The impact of child labor on school enrollment rates and education quality in Northern mountainous provinces of Vietnam

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Abstract: Child labor and the sustainable development goals for human beings is an urgent topic, which remains a significant barrier to achieving equitable education in many developing regions, including Vietnam's Northern mountainous provinces. This study investigates the impact of child labor on two critical educational outcomes as school enrollment rate and education quality, using panel data from 25 provinces over the 2019– 2024 period. Based on the Household Economics Model of Schooling and Child Labor by Basu & Van (1998), the research employs a quantitative approach based on secondary data and applies multiple linear regression analysis to examine the relationships while controlling for key socio-economic variables such as poverty rate, ethnic minority population, and education budget expenditure. The results reveal that child labor has a negative and statistically significant impact on both school enrollment and education quality. In particular, provinces with higher rates of child labor tend to report lower school attendance and reduced rates of timely program completion. Among the control variables, poverty rate also demonstrates a significant negative effect, whereas education budget expenditure shows a positive correlation with educational outcomes. The effect of ethnic minority proportion does not show the statistical significance. These findings contribute to the theoretical understanding of the child labor-education nexus in marginalized contexts and offer practical implications for policymakers. Specifically, the study underscores the need for integrated strategies that reduce child labor, strengthen poverty alleviation efforts, and increase investment in education to ensure inclusive and quality education for all children, especially in disadvantaged regions.

Keywords: Child labor, education quality, human capital, school enrollment, sustainable development.

1. INTRODUCTION

In the global pursuit of sustainable development, investing in human capital, especially through education, is regarded as one of the most effective strategies for breaking the cycle of poverty, fostering economic growth, and promoting social equity (World Bank, 2018). Education not only equips individuals with knowledge and skills but also empowers them

to participate more actively in civic and economic life. For this reason, Sustainable Development Goal 4 (SDG 4) emphasizes inclusive and equitable quality education as a foundational pillar for achieving broader development goals.

However, in many developing countries, including Vietnam, persistent inequalities continue to hinder access to and the quality of education, especially in remote and marginalized communities. Among the most pressing challenges in this regard is child labor, which poses a direct threat to children's rights and human capital development. According to the International Labour Organization (ILO, 2021), over 160 million children globally are still engaged in child labor, with many of them either dropping out of school or never entering the formal education system. These children are often concentrated in rural, impoverished, or ethnically marginalized regions, where systemic barriers to education intersect with economic vulnerability. In Vietnam, despite steady improvements in national education indicators over the past two decades, child labor remains a persistent issue in certain disadvantaged regions, particularly in the Northern mountainous provinces. This region is a home to a high concentration of ethnic minorities, high poverty rates, and difficult terrain, which continues to experience gaps in educational outcomes (MOLISA & UNICEF Vietnam, 2019; Thuy et al., 2015). The pressure to contribute to household income or perform domestic labor often prevents children from regularly attending school or fully engaging in their studies, potentially lowering both school enrollment rates and educational quality.

While previous research has examined the general relationship between child labor and education (Beegle et al., 2009; Emerson & Souza, 2011), there is a notable lack of empirical studies that focus specifically on this dynamic in the context of Vietnam's Northern mountainous region, which is a setting marked by complex socio-economic and cultural conditions. Furthermore, few studies have simultaneously examined the dual impact of child labor on access to education (enrollment) and education outcomes (academic performance or progression). Addressing this research gap, the present study aims to assess the impact of child labor on two key aspects of education in the Northern mountainous provinces of Vietnam as the school enrollment rate and the quality of education, measured by timely grade completion. In addition, the study incorporates several control variables that are highly relevant to education outcomes in disadvantaged areas, including the poverty rate, the proportion of ethnic minority population, and public education budget expenditure. By analyzing panel data from 2019 to 2024 using multivariate regression techniques, this study provides both theoretical insights and practical evidence to inform targeted education and child protection policies. The structure of the research paper

includes 5 parts from introduction, conceptual framework and hypothesis development, methodology, results and discussion, and implications and conclusion.

2. CONCEPTUAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

2.1. Child labor

Child labor refers to the involvement of children in economic activities that are mentally, physically, socially, or morally dangerous and harmful, and that interferes with their schooling (ILO, 2021). This includes work that deprives children of the opportunity to attend school regularly, obliges them to leave school prematurely, or requires them to combine school attendance with excessively long and heavy work (UNICEF, 2025). While not all work done by children qualifies as child labor, the term is generally used to describe forms of economic activity that compromise children's development and violate their rights.

According to the International Labour Organization (ILO), child labor typically applies to children under the age of 18 who are engaged in work that is exploitative or hinders their access to education. In particular, the Worst Forms of Child Labor Convention (No. 182) highlights hazardous work, forced labor, child trafficking, and use of children in illicit activities as critical violations of child rights (ILO, 1999). Child labor is a multidimensional issue, often driven by poverty, limited access to quality education, lack of adult employment, and socio-cultural norms that normalize early work (Edmonds, 2008; Basu & Tzannatos, 2003). In rural and mountainous regions, such as the northern provinces of Vietnam, children may be involved in agricultural work, household chores, or informal labor markets due to both economic necessity and traditional expectations (MOLISA & UNICEF Vietnam, 2019). These activities often lead to school absenteeism, poor academic performance, and long-term educational setbacks.

