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Teacher Development Measurement

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Abstract

Currently, there is no specific form of quantifying assessment criteria in the traditional assessment of teaching staff in Vietnam that is capable of measuring, comparing, and ranking the quality of this human resource comprehensively. This is also an urgent requirement in the management of human resources in education sector. The goal is to find an effective tool to measure the growth of teaching staff to meet the management requirements. Based on acknowledging and applying the United Nations methodologies to calculate the Human Development Index, the author has developed the Teacher Development Index with attributes that meet the requirements to become an effective management tool. Teacher Development Index has been developed since 2003 in Vietnam by the author of this paper. After many experiments and application, it has been authorized for use by the authorities, ranging from school boards to ministerial authorities, which has proven its accuracy and superiority. This initiative has received many scientific awards as well as support from education administrators. The author would like to introduce this initiative to international readers and hopes that this will prove to be a valuable reference for education authorities in other countries and that teacher development index will become widely applied.

Keywords: Teacher development index, teacher development measurement, teachers.

1. Introduction

Quantification of quality factors is very difficult, but essential when we want to measure and compare the progress of the managed subjects. One of common methods that is being used for quantification of quality factors is using assessment indicators or indexes. In fact, many indexes have been used, such as competitiveness index, happiness index, intelligence index, etc. Most importantly, the United Nations has applied human development index (HDI) for assessment of human development level of a country. HDI has been widely recognized and applied in the world and used for comparison and ranking of human development levels of countries for many years (Dang, 2002; Nguyen, 2002; Pham, 2002; UNDP, 2020).

In conducting our study on the development of teaching staff, we raised a question, "Teaching staff is the human resource of education sector and a group of individuals that are bound together by their professional functions or limitations of educational levels, disciplines, or territories; so, is it possible to establish any similar relationship to apply HDI method to assess the development of teaching staff?" (Le, 2005).

There is an urgent need to seek for the answer to that question, as under traditional practices, the development of teaching staff is only assessed from certain aspects, such as: qualification, professional standard, age, salary, job classification, etc. Therefore, it is very difficult to compare the teaching staff of one province with that of another, as well as to rank the development level of teaching staff in a management system. When no method for quantification of quality factors of teaching staff is found,

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there are still difficulties in the measurement, comparison, and assessment of the development of teaching staff that cannot be resolved by traditional assessment methods. In fact, there have been some quantitative studies to measure certain individual factors of teacher staff quality, but similar applications according to HDI have not been found (Marzano, 2012; Soine & Lumpe, 2014, Van Der Schaaf, Slof, Boven & De Jong , 2019).

With the encouragement, support, and insights from the Institute of Human Studies of Vietnam (particularly, Prof. Pham Minh Hac, Director of the Institute), upon reviewing the literature, we have found that HDI is developed on basis of the quantification of three fundamental criteria that dominate human development, i.e. age, education, and income (Pham, 2002; Dang, 2002; Nguyen, 2002). Developing the teaching staff is developing the human resource itself, but influencing criteria should be carefully considered and selected. Then, we consider constructing our Teacher Development Index (TDI) as a solution to address the difficulties in measuring the development of teaching staff.

TDI is constructed on basis of four elements: Age, education, career quality, and financial budget for development of teaching staff. These elements are quantified by using HDI method. After being constructed, TDI has been applied in practice in many semesters and reviewed in both scientific and practical terms, and it has received a lot of appreciation from users. Consequently, TDI has received many science & technology awards (Le, 2005; 2017; 2018).

This paper presents the method of construction, application and experiment process, obtained results, and opinions from scientists and education administrators regarding the superiority of TDI. In addition, we introduce TDI as a new tool for measuring the development level of teaching staff.

2. Discussion and results

2.1. An overview of the United Nations' HDI methodology

The HDI measures the average human development achievement of a country. Since 2010 under an initiative of UNESCO, The UNESCO Institute for Statistics (UIS), The World Bank (WB), The International Monetary Fund (IMF), United Nations Statistics Division (UNSD) and The United Nations Department of Economic and Social Affairs (UNDESA), the HDI is calculated according to the following three criteria (UNDP, 2020; Vietnam Academy of Social Sciences and UNDP, 2016):

- Health (Life Expectancy Index - LEI): A long and healthy life, measured by average life expectancy.
- Knowledge (Education Index - EI): Measured by the average number of years of schooling (Mean Years of Schooling Index - MYSI) and the expected number of years of schooling (Expected Years of Schooling Index - EYSI) of the people.
- Income: Living standard measured in GNI per capita (Income Index - II).

