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The role of informal education in the development of the personality of adolescents in modern society

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SUMMARY: ***PURPOSE:*** *To examine the effects of informal education styles on adolescents' personality traits. Methods: 10,878 junior high school students in C city were the subjects of the study. The General Information Questionnaire and the Personality Self-Rating Scale for Junior High School Students were used to investigate the general situation and personality characteristics of the students, respectively. Independent samples t-tests were conducted to compare the differences in adolescent personality development characteristics, and the latent category model was used to classify adolescent personality traits.* ***RESULTS:*** *Adolescent personality types were categorized as normal (5.29%), withdrawn (7.53%), stressed (37.76%), and positive (9.41%). Informal education had the greatest impact on the withdrawn personality adolescents, followed by the positive type, and the ordinary type was the least affected.* ***CONCLUSION:*** *Informal education methods are important in educating and guiding adolescents in terms of personality, and the personality types suitable for informal education are ranked as withdrawn>positive>stressed>ordinary.*

KEYWORDS: *latent category model; independent samples t-test; informal education; personality traits; adolescents*

1 Introduction

In modern society, with the rapid development of information networks supported by computers, information and communication technologies and the popularization of cell phones and computers, the network has gradually penetrated into all aspects of people's lives [1, 2]. As the main force of the network, adolescents carry out social interactions on the network through cell phones and computers. However, because teenagers are at the age when they are easy to accept new things and rich in creativity, the virtualness, anonymity and openness of the network have made many teenagers addicted to network socialization, and even personality disorders, and they have been cheated and deceived due to the carelessness of network dating [3-6]. Regarding the negative impact of the Internet on adolescents, literature [7] discusses the status of Internet addiction and accompanying psychological problems among adolescents, and analyzes through questionnaires that Internet addiction is common among adolescents and has serious impacts on their mental health, and puts forward suggestions to cope with it. Literature [8] aimed to investigate the impact of the Internet on adolescents' personality traits, and based on the literature review and questionnaire survey, it was revealed that Internet use is prone to cause adolescents' loneliness and emotional anxiety. Literature [9] analyzed the effects of Internet addiction and its related personality traits on the emergence of suicidal thoughts among Chinese

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adolescents, and the findings indicated that Internet genesis is prone to trigger anxiety disorders and susceptibility personality traits in adolescents, and they are significantly associated with adolescents' suicidal and self-injurious thoughts. Literature [10] aimed to examine the relationship between specific personality traits and adolescent Internet use, emphasizing that adolescents who use the Internet inappropriately may lack self-awareness and develop behaviors such as bizarre and delusional. These issues are increasingly receiving widespread attention from families, education, and the community, and it is imperative to take effective educational measures to promote adolescents' personality development.

When it comes to education, it is inevitable to associate it with family education and school education, however, in the development of adolescents' personality, there is a way of education that is more effective than family education and school education - informal education. Informal education refers to the educational method that realizes the educational purpose by carrying out some extracurricular activities such as community activities, volunteering, mountain climbing, traveling and so on [11, 12]. In these activities, adolescents not only learn practical skills, but also learn how to communicate with others, cooperate and build friendships, all of which are “soft skills” that cannot be acquired by traditional education, and are crucial to their personality development [13-15]. In modern society, the influence of the Internet and academic competition are all challenges that young people need to face in their growth process [16], and informal education is like a rope to help them find a balance in such challenges. By engaging in various activities, they can discover their interests and potentials, enhance their self-confidence and independence, and thus achieve personality development [17, 18]. Literature [19] examined the effects of participation in outdoor activities on adolescents' personality development, and the findings indicated that outdoor activities promoted communication and collaboration with peers, and facilitated adolescents' socio-emotional development, identity construction, and personality development. Literature [20] describes outdoor activities as a medium with both educational and recreational functions, which not only develops adolescents' life skills, but also helps to cultivate their creativity and improve their emotional regulation. Literature [21] analyzed the relationship between outdoor activities and adolescents' specific values, revealing through a questionnaire that there is a statistically significant correlation between values of outdoor activities, which are influenced by gender. Literature [22] examined the relationship between adolescents' participation in sports club activities on character and empathy, and through an investigation of a club activity, revealed that sports club activities help to develop adolescents' morality, personality, and socialization.

Therefore, this study will take adolescents as the object of research, and through a large-scale sample research, we will compare the personality development characteristics of adolescents in terms of region, education mode, and gender, and analyze the reasons for the existence of differences. The potential category model is utilized to classify the personality traits of the adolescent group, on the basis of which the relationship between demographic variables and personality types will be explored. The effects of different educational modes on adolescent personality types were also explored, with a view to providing a scientific basis for the development of sound personality in adolescents.

