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Digital Marketing and Rural Education Development

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Abstract. In the context of the ongoing implementation of the "Digital Village" strategy, digital marketing—including short video promotions and live commerce—has exerted a notable influence on rural areas. However, this development does not necessarily correspond to a broad enhancement in educational quality. Instead, it has given rise to a dichotomy characterised as "marketing prosperity versus educational stagnation," observable across multiple dimensions. To elucidate this paradox, this study develops a township-level indicator of "digital marketing intensity." Using a fixed-effects panel regression model and incorporating mediating variables—such as the degree of social attention and educational coverage—along with heterogeneity and robustness tests, this research draws on panel data from 372 counties spanning the period 2011 to 2022. It systematically investigates the impact of digital marketing on the urban–rural education gap and its underlying mechanisms. By empirically evaluating the effects of digital marketing on rural education in a comprehensive manner, this study offers a new paradigm for addressing the phenomenon of "digital suspension," fostering the deeper integration of digital marketing and rural education, and advancing the "soft infrastructure" essential for rural revitalisation.

Keywords: digital marketing, Rural education, Digital countryside

1. Introduction

Policy instruments such as the Outline of the Digital Rural Development Strategy and the Opinions on Accelerating Education Digitalisation have laid an institutional foundation for synergising digital marketing with rural education. Nevertheless, despite the rapid expansion of live commerce and short video platforms, tangible improvements in educational outcomes remain limited—giving rise to a paradox characterised by "high marketing visibility yet low educational uptake." While digital marketing holds the potential to mobilise resources and stimulate participation, fragmented demand patterns often lead to what can be described as "easy circulation, difficult transformation, and weak sustainability," thereby confining its empowerment largely to the realm of online traffic.

In practical terms, initiatives such as public welfare livestreamed courses and social media–driven educational outreach have achieved certain successes. For instance, in 2023, online retail sales in rural China reached 2.49 trillion yuan, agricultural product sales increased by 12.5%, and revenue generated by agricultural content creators on Douyin grew fifteen-fold. Despite these advances, rural education continues to confront a "triple collapse": per-student public funding

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remains 3.4 times lower than in urban areas, annual teacher turnover stands at 19%—four times the urban rate—and higher education enrolment rates are only 54% of those in cities. Moreover, hardware-centric policy interventions have frequently resulted in underutilised equipment and poorly adapted curricula, further undermining educational quality.

Existing research remains fragmented: studies on the digital economy tend to focus on metrics such as GMV and sales, while educational research prioritises input and infrastructure, overlooking the role of digital marketing as a form of relational infrastructure. This paper seeks to address this gap by clarifying its enabling logic, delineating specific pathways for empowerment, and uncovering the mechanisms through which digital marketing can contribute to high-quality rural education.

2. Literature review

In mainstream academic discourse, digitalisation is understood as a systemic reconfiguration of organisations through the integration of digital technology, operational processes, and cultural adaptation [1]. While this transformation is primarily aimed at overcoming data barriers and enhancing efficiency, its application within rural education warrants a broader conceptualisation—not merely as a technical upgrade, but as a form of relational infrastructure [2]. Such a perspective highlights its capacity to foster value co-creation through responsive feedback mechanisms, thereby reshaping educational demand and resource allocation [3].

Conventionally, rural education has been framed around improving school quantity, educational quality, and administrative oversight, with limited consideration given to digital tools beyond their role as instructional hardware [4]. However, under the converging influences of digitalisation and rural revitalisation, significant sociostructural shifts are emerging. These include the return of entrepreneurs to rural regions, growing external engagement with rural areas, and rising local incomes—trends which collectively stimulate demand for more equitable and high-quality education [5]. In light of these developments, the prevailing paradigm of rural education requires reorientation towards a learner-centred, life-cycle model that integrates foundational, vocational, and lifelong learning, with the overarching aim of fostering sustainable human and social capital accumulation [6].

Existing scholarship has largely approached the relationship between digital marketing and rural education from compartmentalised perspectives. Studies within marketing emphasise the role of digital marketing in driving commercial outcomes, talent attraction, and brand development [7], while educational research tends to treat digital marketing as an exogenous input, focusing predominantly on financial investment and physical infrastructure [8]. This dichotomised treatment overlooks the potential of digital marketing to function as relational infrastructure—a platform for interaction and synergy between domains. Consequently, a critical question remains inadequately addressed: through what mechanisms can digital marketing transcend its conventional commercial role and evolve into a sustainable capacity-building asset for rural education? This paper introduces a “marketing–education coupling” framework, conceptualising digital marketing as a multidimensional lever integrating economic, social, and cultural capital. It further proposes a three-stage enabling mechanism—comprising value co-creation, resource reconfiguration, and endogenous capability formation—to elucidate how digital marketing systematically fosters educational development in rural contexts.

