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Research on the Influence Mechanism of Primary School Students' Internet Use on Creativity Development

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Abstract

The 55th "Statistical Report on the Development of China's Internet" released by the China Internet Society in January 2025 shows that as of December 2024, the number of Internet users in China has reached 1.108 billion, among which the proportion of Internet users aged 6 to 19 is 16.7%, and the Internet penetration rate is 77.5%. Among them, the Internet penetration rate of primary school students has reached 97.1%, an increase of nearly 12 percentage points compared with five years ago. The average daily online time has exceeded 2.5 hours. The Internet has become an indispensable part of primary school students' study and life. The influence of Internet usage on the creative development of primary school students has increasingly attracted the attention of educators and researchers. Understanding the current situation of Internet usage among primary school students and analyzing its advantages and disadvantages are of great significance for promoting the healthy growth of primary school students. To explore the current situation of Internet usage among primary school students and its impact on creative development, a total of 726 middle and upper-grade primary school students from four primary schools in four urban districts of Hohhot were selected as the research subjects. A combined method of the Internet Usage Scale and the Creativity Measurement Tool was adopted to analyze the relationship between Internet usage time, types and creative thinking. The research finds that moderate use of educational online content can significantly enhance divergent thinking. The research results provide relevant basis for formulating reasonable online usage strategies for primary school students.

Keywords

Primary School Students, Internet Usage, Creativity

1. Introduction

The 55th "Statistical Report on the Development of China's Internet" released by the China Internet Society in January this year shows that as of December 2024, the number of internet users in China has reached 1.108 billion, among which 16.7% are aged between 6 and 19. In response to the numerous issues faced by teenagers in the healthy, safe and efficient use of the internet, the Party and the government have attached great importance to it and continuously introduced and improved various systems and regulations covering policy guidance, legal norms, and behavioral guidance. For instance, the revised "Law on the Protection of Minors" in 2020 added a special chapter on "Internet Protection", requiring relevant departments to "regularly carry out publicity and education on preventing minors from being addicted to the internet and supervise internet product and service providers in fulfilling their obligations to prevent minors from being addicted to the internet". Dozens of laws, regulations and rules such as the "Cybersecurity Law" and the "Family Education Promotion Law" have made provisions for the safe use of the internet by teenagers. Looking to the future, the whole society should align with the major deployment requirements of implementing the new era's moral education and talent cultivation project and building an education power, further deepen the collaboration among the government, schools, families and society, strengthen internet governance, and promote the unification of awareness, measures and channels for internet-based education, so as to fully promote the healthy growth and success of teenagers.

The internet penetration rate among primary school students in China has reached 97.1%, an increase of nearly 12 percentage points compared to five years ago, with the average daily online time exceeding 2.5 hours. Moreover, the use of the internet by primary school students is showing a trend of popularization and younger age, mainly involving online learning, entertainment and creation. The ownership rate of dedicated devices such as smartwatches and learning tablets exceeds 63%, which has become an important part of their daily life and has had a profound impact on their cognitive development, learning methods and creative models. This penetration is not only reflected in the quantitative aspect but also undergoes a qualitative change in behavioral patterns. Children have transformed from passive information receivers to active content producers. The popularity rate of digital creation behaviors such as short video creation and programming design among the 10 - 12 age group has reached 41.8%. In this wave of change, the education policy system is undergoing structural adjustments—the new "Compulsory Education Information Technology Curriculum Standards" in 2022 for the first time listed "digital innovation ability" as a core subject quality, and 76.3% of primary schools across the country have introduced the STEAM curriculum system. The coverage rate of programming education in the eastern developed regions has reached 89%. However, on the other side of technology empowerment, the "2023 Global Education Monitoring Report" released by the OECD reveals a worrying trend: Chinese students' scores in the "problem reconstruction

ability" of the PISA creative thinking assessment have dropped by 7.3% compared to 2018, and they show a significant "tool dependence" in the digital environment. Some students prefer to search online rather than think independently when faced with open-ended questions. This makes it particularly urgent to explore the internal mechanism between internet use and creativity development, especially under the dual background of the "double reduction" policy reshaping the allocation of after-school time and the penetration of generative AI tools into basic education. Clarifying the role path of digital technology on children's creative thinking has become a strategic issue related to the quality of human capital and the cultivation of innovative talents.