2 Study design

2.1 Objects and Methods

2.1.1 Sample size estimation

The sample size was calculated using the formula $n = \frac{t_\alpha^2 s^2}{d^2}$, where α is taken to be 0.05 and $t_{0.05} = 1.95$ (with t being the distributional threshold), with reference to the Revised Kahlberg's Sixteen Personality Factor Inventory national norm of the standard deviation of the personality factors (s is about 3), and the permissible error d = 0.15s, the minimum sample size for the present study was calculated to be about 195 persons.

2.1.2 Objects of study

Convenience sampling method was used to survey the students enrolled in the class of 2020~2024 in School C. The questionnaires were collected through questionnaire star, and 251 copies were finally recovered, with 240 qualified questionnaires, and the effective recovery rate was 95.6%.

2.1.3 Research tools

(1) General Information Questionnaire

The survey included gender, age, specialty, whether the child was an only child, type of family, parents' occupation and parents' education level.

(2) Personality self-assessment scale

The Personality Self-Assessment Scale for Middle School Students was used, with 59 questions and Likert 5 scoring. The scale establishes the personality structure of junior high school students consisting of five factors and 17 subordinate traits, namely, intelligent traits, conscientious self-control, extraversion, pro-sociality and emotional stability. The pro-sociality dimension includes four traits: agreeableness, empathy and altruism, aggression and resistance, and honesty and trustworthiness. The Intellectual Characteristics dimension includes 3 traits of Intelligence, Exploration and Innovation, and Autonomy. The Conscientious Self-Control dimension includes the 4 traits of Organizedness, Planning, Persistence, and Responsibility. The extroversion dimension includes 3 traits: energetic, optimistic and cheerful, and sociable. The Emotional Stability Dimension includes 3 traits of Sensitivity and Anxiety, Melancholy, and Irritability.

The scale has been used to establish a national norm of Chinese junior high school students' personality based on China-wide sampling, and can be used as an assessment tool for junior high school students' personality. In this study, the five-measure Cronbach's alpha coefficients of the five dimensions of pro-sociality, intelligent traits, conscientious self-control, extraversion, and emotional stability were 0.833, 0.841, 0.83, 0.834, 0.904 (first measurement), 0.935, 0.916, 0.878, 0.852, 0.851 (second measurement) , 0.930, 0.902, 0.851, 0.938, 0.828 (third measurement), 0.840, 0.901, 0.836, 0.875, 0.932 (fourth measurement), 0.940, 0.903, 0.863, 0.843, 0.836 (fifth measurement).

2.1.4 Survey methodology

Questionnaire Star was used to distribute electronic questionnaires online, and the study participants answered the questionnaires in an anonymous manner. After the questionnaires

were collected, a person checked the answer status one by one for quality control, and the questionnaires with the same choice were excluded.

2.1.5 Statistical analysis

SPSS software was used for statistical analysis. The Harman one-way method was used to test for common method bias. Kolmogorov-Smirnov method was used for normality test. Multi-sample Kruskal-Wallis nonparametric test and Mann-Whitney U test were used to examine the differences in personality scores and educational style scores across personality categories. Latent profile analysis of adolescent personality scale scores was performed using Mplus 8.3. Differences were considered statistically significant at $P<0.05$.

2.2 Potential category model

2.2.1 Definition of potential categories

Latent category modeling is an analytical technique for interpreting latent variables by putting them under the assumption that a particular group with heterogeneity is synthesized from different groups. The latent category model contains latent profile analysis (LPA) and latent category analysis (LCA), and the classification of latent variable models is shown in Table 1, where latent profile analysis was originally proposed by Gibson as an extension of latent category analysis. Latent profile analysis is a potential category classification of a group with continuous variables on a probabilistic basis, that is, a certain individual belongs to different categories through certain probability values, and ultimately this individual belongs to the type corresponding to the highest value probability.

Table 1: potential variable model classification

Latent variable	Explicit variable	
	Category	Continuous
Category	Latent Class Analysis	Latent Profile Analysis
Continuous	Latent Trait Analysis/Item Response Theory	Factor Analysis

2.2.2 Principles of the latent class model

(1) Modeling concepts

The principle of latent category analysis is to explain the links between the exogenous variables through the relationships in the latent categories, i.e., it is assumed that the probability distribution of the relationships between the exogenous variables is explained through the latent variables. Assuming the existence of N observed variables, $k=1,2,3\cdots N$, the latent category model formula is shown in (1):

$$P\left(Y_k\right)=\sum_{t=1}^{T}P\left(C=t\right)P\left(Y_k\mid C=t\right) \tag{1}$$

where Y_k is the answer vector of subject k. C is the unique potential category variable. T is the number of potential categories.