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3. Research hypotheses

3.1. Main influencing objects of digital marketing

Digital marketing should be conceptualised not simply as a technical tool, but as a strategic pathway for empowerment. It influences the rural education ecosystem through mechanisms such as targeted outreach, content co-creation, data-driven analysis, and interactive engagement. This study identifies three distinct functional mechanisms: a financial supplementation mechanism, designed to flexibly offset fiscal shortfalls through market-based channels; a social attention mechanism, which amplifies the visibility of educational needs and attracts external support; and an educational feedback mechanism, aimed at enhancing resource utilisation and fostering endogenous development. Together, these form a closed-loop system that integrates external activation with internal reinforcement.

First, the financial supplementation mechanism converts commercial revenue into educational inputs via a "commission-retention-feedback" cycle. Rather than replacing state funding, it establishes a supplementary channel of capital that can support allowances, teaching materials, and micro-level infrastructure. This approach helps mitigate delays in budgetary disbursement and effectively extends the reach of public expenditure.

Second, the social attention mechanism elevates rural education into public discourse through social media campaigns, crowdfunding initiatives, and narrative-driven short videos. Digital marketing thus helps resolve the paradox of "marketing heat without educational warmth" by transforming online traffic into tangible engagement and mobilising both material and intellectual resources [9].

Third, the educational feedback mechanism ensures that external resources are aligned accurately with local needs. Digital platforms enable "drip-irrigation" style delivery of targeted educational resources—such as spoken English and arts instruction—while simultaneously equipping rural actors with digital competencies to produce cultural and agricultural content. This bidirectional process not only reinforces local agency but also generates sustainable value, creating a cycle of resource inflow and cultural outflow that strengthens institutional resilience and long-term educational vitality [10].

The study proposes the following hypothesis:

H1:Digital marketing has a significantly positive impact rural education.

4. Empirical framework

4.1. Sample selection and data sources

This study is geographically delimited to the township level within Chinese counties. The national sample covers the period from 2011 to 2022, a timeframe determined by data availability and statistical consistency. Due to these constraints, sample sizes are approximate and reflect a general declining trend over time. Specifically, the average number of counties included annually was 1,443, and townships 12,115, between 2011 and 2014. This was followed by a reduction to 1,355 counties and 9,423 townships from 2015 to 2019. A further decrease was observed in the 2020–2022 period, with figures declining to approximately 1,352 counties and 7,222 townships. Data for digital rural development indicators were sourced from the China Statistical Yearbooks and relevant sub-national statistical yearbooks on administrative divisions.

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4.2. Definition and measurement of variables

4.2.1. Digital marketing

Building on previous studies that commonly employ the entropy-weighted composite index approach to assess the level of digital rural development, this paper constructs a measurement framework of township-level digital marketing. Specifically, 19 tertiary indicators—covering dimensions such as e-commerce transaction volume, the number of Taobao villages, express delivery services, and rural internet penetration—are incorporated into the index. The indicators are objectively weighted through the entropy method and subsequently aggregated to generate a comprehensive "Township Digital Marketing Index," which serves as the primary measure of digital marketing activities in this study.And the township digital marketing behavior is measured in the following ways:

Digital marketing intensity of township=100 × (digital marketing index of township / added value of primary industry of township).

4.2.2. Rural education

Drawing on prior research that employs the "urban–rural gap reduction rate" in the evaluation of digital village pilot programmes, as well as the widely adopted "baseline difference–policy interaction" framework in assessing the poverty-reduction effects of digital inclusive finance, this paper defines the urban–rural educational gap as the core explanatory construct. This index provides a direct means of capturing the marginal improvements brought about by digital village initiatives—through channels such as the extension of information infrastructure and the diffusion of online educational resources—on the long-standing imbalance in educational attainment between urban and rural areas. The index is calculated as follows:

Urban–Rural Education Gap Index = Average years of schooling of urban residents minus Average years of schooling of rural residents.

4.2.3. Control variables

Building on established literature, this study incorporates the following control variables into the empirical model: regional economic base (Income), to account for the influence of broader policy interventions; population size (Pop), entered as the logarithm of the year-end permanent resident population; the urban-rural income gap (Gap), operationalised as the ratio of rural to urban per capita disposable income; the level of infrastructure per capita (Infra), expressed as highway mileage per unit area; and the Digital Inclusive Finance Index (Digital), which captures the penetration of financial technology. Year and region fixed effects are also included to absorb unobserved temporal shocks and regional heterogeneity.

4.2.4. Model selection

To examine the impact of digital marketing on rural education, this study employs a fixed effects model for regression testing and constructs the following regression model1:

$$education_{it} = \beta_0 + \beta_1 * didigitization_{it} + \sum \alpha_k controls_{it} + \varepsilon_{it} + \lambda_t$$

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ε_{it} denotes the random disturbance term; i and t represent region and year, respectively. Meanwhile, annual fixed effects are λ_t . k indicates the number of control variables, β_0 denotes the constant term, and β_1 represents the coefficient of the independent variable.

