Optimizing Educational Benefits: Exploring Effective School Policies

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Abstract

This study analyzes the benefits of school policies aimed at increasing students' levels of human capital and clarifies the optimal school policy in various cases based on individual initial conditions for studying and the school budget. We focus on three factors that can enhance individual human capital through education: the individual learning environment, the individual earnestness toward studying, and class sizes. Our findings indicate that school policies designed to improve the individual learning environment are beneficial, particularly when the initial level is low, even if the school operates on a limited budget. On the contrary, the direct school policies targeting increased students' earnestness toward studying can be beneficial when individuals have a certain level of initial motivation and require a substantial budget to demonstrate the benefits. Subsequently, we suggest that class-size reduction policies can serve as an alternative indirect approach to increase students' earnestness and be effective, especially in developing countries where the initial level of individual motivation to study is not high, and schools have limited budgets.

Keywords: school policy, human capital, class–size reduction, individual learning environment, students' earnestness toward studying

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1 Introduction

Ever since Becker (1964) proposed that the accumulation of human capital through education positively impacts individual incomes, many studies have concentrated on identifying the factors that increase individual human capital levels through education. Moreover, these studies have examined the effects of school policies aimed at enhancing these factors' levels.

According to the Lazear (2001), two factors can influence the level of individual human capital: students' innate ability and their earnestness toward studying. Futhermore, Corcoran et al. (1991), Seshadri and Yuki (2004), De Lange and Dronkers (2018), and Nakamura (2020) show the effects of individual learning environments on human capital levels. While schools cannot control students' innate abilities, many have adopted direct approaches through school policies to enhance initial factors of individual learning environments and earnestness toward studying.[1]

Our study focuses on the benefits of school policies, considering the individual initial conditions of the learning environments and earnestness toward studying. We also examine school budgets allocated for implementing these policies. While many studies analyze the impact of school policies that influence factors contributing to the enhancement of individual human capital, our emphasis is on how these policies address the specific conditions and dedication to learning within schools.

School policies aimed at enhancing the level of individual learning environment are beneficial, even if schools have a small budget and the initial level of individual learning environments is low. In contrast, school policies that aim to increase individual earnestness toward studying tend to show their benefits especially when schools have a larger budget and the initial motivation to individuals to study is not low under a large class-size, whereas they become beneficial under a small class-size even if schools have a limited budget and individuals' initial earnestness towards studying is low. Consequently, we suggest that indirect school policies for increasing individual earnestness toward studying, such as reducing class sizes, can serve as an alternative to direct approaches.[2]

In many developing countries, the initial level of students' learning environments is typically low, and low earnestness towards studying is often observed due to economic constraints.[3] Moreover, schools tend to have a limited budgets. In this case,

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[1]Gasco et al. (2014) shows the positive impact of learning motivation on academic performance. Pintrich and de Groot (1990), Zimmerman and Martinez-Pons (1990), Pintrich (2000), Steffen (2006), and Khatib (2010) indicate the importance of self-rgulated learning on their performance.

[2]Class-size reduction is one of the school policies which increase individual human capital indirectly. Knueger (1999), Molnar et al. (1999), Ecalle et al. (2006), Nakamura and Dev (2022) demonstrate that human capital increases through indirect school policies like class-size reduction. Browning and Heinesen (2007) indicate that class–size effects are larger for students from disadvantaged backgrounds. Arnott and Rowse (1987) and Lazear (2001) focus on the peer group effect, revealing that the average level of students' diligence when studying in a classroom impacts individual human capital levels.

[3]Even when individual students possess a strong earnestness toward studying, their ability to focus on their studies can be compromised due to poverty-related factors. For example, some

school policies that improve individual learning environments can be readily chosen because their benefits can be demonstrated even with a small budget. Conversely, direct school policies aimed at increasing students' earnestness towards studying might not be chosen, as the costs could outweigh the benefits within a limited budget.

In the following section, we analyze a model that demonstrates the benefits of school policies. In section 3, we examine the optimal school policies to increase the individual human capital levels across multiple cases based on individual initial conditions and school budgets. Finally, section 4 provides concluding remarks.

2   The model

We examine the conditions that maximize the benefits of school policies designed to enhance the value of human capital, utilizing a straightforward model based on Lazear (2001) and Oshio (2002).[4] The individual human capital acquired through education is denoted as H. The value of H contingent on various factors, including an individuals' innate ability to understand, θ, the quality of individual learning environment denoted as, e, and individual's earnestness toward studying, p. Consequently, the value of H can be shown as follows:

$$H = A\theta e^{\alpha}(p^n)^{\beta} = A\theta e^{\alpha}p^{\beta n}, \tag{1}$$

where A represents an exogenous variable. The individual's learning environments and earnestness toward studying are denoted by using the Cobb–Douglas production function, with $0 < \alpha, \beta < 1$. We assume that all students are identical, and $0 \leq p \leq 1$ is satisfied. The variable n is the number of students in a classroom and $2 \leq n$ is satisfied, given that classrooms typically accommodate more than one student.