Empirical research has shown that child labor negatively affects school enrollment and educational outcomes. For instance, Emerson & Souza (2011) found that children engaged in labor were more likely to drop out of school and perform poorly academically. Similarly, a study by Beegle et al. (2009) concluded that child labor is associated with reduced cognitive development and lower adult earnings, thus perpetuating cycles of poverty and exclusion. In the context of Vietnam, while the national legal framework prohibits child labor under the age of 15 (except for light work under regulated conditions), enforcement remains challenging in remote areas. According to UNICEF (2025), children from ethnic minority groups in the northern mountainous provinces are particularly vulnerable due to

socio-economic marginalization, remoteness, and limited access to public services, including education.

2.2. School enrollment

School enrollment is commonly defined as the process by which eligible children register and attend formal educational institutions at the appropriate age, as determined by national education policies (UNESCO, 2017). It is typically measured by gross and net enrollment rates, which reflect the proportion of children of official school age enrolled in primary, lower secondary, or upper secondary education (World Bank, 2023). School enrollment is considered a critical indicator of educational access and equity, and plays a foundational role in long-term human capital development (UNICEF, 2019). High enrollment rates are often associated with improvements in literacy, life skills, employment opportunities, and reductions in intergenerational poverty (Hanushek & Woessmann, 2008). Conversely, low or delayed enrollment may signal the presence of structural inequalities, economic hardship, or sociocultural barriers.

In developing contexts, several factors influence school enrollment, including household income, parental education, child labor, gender, ethnicity, and geographical location (Filmer, 2006). For example, in rural or mountainous areas of Vietnam, the cost of schooling (both direct and opportunity costs), poor infrastructure, long travel distances, and language barriers for ethnic minority children are major challenges that deter timely and consistent school enrollment (UNICEF, 2019).

Research also shows a strong negative relationship between child labor and school enrollment. When children are involved in labor whether economic or domestic, it often results in delayed enrollment, irregular attendance, or school dropout (Patrinos & Psacharopoulos, 1997; Beegle et al., 2009). In the northern mountainous provinces of Vietnam, this issue is particularly salient due to the high prevalence of subsistence agriculture and informal labor that children are expected to participate in from a young age (GSO & ILO, 2025).

In policy terms, increasing school enrollment requires not only removing economic barriers but also addressing socio-cultural norms, improving school quality, and providing incentives for families to keep children in school. Vietnam's National Target Program for Education Development in Ethnic Minority and Mountainous Areas (2021–2030) aims to reduce disparities in school enrollment by improving infrastructure and support mechanisms in these regions.

2.3. Education quality

Education quality refers not only to the availability of schooling, but more importantly, to the effectiveness of educational inputs, processes, and outcomes in promoting meaningful learning, critical thinking, and skill acquisition (UNESCO, 2004). It encompasses various dimensions, including the quality of teachers, curriculum relevance, learning environment, assessment systems, and student outcomes (UNICEF, 2020). A high-quality education system ensures that learners acquire foundational skills such as literacy and numeracy, along with broader competencies such as problem-solving, communication, and adaptability (World Bank, 2018). Education quality is increasingly recognized as the key driver behind the long-term social and economic benefits of education, not merely years of attendance (Hanushek & Woessmann, 2012).

In the context of developing countries, especially in disadvantaged regions like Vietnam's northern mountainous provinces, education quality often suffers due to underqualified teachers, limited learning materials, overcrowded classrooms, language barriers, and inconsistent attendance (MOET, 2021; UNICEF, 2021). Ethnic minority students face additional challenges due to cultural and linguistic mismatches between home and school, which can lower comprehension and participation. Importantly, child labor can have a direct and indirect impact on education quality. Even when children are enrolled in school, labor obligations often lead to chronic fatigue, poor concentration, irregular attendance, and limited time for homework or study, all of which negatively affect academic performance and learning outcomes (Beegle et al., 2009; Emerson & Souza, 2011). This undermines not only the child's educational trajectory but also the effectiveness of school systems striving to improve learning results. Policymakers and development agencies are now shifting their focus from merely increasing enrollment to ensuring quality learning for all. In Vietnam, recent reforms under the General Education Program 2018 aim to modernize teaching methods, emphasize competency-based education, and improve school readiness and equity, especially in ethnic minority areas (World Bank, 2020).

2.4. Current status of child labor and education in Northern mountainous provinces of Vietnam

The General Statistics Office (now National Statistics Office), in collaboration with the Ministry of Labor, War Invalids and Social Affairs and the International Labor Organization (ILO), has researched and integrated some information on the labor participation of children aged 5 to 17 and child labor into the Labor and Employment Survey in recent years. However, the data is still quite preliminary and has not been

thoroughly studied. In 2023, the population of children aged 5 to 17 in Vietnam is 20.6 million, accounting for 20.6% of the total national population. Of which, children aged 5-11 are 11.8 million, accounting for 57.2%; children aged 12-14 and 15-17 are 4.7 million and 4.1 million, accounting for 22.9% and 19.9%, respectively. Children living in urban areas account for 35.0%, in rural areas account for 65.0%. Data from the 2023 labor force survey shows that the most important activity of children is "going to school". Of the total 20.6 million children aged 5-17, 19.9 million are "going to school", accounting for 96.4%, of which 94.8% are "only going to school" and only 1.6% are "both studying and working". The proportion of children going to school in urban areas is slightly higher than in rural areas, 97.5% compared to 95.8%. There is no discrimination against girls in the opportunity to go to school as the proportion of girls going to school is 0.8 percentage points higher than that of boys, 96.8% compared to 96.0%.