The indexes of the above criteria are calculated using the following formulas (this calculation has been applied by UNDP since 2010):

- **Life expectancy index** (LEI) is measured by the average life expectancy of a country:

$$LEI = \frac{LE - 20}{85 - 20}$$

In which:

+ LE is average life expectancy.

+ 85 and 20 are the world's highest and lowest life expectancy at the time of calculation.

- **Education index (EI)** is the arithmetic mean of Mean Years of Schooling Index and Expected Years of Schooling Index:

$$EI = \frac{MYSI + EYSI}{2}$$

In which:

+ Mean Years of Schooling Index (MYSI) is calculated as $MYSI = MYS/2$, in which MYS is the Mean Years of Schooling (the number of years a person over 25 years old spends in formal education).

+ Expected Years of Schooling Index (EYSI) is calculated as $EYSSI = EYS/18$, in which EYS is the Expected Years of Schooling (expected school years for children under 18 years of age).

- **Income index (II):**

$$II = \frac{\ln(\text{GNI/person}) - \ln(100)}{\ln(75000) - \ln(100)}$$

In which:

+ ln is a natural logarithm.

+ GNI/person: Gross National Income per capita is calculated by equivalent purchasing power in US dollar.

+ 75000 and 100 are the highest and lowest GNI/person in the world (in USD based on purchasing power parity) at the time of calculation.

From the above 3 indexes, we deduce the following formula to calculate the HDI:

$$\sqrt[3]{LE.EI.II}$$

It should be noted that before 2010, the formula for calculating HDI differs in some details:

- The education index is measured by the total adult literacy rate (with a weight of 2/3) and the overall population-schooling rate (with a weight of 1/3).

- The HDI is calculated as the arithmetic mean of three indexes including life expectancy, education and GDP/person.

- When calculating income, decimal logarithm is employed instead of natural logarithm.

2.2. Application of the HDI in calculation of the TDI

2.2.1. Selection of TDI constituent criteria

Realizing a concept that teacher development is also human development and human resource development in service of the education sector. The impact aspects of human development factors in HDI method are perfectly suited for teacher development

if criteria are properly selected. Successful selection and application means that we put teachers at the center of educational development. They are the decisive factor for the success or failure of education. If this goal can be achieved, the practical and human significance are extremely great. This is the main idea that leads us in analyzing and choosing the constituent criteria (Le, 2005; 2017).

Age index (Age, abbreviated as A)

The first criterion of HDI is health, specifically reflected by the average life expectancy. With respect to teachers, life expectancy factor is not appropriate, as their lifespan is limited from the time they enter the profession until they reach retirement age, they can work only when they are healthy enough. Therefore, when applying to assessment of teachers, we choose the age as the corresponding criterion.

Teacher age index at a reasonable level is also an important characteristic of a team. From a professional perspective, it reflects the team's experience and expertise; accordingly, costs for teacher training and retraining may be reduced. However, this index is only used to assess the situation at the time of implementation, it does not reflect the trend, as well as there may be errors when the older team becomes conservative and difficult to adapt to innovation.

Training index (Training, abbreviated as T)

The second criterion of the HDI is knowledge/educational achievement, which was measured by the sum of the "adult literacy rate" (denoted by E1, with the weight 2/3) and the "overall schooling rate" (denoted by E2, with weight 1/3): $X2 = 2/3E1 + 1/3E2$ before 2010. Schooling reflects both human rights and the brainpower of a nation. Since 2010, the index has become "mean years of schooling" and "expected years of schooling". We choose training criterion as a corresponding factor in TDI, which tends to evaluate the teacher-training outcome.

The Teacher Training Index was built to match the Education Achievement Index in the HDI methodology before 2010. Since then the calculation method has been innovated (so far this innovation has been proved to be consistent with innovation of the United Nations from 2010 onwards). In particular, the rate of teachers satisfying and exceeding the training standards is equivalent to the adult literacy rate; the mean years of schooling of a teacher is equivalent to the overall population schooling rate (which was changed to the mean years of schooling in 2010) in the HDI.