Correspondingly, the continuous exogenous variable that is processed is the latent profile analysis, which is the change of the probability distribution into a density distribution, and is formulated as follows:

$$\begin{aligned} f\left(Y_k\right) &= \sum_{t=1}^{T} P\left(c=t\right) P\left(Y_k \mid \mu_t, \Sigma_t\right) \\ &= \sum_{t=1}^{T} P\left(c=t\right) \left[\frac{1}{\left(2\pi\right)^{\frac{K}{2}} \mid \Sigma_t \mid^{\frac{1}{2}}}\right] \exp\left(-\left(Y_k-\mu_t\right)^T \sum_t^{-1} \left(Y_k-\mu_t\right)/2\right) \end{aligned} \tag{2}$$

where μ_t is the mean vector. Σ_t is the variance covariance array. $P\left(c=t\right)$ represents the potential category probabilities, and P shows the ratio of the first t category to the total number of observations in the observation, thus summing the probabilities of each category to one.

(2) Parameter estimation

The parameter estimation of potential profile analysis mainly includes the maximum likelihood method and the posterior probability method, the maximum likelihood function model is shown in Eq. (3), when it reaches the maximum, it is the maximum likelihood estimate.

$$\log L = \sum_{k=1}^{N} G_k \log f\left(Y_k \mid \lambda\right) \tag{3}$$

where λ is the unknown parameter. G_k is the first K observation weight.

As above, the functional model of the posterior probability model is shown in (4):

$$\log P = \log L + \log P\left(\lambda\right) \tag{4}$$

where $P\left(\lambda\right)$ is the a priori value of λ.

In Eqs. (3) and (4), in general, the results of the two are very different not very much, but the a posteriori mode is mainly to avoid the boundaries as well as the extreme values.

2.2.3 Model evaluation

(1) Introduction of indicators

In the results of using Mplus to do potential profile analysis, for its M model can be evaluated by fitting indicators such as AIC, BIC, aBIC, Entropy, LMRT, BLRT, etc., and the scope of application of each evaluation indicator as well as the judgment criteria of each indicator are shown in Table 2.

Table 2: Introduction of model indicators

Serial number	Indicator name	Scope of application	Judgment criteria
1	AIC (Akaike Information criterion)	Different types of analysis models are suitable for comparison, and if the sample size is too large, the evaluation of the index will be reduced.	The Smaller the Better
2	BIC (Bayesian Information Criterion)	In this paper, the study of the problem of the sample size in the aic is improved, and the research shows that the evaluation of the model is better than the aic index.	The Smaller the Better
3	aBIC (sample size-adjusted BIC)	It will evaluate the evaluation index of bic and evaluate the performance of the results.	The Smaller the Better
4	Entropy	It is also the index of the classification model of the classification model, which is between 0 and 1, when the entropy value is greater than or equal to 0.8, and the accuracy of the class model is greater than 90%, and when the entropy value is less than 0.6, it indicates that the sample number is divided into 20% of the data classification error.	The closer you get to 1, the better the model
5	LMRT (Lo-Mendell-Rubin LMR Test)	This paper is used to evaluate the suitability of class i and category $i+1$	It's usually judged by $p < 0.05$
6	BLRT (Likelihood Ratio Test)	For the comparison of the fitting degrees of class i and category $i+1$, the significance is evaluated	It's usually judged by $p < 0.05$

(2) Indicator model

In this paper, the main 3 information statistical indicators for and 1 classification evaluation indicators are illustrated, the model of information statistical indicators as shown in (5) ~ (7), the guidelines for evaluating the fit of the model are mainly AIC (Akaikei Information Criteria), BIC (Bayesian Information Rule).

$$AIC = -2\log L + 2\Phi \tag{5}$$

$$BIC = -2\log L + \Phi \ln N \tag{6}$$

$$aBIC = -2\log L + t\log\left(\left(N+2\right)/24\right) \tag{7}$$

where $\log L$ represents the maximum log-likelihood of the model. Φ represents the number of fitting parameters of the model. When evaluating the goodness of fit at LPA, Entropy (entropy value) is usually used to evaluate the accuracy of the model classification, and the entropy model is shown in Equation (8):

$$EN = -\sum_{k=1}^{N}\sum_{t=1}^{T} P\left(c=t \mid Y_k\right)\log P\left(c=t \mid Y_k\right) \tag{8}$$

where $\hat{P}\left(c=t \mid Y_k\right)$ is the probability that the observation K belongs to the category t.

