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The Paradox of "Time Investment" and "Literacy Generation": Cultural Logic and Value Reflection on Shadow Education in China and South Korea

Pei Wu[1], Yang Liu[2*]

[1]Higher Education, Beijing Foreign Studies University, Beijing, China
[2]Curriculum and Instruction, Beijing Foreign Studies University, Beijing, China
**Corresponding Author. Email: 15771211206@163.com*

Abstract. The increasingly fierce educational competition has driven the continuous expansion of shadow education, mainly manifested as after-school tutoring, in East Asian societies. However, whether excessive time investment has effectively promoted the substantial improvement of adolescents' scientific literacy, or led to the alienation risk of "growth without development", has become a core issue that urgently needs reflection in the educational academic community. Through a comparative analysis of the shadow education systems in China and South Korea, this study finds that although the two countries share a similar Confucian cultural foundation, shadow education has taken differentiated development paths of "market-oriented profit-seeking" and "in-system supplementation" respectively, due to differences in social class structures and educational governance models. The continuous accumulation of time spent on shadow education often falls into the dilemma of involution, deviating from the inquisitive and critical nature that scientific literacy should encompass. Moreover, through the reproduction mechanism of family capital and social structure, it further exacerbates the fragility of educational equity at the grassroots level. In view of this, it is necessary to transcend the time worship driven by instrumental rationality and return to value rationality aimed at "high-quality teaching and learning", so as to provide a theoretical basis for the in-depth advancement of the "Double Reduction" policy and the benign reconstruction of the educational ecosystem.

Keywords: shadow education, scientific literacy, China-South Korea comparison, educational equity, involution

1. Introduction

Against the background where the knowledge economy and the intelligent society intersect, the strategic status of education has been given unprecedented importance. The essence of competition in science and technology is competition for talents, and the foundation of talent competitiveness is deeply rooted in the quality and depth of basic education. Within the East Asian Confucian cultural circle, fierce competition for school admission has fostered and maintained a large-scale and highly resilient "shadow education" system. This system is not merely a superficial extension of formal

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school education in time and space; it also more profoundly reflects social cultural identity and value pursuit regarding "success from humble origins" and "upward social class mobility". China and South Korea, in particular, as both deeply influenced by the traditional Confucian idea that "excellence in learning leads to official career", provide highly typical samples worldwide for examining educational reform and equity issues through the development scale, policy interaction, and social psychology of their shadow education sectors.

Among the many components involved in shadow education, "time" is regarded as the most central input variable. Families devote considerable economic resources and time costs, and in turn students have to sacrifice opportunities for rest, entertainment, and independent exploration in exchange for better academic performance. Can such high-intensity and long-term investment necessarily translate into sustainable literacy development for students? Especially for rigorous curricula that emphasize a spirit of inquiry, critical thinking, and practical ability, can simply extending learning time truly achieve educational goals? This has become an important issue in urgent need of examination. At present, academic research on the impact of shadow education has accumulated considerable results. For example, studies by Xue Haiping and Shi Huanhuan show that after-school tutoring can significantly improve students' academic performance [1], whereas Hu Yongmei and others argue that shadow education exacerbates inequality in educational outcomes [2]. Most existing studies rely on analyses based on specific datasets and often lack systematic theoretical elaboration on the deep-seated cultural logic, institutional paradoxes, and value contradictions behind the phenomenon. This paper goes beyond the traditional paradigm of digital empirical research. By adopting theoretical speculation and comparative analysis, it focuses on the cultural genes and institutional tensions in the evolution of shadow education in China and South Korea, and carries out critical reflection on the alienated relationship between "time investment" and "the cultivation of scientific literacy", so as to provide a deeper and broader theoretical perspective for the formulation and optimization of educational policies.

2. Cultural isomorphism and divergent paths: differentiated patterns of shadow education development in China and South Korea

Educational competition in East Asian societies is rooted in a unique historical origin. The moral education of "achieving success through diligence in learning" advocated by Confucian culture, together with its close integration with the selection system of "excellence in learning leads to official career", has jointly constructed the cultural ideal for students from ordinary families in East Asian societies to achieve upward social mobility through diligent study. "Ten years of hard study in a cold window" is not only a description of time span, but also a code of conduct with strong ethical implications, reflecting the collective unconsciousness of "Heaven rewards the diligent". Such a cultural schema is deeply embedded in the educational ecology of both China and South Korea, providing a historical and cultural justification for the existence of shadow education.