It is clear that such a setting is reasonable, as the difference between teachers and population is that they are a trained collective (they have a profession, which is different from learning in general), with the specific training standard, corresponding to the specified number of years of schooling. In the HDI, "literacy" is considered as a standard, while in the TDI, training standard is taken into account. In the HDI, "overall schooling rate" is selected, while in TDI, "mean years of schooling" is chosen, as it is easy to calculate and such selection reflects the higher accuracy of the team development.

The weights for the constituent factors are taken the same as that of the HDI.

Finance Expenditure Index (Finance, abbreviated as F)

The third criterion of the HDI is the average GDP per capita (GDP has been replaced by GNI since 2010), which has been attributed to purchasing power parity. In the TDI, we select average recurrent expenditure per teacher. In order to regulate the effect, the logarithmic approach is applied the same as in the HDI.

Recurrent expenditure is not required to be attributed to purchasing power parity in case of application within the same country, because the difference in purchasing power between provinces/cities at a specific time exists, but is not significant

enough to falsify TDI results. However, in case of application in different countries or when there is a significant difference in the price index between places of comparison, it should be attributed to the same purchasing power parity for more accurate results.

We initially calculated the average expenditure per teacher from the sum of all sources of expenditures (recurrent expenditures and capital construction investment expenditures), and later we found that capital construction investment expenditures has a slow impact on the development of the team is slow and the dominant proportion is not significant; moreover, data collection is more difficult; hence it was limited to recurrent expenditures.

Average financial expenditure on education per teacher reflects factors that directly affect the development of teachers such as salaries, allowances, overtime teaching expenditure, and teacher training and retraining expenditure, expenditure on improving working conditions and working environment of teachers ... Therefore, it also significantly contributes to the development of teachers.

Performance quality index (Quality, abbreviated as Q)

When calculating the HDI, three criteria as mentioned above were applied and we have built three corresponding criteria of the TDI. Considering the development of a team, their performance is also an indication of the team development level, which is a qualitative manifestation, as a result of overall development achievements. Therefore, we introduce the 4th criterion of the TDI based on the annual performance results of the teachers. This is the additional index of the TDI in comparison with the HDI (4 constituent indexes compared to 3). Performance ratings are an output of teacher development. This index is clear with complete data in the annual review. Therefore, adding this index is reasonable for improving the accuracy of the TDI.

In 2015, during a Conference with the participation of the Department of Teachers and Education Managers of the Ministry of Education and Training of Vietnam (The MOET), this criterion was added a constituent on the situation of teachers satisfying professional standards. The addition of criteria enables the TDI to achieve higher quality.

2.2.2. Formula for calculating TDI indexes

i) Training index (T)

- Step 1, calculate 2 constituent criteria:

+ T₁ means the percentage of teachers satisfying and exceeding training standards.

+ T₂ means the mean years of schooling of the entire team:

$$T_2 = \frac{\sum N_i \times Y_i}{\sum \sum N_i}$$

In which: N_i means the number of teachers at the same training level i, Y_i is the number of years of schooling to level i (Y_i = 13,14,15,16,18,20 - in ascending order of expertise: elementary level, intermediate level, College, University, Master's degree, Doctoral degree; for example: we assume N₁ as the number of teachers at intermediate level, then Y₁ will be 14) and $\sum \sum N_i$ is the total number of teachers at all levels.

- Step 2, calculate the constituent indexes I(T₁), I(T₂) according to the formula for calculating the indexes I_i listed below.

- Step 3, take the weight 2/3 for I(T₁), 1/3 for I(T₂) and calculate I₁(T) by the formula: I₁(T) = 2/3.I(T₁) + 1/3.I(T₂).

ii) Financial Expenditure Index (F)

$$F = \lg (\text{Recurrent financial expenditure per teacher})$$

In which: Recurrent financial expenditure is the total recurrent expenditure of all financial sources at the unit of calculation and in the calculation period (usually one year). Divide the total recurrent expenditure by the total number of teachers to get the average expenditure. For adjustment, this average expenditure is also taken through lg (and later replaced by ln) in the correct method defined in HDI calculation.

iii) Age index (A)

In fact, due to the large amount of calculations, it is difficult to calculate the age of each teacher and there is only data for each age group (each group includes 5 years) in the current statistics. Therefore, the calculated formula is designed to calculate relative age according to N_j which is the number of teachers in age group j , A_j is the average age of group j and $\sum N_j$ is the total number of teachers in all age groups.