3 Findings and analysis

3.1 Comparison of Differences in Personality Development Characteristics

In order to gain a deeper understanding of the personality development characteristics of adolescents, this study compares the differences between the five dimensions of personality development and 17 traits in terms of region, education mode, and gender, respectively, and analyzes the results as follows:

3.1.1 Comparison of regional differences

In order to examine whether there are regional differences in personality development characteristics of adolescents, an independent samples t-test was conducted on five dimensions of personality development of adolescents in rural and urban areas, and the results of regional differences in personality development characteristics are shown in Table 3. There are significant differences in personality development characteristics of adolescents in different regions, the mean value of adolescent pro-sociality in rural areas is 3.56, and the mean value of adolescent pro-sociality in urban areas is 3.93, and there is a significant difference between adolescents in rural areas and those in urban areas at the 0.001 level. The mean value of emotional stability of adolescents in urban areas was 3.65 and the mean value of emotional stability of adolescents in urban areas was 3.90, and there was a significant difference between adolescents in rural areas and those in urban areas at the 0.001 level.

Table 3: The results of regional differences in personality development characteristics

	Rural areas (M±SD)	Urban area (M±SD)	t
Sociality	3.56±0.87	3.93±0.45	-4.35***
Intelligent feature	3.27±0.88	3.37±0.62	-0.35
Careful control	3.49±0.52	3.5±0.35	-0.47
Extroversion	3.58±0.86	3.62±0.35	-0.89
Emotional stability	3.65±0.71	3.90±0.76	-3.08***

Note:*p<0.05, **p<0.01, ***p<0.001 all the same below

In order to show more clearly the developmental characteristics of each trait of the personality development characteristics of adolescents on a regional basis, independent sample t-tests were conducted on the seven traits under the pro-sociality and emotional stability dimensions of adolescents in rural and urban areas, and the results of the differences in personality development traits on a regional basis are shown in Table 4. In the pro-sociality dimension, there was a significant difference between adolescents in rural and urban areas in the traits of agreeableness, sympathetic altruism, and aggressive defiance at the 0.001 level, and in the trait of honesty and trustworthiness at the 0.01 level. In the dimension of emotional stability, there was a significant difference between rural and urban adolescents in the trait of depression at the 0.001 level.

Table 4: The results of regional differences in personality development traits

	Rural areas (M±SD)	Urban areas (M±SD)	t
Gregarious property	3.68±0.55	3.93±0.7	-3.47***
Sympathism	3.87±0.51	4.22±0.85	-3.71***
Honest Faith	3.69±0.55	4.42±0.85	-2.73**
Attack Against	3.2±0.72	3.95±0.44	-5.72***
Irritability	3.63±0.88	3.7±0.58	0.4
Sensitive Anxiety	3.83±0.44	3.85±0.33	0.43
Gloom	3.4±0.62	4.45±0.52	-5.55***

3.1.2 Comparison of differences in educational methods

In order to examine whether there is a difference in personality development characteristics of adolescents in terms of educational approach, independent samples t-tests were conducted on five dimensions of personality development of adolescents with different educational approaches, and the results of the differences in personality development characteristics in terms of educational approaches are shown in Table 5. There are differences in personality development traits of adolescents in educational styles, and the dimensions of pro-sociality, conscientious self-control, and emotional stability of adolescents in different educational styles are significantly different at the 0.001 level.

Table 5: The results of the differences in personality development characteristics

	Informal education (M±SD)	Formal education (M±SD)	t
Sociality	3.8±0.37	3.44±0.36	4.6***
Intelligent Feature	3.44±0.68	3.3±0.87	0.77
Careful Control	3.92±0.73	3.59±0.82	4.62***
Extroversion	3.34±0.58	3.47±0.7	-0.43
Emotional Stability	3.8±0.74	3.24±0.81	5.47***

In order to show more clearly the developmental characteristics of each trait of adolescent personality development traits in terms of educational approaches and to understand the specific reasons for the differences, independent sample t-tests were conducted on the seven traits under the pro-sociality and intelligence trait dimensions of adolescents with different educational approaches, and the results of the differences in personality development traits in terms of educational approaches are shown in Table 6. In the pro-sociality dimension, the traits of agreeableness, sympathetic altruism, and honesty and trustworthiness were significantly higher in adolescents with informal education than in those with formal education ($p<0.01$). In the dimension of intelligence characteristics, the traits of exploration and innovation ($p<0.05$) and autonomy ($p<0.001$) were significantly higher in adolescents with informal education than in adolescents with formal education.

