasizes community collaboration. These elements collectively promote a teaching characteristic that values both' academic rigor 'and' practical innovation. 'The expectation of social mobility also has a profound impact: parents in the Greater Bay Area view AI education as a new track to break through' involution, 'which translates into a pursuit of visible learning outcomes; Singapore, with its relatively balanced income distribution, focuses more on developing real-world skills. Notably, the technological cultural differences between the two countries are equally significant: the Greater Bay Area's urgent need for independent innovation technology makes AI education emphasize the mastery of basic theories; Singapore, as a global technology hub, places greater emphasis on practical problem-solving skills. These cultural codes are continuously reproduced through curriculum policies, teaching practices and evaluation standards, forming an education model with high path dependence. Any reform must take these deep cultural constraints into consideration.

5. Conclusion

By systematically comparing the AI education models for young people in the Greater Bay Area and Singapore, the study reveals that both regions share commonalities in their curriculum systems and teaching methods, while also having distinct characteristics. The educational model in the Greater Bay Area emphasizes the systematic and foundational aspects of knowledge, whereas Singapore places greater emphasis on the development of practical skills and innovative thinking. This difference not only highlights the divergent educational philosophies but also reflects the significant influence of the social and cultural backgrounds and educational policies of the two countries. In the future, China can draw on Singapore's flexibility and practice-oriented approach to promote AI education, while integrating its own educational traditions to develop a more adaptable and forward-looking educational model.

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