Formula for calculation:

$$A = \frac{\sum N_j \times A_j}{\sum N_j}$$

For example: Group 1 in the age group [20,25) consists of 80 teachers, then $N_1 = 80$; $A_1 = (20 + 25)/2 = 22.5$.

This selection does not change the nature of TDI outcome because the difference in 5-year groups over the large number is not significant and the influence of this criterion on TDI is negligible.

iv) Performance Quality Index (Q)

With respect to ranking of teachers' performance, the satisfactory grade or higher is not considered, weak grade (unsatisfactory) is taken into account.

To assess the satisfactory quality, the following formula is used:

$$Q = 1 - \{\text{Percentage of weak teachers}\}$$

In 2015, the Department of Teachers and Education Managers of the MOET proposed to include the percentage of teachers satisfying professional standards and calculate the Q index according to a more comprehensive formula:

$$Q_1 = 1 - \{\text{Percentage of weak teachers}\}$$

$$Q_2 = 1 - \{\text{Percentage of teachers fail to satisfy professional standards}\}$$

$$\text{Then the quality index is } Q = (Q_1 + Q_2)/2$$

Note: Through the above presentation, it can be seen that the selection of TDI's assessment criteria is very flexible and may vary during application, depending on accuracy requirements. Selection principle is whether the criterion really has an impact on the quality and the advancement of teachers, whether data can be collected in accordance with the assessment standards of the teacher management agency while inheriting HDI's methodology.

2.2.3. TDI calculation method

With the selected indicators, the maximum and minimum values of each factor should be found to be included in the calculation formula. There are 5 factors for determining the maximum and minimum values as shown in Table 1. The principle of determining the maximum and minimum values is as follows:

- Minimum value: If no minimum value is specified for the factor, the lowest actual figure at the time of calculation will be taken (for example: Average financial expenditure per teacher). If a minimum value is specified for the factor, such minimum value will be taken (for example, the number of years of schooling of teachers, if calculated at the elementary level, the former minimum standard is intermediate vocational training level, i.e. is attending school for at least 14 years, so the minimum value must be 14).

- Maximum value: with respect to the factors for which a ceiling value is specified, such ceiling value will be taken (for example: the highest age is 60, because the retirement age is 60; the highest percentage of teachers satisfying and exceeding the standard is 100 % ...). If no ceiling value is specified for the factor, the highest actual attainable value at the time of calculation will be taken (e.g., average financial expenditure per teacher).

- Maximum and minimum values must be taken in a homogeneous space. For example: "the percentage of teachers who satisfy and exceed standards" is taken in calculation to compare the high school teacher development of 63 provinces in Vietnam, the maximum value is 100% and the minimum is the lowest actual value among 63 provinces in Vietnam at the time of calculation.

Table 1. Maximum and minimum values for calculating TDI index

Criteria	Maximum value	Minimum value
Percentage of teachers satisfying and exceeding standards (%)	100	Actual minimum value
The number of years of schooling of teachers (years)	Ceiling maximum value	Minimum value below the threshold
Financial expenditure per teacher (million VND)	Actual maximum value	Minimum value below the threshold
Teacher age (years)	60	Min below the threshold
Percentage of teachers rated as satisfactory (%)	100	Actual minimum value

In which:

- Ceiling maximum value: Maximum value of the factor for which a ceiling is specified
- Minimum value below the threshold: The minimum value of the factor for which a minimum threshold is specified
- Actual minimum value: is the actual minimum achieved value at the time of calculation.
- Actual maximum value: The actual maximum value achieved at the time of calculation.

The constituent development indexes are calculated by the formula:

$$li(k) = \frac{\text{Actual value (k)} - \text{Minimum value (k)}}{\text{Maximum value (k)} - \text{Minimum value (k)}}$$

In which: $i = 1, 2, 3, 4$ and k is the constituent factor ($k = T_1, T_2, F, A, Q$).

Teachers Development Index (TDI) is calculated by the formula:

$$I = (I_1 + I_2 + I_3 + I_4)/4 \text{ or } I = \sqrt[4]{I_1 \cdot I_2 \cdot I_3 \cdot I_4}$$

In which: I_1, I_2, I_3, I_4 are the constituent indexes of training (T), financial expenditure (F), age (A) and performance quality (Q), respectively.