Table 6: The results of the differences in personality development traits

	Informal education (M±SD)	Formal education (M±SD)	t
Gregarious property	4.11±0.72	3.72±0.34	2.88**
Sympathism	4.39±0.43	3.96±0.64	7.56**
Honest Faith	4.29±0.69	3.84±0.85	2.68**
Attack Against	3.71±0.66	3.66±0.41	0.68
Intellectuality	3.42±0.76	3.36±0.38	0.76
Explore Innovation	3.81±0.56	3.55±0.82	0.87*
Autonomy	4.42±0.76	3.26±0.38	6.76***

3.1.3 Comparison of differences by gender

In order to examine whether there is any difference in personality development characteristics of adolescents in terms of gender, independent samples t-test was conducted on the five dimensions of personality development of adolescents of boys and girls, and the results of the differences in personality development characteristics in terms of gender are shown in Table 7. There is a significant difference in personality development traits of adolescents of different genders, the mean value of conscientiousness of boys is 3.53 and the mean value of conscientiousness of girls is 3.89, and there is a significant difference in the level of conscientiousness between boys and girls at the level of 0.01. The mean value of conscientious self-control was 3.37 for boys and 3.93 for girls and there was a significant difference in the level of conscientious self-control between boys and girls at 0.001 level.

Table 7: The results of gender differences in personality development characteristics

	Male (M±SD)	Female (M±SD)	t
Sociality	3.53±0.54	3.89±0.64	-2.45**
Intelligent feature	3.57±0.83	3.66±0.31	-0.6
Careful control	3.37±0.88	3.93±0.39	-4.86***
Extroversion	3.76±0.5	3.72±0.65	0.44
Emotional stability	3.61±0.38	3.52±0.84	0.57

In order to show more clearly the developmental characteristics of each trait of adolescent personality development traits on gender, independent samples t-tests were conducted on eight traits under the pro-sociality and conscientious self-control dimensions of male and female adolescents, and the results of the differences in personality development traits on gender are shown in Table 8. In the pro-sociality dimension, there was a significant difference between male and female adolescents in the Aggressive Resistance trait at the 0.001 level. In the conscientious self-control dimension, there was a significant difference between male and female adolescents in the Organized trait at the 0.001 level and in the Responsible trait at the 0.05 level.

Table 8: The results of gender differences in personality development traits

	Male (M±SD)	Female (M±SD)	t
Gregarious property	3.92±0.61	4.01±0.51	-0.38
Sympathism	3.94±0.78	4.06±0.76	-0.4
Honest Faith	3.39±0.33	3.56±0.38	-0.77
Attack Against	3.43±0.74	4.03±0.8	-4.43***
Rationalization	3.27±0.69	4.32±0.77	-7.88***
Planning	3.32±0.63	3.45±0.81	-0.6
Persistence	3.81±0.44	3.92±0.56	-0.66
Accountability	3.79±0.42	3.61±0.81	1.42*

Independent samples t-test was conducted on educational approach and personality of boys and girls and the results of the test are shown in Table 9. The results show that the personality dimensions of conscientious self-control, pro-sociality, and emotional stability of male students with an informal education approach are greater than those with a formal education approach, and there is a significant difference. The personality dimensions of pro-sociality and emotional stability of female students are greater in informal education than in formal education, and there is a significant difference.

Table 9: Independent sample t-test of educational methods and personality traits

	Dimension	Informal education	Formal education	t
Male	Intelligent feature	3.42±0.86	3.32±0.7	0.32
	Careful control	4.08±0.37	3.56±0.29	5.09***
	Extroversion	3.36±0.34	3.49±0.68	-0.31
	Sociality	3.91±0.55	3.35±0.59	3.26***
	Emotional stability	4.2±0.32	3.87±0.93	0.58***
Female	Intelligent feature	3.33±0.34	3.46±0.56	-0.52
	Careful control	4.01±0.15	3.97±0.57	0.76
	Extroversion	3.65±0.76	3.73±0.7	-0.49
	Sociality	4.22±0.86	3.62±0.7	4.982***
	Emotional stability	4.18±0.37	3.36±0.29	5.609***

3.2 Common methodological biases

The Harman one-factor test was used to control and test for common method bias. The results showed that 11 factors had eigenvalues greater than 1 in the unrotated case, explaining a total of 55.7% of the variance, and the first factor explained 24.6% of the variance, which did not exceed 40%, indicating that there was no serious common method bias.