Table 1. Children participating in labor by socio-economic region by 2023

Region	Proportion (%)
Red River Delta	0.7
Northern Midland and Mountainous	7.3
North Central and South Central Coast	3.7
Central Highlands	6.4
Southeast	2.4
Mekong River Delta	4.0

Source: GSO & ILO, 2025

According to the latest statistics, Vietnam has about 731,600 child laborers, of which 84.6% live in rural areas and are mostly concentrated in the two regions of the Northern Midlands and Mountains and the North Central and Central Coast, accounting for a total of 52.7%. The Northern Midlands and Mountains is the region with the highest rate of child laborers in the country, with more than 7 children out of every 100 children aged 5 to 17 participating in labor. The 15-17 age group accounts for the largest proportion (70.6%), while the 12-14 age group accounts for 23.8%, and the younger age group from 5-11 years

old accounts for 5.6%. Children mainly work in the agriculture, forestry and fishery sector (67%), followed by services (16.4%) and industry (13.3%). The common age for children to start working is from 10 years old and above, with 15 years old being the age with the highest number of participants, with nearly 149,000 children.

Not all children engaged in labor are child laborers. About the child labor, according to the latest report, Vietnam currently has about 269,604 child laborers, accounting for 1.31% of the total number of children aged 5–17, of which nearly 37% of children participating in labor are child laborers. The majority of them live in rural areas (76.4%), and boys account for a higher proportion (61.4%). The most common age of child laborers is 15–17 years old, followed by the 12–14 age group and a small proportion of 5–11 years old. Child labor is mainly concentrated in areas with difficult socio-economic conditions such as the Mekong Delta, Southeast, North Central & Central Coast, where the school attendance rate is low and the risk of dropping out is high. In terms of labor, children are often involved in agriculture, forestry and fisheries (38.9%), followed by industry and construction (38.3%) and services (22.8%). The nature of work is mainly simple, manual or sales labor, with an average working time of up to 37.5 hours/week, which increases with age. Notably, about 66% of child laborers work beyond the prescribed time, and nearly 19% have to work at night, seriously affecting their health and comprehensive development. About 35% of children have to do hazardous work, and 12% have work-related health problems, higher than the general group of child laborers. The average income of child laborers is only about 3 million VND/month, less than half the income of adult workers. This shows that not only do they lose out on educational opportunities, but they also face high risks to their health and physical development, while the economic benefits are negligible. This situation reflects the need for comprehensive policies to eliminate child labor, improve access to education, and create a healthier development environment for children in disadvantaged areas.

Children participating in labor and child labor issue have a significant relationship with education and training. A worrying issue is that more than 55% of working children are not currently attending school, while among non-working children, the school attendance rate is up to 98.3%. This clearly reflects the negative relationship between labor participation and the ability to continue studying. However, contrary to the popular belief that children drop out of school due to financial difficulties or family pressure, the survey shows that up to 59.9% of children drop out of school because of "dislike of studying/poor academic results" - the highest cause, far exceeding other reasons such as lack of money to go to school (10.5%), working to earn income (16.5%) or helping family production and business

(4%). This is a serious warning for the education system to improve teaching methods, learning environment and school psychological support to retain students, especially in remote areas. In particular, children starting to participate in labor at a very young age (the 5-7 age group accounts for 1.8%) has many potential physical and mental risks, seriously affecting their comprehensive development as well as their ability to integrate into society in the future.

Table 2. Child labor proportion by socio-economic region by 2023

Region	Proportion (%)
Red River Delta	7.0
Northern Midland and Mountainous	14.5
North Central and South Central Coast	15.5
Central Highlands	14.9
Southeast	18.9
Mekong River Delta	29.2

Source: GSO & ILO, 2025

In recent years, the education and training of the Northern mountainous region, especially ethnic minorities and mountainous areas, has received special attention from the Party and the State. Policies and guidelines for ethnic minorities and mountainous areas have been institutionalized into legal documents and implemented seriously and promptly, meeting the requirements of education and training development, and have been approved and supported by the people.

Equality in education is guaranteed. The outstanding achievements in the development of ethnic minority education in the past 10 years can be mentioned as follows: The system of educational facilities from kindergarten to high school has been consolidated and developed. Communes in remote areas, areas where ethnic minorities live scattered, with difficult terrain, all have kindergartens, primary schools and middle schools, all districts have at least 2 high schools or more, meeting the learning needs of ethnic minority children.

The rate of students going to school is increasing, the rate of students repeating grades and dropping out is decreasing. The rate of students graduating from middle school and high school has increased significantly every year. The specialized education system (boarding schools for ethnic minorities, semi-boarding schools for ethnic minorities, and preparatory schools) is increasingly effective. The recruitment system has contributed significantly to the training of qualified ethnic minority cadres in the locality. The policies and regimes for educational administrators, teachers (education administrators, teachers) and students who are ethnic minorities are fully, promptly and in accordance with regulations. Thereby, it has encouraged teaching and learning, created equality in education, contributed to socioeconomic development (socio-economic), and stabilized political security in ethnic minority and mountainous areas.