From (1), schools possess the capacity to manage three key variables: e, p, and n. Consequently, they are presented with three distinct school policy choices aimed at increasing individual human capital. First, a school can enhance the individuals' learning environments, given that H is the increasing function of e. For example, the schools provide school supplies and school lunch to each student, or study spaces where students can complete assignments beyond regular class hours. Second, since H is the increasing function of p, a school can provide opportunities that increase students' earnestness toward studying. For instance, schools could facilitate opportunities for students to engage with individuals from different cultures or organize

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students might be required to assist with family business, resulting in inadequate sleep and gradually diminishing their earnestness.

[4]Lazear (2001) presented a model that explores the connection between class size and students' earnestness toward studying. Oshio (2002) simplified this model. In our study, we introduce additional factors pertaining to individual learning environments, which contribute to the development of individual human capital. We also examine the impacts of specific school policies to better represent real-world societal conditions.

Moreover, we use the Cobb–Douglas production function to access the influence of each individual factor.

school trip to go to venues like museums, concert halls, zoos, and aquariums. Engaging in these activities can increase students' curiosity in learning foreign languages, arts, music, and science, consequently heightening their motivation to delve into each academic subject. Third, a school can opt to employ more teachers and creates small class sizes, driven by the fact that H is the decreasing function of n. The first two school policies directly influence students' possessions, including their learning environments and earnestness toward studying, thus directly contributing to the enhancement of their human capital. Contrarily, the final school policy exerts an indirect influence on students' possessions, subsequently augmenting individual human capital.

Let us examine the benefits of these school policies, focusing on the initial level of individual learning environments and earnestness toward studying and the amount of budgets for implementing these policies. We assume that the cost associated with enhancing the learning environments and fostering earnestness toward studying per student are denoted as $(e' - e)C_e$ and $(p' - p)C_p$, respectively. C_e and C_p stand as exogenous variables, while e' and p' represent the improved levels of individual environments and earnestness toward studying due to the school policies. Consequently, it is satisfied that $0 \leq e < e'$ and $0 \leq p < p'$. Moreover, the operational expenses for a classroom, covering elements such as teacher salaries and the installation of learning equipment (e.g., blackboards or air conditioners) are designated as W. Increased earnestness by reduction of a class size is p''. Therefore, $0 \leq p < p''$ is satisfied. These costs, $(e'-e)C_e$, $(p'-p)C_p$, and W are distributed across all families through adjustments in the school's billing system. Subsequently, we can formulate the benefits per student from education, π, can be written as follows:

$$\pi_j = A\theta(\gamma e'^{\alpha}p^{\beta n} + \delta e^{\alpha}p'^{\beta n} + \epsilon e^{\alpha}p''^{\beta m}) - \gamma(e'-e)C_e - \delta(p'-p)C_p - (\gamma+\delta)\frac{W}{n} - \epsilon\frac{W}{m}, \quad (2)$$

where γ, δ and ϵ are dummy valuables and j indicates the specific type of school policy. m represents the number of students after hiring new teachers and $2 < m < n$ is satisfied.

2.1   Direct school policies to increase human capital

Let us examine the maximum benefits achievable from each school policy, respectively. First, we focus on a school policy designed to enhance individual learning environments. In this case, $\gamma = 1$ and $\delta, \epsilon = 0$ are satisfied and (2) can be written as follows:

$$\pi_e = A\theta e'^{\alpha}p^{\beta n} - (e' - e)C_e - \frac{W}{n}. \quad (3)$$

The optimal level of individual learning environment, e^*, is introduced by the first order condition of (3) for e' as

$$\frac{\partial \pi_e}{\partial e'} = A\theta\alpha e'^{\alpha-1}p^{\beta n} - C_e = 0. \quad (4)$$

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Moreover, the benefit function of individual learning environment is concave because

$$\frac{\partial^2 \pi_e}{\partial e'^2} = A\theta\alpha(\alpha - 1)e'^{\alpha-2}p^{\beta n} < 0 \tag{5}$$

is satisfied. Hence, the impact of the policy is significant when the initial level of individual learning environment is low, and it diminishes as the environment improves. That is, the benefits surpass the costs when $e' < e^*$, whereas the costs exceed the benefits when $e^* < e'$.

