Intelligence Quotient (IQ) and Its Correlation with Types Fingerprints of Kinh, Thai, H'mong Students Living in Thuan Chau District, Son La Province

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Abstract

The study was conducted on 784 students aged 14 to 17 (383 boys and 401 girls), who were randomly selected, in Son La province. Following the standards of morphological and anthropological studies, this study aims to investigate IQ and find out the correlation between IQ and the fingerprint patterns of these teenagers. The results show that the average IQ of 14-17-year-old students is 102.28 points, with an annual increase of about 2.01 per year. The average IQ of the Kinh male students is the highest, at 104.04 points, whereas the lowest goes to the H'Mong male students (101.25 points). For female students, the highest average IQ is of Kinh ethnic group with 104.04 points while the lowest is for those of H'Mong ethnic group with 100.05 points. The distribution of students by intelligence level is in agreement with the normal distribution, with 46.04% of studied students having average IQ (level IV). The distribution of IQ levels varies by age. The pearson correlation value between IQ and fingerprint patterns Whereas is -0.001, AT is -0.021, LU is -0.02, LR is -0.04 and Wdl is -0.06 is a negative correlation with the weak correlation value. On the contrary, pearson correlation value between IQ and the remaining fingerprints where WC is 0.03, WS is 0.06 and Wcp is 0.008 is a positive correlation but it is still a weak correlation value.

Keywords: Intelligence; Student; Fingerprints; Son La

Introduction

Intellectual competencies play an important role in the learning and working processes; therefore, identifying intellectual indicators will help us get an overview of individual capacity, which, in turn, helps to adjust educational methods as well as to have suitable future career orientations. For these reasons, it is necessary to identify the correlation between intellectual capacity and genetic biological indicators [13].

As one of the most mysterious innate human traits, fingerprints is unique, highly individual, and do not change throughout a person's life [7,11]. During the formation process, the individual characteristics of the fingerprints have been specified in the genotype, but there is no regular inheritance from one generation to the next. It has long been confirmed by scientists that there is no complete similarity of fingerprints between two people, even identical twins. Because of such high individuality, fingerprints are now being applied in various fields such as: tracing criminals, early identification of some diseases, brain fingerprinting, etc. [7,15].

Son La is a mountainous province in the northwest of Vietnam with 12 ethnic groups living together [3]. Thuan Chau, a district in Son La province, is chosen to carry out the study. The secondary schools under study include Chieng Ly, Thom Mon, Chu Van An, and Co Ma, whose students are mostly ethnic minorities (99%), coming from upland communes of the district like Thom Mon commune, Chieng Ly commune, Tong Lanh commune, Co Ma commune, Long He commune, Pa Long commune, etc. Children and their families in these communes have very difficult economic conditions, low educational attainment, and lack knowledge about nutrition and daily

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activities for comprehensive physical development. Therefore, the stature and nutritional status of students are much lower than the general average [10,12]. In recent years, the quality of life and education have been invested and promoted in order to create a high-quality labor force that can meet the need of the continuously developing economy and society [2,16].

The understanding of biological and intellectual indicators and the discovery of the relation between them (if any) are important in that they can help to make reasonable adjustments in the educational process and children's development orientation, from that, help them to have a better life.

Research Subjects and Method

The study was conducted on 784 students of Thai, Kinh, and H'Mong ethnic groups in Son La province, of which 383 were male students and 401 were female students. The research subjects were randomly selected and the study followed all the standards of morphological and anthropological studies [1].

The study lasted from September 2019 to October 2020.

The investigated anthropometric index is the fingerprints of the Thai, Kinh and H'Mong ethnic minority students aged 14, 15, 16, 17. The descriptive epidemiological design through a cross-sectional study combined with a retrospective study was applied in the study.

The data were processed using Excel 2010 and SPSS 2.0 software and the data analysis was carried out at the "Anthropology lab" at the Center for Anthropology Research and Intellectual Development, University of Education, Vietnam National University, Hanoi.