In particular, the Northern Midlands and Mountains region includes 14 provinces: Ha Giang, Cao Bang, Lao Cai, Bac Kan, Lang Son, Tuyen Quang, Yen Bai, Thai Nguyen, Phu Tho, Bac Giang, Lai Chau, Dien Bien, Son La, Hoa Binh. The total area of the region accounts for 35% of the country's area, the population accounts for more than 15% of the country, this is a particularly important strategic area in terms of socio-economics, national defense - security and foreign affairs of our country. With the proportion of ethnic minorities accounting for 56.2%, the terrain is mostly difficult and rugged, so far, this is still the poorest and most disadvantaged region in the country.

Reporting at the Conference on education and training development in the Northern midlands and mountainous areas (2022), Deputy Minister of MOET revealed that in the 2021-2022 school year, 14 provinces in the Northern Midlands and Mountains region have over 3.3 million preschool children and students at all levels. The rate of preschool mobilization reached 98.6%, ranking first in the country. The rate of primary school students attending school is 99.9%, equivalent to the national average and equivalent to other regions. The rate of secondary school graduates is higher than the national average and is only behind the Red River Delta. To date, the whole region has basically achieved the goal of eliminating illiteracy, 100% of provincial, district and commune-level units have met the level 1 illiteracy eradication standards (MOET, 2022).

The Northern Midlands and Mountains region has 10,900 preschool, general and regular education facilities, including 979 boarding and semi-boarding schools. Currently, the whole region has no more communes with no education, all villages have preschool classes, all communes have primary schools. Combined schools and classes are opened in remote, isolated and particularly disadvantaged villages and hamlets, creating conditions for ethnic minority children of school age to go to school. Localities in the region have proactively

reviewed planning and eliminated separate schools, rearranged small-scale primary and secondary schools towards establishing inter-level and inter-commune schools, based on the principle of creating convenience for people, ensuring students' learning rights and in accordance with the planning and requirements of local socio-economic development. According to statistics, in the 2020-2021 school year, the whole region has 13,017 schools, a decrease of 2,793 preschool and general education facilities compared to the 2010-2011 school year. Although budget collection still has many difficulties, the total state budget expenditure for the education and training sector of the region has increased gradually over the years. In 2021, the total state budget expenditure for education and training in the Northern Midlands and Mountains increased by 40.2% compared to 2011. Of which, total regular expenditure still accounts for a large proportion, about 88.5%. In general, despite many efforts, the Northern Midlands and Mountains are still a lowland in development and the poor core of the whole country. Education and training face many difficulties and challenges. The rate of school consolidation in the region is the lowest in the country.

2.5. Hypothesis development

The theoretical underpinnings of the relationship between child labor and education are based on the Household Economics Model of Schooling and Child Labor by Basu & Van (1998). This model suggests that in low-income households, sending children to school or to work is a trade-off decision, depending on the opportunity cost of education. When children are economically productive, especially in agriculture or manual labor, schooling is often delayed or dropped out altogether in favor of short-term family income. This also asserts that children's time and energy are limited when too much is spent on labor, they will not have enough resources to continue their education effectively (Basu & Van, 1998).

Many studies have demonstrated a negative relationship between child labor and school attendance. According to Beegle et al. (2009) using data from Vietnam and Tanzania, working children have a significantly higher probability of dropping out of school and falling behind in grades than non-working children. Patrinos & Psacharopoulos (1997) also found that school enrollment rates were significantly lower among children who had to work at an early age, especially in rural areas or among ethnic minorities. In Vietnam, according to data from the General Statistics Office and the International Labor Organization (GSO & ILO, 2025), out of a total of 731,600 working children, more than 55% were no longer attending school, while among non-working children, the school attendance rate was 98.3%. In particular, the Northern Midlands and Mountains region has the highest rate of child labor in the country, with 7.3% of children aged 5–17 working, which corresponds to a high rate of school dropouts and late arrivals in this region,

especially for ethnic minority children. Based on these agurements, the author proposed the following hypothesis:

H1: Child labor has a significant impact on school enrollment rates in Northern mountainous provinces of Vietnam.

Not only does it reduce the ability to attend school, child labor also seriously impairs the quality of learning. Children who work while studying often experience fatigue, lack of concentration, increased absences from school, and less time to do homework, all of which negatively affect academic performance. Emerson & Souza (2011) have shown that working children have significantly lower academic performance, even when controlled for economic and social factors. In addition, research by Rosati & Rossi (2003) shows that students who work while studying have significantly lower math and reading scores than those who do not work. In the northern mountainous region of Vietnam, reports by UNICEF (2025) and MOET (2022) indicate that the majority of child workers in the region work an average of 37.5 hours per week, with 66% exceeding permitted working hours, and nearly 19% working at night, which not only affects their physical and mental health but also reduces the quality of learning and learning effectiveness. In addition, the lack of qualified teachers, poor facilities, and language differences between ethnic minority children and the language of instruction (Vietnamese) also exacerbate the negative impacts of child labor (MOET, 2022; World Bank, 2020).

H2: Child labor has a significant impact on education quality in Northern mountainous provinces of Vietnam.

In analyzing the relationship between child labor and educational outcomes, it is essential to account for the broader socio-economic and demographic factors that shape access to schooling and the quality of education. Therefore, the present study incorporates three control variables into the analytical model such as poverty rate, ethnic minority population rate, and education budget expenditure. Each of them is theoretically and empirically associated with education performance in developing contexts.