2. Literature Review

In recent years, the impact of digital technology on children's development has sparked extensive academic discussions, particularly in the field of creativity research, where two opposing paradigms have emerged. The "technology-enabled" camp, represented by Resnick (2017), based on constructivist learning theory, demonstrated through empirical research at the MIT Media Lab that children's metacognitive abilities (such as planning and monitoring, strategy adjustment) improved by 0.32 standard deviations (d = 0.47) for every 10 hours of collaborative projects in the Scratch programming community, and their creative problem-solving abilities were significantly positively correlated with the number of code iterations (r = 0.41) (Roque, 2016). This "digital scaffolding" effect is even more pronounced in immersive environments such as 3D modeling and virtual reality: a Stanford University team found that children using Tinkercad for 3D design scored 29% higher on spatial imagination tests than the traditional teaching group (N = 120, $p < 0.001$), and the complexity of their works increased exponentially over time ($R^2 = 0.83$). However, scholars in the "cognitive depletion" camp have raised warnings. A tracking survey by the Korea Institute of Curriculum and Evaluation showed that children who spent more than one hour per day watching short videos (n = 450) had a 17% decrease in narrative coherence scores and a 42% reduction in metaphor usage frequency (Kim et al., 2021). This "fragmented cognition syndrome" was confirmed in brain imaging studies—frequent short video users had a 31% lower activation level in the prefrontal cortex than the low-use group (fMRI, $p < 0.05$), suggesting impaired executive function (Kim et al., 2021).

The core of the controversy in some related studies lies in the heterogeneity of online content and differences in behavioral patterns. Gentile & Oswald (2021)'s media classification framework indicates that the "openness index" of educational applications (such as whether they allow free exploration) is a key variable in predicting creativity gains: in a comparison between Khan Academy (open tasks) and traditional electronic exercise books (closed tasks), users of the former scored 23% higher on the TTCT fluency test (β = 0.29). This finding is in tension with the "digital cognitive load theory" (Kirschner et al., 2018)—when children face high sensory stimulation and low cognitive demands in entertain-

ment applications, their attention resources are inefficiently occupied, leading to "creative exhaustion". For example, a team from the University of California found through eye-tracking experiments that children's average fixation duration when watching TikTok recommendation streams was only 0.8 seconds, a 75% reduction compared to educational videos (3.2 seconds), and the activation level of the information integration brain region (angular gyrus) was significantly lower ($p < 0.01$) (Rhone, 2021).

Regarding the impact of internet use on creativity, a large number of studies have also been conducted in China. For instance, a tracking study by a research team from Peking University on 2800 primary school students showed that the impact of internet use on creativity has a rural-urban divide: urban children gained more divergent thinking from online programming courses ($\Delta = 0.41$SD) than rural children ($\Delta = 0.12$SD), but the negative impact of short videos was more severe in rural areas ($\beta = -0.38$ vs -0.22), which was attributed to the intergenerational transmission differences in digital literacy (Fang et al., 2024). Additionally, "active usage behaviors" such as game mod creation may break through traditional cognitive frameworks: a survey by the Tencent Research Institute found that highly active internet users (30 hours per month) demonstrated superior topological thinking in architectural design tasks compared to the control group ($t = 3.18$), and the originality of their works was highly correlated with the diversity of in-game resource combinations ($r = 0.57$). This echoes Glăveanu's distributed creativity theory, emphasizing that creativity in the digital environment is a product of the co-evolution of "human-machine-community" (Glăveanu, 2015). To sum up, the existing related research may have limitations. Firstly, some studies overly rely on single-dimensional indicators such as usage duration, while neglecting the impact of content quality (such as CPI index) on individual creativity. Secondly, there is a lack of localized theoretical construction, and the shaping effect of China's unique digital divide (such as the online education boom triggered by the "Double Reduction" policy) on children's cognitive development has not been fully considered. This study combines the network usage scale and the creativity measurement tool to analyze the relationship between the time and type of network usage by primary school students and their creative thinking, in order to reveal the influence mechanism of primary school students' network usage on creativity development.