IQ determination method

Intelligence Quotient (IQ) is determined by multiple-choice method, using Raven's standard progressive matrices test for normal people aged 6 years or over. Raven's test consists of 60 problems organized into five series (A, B, C, D and E), twelve items each. In each of the series, items are ordered by increasing difficulty, beginning with simple problems. Each series is with a higher degree of difficulty than before. There is no limit on time to do the test, but in fact, no student needs more than 60 minutes to finish the test. Each series has different content [4,14]

- **Series A:** Shows the continuity and completeness of the structure. The results obtained allow the evaluation of the thinking processes that distinguish the basic elements of the structure, map out the relationships between them, identify the missing parts of the structure and compare them with the sample patterns.
- **Series B:** Shows the similarity and relativity between configurations. Students need to study the elements to find out the resemblances and similarities between pairs of pictures.
- **Series C:** Shows continuity, logic of structural change, consistent with development principles, very rich in horizontal and vertical direction.
- **Series D:** Shows the change of logical positions of shapes. This change occurs either horizontally or vertically.
- **Series E:** Determines the concept of structural analysis of parts. As the most complicated series, it requires students to think, analyze and synthesize to be able to solve.

Scoring is aggregated according to Raven's grading key. Each correct answer gets 1 point, and the maximum score is 60 points. Once having had student's test score, IQ was then calculated using D. Wechsler's formula

$$IQ = \frac{X - \overline{X}}{SD} \cdot 15 + 100 \qquad \text{----- (1)}$$

In which

SD: standard deviation.

X: individual test score

$\overline{X}$: Average test score for the same age group.

On the basis of IQ, 7 levels of intelligence can be defined.

Fingerprint identification method

There are 3 basic patterns for the outermost phalange ridges: Arch (A), Loop (L), Whorl (W). Furthermore, the 10 fingerprints is classified according to the Galton-Henry system.

Proceed with 10 fingers. First, based on the above basic patterns of fingerprint, we use symbol letter for fingerprint boxes. Rules for writing letters in boxes are as followed

+ The arch fingerprint is denoted by letter A (Arch)

- Symbole letter for simple arch is A^S
- Tented arch is A^T

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STT	Level of Intelligence	IQ	Intelligence scale
1	I	>130	Very Superior
2	II	120 - 129	Superior
3	III	110 - 119	High Average
4	IV	90 - 109	Average
5	V	80 - 89	Low Average
6	VI	70 - 79	Very low
7	VII	< 70	Extremely Low

Table 1: IQ classification.

+ Loop is denoted by letter L

- The loop that opens toward the ulna side of the hand (toward the pinkie) is symboled as L^U.
- The loop that flows in the direction of the radius bone is symboled as L^R

+ Whorl (W) is divided into 4 types based on morphology [48].

- Concentric whorl (W^c)
- Spiral whorl (W^S)
- Central pocket whorl (W^{CP})
- Double loop whorl (W^{dl})
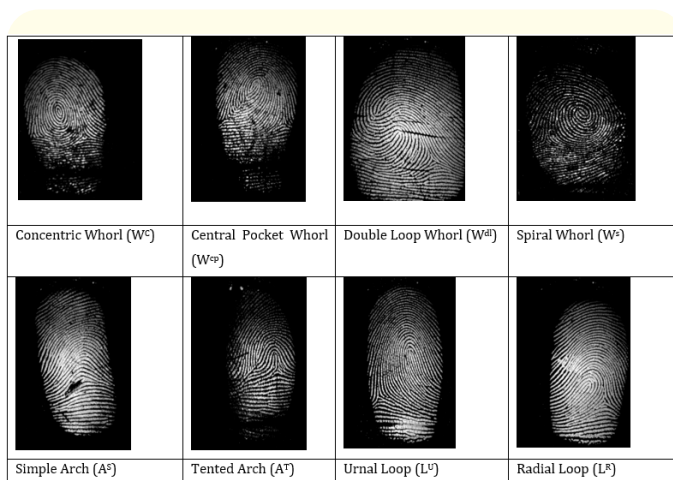
+ DL_{10}: delta

Figure 1: Basic types of fingerprints.

+ Arch-Loop index is calculated by formula:

+ Arch- Whorl index is calculated by formula:

+ Whorl- Loop index is calculated by formula:

Research ethics

- To get the best participation and cooperation from the participants during the research process, all research subjects and their parents were explained in detail about the purpose and content of the research. They also have the right to refuse to be part of the study.
- All information of the subject is kept confidential and the collected data is used for research purposes only. All information can only be accessed by the researchers.
- Results of the study are fully communicated to the participants.
- The study was approved by the leadership of Chieng Ly, Thom Mon and Co Ma secondary schools, Thuan Chau district, Son La province.