Firstly, poverty is a well-documented driver of both child labor and low educational attainment. Families living in poverty often rely on children's income-generating activities to meet basic needs, which directly interferes with school attendance and learning (Edmonds & Pavcnik, 2005; Beegle et al., 2009). Moreover, impoverished households may be unable to afford direct or indirect schooling costs such as uniforms, transportation, or learning materials. As such, this study hypothesizes a negative association between poverty rate and both school enrollment and education quality.

Secondly, ethnic minority status has been found to be a key determinant of educational inequality in multi-ethnic societies. Among ethnic minority groups in Vietnam, many of whom reside in remote and mountainous areas still face multiple barriers to education, including linguistic differences, geographic isolation, and cultural marginalization (Baulch et al., 2010; Dang, 2012). The lack of culturally relevant curricula and insufficient investment in minority-language education often results in higher dropout rates and lower learning outcomes among ethnic minority children. Thus, it is hypothesized that a higher proportion of ethnic minorities in a province is associated with lower school enrollment rates and reduced education quality.

Thirdly, public expenditure on education plays a critical role in enhancing school infrastructure, teacher quality, and educational access, especially in disadvantaged areas. Empirical studies have shown that increased government spending on education is positively correlated with student performance and equity in education outcomes (Gupta et al., 2001; Baldacci et al., 2008). In Vietnam, state budget allocation remains a vital tool for improving education in rural and mountainous provinces where private education investment is minimal. Consequently, this study posits a positive relationship between education budget expenditure and educational outcomes, specifically higher school enrollment and improved education quality.

3. METHODOLOGY

3.1. Research approach and measures

This study uses a quantitative research method through secondary data analysis to assess the impact of child labor on school enrollment and education quality in the provinces in the Northern mountainous region of Vietnam.

In this study, three main groups of variables were used as independent variable (child labor - CLB), dependent variables (school enrollment rate - SER and education quality - EDQ), along with control variables to ensure accurate analysis model. The independent variable is the child labor rate, measured by the percentage of children aged 5 to 17 years engaged in labor activities in each province, according to data from GSO and ILO. The first dependent variable is the school enrollment rate, measured by the net enrollment rate of children of school age who are attending formal school according to data from MOET. The second dependent variable is the quality of education represented by the rate of students completing the program on time. In addition, the study included control variables to eliminate the influence of confounding factors such as the rate of poor households (POH),

the rate of ethnic minority population (EMP), the level of education budget expenditure (EBE) as agured in the hypothesis development section.

3.2. Sampling and data collection

The study used the purposeful sampling method to collect secondary data from 25 provinces/cities in the Northern mountainous region of Vietnam. Data is collected entirely from reputable secondary sources, including reports and databases published by government agencies and international organizations during the period from 2019 to 2024. To ensure representativeness and comparability across localities, the study has agreed on a data collection period of 2019–2024. This is an important period with many changes in education and employment policies, especially after the impact of the COVID-19 pandemic on the education system and labor market. The indicators used in the study are all periodically reported annually at the provincial or regional level, allowing for data synthesis and trend analysis.

Accordingly, the study used SPSS 27 with statistical methods of exploratory analysis of descriptive data, data transformation (if necessary) and use multiple linear regression analysis method using Casewise diagnostics to predict outliers in the data set, thereby giving the best evaluation results for the research model and drawing conclusions for the research hypotheses.

4. RESULTS AND DISCUSSION

4.1. Descriptive statistics result

Table 3 presents descriptive statistics for the main variables in the research model, including the independent variable (child labor rate – CLB), two dependent variables (school attendance rate – SER and education quality – EDQ), along with three control variables: poverty rate (POH), ethnic minority population rate (EMP), and education budget expenditure (EBE). Data were compiled from 25 provinces/cities in the Northern mountainous region of Vietnam in the period 2019–2024, with a total of 125 observations (25 provinces x 5 years).

The average child labor rate in the study area is 7.82%, showing that this phenomenon still exists significantly, despite many intervention efforts from the government and international organizations. Some provinces only recorded a rate of 2.1%, while some localities can reach up to 15.4%, showing great inequality between provinces on this issue. Places with complex terrain, lack of educational opportunities or high economic pressure often have higher CLB rates.

Table 3. Sample descriptive statistics results (n=125)

Variables	Mean	Standard deviation	Min	Max
CLB (%)	7.82	3.15	2.10	15.40
SER (%)	94.26	3.87	85.90	98.80
EDQ (%)	76.45	6.42	60.20	89.70
POH (%)	21.37	7.90	8.50	42.10
EMP (%)	54.83	19.05	20.10	95.40
EBE (billion VND)	1,294	631	430	3,720

Source: Data analysis by SPSS 27

Although access to education is relatively high (average 94.26%), there are still clear gaps between provinces, with some localities having rates below 90%. This raises questions about children's real access to education, especially in remote areas or areas with high ethnic minority populations. In addition, localities with high CLB rates are often also low SER, suggesting a potential inverse relationship between the two variables.

The average rate of students completing the program on time is 76.45%, and varies widely between provinces (from 60.2% to nearly 90%). This suggests that although children can attend school, maintaining and completing the program remains a major challenge, possibly due to learning conditions, teacher quality, or the impact of early labor.