3.3 Correlation analysis

The personality scale and education style dimension scores and their correlation coefficients are shown in Table 10, where intelligence traits were positively correlated with informal education ($r=0.771$, $p<0.001$) and formal education ($r=0.685$, $p<0.001$). Extraversion was positively correlated with informal education ($r=0.529$, $p<0.001$) and formal education ($r=0.384$, $p<0.001$). Emotional stability was positively correlated with informal education ($r=0.393$, $p<0.001$) and formal education ($r=0.377$, $p<0.001$). Conscientious self-control was positively correlated with informal education ($r=0.432$, $p<0.001$) and formal education ($r=0.524$, $p<0.001$). Except for Conscientious Self-Control, Informal Education had a greater effect on the other four personalities compared to Formal Education.

Table 10: Dimension scoring and correlation coefficient

	M	SD	1	2	3	4	5	6	7
1. Intelligent feature	2.7	0.5	1						
2. Extroversion	3.2	0.3	0.532***	1					
3. Sociality	3.1	0.7	0.059***	0.166***	1				
4. Emotional stability	3.8	0.5	0.367***	0.323***	0.036**	1			
5. Careful control	3.7	0.7	0.539***	0.441***	0.218***	0.262***	1		
6. Informal education	1.7	0.9	0.771***	0.529***	0.094***	0.393***	0.432***	1	
7. Formal education	1.7	0.5	0.685***	0.384***	0.076***	0.377***	0.524***	0.873***	1

3.4 Potential profiling of adolescent personality

3.4.1 Potential category results

To explore the potential types of personality, this study first converted the dimension scores to standardized scores, and then created one to five potential categories based on the five dimension scores, in that order. Good models have low Akaike Information Criterion (AIC) values, Bayesian Information Criterion (BIC) values, sample-corrected BIC (aBIC) values, and high entropy of information (entropy) values (usually required to be greater than 0.7). Whereas, p-values of the Law-Mondale-Reuben corrected likelihood ratio test (LMR) and Bootstrap-based likelihood ratio test (BLRT) were statistically significant at the 0.05 level indicating that the model with k categories outperformed the model with k-1 categories. The potential category model fit information is shown in Table 11, comparing the fit indices of the models, the four-category model is more reasonable. The potential categories of adolescent personality were examined by potential profile analysis. The results showed that adolescent personality types could be categorized into four categories: positive, average, intense, and withdrawn.

Table 11: Personality potential profile analysis model fitting information

Model	AIC	BIC	aBIC	LMR (p)	BLRT (p)	Entropy	Class probability
1	95838.26	95834.72	95754.36	-	-	-	1
2	87895.24	88138.99	87972.47	<0.001	<0.001	0.849	0.479/0.526
3	85953.88	86028.67	85992.45	<0.001	<0.001	0.408	0.565/0.274/0.172
4	85239.08	85455.89	85123.71	<0.001	<0.001	0.704	0.466/0.083/0.369/0.061
5	84916.30	84994.92	84949.77	0.169	0.177	0.780	0.084/0.367/0.452/0.047/0.078

3.4.2 Potential category naming and characterization

The Kolmogorov-Smirnov test was conducted on the personality scale data of this study and the data were found to be non-normally distributed ($p<0.05$), Kruskal Wallis multiple independent samples non-parametric test was conducted with adolescent personality type as the independent variable and personality scores as the dependent variable, and two-by-two comparisons were made by Mann-Whitney U test. The results, as shown in Table 12, showed statistically significant differences in individual personality dimension scores across potential categories ($p<0.001$).

Individuals in this category scored higher on intelligence traits and lower on the remaining dimensions. a reflects the individuals who are closest to the mean of all personality types and represent the majority of adolescents' personality traits named average (n=4927, 45.29%). b Individuals in this category scored high on intelligence traits and low on the rest of the dimensions. Individuals in this category are emotionally prone to experiencing negative emotions, less stable, and avoid participating in social activities and interacting with others, named the withdrawal type (n=819, 7.53%). c scores between a and b, but the fluctuation of their scores is less compared to c. However, they are emotionally more sensitive, vulnerable, and less motivated to participate in things, named the nervous type (n=4108, 37.76%). d has a high score on the intelligent traits, and the rest of the dimensions are low. 37.76%). d has the lowest intelligence trait score and scores higher on the remaining four dimensions. Individuals in this category are optimistic and cheerful, like to participate in activities and are able to establish good interpersonal relationships, and are conscientious and responsible in their work, and are named positive (n=1024, 9.41%).