Nevertheless, on the basis of shared cultural foundations, shadow education in the two countries shows significant divergent paths. In South Korea, the pyramid-shaped social structure topped by chaebol groups such as Samsung and Hyundai highly concentrates educational resources, especially admission opportunities to top universities, in Seoul and a small number of elite classes. The "SKY universities" represented by Seoul National University, Korea University and Yonsei University are endowed with decisive weight in determining individual social mobility. Under such a monopoly pattern of academic elitism, shadow education in South Korea has evolved into a highly market-oriented, industrialized, and even "tragic" tool for survival competition [3]. To break through class barriers, parents spend all their family financial resources, which even leads to national-level

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governance failure and gives rise to the extreme sleep-deprivation culture of "sleeping four hours leads to admission, five hours to failure".

In contrast, although China is also deeply influenced by Confucian traditions and examination-oriented pressure, the public school system still firmly holds the dominant power of basic education at the institutional level. The government has continuously strengthened the policy orientation of "promoting equity" in educational supply. Since the implementation of the "Double Reduction" policy in 2021, the state has regulated off-campus training with strong measures to curb the erosion of the public welfare nature of education by market logic. However, there is a structural tension between the "low burden" advocated by public schools and the "high efficiency" pursued by parents, and shadow education has survived in the cracks in the forms of one-on-one tutoring and "invisible and mutated training". Compared with the highly professional and systematic high-end chain of the South Korean tutoring industry, China's shadow education market, especially in the field of science education, generally has drawbacks such as uneven teacher quality, homogeneous teaching content, and instrumental curriculum design, making it difficult to effectively provide additional value beyond school education [4].

3. Imbalance between quantity and quality: the logic of shadow education time devouring scientific literacy

In academia, extensive attention has been paid to the effects of "time investment" in shadow education. This attention often implies educational considerations, deepens and broadens thinking through the examination of this phenomenon, and reflects academia's emphasis on educational issues. It involves not only time investment itself but also various related factors and their comprehensive impacts. The specific modes and degrees of time investment are being studied in detail, bringing new perspectives and directions to the field of educational research. The operation mechanism of shadow education often exhibits a strong "trainingism" feature. This is mainly because, in today's fast-paced educational environment, to achieve various teaching goals and expected effects efficiently within limited time, it particularly emphasizes improving students' academic performance and examination-taking abilities through extensive training. This extensive training brings students a rather mechanical and repetitive learning experience, making the entire teaching process lack flexibility and innovation. This "trainingism" feature is widespread in many after-school tutoring institutions and private educational activities. It is closely related to the current examination-oriented education environment. When students face enormous pressure from school admission and examinations, parents and society at large tend to focus more on improving students' academic performance, prompting shadow education to adopt this "trainingism" operation mechanism. Although this may boost students' academic performance in the short term, it is detrimental to the all-round development of students' comprehensive qualities and the cultivation of their innovative abilities in the long run. It is necessary to conduct in-depth research on this feature of shadow education, adopt more scientific and reasonable educational methods, and promote students' healthy growth and all-round development.

In South Korea, despite the short-term improvement in academic performance that may result from the high specialization and targeted nature of its tutoring industry, the costs are equally significant. Over-reliance on "key" test questions and advanced learning content provided by after-school tutoring institutions not only erodes students' opportunities to independently construct scientific knowledge systems but also alienates education into a "gatekeeper" for a small number of elite classes to consolidate their social status [5]. Therefore, whether in China or South Korea, massive time investment in shadow education essentially constitutes a "negative asset" for the

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cultivation of scientific literacy. Such time consumption fails to enrich students' internal knowledge structures; instead, it is alienated into irrational internal friction driven by increasingly fierce peer competition.