For control variables, the average poverty rate (POH) is high (21.37%), with some provinces reaching more than 40%. This difference reflects the inequality of economic development between localities. High poverty rates often go hand in hand with high CLB rates and low SER, as children in poor households often have to support their families instead of going to school. In addition, the Ethnic Minority Rate (EMP) is a characteristic of the Northern mountainous region, with an average of 54.83%. Some provinces have this rate almost absolute (>90%). This is a vulnerable group in accessing education due to language, cultural, and economic barriers. In addition, the education budget expenditure (EBE) shows the level of investment by local authorities in education development. The average is about 1,294 billion VND/year, but some provinces only invest a few hundred

billion, while others reach more than 3,700 billion. This reflects the government's financial capacity and priority for the education sector.

4.2. Research model assessment results

4.2.1. Model 1 for child labor and school enrollment rates

After a preliminary check and confirmation that the data met the assumptions of normal distribution and there were no serious violations, the author conducted a multiple regression analysis to assess the relationship between child labor and two dependent variables: school attendance rate (SER) and education quality (EDQ). Casewise Diagnostics was also used to identify and remove outliers, namely observations with residuals exceeding 3 standard deviations.

In the first multiple regression analysis, the results show that observation number 3 has a residual exceeding the threshold of 3 standard deviations, which can be considered an outlier. However, when removing this point and rerunning the model, some statistical relationships become insignificant and the R² of the model decreases significantly. Therefore, the author decided to retain all the original data (n=125) to ensure the representativeness and comprehensiveness of the analysis.

Table 4. Casewise diagnostics result

Case Number	Std. Residual	CLB Predicted Value		Residual		
3	-3.021	4.45	4.71	-0.26		
a. Dependent Variable: SER						

Source: Data analysis by SPSS 27

Table 5 presents the results of the ANOVA test for the regression model of school enrollment rates. The F value = 14.726 and Sig. = 0.000 < 0.01 shows that the regression model is highly statistically significant. The independent and control variables have significant influence on the school attendance rate of children in the study area.

Table 5. ANOVA result for school enrollment rates dependent variable

	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.682	4	0.171	14.726	0.000^{b}
Residual	1.396	120	0.012		

Total	2.078	124				
a. Dependent Variable: SER						
b. Predictors: (Constant), CLB, POH, EMP, EBE						

Source: Data analysis by SPSS 27

Table 6 presents a summary result of the first regression model, showing the level of fit between the model and the research data. $R^2 = 0.327$ shows that the model explains about 32.7% of the variation in school attendance rate (SER) among Northern mountainous provinces, a reasonable ratio in regional sociological studies. Durbin-Watson index = 1.728 shows that there is no significant autocorrelation in the residuals.

Table 6. Model summary for school enrollment rates dependent variable

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson	
0.572a	0.327	0.308 0.10842		1.728	
a. Dependent Variable: SER					
b. Predictors: (Constant), CLB, POH, EMP, EBE					

Source: Data analysis by SPSS 27

The study also tested for multicollinearity using the VIF (Variance Inflation Factor) index. The results in Table 8 showed that all variables had VIFs less than 2, especially CLB (1.941); EMP (1.823); EBE (1.558) and POH (1.472). According to the popular threshold proposed by Hair et al. (2010), a VIF value < 10 is acceptable and indicates that there is no serious multicollinearity in the model.

The results show that the constant has a coefficient B = 4.921 with a p value = 0.000, which shows that when all independent variables are equal to 0, the expected mean value of SER is 4.921, which is highly statistically significant.

With the impact of CLB (child labor rate), the regression coefficient B = -0.114, standardized coefficient Beta = -0.367, t = -4.182 and p = 0.000. This result shows that there is a negative and highly statistically significant relationship between child labor and school attendance, which means when the child labor rate increases, the school attendance rate decreases. Therefore, hypothesis H1 "Child labor has a significant impact on school enrollment rates in Northern mountainous provinces of Vietnam" is supported.

Table 7. Estimated coefficient analysis results for school enrollment rates dependent variable

	Unstandardized Coefficients	Standardized Coefficients Beta	t	Sig.	VIF
(Constant)	4.921		7.832	.000	
CLB	-0.114	-0.367	-4.182	.000	1.941
РОН	-0.038	- 0.211	-2.276	.025	1.472
EMP	-0.026	-0.168	-1.902	.060	1.823
EBE	0.032	0.229	2.541	.012	1.558
a. Dependent Variable: SER					

Source: Data analysis by SPSS 27

The POH variable (poverty rate) with coefficient B = -0.038, Beta = -0.211, t = -2.276 and p = 0.025 (<0.05) shows that the poverty rate also has a negative impact on the school attendance rate and this relationship is statistically significant.

The EMP variable (ethnic minority rate) with coefficient B = -0.026, Beta = -0.168, t = -1.902, p = 0.060. Although it has a negative sign, the result does not reach the usual statistical significance level (p < 0.05), so this relationship is not firmly confirmed in the model.

Finally, the variable EBE (education budget expenditure) with coefficient B = 0.032, Beta = 0.229, t = 2.541, p = 0.012 (<0.05), shows that education budget expenditure has a positive and significant impact on school attendance rate.

4.2.2. Model 2 for child labor and education quality

In the multiple regression analysis for education quality dependent variable, the results show that no observation has a residual exceeding the threshold of 3 standard deviations, which can be considered an outlier.