Findings and Discussions
(Intelligence Quotient - IQ)

As part of the investigation of biological indicators in 2020, an intelligence test was carried out for the group of students from 3 ethnic groups: Thai, Kinh, and H'Mong in Thuan Chau district, Son La province in order to assess their IQ.

The results of the IQ scores of 784 students from 3 ethnic groups from 14 to 17 years old are presented in table 2.

The results of the study show that the IQ of students from 14 to 17 years old is around 102.28 points, which is at average intelligence category (type IV). Students' IQ increase with age, with an increase of 2.00 points/year on average, and the growth is fastest in the period from 16-17 years old with an increase of 2.97 points/year. In general, the IQ of students from 14 to 17 years old increased unevenly, and the annual increase is neither considerable nor statistically significant (p > 0.05).

Synchronous intelligence tests were applied for all 3 groups of students from Thai, Kinh, and H'Mong ethnic groups. The re-

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Age	n	IQ		p
		$\overline{X}$ ± SD	Increase	
14	208	99.46 ± 14.46	-	-
15	189	101.72 ± 15.00	2.26	> 0.05
16	199	102.50 ± 13.98	0.78	> 0.05
17	208	105.46 ± 15.26	2.97	> 0.05
Sum	784	102.28 ± 14.67	2.00	> 0.05

Table 2: Student's IQ by age.

Age	Male						P (1,2)	P (1,3)	P (2,3)
	Thai (1)		Kinh (2)		H'Mong (3)				
	n	$\overline{X}$ ± SD	N	$\overline{X}$ ± SD	n	$\overline{X}$ ± SD			
14	30	99.14 ± 17.62	30	101.59 ± 14.17	30	99.36 ± 13.50	>0.05	>0.05	>0.05
15	32	101.26 ± 13.74	40	102.19 ± 12.67	30	101.42 ± 14.48	>0.05	>0.05	>0.05
16	31	102.89 ± 11.00	28	102.87 ± 14,20	31	101.34 ± 14.39	>0.05	>0.05	>0.05
17	37	105.01 ± 15.38	33	109.50 ± 10.55	31	102.89 ± 17.81	>0.05	>0.05	<0.05
Female									
14	32	100.86 ± 12.67	36	101.90 ± 12.29	30	93,88 ± 16,51	>0.05	>0.05	<0.05
15	30	101.89 ± 16.26	35	102.65 ± 17.33	32	101.71 ± 15.52	>0.05	>0.05	>0.05
16	31	103.00 ± 12.87	35	102.98 ± 15,80	33	101.89 ± 15.61	>0.05	>0.05	>0.05
17	44	103.27 ± 13.33	33	109.72 ± 19.45	30	102.73 ± 15.00	<0.05	<0.05	<0.05

Table 3: IQ of students by ethnicity and age.

sults show that there are differences in IQ among the three ethnic groups. The IQ scores of the 3 ethnic groups are presented in table 3.

The IQ of all 3 ethnic groups increases with age, and the sharpest increase is in the period of 16-17 years old. Students' intelligence is at the average level, lower than the figure of some other studies that were conducted with students of the same age, but in other places: Ta Thuy Lan - Vo Van Toan (1995), "Study on the intellectual capacity of students in a number of high schools in Hanoi and Quy Nhon" [8]; Tran Thi Loan (2002), Research on some physical and intellectual indicators of students aged 6 to 17 in Cau Giay district - Hanoi, PhD thesis in Biology, Hanoi National University of Education [9].

The T-test of different age groups in the studied ethnic groups reveals that most of the differences in IQ among ethnic groups are not statistically significant (p > 0.05). However, there exists the statistically significant differences (p < 0.05) in IQ in some age groups between the two ethnic groups: Kinh and H'Mong ethnic group aged 17; Kinh - Hmong female aged 14, 17 years old students in all 3 ethnic groups.

Figure 2 shows the mean IQ values of the students under study by ethnicity and sex.

Figure 2 shows that, of the male students, the average IQ of the Kinh is highest with 104.04 points, and the lowest is for H'Mong students with 101.25 points. For female students, the highest average IQ is of Kinh ethnic group (104.04 points), while the lowest is for those of H'Mong ethnic group with 100.05 points. Research data indicate that Kinh students have the highest average IQ, followed by Thai and then H'Mong students.