Next, we examine a school policy aimed at enhancing individual earnestness toward studying. In this case, $\gamma, \epsilon = 0$ and $\delta = 1$ are satisfied and (2) can be written as follows:

$$\pi_p = A\theta e^\alpha p'^{\beta n} - (p' - p)C_p - \frac{W}{n}. \tag{6}$$

The first order condition of (6) for p' becomes as follows:

$$\frac{\partial \pi_p}{\partial p'} = A\theta e^\alpha \beta n p'^{\beta n-1} - C_p = 0. \tag{7}$$

(7) shows the level of individual earnestness, p^*, which realizes the benefit equals the cost. When $\beta n > 1$ is satisfied, the second derivative of (6) is as

$$\frac{\partial^2 \pi_p}{\partial p'^2} = A\theta e^\alpha \beta n(\beta n - 1)p'^{\beta n-2} > 0. \tag{8}$$

Therefore, the benefit function of individual earnestness toward studying is convex because the benefit consistently outweighs its cost when $p^* < p'$ is satisfied, whereas the cost prevails over the benefit when $p' < p^*$ is satisfied. It means that the policy's effects are minimal when the initial level of individual earnestness toward studying is low. On the other hand, when $\beta n < 1$ is satisfied, the value of the second derivation of (6) becomes as

$$\frac{\partial^2 \pi_p}{\partial p'^2} = A\theta e^\alpha \beta n(\beta n - 1)p'^{\beta n-2} < 0. \tag{9}$$

The concavity of the benefit function means that the policy's effectiveness even if the initial level of individual earnestness is low and p^* maximizes the benefits from the direct approach to increase students' earnestness toward studying. From (8) and (9), it is indicated that the school policy can be effective even if the initial level of individuals' earnestness toward studying is low and the budget is limited where class-size is small.

2.2   Indirect school policies to increase human capital

In the previous section, we consider the impact of the direct school policy to increase students' earnestness toward studying and find that it is not effective under the

condition that the initial level is low and the budget is limited under a large class-size. Let us examine the benefit of the indirect approach to it such as reduction of class size as an alternative school policy. In this case, γ, $\delta = 0$ and $\epsilon = 1$ are satisfied and (2) can be written as follows:

$$\pi_{csr} = A\theta e^{\alpha} p''^{\beta m} - \frac{W}{m}. \tag{10}$$

The smaller m is, the higher $p''^{\beta m}$ is. Therefore, the school policy of class-size reduction is feasible when p'' increases by the policy. Subsequently, the direct approach to individual earnestness for studying can be effective after the implementation of the policy for class-size reduction even if the initial level is low and the budget for it is limited because $\beta m < 1$ can be realized and the benefit function shows its concavity.

3　The optimal school policy to increase human capital

By analyzing the benefits of the three school policies aimed at increasing human capital, we present two propositions.

Proposition 1 *Under the condition where the class-size is large, school policies designed to enhance individual learning environments are more likely to be adopted compared to school policies aimed at increasing individual earnestness toward studying, particularly when both initial levels are low and schools have limited budgets.*

Proof. The benefits function resulting from policies that improve learning environments exhibits concavity, while the benefits function from policies focused on increasing individual earnestness toward studying demonstrates convexity when class-size is large. Therefore, the former policy can exhibit greater effectiveness relative to the latter policy when both the initial levels of individual learning environments and earnestness toward studying are low. Consequently, even in cases where schools have constrained budgets, adoption of the former policy is more feasible. ∎

Proposition 2 *Class-size reduction can be a prioritized policy to increase individual earnestness toward studying in developing countries.*

Proof. As Proposition 1 shows, it becomes evident that direct school policies designed to heighten individual earnestness toward studying yield limited benefits when the initial level of earnestness is low and the class-size is large. From (9), it is observed that the policies to increase individual earnestness becomes effective under the small class size even if the initial level is low. Therefore, reducing class size can be a prioritized policy in developing countries where the initial level is not high because of poverty. ∎

The optimal school policy for enhancing individual human capital is contingent on the available budget and the initial level of individual learning environments and earnestness toward studying. Many developing countries where these factors are low should explore various approaches to increase human capital.

4   Conclusion

In this study, we focus on three school policies and their corresponding benefits in various cases. Our findings indicate that the policy aimed at improving learning environments, such as supplying school materials and offering school lunches to students, can demonstrate its benefits readily, even with limited budgets, especially in situations when the initial individual learning environments are lacking. By contrast, school policies aimed at directly increasing students' earnestness toward studying, such as providing the opportunities for interactions with foreigners within the school environment or organizing educational trips to museums, concert halls, zoos, aquariums, yield benefits primarily under the situation where class size is small, when students already possess a certain level of motivation to study or when schools have substantial budgets.

In situations where school face challenges in persuading every family to contribute funds and have only a limited budget available for implementing school policies, the direct approach of stimulating individual earnestness toward studying might encounter difficulties in realization, particularly due to the inability to demonstrate short-term benefits under the large class-size. In such cases, the school prioritize alternative strategies to reduce class sizes if the operating expenses associated with a classroom are not excessively high.

In developing countries, the accumulation of human capital stands as a pivotal approach to alleviate poverty. As each school endeavors to enhance this accumulation through various policies, they must factor in the priority of these policies based on individual starting conditions. Moreover, school should access both direct and indirect strategies to effectively stimulate the attributes individual possess, thereby fostering a more efficient increase in their human capital.

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