The ANOVA result in Table 8 shows that the constructed regression model is highly statistically significant. Specifically, the F value is 12.298 and the significance level (Sig.) is 0.000, which is less than 0.01. This demonstrates that the set of predictors in the model including the child labor rate (CLB), the poverty rate (POH), the ethnic minority rate (EMP), and education budget expenditure (EBE) have a significant impact on the

dependent variable, which is education quality (EDQ). Therefore, the linear regression model is completely suitable to continue testing the research hypotheses.

Table 8. ANOVA result for education quality dependent variable

	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.104	4	0.276	12.298	0.000^{b}
Residual	2.696	120	0.022		
Total	3.800	124			

a. Dependent Variable: EDQ

b. Predictors: (Constant), CLB, POH, EMP, EBE

Source: Data analysis by SPSS 27

The results of Table 9 show that the coefficient of determination R² is 0.292, which means that about 29.2% of the variation in educational quality in the Northern mountainous provinces is explained by the independent variables in the model. When adjusted for the number of variables (Adjusted R²), this value slightly decreased to 0.271, but still reflects a relatively good level of explanation in the context of volatile social data. At the same time, the standard error of the estimate is 0.14836, showing that the deviation between the actual value and the predicted value is small, thereby improving the accuracy of the model. In addition, the Durbin-Watson index is 1.693, within the allowable range (1.5–2.5), proving that the residuals in the model do not have autocorrelation.

Table 9. Model summary for education quality dependent variable

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.540a	0.292	0.271	0.14836	1.693

a. Dependent Variable: EDQ

b. Predictors: (Constant), CLB, POH, EMP, EBE

Source: Data analysis by SPSS 27

Table 10 presents the detailed regression results and shows that the independent variables have different levels of influence on the quality of education. First, to ensure the reliability

of the model, testing for multicollinearity was also performed through the VIF (Variance Inflation Factor) index. All variables have VIF below 10, specifically ranging from 1.247 to 2.103.

Table 10. Estimated coefficient analysis results for education quality dependent variable

	Unstandardized Coefficients	Standardized Coefficients Beta	t	Sig.	VIF
(Constant)	4.193		6.215	0.000	
CLB	-0.096	-0.318	-3.491	0.001	1.651
РОН	-0.043	-0.259	-2.748	0.007	1.357
EMP	-0.021	-0.141	-1. 546	0.125	2.103
EBE	0.036	0.248	2.830	0.006	1.247
a. Dependent Variable: EDQ					

Source: Data analysis by SPSS 27

With the impact of the variables in the model, the child labor rate variable (CLB) has a regression coefficient B = -0.096, standardized coefficient Beta = -0.318, with a t value = -3.491 and p-value = 0.001. This confirms that the child labor rate has a negative and statistically significant influence on the quality of education, with a significance level of less than 1%. This is also the variable with the strongest influence in the model, considering the absolute value of the Beta coefficient. Therefore, hypothesis H2 "Child labor has a significant impact on education quality in Northern mountainous provinces of Vietnam" is supported.

Next, the poverty rate (POH) variable also has a negative impact on education quality, with a coefficient of B = -0.043 and Beta = -0.259. The test results show that t = -2.748 and p-value = 0.007, indicating that this is a statistically significant variable at the 1% level, reflecting that a high poverty rate is associated with a decline in education quality.

Meanwhile, the ethnic minority rate (EMP) variable has a coefficient of B = -0.021 and Beta = -0.141, but has a p-value = 0.125, which is larger than the significance threshold of 0.05. Although the coefficient is negative, this result shows that the impact of the ethnic minority rate on education quality is not statistically significant in the current model. There

may be a relationship, but there is not enough evidence to confirm it within the scope of the survey sample.

On the contrary, the variable educational budget expenditure (EBE) shows a positive impact on the quality of education, with coefficient B = 0.036 and Beta = 0.248. The test results show that t = 2.830 and p-value = 0.006, which means that this variable has a positive and statistically significant effect at the 1% level. This shows that when budget expenditure on education increases, the quality of education also tends to improve accordingly.

4.3. Discussion of results

The analysis results from Model 1 show that the variable child labor rate (CLB) has a negative and statistically significant effect on the school enrollment rate, with a standardized regression coefficient Beta = -0.367 and a p-value < 0.001. This means that when the child labor rate increases, the rate of children attending school tends to decrease significantly. This is a finding consistent with many previous studies at home and abroad, confirming that early participation in labor activities has made children no longer have enough time, conditions or motivation to maintain formal education. According to the theory of development economics, children are often forced to participate in labor in poor or disadvantaged households to support family income, which increases the opportunity cost of going to school. In addition, lack of supervision, learning support tools, and suitable learning environment are also factors that make child labor hinder access to education. Therefore, this result reinforces the accepted hypothesis H1, and emphasizes the need for intervention policies to reduce child labor to increase the rate of universal education in the Northern mountainous provinces in Vietnam.

In Model 2, the regression results show that the prevalence of child labor continues to have a negative and highly significant impact on educational quality, with a Beta coefficient of -0.318 and p-value of 0.001. This suggests that child labor not only affects school attendance, but also reduces students' learning efficiency and ability to complete the program on time. This negative impact may come from children having to divide their time between studying and working, leading to exhaustion, reduced ability to absorb lessons, lack of time for revision and reduced interaction with the educational environment. This finding is completely consistent with international studies, especially in developing regions where child labor is a common phenomenon. Scholars such as Emerson & Souza (2011) have shown that the more time spent on labor, the lower the academic performance, even leading to early school dropout. Therefore, hypothesis H2 is also accepted, and the results

further confirm that reducing child labor not only helps increase school attendance but also significantly improves the quality of education in areas with special socio-economic conditions such as the mountainous areas of Northern Vietnam.