2.3. Experimentation and testing TDI

2.3.1. Experimentation and testing phases

The TDI was first established by Le Khanh Tuan in 2003 (temporarily called Le Khanh Tuan index) and the results were initially presented at a scientific conference in China. Thanks to the encouragement of the Institute of Human Studies (Vietnam), the author conducted an experiment in Thua Thien Hue province, which was evaluated as excellent by the acceptance board. This initiative was later awarded the People's Committee of Thua Thien Hue province with the prize "Science - Technology Innovation".

In 2008, Thua Thien Hue province was permitted to use the TDI as a tool for evaluating teachers in the province's key program for "developing education and training human resources". This was the second time the TDI has been applied on a large scale and has affirmed its superiority. As a result, in 2009 the author received "Creative Labor Certificate" from the Vietnam General Confederation of Labor.

Upon confirmation, the TDI was honored by the MOET with "Educational Innovation" award. By 2015, the MOET approved the application and deployment in 12 provinces/cities of Vietnam. At the trial review conference, the TDI was evaluated as a good tool and recommended to be widely applied by experts.

All research findings, experimentation and testing results have been published by the author in the monograph titled "Evaluation of teacher development by the index method" (Vietnam Education Publishing House). In December 2019, the Copyright Office (under the Ministry of Culture, Sports and Tourism) issued a copyright certificate to author Le Khanh Tuan (Le, 2017).

2.3.2. Some testing results on a mass scale

i) Testing locations: In 12 provinces and cities in the North, Central and South of Vietnam, namely Hanoi, Quang Ninh, Hung Yen, Hai Phong, Bac Ninh, Ha Nam, Nghe An, Ha Tinh, Quang Binh, Ho Chi Minh City, Soc Trang and Bac Lieu (The MOET, 2017).

ii) Scope of testing: Data at preschool, primary, secondary, and high school levels in all provinces/cities in service of evaluation of the entire outcomes of human resources and TDI.

iii) Testing period: In 2016, review and evaluation in mid-2017.

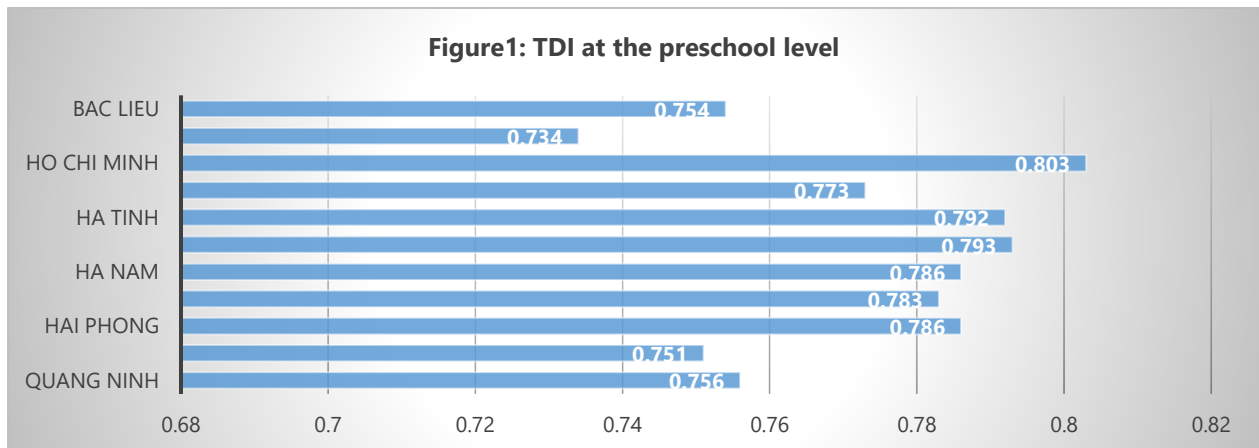
iv) Some basic results are as follows:

Pilot implementation took place in 12 provinces, but complete results were obtained from 11 provinces (data collected in Hanoi is not sufficient). The actual TDI in 2016 for all levels of education is shown in the tables and charts below, accompanying with the opinion of some education experts and administrators about the TDI (The MOET, 2017 and Le, 2017).