3. Research Design

3.1. Research Objectives

This study aims to deeply explore the correlation between primary school students' Internet usage and creative thinking from multiple dimensions through scientific and rigorous research methods and the comprehensive application of the Internet Usage Scale with good reliability and validity and the widely used Creativity Measurement Tool internationally. Specifically, in terms of Internet usage, it is not only necessary to accurately measure the length of time primary school

students spend on the Internet, but also to meticulously classify the types of Internet usage, including but not limited to learning (such as online course learning and the use of educational apps), entertainment (such as playing online games and watching online videos), and social interaction (such as using social software to communicate with peers). In the assessment of creative thinking, the Creativity Measurement Tool is utilized to comprehensively evaluate the creative thinking level of primary school students from three dimensions: fluency (the number of concepts or ideas generated by an individual within a certain period of time), flexibility (the number of categories covered by the viewpoints generated by the subjects), and originality (the number of original viewpoints generated by the subjects). By deeply analyzing the complex relationships among various dimensions of Internet usage time, types and creative thinking, the internal influence mechanism of Internet usage in the process of creativity development of primary school students is systematically revealed. The research results will provide a solid scientific basis for educators to formulate scientific and reasonable guidance strategies for network usage, for parents to create a suitable family network environment, and for primary school students to improve their own network usage literacy, ultimately achieving the goal of optimizing the network usage environment for primary school students and effectively promoting the cultivation and development of their creativity.

3.2. Research Hypothesis

Based on relevant research and theoretical foundations, the following hypotheses are proposed: The impact of Internet usage on the creativity development of primary school students is highly correlated with the type of content and the duration of Internet usage. Specifically, the daily average use of educational networks (such as online learning platforms) within an appropriate range can significantly enhance divergent thinking, but the benefits decline after exceeding the threshold. The use of entertainment-related networks (such as short videos) was significantly negatively correlated with the total score of creativity. Creative online usage (such as digital painting and programming tools) is positively correlated with the duration of online usage. Rural students benefit more from educational uses, while urban students perform better in creative uses. Boys enhance spatial creativity through game mod creation, while girls strengthen language creativity through social media narrative.

3.3. Research Object

The subjects selected some students from a total of four primary schools in the four urban districts of Hohhot (Saihan District, Xincheng District, Yuquan District, and Huimin District). Since the content of the questionnaire survey method is only applicable to middle and upper grade students, the research subjects selected for this study were middle and upper grade primary school students from the four primary schools. The convenient sampling method was adopted to con-

duct questionnaire tests on the students of the four primary schools, and 750 questionnaires were distributed. A total of 726 samples were retrieved, with an effective recovery rate of 96.8%. Among them, there are 352 boys and 364 girls. There are 615 only children and 111 non-only children. 387 people in urban areas and 339 people in rural areas. The average age was (11.04 ± 1.64) years old. The sample distribution is detailed in Table 1. Furthermore, one fifth-grade class and one sixth-grade class were selected from the research sample, with a total of 80 students, for the measurement of creativity, in order to study the relationship between Internet usage and creativity.

Table 1. Basic information table of valid samples.

Demographic variable	Category	Quantity	Percentage
Gender	Male	352	48.48
	Female	364	50.14
Whether an only child or not	Only child	615	84.71
	Not an only child	111	15.28
Type of family location	Urban	387	53.31
	rural areas	339	46.69

3.4. Research Method

3.4.1. Internet Usage Scale

The Internet Usage scale compiled by Young (1998) consists of 20 questions and uses a 5-point scoring system. The higher the score, the higher the degree of addiction. The scale mainly measures the relevant problems caused by the subjects during the process of using the Internet, reflecting the specific situations of the subjects during the process of using the Internet, including aspects such as usage time, physical reactions and learning situations. In addition, demographic indicators such as gender, place of origin, type and duration of app usage have also been added to the scale to facilitate statistical data analysis. Since its introduction, this scale has been widely used and has been proven to have good reliability and validity in the differentiation of Internet addiction disorders. The Cronbach's alpha reliability of this questionnaire in this study was 0.87, exceeding the critical index of 0.7, indicating a good reliability index.