On the basis of IQ intelligence of each age, intellectual capacity can be divided into 7 different levels. The distribution of students by intelligence level is presented in table 4.
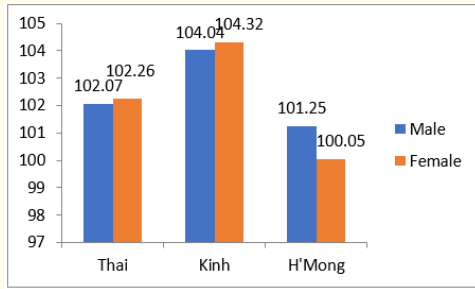
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Figure 2: Average IQ of ethnic students in Thuan Chau district, Son La province.

Table 4 data shows that 46.04% of students in the study have intelligence at level IV (Average). The distribution of intelligence levels varies by age. At the age of 14, the number of students with average IQ is 50.33%, of which 45.56% are male and 55.10% are female. The number of male students with Low Average IQ and Hight Average IQ was lower than that of female students.

At the age of 15, the number of students achieving High Average intellectual IQ level was higher in males than females, 46.08% and 39.18% respectively. Interestingly, there are no male students at

Age	Sex	n	The percentage of students by IQ						
			VII	VI	V	IV	III	II	I
14	Male	90	6.67	5.56	3.33	45.56	30.00	8.89	0.00
	Female	98	5.10	11.22	9,18	55.10	18.37	1.02	0.00
	Both	188	5.88	8.39	6.26	50.33	24.18	4.95	0.00
15	Male	102	0.00	10.78	19.61	46.08	18.63	3.92	0.98
	Female	97	4.12	7.22	16.49	39.18	25.77	11.34	0.00
	Both	199	2.06	9.00	18.05	42.63	22.20	7,63	0.49
16	Male	90	1.96	1.96	9.80	50.00	19,61	3.92	0.98
	Female	99	2.02	8.08	15.15	42.42	24.24	8,08	0.00
	Both	189	1.99	5.02	12.48	46.21	21.93	6.00	0.49
17	Male	101	2.97	3.96	14.85	37.62	26,73	13.86	0.00
	Female	107	5.61	8.41	10.28	52.34	16.82	5.61	0.93
	Both	208	4.29	6.19	12.57	44.98	21.78	9.73	0.47
Sum	Male	383	2,90	5.57	11.90	44.81	23.74	7.65	0.49
	Female	401	4.21	8.73	12.78	47.26	21.30	6.51	0.23
	Both	784	3.56	7.15	12.34	46.04	22.52	7.08	0.36

Table 4: Distribution of students by intelligence level, age and sex.

the Extremely Low IQ level (level VII) and 0.98% of male students in the survey have IQ scores of over 130, ranked as Very Superior (level I).

At the age of 16, the number of male and female students with the Average intellectual level was 46.21%. Male students with High Average intellectual level are 24.51%, which is lower than that of female students (32.32%). At this age, 0.98% of male students in the study are at the highest intellectual level (level I-Very Superior).

In the group of 17-year-olds, the number of students achieving Average IQ level is higher in females than in males (52.34% and 37.62% respectively). However, the number of students with High Average IQ level of males is higher than that of females.

Data from figure 3 show that students with Average intelligence (level IV) make up the highest rate (46.04%), followed by High Average (level III) accounting for 22.52%, Low Average (level V) take 12.34%, Superior (level II) account for 7.15%, Very Low (level VI)
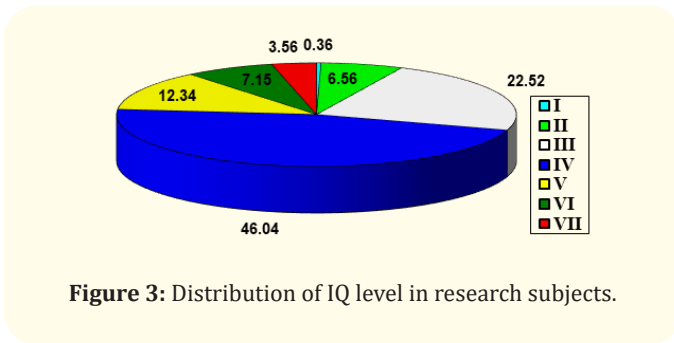
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Figure 3: Distribution of IQ level in research subjects.

has 6.56%, and level VII (Extremely Low) is 3.56%. The number of students reaching Very Superior level is very small, only 0.36%.