4. Intergenerational transmission and class solidification: a deep deconstruction of the equity paradox of shadow education

The impact of shadow education on social classes demonstrates a typical "Matthew Effect," posing a severe challenge to the modern concept of educational equity. On the surface, shadow education seems to provide students from different classes with opportunities to bridge academic gaps through after-school tutoring, possessing a certain "compensatory" function. However, its essential mechanism is actually a hidden channel for the reproduction of social classes [6]. Families with higher socioeconomic status (SES) usually possess abundant economic, cultural, and social capital. These families can not only afford high tutoring expenses for their children but also access high-quality educational information and resources of renowned teachers through extensive social networks. In South Korea's chaebol system, such capital advantages are particularly prominent. The "alumni circles" formed by top universities and chaebol enterprises have become explicit class markers. When high-income families compete for "high-end, international" educational resources in the shadow education market, their children are already on different starting lines from their competitors. Under the elite-oriented competition logic, shadow education in which low-income families invest large amounts of funds essentially only plays a "low-end maintenance" role and cannot compete with the educational investments of high-capital families.

Although the state has introduced measures to curb the overheated tutoring market, as long as the "score-first" evaluation standard remains unbroken, parental anxiety and the profit-seeking nature of capital will continue to manifest in mutated forms. For example, some wealthy families turn to foreign teacher resources or overseas study tour programs, while middle- and low-income families may lose limited ways to catch up due to the ban on formal tutoring channels, further widening the practical gap in literacy cultivation [7]. Shadow education has not promoted genuine equal opportunities; instead, by squeezing public educational resources, it has implicitly intensified competition and differentiation within the educational system, causing cracks in the vision of educational equity under the fierce impact of social capital.

5. Value reconstruction: from instrumental rationality to high-quality "teaching and learning"

Addressing the paradox between time investment in shadow education and scientific literacy cultivation, as well as its erosion of educational equity, requires fundamental reflection on educational evaluation and learning values. The purpose of education should not be limited to elite selection; it should also aim to stimulate the inherent potential of every individual. Against the backdrop of increasingly prominent educational involution, academia and policymakers urgently need to collaborate to drive the return of educational logic from instrumental rationality to value rationality.

First, blind worship of "time investment" must be dismantled. All learning activities are constrained by learners' physiological, psychological, and cognitive development thresholds. Excessive after-school tutoring time not only fails to achieve "fostering excellence" but may also trigger learning burnout and produce counterproductive effects. When governing shadow education, the government should not only strictly supervise institutional qualifications and teaching content but also guide the public to rationally examine the marginal benefits of time spent on shadow

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education. Parents and society must deeply recognize that high-quality "teaching and learning" does not stem from simple time accumulation but depends on whether students' intrinsic learning motivation is stimulated and whether space is provided for independent inquiry and creative problem-solving [8].

Second, the functional boundaries between school-based science education and shadow education should be re-clarified. School science education should focus on imparting systematic disciplinary knowledge and cultivating key competencies, providing foundational and equitable scientific literacy guarantees for all students. If shadow education aims to embody its unique social value, it should shift its focus to imparting practical knowledge, guiding project-based learning, or designing personalized learning experiences, rather than repeatedly providing exam-oriented training. Only when in-school education and out-of-school tutoring form complementary synergy in educational goals can scattered "tutoring time" be transformed into high-quality "growth experiences" with positive emergent effects [9].

Finally, educational researchers and the public should maintain a prudent and humble attitude toward the education system. In an era where technology deeply intervenes in all social fields, avoiding being swept up in the "social irrationality" spawned by peer competition pressure is an issue that every educational participant must confront. We should actively construct a gentle, healthy, and inclusive educational culture in micro-level educational practices, dispel collective anxiety caused by excessive educational utilitarianism, and truly return education to its authentic purpose of human comprehensive liberation and scientific development.

6. Conclusion

The expansion of shadow education is rooted in specific cultural backgrounds and socioeconomic structures. Practices in China and South Korea demonstrate that in the relationship between shadow education time and scientific literacy, "time investment" and "literacy output" in education do not exhibit a simple linear causal relationship. Only by transcending the narrow pursuit of scores and rankings can we reveal the alienation logic implicit in shadow education.

The core of science education lies not in memorizing formulas but in using the light of reason to understand the objective world. For the widespread phenomenon of "educational involution" in East Asian societies, short-term mitigation strategies rely on the institutional rigidity of the "Double Reduction" policy, while the fundamental solution lies in reconstructing society's value perception of educational success. Only by abandoning the blind accumulation of time to win peer competition can education return to its original intention of cultivating independent personality and innovative spirit. Looking ahead, it is hoped that educational policymakers, practitioners, and families will work together to drive the transformation of the educational ecosystem from "stock competition" to "incremental creation."

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