3.4.2. Creativity Measurement Tools

In this study, the graphic tasks in the creativity measurement tool (RCAB, Runco creativity assessment battery) developed by Runco and colleagues were used to measure creativity (Runco & Acara, 2012). The specific steps are as follows: Present three figures to the subjects and ask them to list as many things represented by the given figures as possible within 4 minutes. After the test is over, the responses of the participants will be scored, including from three dimensions: fluency (the number of ideas or concepts generated by an individual within a certain

period of time), flexibility (the number of categories covered by the viewpoints generated by the participants), and originality (the number of original viewpoints generated by the participants). The specific steps are as follows: Present three figures to the subjects and ask them to list as many things represented by the given figures as possible within 4 minutes. After the test is over, the responses of the participants will be scored, covering three dimensions: fluency, flexibility and originality. Fluency is the total number of viewpoints generated by the subjects on each topic; Flexibility is the number of categories covered by the viewpoints generated by the subjects; Originality refers to the quantity of original viewpoints produced by the subjects. In the measurements at the primary school stage, the Cronbach's alpha coefficients for fluency were 0.88 respectively, those for flexibility were 0.83 respectively, and those for originality were 0.75 respectively.

4. Research Results

4.1. The Current Situation of Internet Usage among Primary School Students

4.1.1. The Duration and Frequency of Internet Usage by Primary School Students

The average daily total online time of urban students is 163.6 minutes, which is 65.4% higher than that of rural students (98.9 minutes). The gap is mainly driven by the use of entertainment. Among them, the average daily time of urban students using entertainment applications is 89.5 minutes, and that of rural students is 50.3 minutes. There are also significant urban-rural differences in the use of educational applications. Among them, the average daily usage time of educational applications by urban students is 52.4 minutes, while that of rural students is 36.1 minutes ($t = 8.76^{***}$). The overall use of creative applications is weak. All students use creative applications for only 17.1 minutes per day on average. Moreover, there is a significant disparity between urban and rural areas, with 21.7 minutes in urban areas and 12.5 minutes in rural areas ($t = 5.18^{***}$), reflecting the scarcity of digital creation opportunities for rural students. Overall, the average daily usage percentages of various applications are as follows: education accounts for 33.74%, entertainment for 53.24%, and creation for 13.02%. The specific data is shown in Table 2.

Table 2. The duration and frequency of internet usage by primary school students.

Indicator	N	Urban students	Rural students	SD	t
Total daily usage duration (minutes)	131.3	163.6	98.9	62.7	15.32***
Usage duration of educational applications	44.3	52.4	36.1	31.2	8.76***
The usage duration of entertainment applications	69.9	89.5	50.3	47.5	12.94***

Continued

The usage duration of creative applications	17.1	21.7	12.5	29.7	5.18***
Daily usage frequency	8.5	9.5	7.4	3.9	8.21***

Note: *indicates $p < 0.05$, **indicates $p < 0.01$, ***indicates $p < 0.001$.

4.1.2. The Distribution of Content Types Used by Primary School Students Online

To investigate the usage rates of different types of apps among primary school students during their Internet usage (referring to apps that have been used at least once in the past week), the data statistics from the questionnaire survey revealed that the usage rates of different types of apps among primary school students during their Internet usage are as follows: 78.6% for educational apps and 92.3% for entertainment apps. The creative category accounts for 34.7%. The specific data is shown in Table 3.

Table 3. Distribution of content types used online.

app content category	Utilization rate (%)	Typical behavior
Education category	78.6%	Finish homework, watch popular science videos, learn knowledge, etc.
Entertainment category	92.3%	Browsing Douyin, playing mobile games, chatting and making friends, etc.
Creation category	34.7%	Painting, making videos, writing, etc.

4.2. The Current Situation of Creativity of Primary School Students

Through data analysis, it was found that the total score of creativity of primary school students presented a systematic stratification. The average score of creativity of urban students was significantly higher than that of rural students (t = 4.88***), and the scores of rural students in all dimensions of creativity were significantly lower than those of urban students. Furthermore, the gender differentiation characteristics are obvious: Girls have a significant advantage over boys in terms of fluency and flexibility ($p < 0.01$), but there was no difference in the dimension of originality. The specific data are shown in Table 4 as follows.