The TDI results at preschool level

Table 2. Synthesize index at the preschool level

Province	I ₁	I ₂	I ₃	I ₄	I
Quang Ninh	0.765	0.908	0.369	0.981	0.756
Bac Ninh	0.772	0.845	0.415	0.973	0.751
Hai Phong	0.759	0.982	0.427	0.975	0.786
Hung Yen	0.756	0.973	0.439	0.965	0.783
Ha Nam	0.761	0.884	0.510	0.989	0.786
Nghe An	0.775	0.958	0.451	0.989	0.793
Ha Tinh	0.782	0.965	0.451	0.972	0.792
Quang Binh	0.775	0.915	0.413	0.991	0.773
Ho Chi Minh	0.777	0.998	0.445	0.994	0.803
Soc Trang	0.771	0.803	0.368	0.995	0.734
Bac Lieu	0.767	0.917	0.344	0.987	0.754



Expert's comments (The MOET, 2017)

"The groups of indexes T, F, A, Q cover the overall important factors of the TDI, thereby it can be easily to evaluate the chart of the difference between education levels, geographic regions, schools and aggregate the growth chart for evaluating the effectiveness of action programs and educational policies"

The TDI gives teachers an overview, orientation for further research, development and promotion opportunities. This is approach is much more comprehensive and effective than the pure standard assessment plans"

(Mr. Narin Lee, Deputy General Director of Cosmic Lion Education

Development Corporation, Korea)



Comments of educational administrators (The MOET, 2017)

"TDI is a tool that intelligently inherits HDI calculation method. This is a new, modern method for measuring and comparing the development between teachers, which has not been realized by conventional methods.

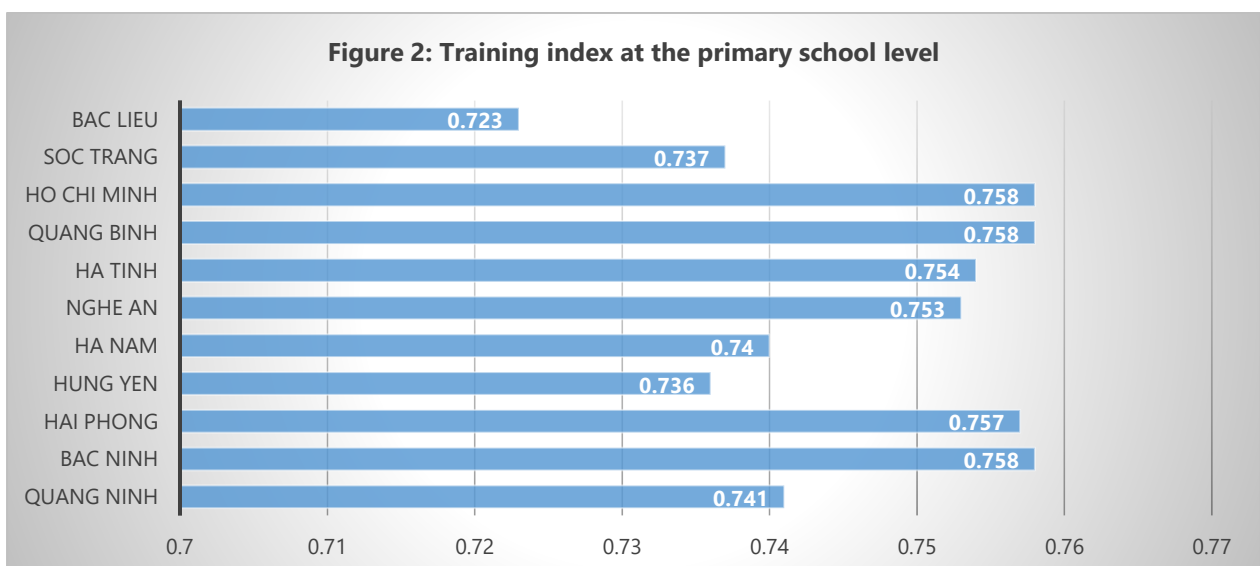
Intensive deployment of the TDI is a need for management. We hope that the TDI will be widely applied by managers at all levels"

(Mr. Nguyen Van Hieu, Director of Ho Chi Minh City Department of Education and Training)