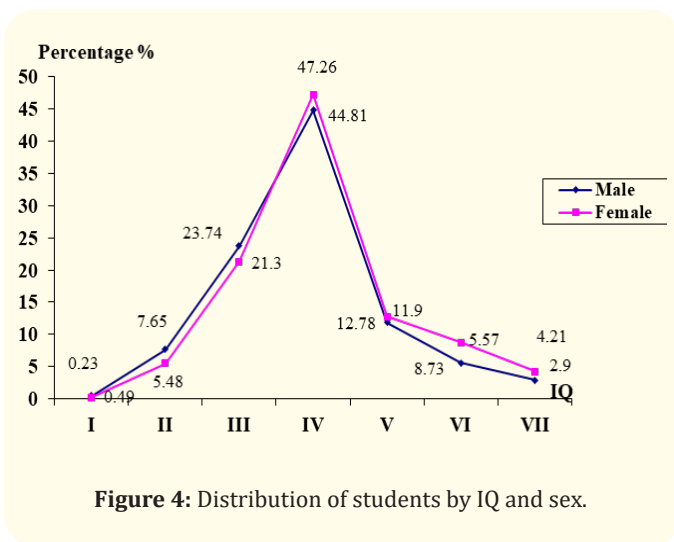The distribution of intelligence levels between the two sexes is shown in figure 4.

Figure 4: Distribution of students by IQ and sex.

There is a difference in IQ between male and female students, though not much. Both groups have the highest number of students distributed at average level IV and the lowest at level I. The change in intellectual ability of students by age is very small and insignificant.

Correlation between one intellectual indicator and fingerprints

Pearson's correlation analysis method is used to evaluate the correlation between IQ score and the distribution of finger patterns. The results are presented in table 5.

Index		IQ
	N	784
	$\overline{X}$	100.83
	SD	16.68
A^S	Cov (x, y)	-0.02
	p	<0.05
	(r)	-0.001
A^T	Cov (x, y)	-0.29
	p	<0.05
	(r)	-0.021
L^U	Cov (x, y)	-1.061
	p	<0.05
	(r)	-0.02
L^R	Cov (x, y)	-0.22
	p	<0.05
	(r)	-0.04
W^C	Cov (x, y)	1.18
	p	<0.05
	(r)	0.03
W^S	Cov (x, y)	1.01
	p	<0.05
	(r)	0.06
W^{dl}	Cov (x, y)	-0.6
	p	<0.05
	(r)	-0.06
W^{cp}	Cov (x, y)	0.07
	p	<0.05
	(r)	0.008

Table 5: Correlation between IQ and the distribution of fingerprints.

n: Sample Size

Cov (x,y): Covariance of Two Compared Sets

$\overline{X}$: Average Value

r: Pearson Correlation Coefficient

SD: Standard Deviation

p: Statistical Value.

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Correlation between IQ index and types of fingerprints

Table 5 shows the pearson correlation coefficient between IQ and fingerprint types: W^c is 0.03, W^S is 0.06 and W^{cp} is 0.008. This is a positive but weak correlation. Meanwhile, pearson correlation between IQ and the remaining fingerprint types, with A^S equals -0.001, A^T equals -0.021, L^U equals -0.02, L^R equals -0.04 and Wdl equals -0.06, is a negative correlation, and the correlation value is weak.

IQ index has a linear correlation with the distribution of different types of fingerprints, with the reliability of 95%, $p < 0.05$.

+ Linear regression analysis with IQ being dependent variable and fingerprints being independent variables.

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	0.09	0.01	0.002	15.11

Table 6: Linear regression analysis.

The correlation coefficient r = 0.09 shows that this is a weak correlation, the coefficient of determination of multiple $R^2 = 0.01$ infers that the fingerprints as independent variables only affect 1% of the change of IQ. The rest is due to random error. Adjusted $R^2 = 0.002 < 0.5$.

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	1522,72	8	190.34	0.83	0.57
	Residual	176911,88	775	228.27		
	Total	178434,60	783			

Table 7: ANOVA Analysis.

Value F = 0.83, with $p > 0.05$, shows that IQ does depend on the distribution of different fingerprint types.