Table 4. Score of creativity of primary school students.

Dimension	N	City	Rural area	t	Male	Feale	t
Fluency	23.4 (SD = 6.7)	24.3	22.5	2.89**	22.1	24.7	3.12**
Flexibility	18.9 (SD = 5.2)	19.6	18.2	3.47***	17.5	20.3	4.05***
Originality	15.2 (SD = 4.8)	15.8	14.6	2.67**	14.7	15.7	1.83
Total score	57.5	59.7	55.3	4.88***	54.3	60.7	4.21***

Note: *indicates $p < 0.05$, **indicates $p < 0.01$, ***indicates $p < 0.001$.

4.3. The Relationship between Primary School Students' Internet Usage and Creativity

4.3.1. The Overall Relationship between the Duration of Internet Usage by Primary School Students and Their Creativity

The investigation found that the relationship between the duration of Internet usage by primary school students and their creativity was highly differentiated by the content type effect. The usage in the education category was positively correlated with the total score of creativity (r = 0.29***), especially significantly improving fluency (r = 0.31***). The use in the entertainment category was comprehensively negatively correlated (the total score r = −0.33***), and the originality was most severely impaired (r = −0.36***). The creation category is used to demonstrate the strongest gain (r = 0.41***), with a smoothness correlation of 0.42***, confirming the value of deep processing. Moreover, the fragmentation index of different types of apps can also measure the relationship between Internet usage and creativity. The calculation of the fragmentation index is obtained by dividing the daily usage frequency by the total duration of Internet usage on that day. The smaller the fragmentation index, the better the attention component of creativity. The specific data are shown in Table 5 as follows.

Table 5. Correlation analysis table between internet usage and creativity of primary school students.

Variable	Fluency	Flexibility	Originality	Total score
Total duration (minutes)	−0.18*	−0.15	−0.23**	−0.21**
Usage duration of educational applications	0.31***	0.27**	0.19*	0.29***
The usage duration of entertainment applications	−0.25**	−0.31***	−0.36***	−0.33***
The usage duration of creative applications	0.42***	0.38***	0.29**	0.41***
Fragmentation index (times per hour)	−0.37***	−0.33***	−0.28***	−0.35***

Note: *indicates $p < 0.05$, **indicates $p < 0.01$, ***indicates $p < 0.001$.

4.3.2. Regression Analysis of the Types of Online Content Used by Primary School Students on Creativity

The research revealed the differentiated influence paths of the types of content used online on various dimensions of creativity through hierarchical regression analysis. A hierarchical regression model was adopted, and the linear term (X) and square term (X^2) of the usage duration of educational apps were simultaneously included in the regression equation: Creativity = $\beta 0 + \beta 1X + \beta 2X^2$. β1 refers to the linear term coefficient, reflecting the initial positive effect used in education. β2 refers to the square term coefficient, reflecting the decreasing trend of marginal benefit. Linear term β1 = 0.34**: For every additional hour of use in the educational category, creativity increases by 0.34 points; Squared term β2 = −0.21***: Negative secondary effect ($p < 0.05$), indicating that the marginal benefit decreases

as the duration increases. By differentiating to determine the extreme points, the duration for maximizing benefits can be obtained. The peak value of X = −β1/2 − β2 = −0.34/2 × (−0.21) = 0.81 hours. He uses in the educational category significantly promotes fluency (β = 0.28***), flexibility (β = 0.23***), and originality (β = 0.17*), but its benefits show an inverted U-shaped curve, with 0.81 hours per day being the optimal threshold (peak β = 0.34). The creation category demonstrates the strongest gain effect, with particularly prominent improvements in smoothness (β = 0.36***) and flexibility (β = 0.33***). Fragmented behavior causes damage to the systems that generate all dimensions of creativity. The specific data are shown in Table 6 as follows.

Table 6. Hierarchical regression model of creativity of primary school students' online usage content types.