Table 12: Descriptive data and difference testing

	Number	Intelligent feature	Extroversion	Sociality	Emotional stability	Careful control
Common type (a)	4927	-0.4(0.3)	0.2(0.6)	-0.3(0.8)	0.2(0.6)	0.4(1)
Withdrawal type (b)	819	1.5(0.6)	-1.1(0.7)	0.2(0.9)	-0.8(1.3)	-1.4(0.7)
Strain type (c)	4108	0.7(0.6)	-0.3(0.5)	-0.1(0.8)	-0.3(0.7)	-0.3(0.9)
Positive type (d)	1024	-1.4(0.5)	1.1(0.6)	0.8(0.9)	0.7(0.5)	0.9(0.7)
χ^2		8442.35***	4916.25***	533.62***	2576.22***	5268.33***
Back testing		d<a<c<b	b<c<a<d	a<c<b<d	b<c<a<d	b<c<a<d

3.5 Relationship between personality type and educational style

The Kolmogorov-Smirnov test was performed on the scores of the Adolescent Mental Health Screening Scale in this study, and the data were found to be non-normally distributed ($p<0.05$), and the Kruskal Wallis multiple independent samples non-parametric test was performed with the adolescent's personality type as the independent variable, and with the informal versus formal education style as the dependent variable, and the Mann- Whitney U test for two-by-two comparison. The results of the test are shown in Table 13, which shows that there is a significant difference between formal and informal education scores of adolescents with different personality types (χ^2 informal=5766.358, $p<0.001$. χ^2 formal=4736.841, $p<0.001$). Among them, the most affected by informal education was the withdrawn personality, followed by the positive type, and the least affected by the ordinary type. The most affected by formal education is the ordinary type of personality, followed by the positive type and the least affected by the withdrawal type. Withdrawn personality is a danger sign of mental sub-health, and this type of student is more likely to have internalization and externalization problems than other personality types in formal education, and more likely to build self-confidence and realize their potential in informal type of education. In contrast, the positive personality type is low in neuroticism, which makes this type of individual less likely to be emotionally disturbed by negative emotions and have a certain degree of self-regulation, while a cheerful personality and strong self-control can help them build good interpersonal relationships and achieve success in work and study. Therefore, this type of personality can successfully accomplish learning goals in both formal and informal education.

Table 13: Test results

	Common type (a)	Withdrawal type (b)	Strain type (c)	Positive type (d)	χ^2	Back testing
Informal education	1.05	2.26	1.42	1.8	5766.358***	a<c<d<b
Intelligent feature	1.03	2.54	1.35	1.81	4408.425***	a<c<d<b
Careful control	1.12	2.6	1.53	2.13	5072.857***	a<c<d<b
Extroversion	1.11	2.17	1.24	1.89	3543.965***	a<c<d<b
Sociality	1.01	2.52	1.29	1.73	4891.623***	a<c<d<b
Emotional stability	1.23	2.94	1.42	2.07	4142.747***	a<c<d<b
Formal education	2.23	1.18	1.34	1.8	4736.841***	b<c<d<a
Intelligent feature	2.39	1.11	1.37	1.87	3263.657***	b<c<d<a
Careful control	1.62	1.05	1.22	1.47	2696.386***	b<c<d<a
Extroversion	2.28	1.15	1.54	2.02	3729.158***	b<c<d<a
Sociality	2.84	1.13	1.73	1.8	3879.488***	b<c<d<a
Emotional stability	2.69	1.51	1.82	2.23	2318.211***	b<c<d<a

4 Conclusion

(1) There are significant differences in the personality development characteristics of adolescents in different regions, and the mean scores of both pro-sociality and emotional stability dimensions of adolescents in urban areas are higher than those of adolescents in rural areas.

(2) There are differences in the personality development characteristics of adolescents in terms of educational methods. Adolescents who received informal education had significantly higher scores on the pro-sociality dimension for the traits of agreeableness, empathy and altruism, and honesty and trustworthiness, and on the intelligence trait dimension for the traits of exploration and innovation and autonomy than did adolescents who received formal education.

(3) There are significant differences in the personality development traits of adolescents of different genders in the dimensions of pro-sociality and conscientious self-control. Compared to the formal education approach, the personality dimensions of conscientious self-control, pro-sociality, and emotional stability were significantly different for boys who were subjected to the informal education approach. There is a significant difference in the personality dimensions of pro-sociality and emotional stability of girls who are subjected to informal education.

(4) According to the potential category model for adolescent personality traits, adolescent personality types can be categorized as: positive (9.41%), average (45.29%), nervous (37.76%) and withdrawn (7.53%). The degree of influence of informal education on these personality types was ranked as withdrawn > positive > intense > normal.

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References

[1] Castells, M. (2020). The information city, the new economy, and the network society. In The information society reader (pp. 150-164). Routledge.

[2] Graham, M., & Dutton, W. H. (Eds.). (2019). Society and the internet: How networks of information and communication are changing our lives. Oxford University Press.