TDI results at primary school level

Table 3. Synthesize index at the primary school level

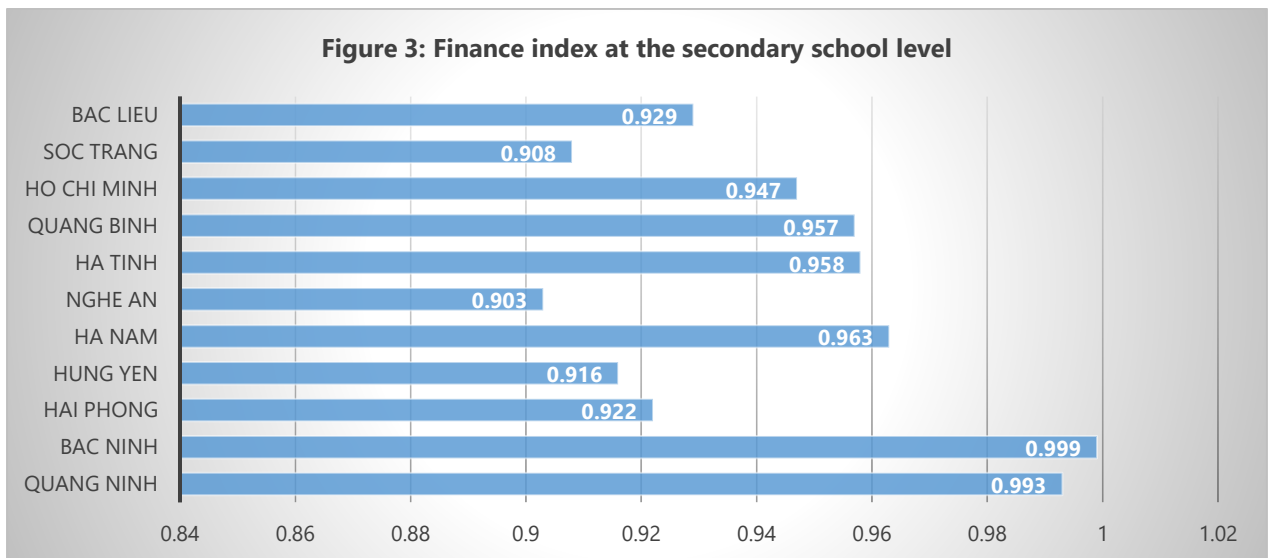
Province	I ₁	I ₂	I ₃	I ₄	I
Quang Ninh	0.741	0.980	0.454	0.944	0.780
Bac Ninh	0.758	0.992	0.500	0.945	0.799
Hai Phong	0.757	0.919	0.561	0.914	0.788
Hung Yen	0.736	0.920	0.524	0.985	0.791
Ha Nam	0.740	0.954	0.513	1.000	0.802
Nghe An	0.753	0.916	0.571	0.979	0.805
Ha Tinh	0.754	0.955	0.552	0.970	0.808
Quang Binh	0.758	0.985	0.465	0.997	0.801
Ho Chi Minh	0.758	0.999	0.504	0.990	0.813
Soc Trang	0.737	0.944	0.538	0.994	0.803
Bac Lieu	0.723	0.970	0.557	0.975	0.806

Figure 2: Training index at the primary school level

The TDI results at secondary school level:

Table 4. Synthesize index at the secondary school level

Province	I ₁	I ₂	I ₃	I ₄	I
Quang Ninh	0.680	0.993	0.498	0.949	0.780
Bac Ninh	0.718	0.999	0.474	0.916	0.777
Hai Phong	0.725	0.922	0.502	0.953	0.776
Hung Yen	0.701	0.916	0.473	0.938	0.757
Ha Nam	0.705	0.963	0.467	0.968	0.776
Nghe An	0.724	0.903	0.511	0.974	0.778
Ha Tinh	0.720	0.958	0.493	0.958	0.782
Quang Binh	0.719	0.957	0.458	0.944	0.770
Ho Chi Minh	0.724	0.947	0.461	0.998	0.783
Soc Trang	0.707	0.908	0.448	0.993	0.764
Bac Lieu	0.706	0.929	0.484	0.992	0.778



Expert’s comments (The MOET, 2017)