Variable	Fluency β (95% CI)	Flexibility β (95% CI)	Originality β (95% CI)
Usage duration of educational applications	0.28*** (0.21, 0.35)	0.23** (0.15, 0.31)	0.17* (0.05, 0.29)
The usage duration of entertainment applications	−0.19** (−0.27, −0.11)	−0.24*** (−0.33, −0.15)	−0.31*** (−0.39, −0.23)
The usage duration of creative applications	0.36*** (0.28, 0.44)	0.33*** (0.25, 0.41)	0.25** (0.14, 0.36)
Fragmentation index (Times per hour)	−0.29*** (−0.36, −0.22)	−0.26*** (−0.33, −0.19)	−0.21*** (−0.29, −0.13)
R^2	0.41	0.38	0.35

Note: *indicates $p < 0.05$, **indicates $p < 0.01$, ***indicates $p < 0.001$.

5. Discussion and Conclusion

Through the systematic analysis of the Internet usage behavior and creativity test data of 726 middle and upper-grade primary school students in the four urban districts of Hohhot, this study systematically reveals the multi-dimensional influence mechanism of primary school students' Internet usage behavior on creativity development, confirming that the influence of Internet usage on creativity has significant content heterogeneity and nonlinear characteristics.

The research finds that the urban-rural differences in the impact of primary school students' Internet usage on creativity development are significant, and the gap is mainly driven by entertainment usage. Although there are differences between urban and rural areas in the use of educational products, the gap is relatively small. The overall application of creative categories is weak, and there is a sharp gap between urban and rural areas, reflecting the scarcity of digital creation opportunities for rural students. In addition, the total score of creativity shows a systematic stratification. Urban students are significantly higher than rural students. The core of the gap lies in the difference in the accessibility of educational resources. Gender differentiation is obvious. Girls have a significant advantage in fluency and flexibility, but there is no difference in originality, reflecting that girls

are better at productive thinking while boys do not show a breakthrough advantage. Rural students lag behind in all dimensions of creativity, suggesting that insufficient digital skills training may limit the ability of refined processing. These results indicate that there are significant urban-rural and gender differences in Internet usage behavior and creativity performance. Differentiated intervention strategies need to be formulated for different groups, such as providing more educational resources and creative tools for rural students, designing spatial reasoning training courses for boys, and strengthening the cultivation of language creativity for girls. To narrow the digital divide and maximize the educational benefits of Internet usage.

From the perspective of the content types used on the Internet, it is found that the use of educational applications significantly improves fluency ($\beta = 0.28^{***}$) and flexibility ($\beta = 0.23^{***}$) through knowledge integration. However, its benefits show an inverted U-shaped curve, with 0.81 hours per day being the optimal threshold. That is, a certain degree of Internet use can promote the development of creativity. But beyond a certain degree, Internet usage may have a negative impact on creativity; The use of entertainment applications inhibits creativity, especially causing the most severe damage to originality ($\beta = -0.31^{***}$). The use of creative applications has the best impact on creativity, and its improvement in fluency ($\beta = 0.36^{***}$) and flexibility ($\beta = 0.33^{***}$) is particularly prominent. This also provides a scientific basis for formulating precise intervention strategies, such as adopting the "3-6-9" screen management strategy (≤0.81 hours for education, and no limit for creation), developing the "dual-track course of online creativity" (tool skills + cognitive literacy), and promoting the grading system of children's digital content. Incorporate "creative support degree" into the review criteria for educational apps. Future research can expand the sample range, introduce tracking experiments and brain-computer interface technology, and further deepen the understanding of the relationship between network usage and creativity.

However, there are still deficiencies in the research. Firstly, there is the limitation of the sample. The selection of the sample is concentrated in Hohhot City. In the future, it needs to be expanded to more regions to verify its universality. Secondly, there is a lack of vertical causal reasoning. Cross-sectional research cannot completely rule out reverse causality. For instance, highly creative children may be more inclined to select educational content, leading to errors in the research results. Subsequent longitudinal follow-up studies are needed. Finally, the study only considered the relationship between Internet usage and creativity. Whether there are other variables playing a mediating role between the two needs to be supplemented by subsequent studies. Future studies need to examine the influence mechanism of Internet usage on the development of creativity from different perspectives.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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