[3] Tserkovnikova, N. G., Shchipanova, D. Y., Uskova, B. A., Puzyrev, V. V., & Fedotovskih, O. (2016). Psychological Aspects of Internet Addiction of Teenagers. International Journal of Environmental and Science Education, 11(16), 8846-8857.

[4] Munno, D., Cappellin, F., Saroldi, M., Bechon, E., Guglielmucci, F., Passera, R., & Zullo, G. (2017). Internet Addiction Disorder: Personality characteristics and risk of pathological overuse in adolescents. Psychiatry research, 248, 1-5.

[5] Chern, K. C., & Huang, J. H. (2018). Internet addiction: Associated with lower health-related quality of life among college students in Taiwan, and in what aspects?. Computers in Human Behavior, 84, 460-466.

[6] Öztürk, C., Bektas, M., Ayar, D., Öztornacı, B. Ö., & Yağcı, D. (2015). Association of personality traits and risk of internet addiction in adolescents. Asian Nursing Research, 9(2), 120-124.

[7] Xue, Y., Xue, B., Zheng, X., Shi, L., Liang, P., Xiao, S., ... & Zhang, C. (2023). Associations between internet addiction and psychological problems among adolescents: description and possible explanations. Frontiers in psychology, 14, 1097331.

[8] Shmurakova, M. E., Soveiko, E. I., & Miying, Y. A. N. G. (2021). The Influence of Information Technologies on Adolescent Personality Traits. Law. Economics. Psychology, (4), 24.

[9] Kuang, L., Wang, W., Huang, Y., Chen, X., Lv, Z., Cao, J., ... & Chen, J. (2020). Relationship between Internet addiction, susceptible personality traits, and suicidal and self-harm ideation in Chinese adolescent students. Journal of behavioral addictions, 9(3), 676-685.

[10] Guglielmucci, F., Saroldi, M., Zullo, G., Munno, D., & Granieri, A. (2017). Personality profiles and problematic internet use in a sample of Italian adolescents. Clinical Neuropsychiatry, 14(1), 94-103.

[11] Kim, M., & Dopico, E. (2016). Science education through informal education. Cultural studies of science education, 11(2), 439-445.

[12] Smith, A., & Seal, M. (2021). The contested terrain of critical pedagogy and teaching informal education in higher education. Education Sciences, 11(9), 476.

[13] Gross, Z., & Rutland, S. D. (2017). Experiential learning in informal educational settings. International Review of Education, 63(1), 1-8.

[14] Nasyrova, E. F., Arpentieva, M. R., & Demchuk, A. V. (2019, July). Additional education in the self-development of teenagers. In 1st International Scientific Practical Conference" The Individual and Society in the Modern Geopolitical Environment"(ISMGE 2019) (pp. 493-500). Atlantis Press.

[15] Rogoff, B., Callanan, M., Gutiérrez, K. D., & Erickson, F. (2016). The organization of informal learning. Review of Research in education, 40(1), 356-401.

[16] Pienyu, K., Margaret, B., & D'Souza, A. (2024). Academic stress, perceived parental pressure, and anxiety related to competitive entrance examinations and the general well-being among adolescents–A cross-sectional survey from Karnataka, India. Journal of Education and Health Promotion, 13(1), 474.

[17] Solomchak, H. (2020). Forming an Interest in Practicing Tourism Activity for the Purpose of Recreation and Well-Being of Teenagers in a Present-Day Environment. Scientific Journal of Polonia University, 38(1-1), 218-223.

[18] Taheri, S. A., & Welsh, B. C. (2016). After-school programs for delinquency prevention: A systematic review and meta-analysis. Youth violence and juvenile justice, 14(3), 272-290.

[19] Berger, C., Deutsch, N., Cuadros, O., Franco, E., Rojas, M., Roux, G., & Sanchez, F. (2020). Adolescent peer processes in extracurricular activities: Identifying developmental opportunities. Children and Youth Services Review, 118, 105457.

[20] Kurniawan, A. R., Komarudin, A. M. M., & Iskandar, D. (2023). Promoting Positive Youth Development Through Outdoor Physical Activity As An Alternative To Growing Life Skills; Narrative Literature Reviewer. Competitor: Jurnal Pendidikan Kepelatihan Olahraga, 15(1), 116-125.

[21] Trochtová, L., Pospíšil, J., & Pospíšilová, H. (2021). The role and importance of outdoor leisure activities on the change of values: impacts on personal development and education. In INTED2021 Proceedings (pp. 5334-5340). IATED.

[22] Kwon, S. J. (2018). A relationship between personality and empathy in teenagers' school sports club participation. Journal of exercise rehabilitation, 14(5), 746.