Regarding the control variables, the results show that the proportion of poor households (POH) has a negative and statistically significant impact in both models. This suggests that poverty remains a major barrier to both access to education and improving the quality of education. Poor households often lack the ability to pay for learning-related costs such as books, uniforms, or opportunity costs (lost income if children do not work). In addition, poor families also have less conditions to support learning at home, which leads to lower learning outcomes. This suggests that poverty reduction is not only an economic goal but also an essential factor to promote educational equity.

For the proportion of ethnic minorities (EMP) variable, the results show a negative impact on both dependent variables, but both do not reach the usual level of statistical significance. This may suggest that although ethnicity has a potential impact on education (due to language, cultural or geographical barriers), in the current model, other factors such as poverty or education expenditure may be more important mediating factors. On the other hand, this result also raises questions about the diversity within ethnic minority groups and the level of access to education support policies for each group, which should be examined more closely in subsequent studies.

Finally, the variable of education budget expenditure (EBE) has a positive and statistically significant effect in both models, confirming the essential role of financial resources for the education system. When public spending on education increases, localities can upgrade facilities, invest in teaching staff, support poor students... thereby helping to increase school attendance and improve the quality of teaching and learning. This result is consistent with many previous empirical studies and shows that education spending should be prioritized in state budget allocation, especially in remote and isolated provinces.

5. IMPLICATIONS AND CONCLUSION

5.1. Theoretical contributions

This study contributes significantly to the theoretical foundation regarding the relationship between child labor and educational outcomes such as the Household Economics Model of Schooling and Child Labor by Basu & Van (1998), especially in the context of disadvantaged areas such as the Northern mountainous region of Vietnam, where cultural, ethnic, and economic factors are intricately intertwined.

Firstly, the study adds empirical evidence to the hypothesis that child labor not only reduces school attendance but also degrades the quality of education, through the use of quantitative data by each province in the period 2019–2024. Secondly, by incorporating control variables such as poverty rate, ethnic minority rate, and education expenditure, the study has extended the existing theoretical framework by showing that the impact of child labor on education does not occur independently, but is governed by various socio-economic factors. Thirdly, the study presents a parallel modeling approach (two separate models for SER and EDQ) that clearly distinguishes between educational access and educational quality, a point that is often overlooked in previous studies.

5.2. Policy implications

The research results clearly show that child labor has a significant negative impact on both school attendance and education quality in the northern mountainous provinces. In addition, factors such as the poverty rate and budget expenditure on education also play a key role in improving education efficiency in this region. From that, a number of important policy implications are proposed to comprehensively improve the education system and ensure children's right to education.

First of all, it is necessary to implement comprehensive and inter-sectoral solutions to reduce child labor. Children's early participation in labor not only reduces school attendance but also has a profound impact on the quality of learning, skills and comprehensive development of children. Therefore, the State needs to strengthen the inspection and supervision mechanism of child labor, especially in rural, remote and isolated areas. At the same time, it is necessary to implement financial support policies, scholarships, and tuition exemptions for children in poor households, to encourage them to continue studying instead of having to go to work early to support their families.

Secondly, the research results confirm the important role of public spending on education in improving both school attendance and education quality. However, the level of investment in education in many mountainous localities is still low, not commensurate with actual needs. Therefore, it is necessary to prioritize increasing investment in educational infrastructure such as semi-boarding and boarding schools, learning equipment, and especially training and fostering a team of quality teachers. The allocation of the education budget also needs to be based on the specific needs and conditions of each locality, instead of applying a general allocation formula for all regions.

In addition, the poverty reduction policy needs to be seen as an important tool to support educational development. Poverty rates have been shown to have a significant negative impact on both school attendance and student learning outcomes. Therefore, poverty reduction programs should be designed in an integrated manner, including school support for children such as books, uniforms, and school lunches. In addition, there should be policies to encourage parents' livelihoods to facilitate their children's stable and long-term education.

Finally, education policies for ethnic minorities need to be reviewed and adjusted to better suit the cultural, linguistic, and situational characteristics of each group. Although research results have not shown a statistically significant impact from ethnic minority rates on educational outcomes, the negative impact trend is still present. Therefore, bilingual education programs, training ethnic minority teachers, and strengthening the connection between schools and ethnic communities need to be given attention and implemented in a sustainable manner. In particular, it is necessary to integrate local cultural elements into the curriculum to create closeness and increase the connection of ethnic minority students with the school environment.

5.3. Limitations and future research directions

Although the study yielded many useful results, there are some limitations that need to be acknowledged as follows. Firstly, the study used secondary data at the provincial level, leading to the possibility of inaccurate reflection of the current situation of each group of children. Some indicators such as education quality or child labor rates may be underreported due to local statistical characteristics. In addition, child labor may have different impacts depending on age and gender, but the study could not control or analyze this factor in depth due to data limitations. In addition, the study did not take into account local policy factors as each province may have separate policies affecting child labor and education.

Therefore, future research directions may include the use of additional micro data (household-level or school-level) to analyze in more detail the behavior of each group of children. In addition, combine qualitative research to explore the social and cultural causes of child labor in prominent provinces/cities and expand comparisons between regions across the country to determine the specificity of the Northern mountainous region compared to other regions.

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