...al, scientific work, which combines
...n and training sector “.
...t in education and training human
...y and its findings to international
...ment of teacher development”

Comments of educational administrators (The MOET, 2017)

“The TDI is an innovative application based on the United Nations’ Human Development Index approach. The constituent indexes serve as the basic factors for determining the quality of teachers. The TDI is the integrated result from these constituent indexes, so it accurately reflects the quality and development of teachers”

“The TDI enables managers to compare two teams with a composite index, in a way that HDI has been recognized and widely applied in the world. Therefore, it is very useful for management and should be widely deployed”

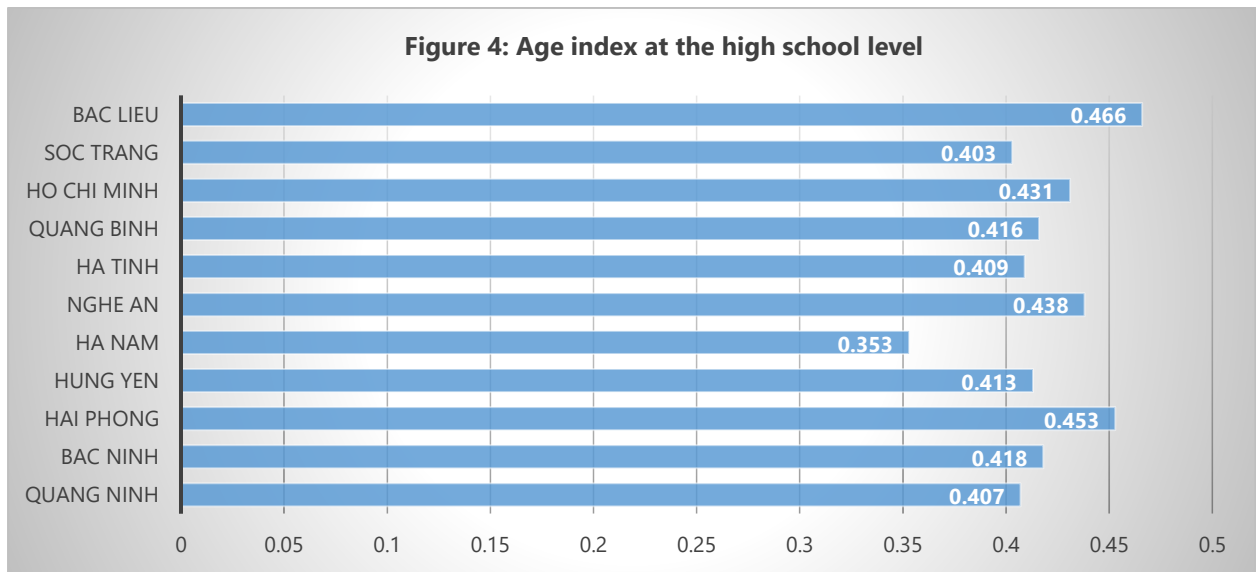
(Mr. Nguyen Van Phe, Director of Department
of Education and Training of Hung Yen province)

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The TDI results at the high school level

Table 5. Synthesize index at the high school level

Province	I ₁	I ₂	I ₃	I ₄	I
Quang Ninh	0.664	0.966	0.407	0.978	0.754
Bac Ninh	0.709	0.893	0.418	0.985	0.751
Hai Phong	0.692	0.903	0.453	0.924	0.743
Hung Yen	0.678	0.891	0.413	0.965	0.737
Ha Nam	0.691	0.890	0.353	0.992	0.732
Nghe An	0.706	0.921	0.438	0.967	0.758
Ha Tinh	0.694	0.922	0.409	0.993	0.755
Quang Binh	0.688	0.940	0.416	0.985	0.757
Ho Chi Minh	0.685	0.999	0.431	0.999	0.778
Soc Trang	0.635	0.941	0.403	0.996	0.744
Bac Lieu	0.640	0.945	0.466	0.989	0.760



3. Conclusions

TDI was built on the basis of application of the HDI approach, which is a widely recognized method. Through the experimentation and testing, the TDI has been highly appreciated by scientists, educational administrators at all levels, confirming its superiority in comparison with conventional evaluation methods. During application, users can update more appropriately criteria, thereby satisfying the change in educational human resources.

The author would like to introduce it to international friends and looks forward to reference and application.

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