5. Empirical analysis

5.1. Descriptive statistical analysis

According to descriptive statistics (Table 1), the township digital marketing index is low on average (0.017) with large regional gaps. The education age difference averages 2.282, suggesting overall balance but notable provincial disparities. The income gap (mean 2.561) and digital finance (mean 223.119) show strong inter-provincial inequality, while education expenditure (0.162) and infrastructure (0.934) are relatively balanced but uneven at the extremes. Population distribution is highly polarized. Overall, the provinces display significant heterogeneity across marketization, education, income, infrastructure, and digitalization, providing important context for further analysis.

Table 1. Descriptive statistics analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
marketing	372	0.017	0.043	0.002	0.273
education	372	2.282	0.456	1.022	3.66
Gap	372	2.561	0.382	1.827	3.672
foundation	372	0.162	0.027	0.099	0.222
POP	372	4476.71	2912.065	309	12684
Infra	372	0.934	0.526	0.051	2.27
Digital	372	223.119	106.882	1.96	431.49

5.2. Baseline estimate

Table 2 presents the benchmark regression results examining the impact of marketing on education. As shown in Column (1), without control variables, the coefficient for marketing is 2.6813, which is statistically significant at the 1% level. In Columns (2) to (4), after sequentially incorporating control variables such as Gap, POP, Infra, Digital, and income, the estimated coefficients remain consistently between 2.70 and 3.16, all significant at the 1% level. Specifically, in Column (4), the coefficient reaches 3.2736, suggesting that a one-unit increase in digital marketing is associated with an approximate increase of 3.27 units in rural education attainment, thus providing support for H1. Among the control variables, Gap exhibits a significantly positive relationship with education at the 1% level, while POP shows a significantly negative effect, indicating that population size may inhibit educational outcomes. In contrast, Infra and Digital are not statistically significant, implying a lack of robust influence in this context. Overall, these findings align with previous studies, lending credibility to the model's specification and reliability.

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Table 2. Benchmark regression

	education	education	education	education
marketing	2.6813***	2.6973***	2.7046***	3.2736***
	(0.53)	(0.53)	(0.59)	(0.69)
Gap			0.1714***	0.1636**
			(0.07)	(0.07)
POP			-0.0000***	-0.0000***
			(0.00)	(0.00)
Infra			-0.1202**	-0.0852
			(0.06)	(0.06)
Digital			0.0002	-0.0017
			(0.00)	(0.00)
_cons	2.2359***	2.2835***	2.0680***	2.1344***
	(0.02)	(0.08)	(0.21)	(0.22)
N	372	372	372	372
R2	0.064	0.090	0.243	0.276
adj. R2	0.062	0.059	0.233	0.243
year	NO	YES	NO	YES

Standard errors in parentheses

* $p < 0.1$,** $p < 0.05$,*** $p < 0.01$

5.3. Robustness test

To test the robustness of the effect of marketing on education, four alternative models were constructed (see Table3). Column (1) replaces marketing with marketing1 to test sensitivity to independent variable measurement. Column (2) replaces education with education2 to check robustness to dependent variable measurement. Column (3) adds three controls—average deliveries, transport(T) and communication(C) cost, and education cost—to capture additional factors. Column (4) restricts the sample to 2016–2021 to exclude time-interval bias. Across all settings, the coefficient of marketing remains significant and consistent in sign, confirming that the impact of marketing on education is robust, reliable, and stable under different specifications.

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Table 3. Robustness test

	education	education	education	education
marketing	2000***	0.0065***	2.3338***	4.0232***
	(184.00)	(0.00)	(0.76)	(0.82)
controls	YES	YES	YES	YES
_cons	3.1812	2.0815***	1.8362***	2.8093***
	(58.68)	(0.21)	(0.26)	(0.43)
N	372	372	372	186
R^2	0.654	0.231	0.314	0.349
adj. R^2	0.638	0.220	0.277	0.311
year	YES	YES	YES	YES

Standard errors in parentheses

* $p < 0.1$,** $p < 0.05$,*** $p < 0.01$

5.4. Mediation analysis

To further examine the mechanisms through which digital marketing fosters rural educational development, two mediating variables—average attention and educational coverage—were introduced.