From the above results, the form of the regression equation including 8 independent variables A^S, A^t, L^u, L^R, W^c, W^S, W^{dl}, W^{cp} and one dependent variable (IQ) will be

$$y = a_1 * x_1 + a_2 * x_2 + a_3 * x_3 + a_4 * x_4 + a_5 * x_5 + a_6 * x_6 + a_7 * x_7 + a_8 + b$$

	Regression coefficient		t	p	95%CI	
	β	Std. Error			Lower Bound	Upper Bound
Constant	95.12	14.82	6.42	0.00	66.03	124.21
A^S	0.65	1.58	0.41	0.68	-2.44	3.75
A^t	0.29	1.59	0.18	0.85	-2.84	3.42
L^u	0.55	1.49	0.37	0.71	-2.37	3.47
L^R	-0.66	1.99	-0.33	0.74	-4.57	3.25
W^c	0.65	1.49	0.44	0.66	-2.27	3.58
W^s	1.30	1.55	0.84	0.40	-1.75	4.34
W^{dl}	-0.57	1.66	-0.34	0.73	-3.83	2.69
W^{cp}	0.74	1.72	0.43	0.67	-2.64	4.13

Table 8: Regression coefficient with IQ as dependent variable.

Substituting parameters into the form, we'll get the following equation

IQ = $0,65*A^S + 0,29*A^T + 0,55*L^U - 0,66*L^R + 0,65*W^C + 1,30*W^S - 0,57*W^{dl} + 0,74*W^{cp} + 95,12$

Scatter Plot chart examines the hypythesis of linear correlation.

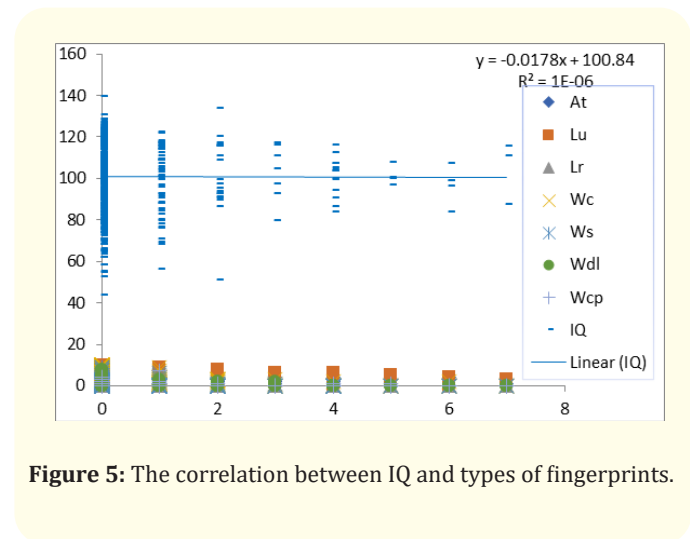## The correlation between IQ and types of fingerprints

Figure 5: The correlation between IQ and types of fingerprints.

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Figure 5 shows that the correlation between IQ and fingerprint types is a linear correlation, though this correlation is not close (r = 0.09). Most of the high IQ students are likely to have a high number of fingerprint types W^{dl}, L^U, and W^S. However, IQ is not entirely dependent on the number of fingerprint patterns appearing at the tip of fingers, or in other words, genetic factors. Physical condition, social relationships, and appropriate learning environment can also help improve students' IQ.

The findings are consistent with prior studies on intelligence by other authors such as Mai Van Hung (2003), Research on some biological indicators and intellectual capacity of students at some Northern universities, PhD thesis in Biology, Hanoi National University of Education [6]; Ta Thuy Lan - Vo Van Toan (1995), "Study on the intellectual capacity of students in some high schools in Hanoi and Quy Nhon", Research report, Hanoi National University of Education [8]; Nguyen Thac, Le Van Hong (1993), "A diagnostic research on the intellectual development of students", Educational research, [5], etc. They all confirmed that the IQ of adolescents increases with age. Thus, our conclusion about characteristics of IQ are consistent with that of previous studies from other researchers.

This is also the first study of its kind that focuses on analyzing the relationship between IQ and fingerprint patterns.

Conclusion

In conclusion, there is no significant difference in the overall IQ of all participants and the IQ of each student by age and gender. However, students' IQ scores vary by region and ethnicity. Kinh students (both male and female) have higher IQ than those of the other two ethnic groups and this difference is statistically significant.

The correlation between IQ and fingerprint patterns is a linear one, but this correlation is not strong. The study shows that most students with a high IQ are likely to have a high number of W^c, W^s and W^{cp} fingerprints. However, genes is not the only factor affecting the intellectual index. Other factors like physical condition, social relationships, or appropriate learning environment also play their roles in improving students' IQ.

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