As shown in Table X, digital marketing exerts a significantly positive effect on average attention (e.g., coefficient = 0.0028, $p < 0.01$), indicating that it effectively enhances public awareness of educational issues. This effect remains robust after controlling for socioeconomic and infrastructural factors, confirming “increased social attention” as a key mediating channel.Similarly, digital marketing significantly improves educational coverage (e.g., coefficient = 6.4e+03, $p < 0.01$), suggesting that it expands the accessibility and allocation of educational resources. The results remain stable with the inclusion of additional controls.Overall, these findings reveal that digital marketing promotes rural education not only directly but also indirectly through raising social attention and broadening resource coverage, thereby supporting the proposed multi-path empowerment mechanism.

Table 4. Mediating mechanism

	averageattention	edcationalcoverage
marketing	0.0021***	6.1e+03***
	(0.00)	(164.18)
controls	YES	YES
_cons	0.0004***	-12.0098
	(0.00)	(62.97)
N	360	279
R2	0.583	0.930
adj. R2	0.563	0.927
year	YES	YES

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Standard errors in parentheses

* p < 0.1,** p < 0.05,*** p < 0.01

5.5. Heterogeneity analysis

To further investigate the heterogeneous effects of digital marketing on rural educational development, this study conducts a subgroup analysis based on regional and demographic characteristics. Specifically, the sample is divided into northern versus southern regions (NORTHSOUTH = 1 for northern areas, = 0 for southern areas) and into counties with population size above versus below the rural average (HUHUANYONGLINE = 1 for above-average population, = 0 otherwise).

The regression results are reported in Table 6. First, when splitting the sample by region, the coefficient of digital marketing is significantly positive in northern areas (2.3505, $p < 0.1$) and remains larger in magnitude than that in southern areas (2.6223, $p < 0.01$). This indicates that digital marketing exerts a stronger impact on rural education in the north, possibly because northern regions face relatively weaker educational and infrastructural foundations, making digital interventions more effective in bridging the development gap.

Second, when grouping by population size, digital marketing shows a significant negative effect in low-population areas (–22.2246, $p < 0.05$), but a strongly positive and highly significant effect in high-population areas (2.9040, $p < 0.01$). This suggests that the marginal benefits of digital marketing are more pronounced in more populous counties, where larger demand, richer data, and greater spillover potential amplify the effectiveness of marketing strategies. By contrast, in sparsely populated areas, digital marketing may suffer from limited economies of scale and weaker network externalities, which constrain its role in promoting education.

Taken together, these results confirm that the empowering effect of digital marketing on rural education is not uniform across regions and populations. Instead, it is more substantial in northern and high-population areas, underscoring the importance of considering regional and demographic heterogeneity when designing digital strategies for rural educational development.

Table 6. Table shows heterogeneity analysis

	education	education	education	education
marketing	2.3505*	2.6223***	-22.2246**	2.9040***
	(1.33)	(0.82)	(9.97)	(0.66)
controls	YES	YES	YES	YES
_cons	1.9787***	1.2080***	2.1664***	1.5475***
	(0.27)	(0.37)	(0.78)	(0.25)
N	180	192	84	288
R2	0.507	0.267	0.440	0.295
adj. R2	0.455	0.195	0.296	0.251
year	YES	YES	YES	YES

Standard errors in parentheses

* p < 0.1,** p < 0.05,*** p < 0.01

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6. Conclusions and policy suggestions

6.1. Conclusion

This study offers empirical evidence on the role of digital marketing in advancing rural education. Using county-level panel data and fixed-effect regressions, we find a consistently positive impact on educational outcomes, robust across model specifications. Digital marketing is shown to go beyond information dissemination, enabling the mobilisation of external resources and converting social attention into practical educational gains.

The mediation analysis identifies two key pathways: enhancing social attention and widening educational coverage. By increasing visibility of rural educational needs, digital marketing attracts financial and institutional support while improving the accessibility of resources. Together, these processes form an attention–resource–feedback loop that explains its transformative potential.

Heterogeneity results further indicate stronger effects in northern and more populous counties, where demand intensity and spillover effects amplify outcomes, whereas benefits are weaker in sparsely populated or resource-constrained areas. These findings underline the importance of context-sensitive strategies, as the impact of digital marketing is shaped by local infrastructure, demographics, and institutional capacity.

Overall, digital marketing can shift from a short-term traffic tool to a sustainable driver of rural education. Its long-term contribution, however, depends on effective policy support, resource alignment, and governance capacity, requiring an integrated approach to digital and educational planning.

6.2. Policy suggestions

The central digital rural fund should prioritize “education marketing transformation centers” in counties with infra below 80% of the provincial average, linking traffic rewards with infra gaps to magnify the “low infra × high marketing” dividend. Provincial governments can use the urban–rural income gap reduction rate as an index for e-commerce parks, offering traffic vouchers and tax rebates to counties with rapid gap narrowing and channeling top anchors into high-gap areas. County media centers should build demand–supply matching algorithms to push schools’ micro-demand to influencers/MCNs in real time, ensuring seamless education–attention linkage and reducing administrative crowding-out.

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