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Development of a Questionnaire on Subject Interest among Primary School Students

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ABSTRACT

The development of interest can improve the efficiency and quality of students' learning activities. Previous research mainly explored professional interest, but less on subject interest. This study designed and validated a subject interest questionnaire for primary school students to assess their potential to predict academic performance and offer reference for educational assessment and counseling. A sample of 545 students from two primary schools in Beijing was selected. The questionnaire consisted of 138 questions involving eight major courses, such as Chinese, mathematics and English. Through analysis, questions with good discrimination and social desirability were screened out, and nine questions of each sub-scale were finally retained. According to the result, the reliability and validity of the questionnaire reached an acceptable level. Further analysis of exploratory and confirmatory factors revealed that the subject interest can be summarized into two dimensions: "humanities-related factor" and "mathematics-related factor". The two dimensions are consistent with the "human and material dimensions" proposed by ACT. As a preliminary exploration, this study lays a foundation for further research on the relationship between subject interest and basic interest and provides a practical evaluation tool for primary education.

Keywords: Subject Interest; Questionnaire Design; Primary School Students

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1. Introduction

Interest is defined as an individual's inclination towards acquiring knowledge about certain things or participating in specific activities. The development of interest can improve the efficiency and quality of students' learning activities[1]. The results of interest-driven learning differ from those of effort-based learning in essence. As posited by Fryer et al.[2], there is a proportional relationship between interest and learning outcomes. Thus, subject interest serves as a crucial predictor of academic achievement in the realms of educational evaluation and counseling[3]. Subject interest both affects students' learning motivation as well as participation and correlates with students' understanding and application ability concerning subject content[4].

Questionnaire is a pivotal means to explore and understand interest[5]. In China, interest research focuses on professional interest. Bai Ligang, Ling Wenquan and Fang Liluo[6] revised Holland's SDS scale by factor analysis. Their study involved 1535 college students from 23 departments across ten universities in Beijing. Long Lirong, Peng Pingen and Zheng Bo revised Holland's 1985 version of SDS and verified its applicability among 853 junior and senior high school students in Wuhan[7]. Dai Yiyun, Li Jian, Jaco and Gao Yiran examined the structure of contemporary college students' career interest[8]. To measure college students' career interest, they developed a set of scale tools with nine dimensions: research, artistic, display, social, risk-taking, enterprise, conventional, realistic and ecological. The reliability and validity of these scale tools were verified. Zhang Yu localized the "Personal Spherical Career Interest Scale Brief Version" (PGI - S), the most recent career interest assessment tool[9]. This led to the formation of a version (PGI - SC) tailored to Chinese high school students.

The abovementioned study primarily centers on professional interest while subject interest is less involved. However, as pupils' professional interest is still in its infancy[10], they know little about vocational activities, so it is ill-advised to compile the professional interest scale. Instead, it is essential to assess pupils' subject interest by enumerating learning activities. In this regard, several researchers have designed some subject interest tests[11]. For example, Zeng Fanmei designed the questionnaire involving Chinese and mathematics for specific grades of primary schools[12]. Nevertheless, the existing research fails to satisfy academia's needs.

Furthermore, from the perspective of result interpretation, the existing research merely focuses on the classification of students' interest, but overlooks the strength of interest and the relationship between interest and mental health. According to the "whole-person education model" by Zheng Richang, interest correlates with both strength and elegance[13]. Interest is central to teaching and learning[14]. Interest can stimulate individuals' enthusiasm, promote study as well as work, and enhance life quality whether their interest is wide-ranging or single-minded. If an individual has no interest in all things and activities, they struggle to acquire fun and meaning in everything. Consequently, they will become pessimistic as well as world-weary and even go to a dead end.

This study aims to develop a subject interest questionnaire covering the major course of primary school through interviews with primary school teachers and students to learn their needs. The interpretation of the questionnaire result involved not only the classification of students' interest, but also the analysis of its strength. Through these efforts, this study can satisfy the needs of teaching evaluation, academic guidance and interest research and provide reference for mental health counseling at primary school.

2. Materials and Methods

2.1. Research Concept

The operation is defined as an activity to "ascertain individuals' propensity towards acquiring knowledge about specific subjects or participating in learning activities". As regards that, researchers formulated 138 questions with each major course involving 16 to 19 questions. The course includes Chinese, mathematics, English, computer, nature, physical education, music and fine arts.

2.2. Application of Questionnaire

A sample of 545 students from two primary schools in Beijing was selected and then the subject interest scale was tested. For the detailed questionnaire, please refer to the **Appendix A**. The test was conducted collectively in class units. The experimenter distributed the questionnaire and read out instructions to subjects. If the subject had unclear

questions, they could raise their hands to inquire.

3. Results

3.1. Project Analysis

3.1.1. Discrimination

This study used the critical ratio or CR to calculate the discrimination degree. The calculation involved the significance test of the difference in the average score of each question between the group with the total score in the top 27% and the group in the bottom 27%. If the CR value reaches a significant level, then the question shows discrimination among subjects, which means it can identify the response degree of different subjects.

According to the result calculation of the first test, the CR value of all questions has reached a significant level, which means the question shows good discrimination.

3.1.2. Social Desirability

This study employed the selection rate of questions as a measure of social desirability. This study adopted five-point Likert scale. Specifically, if the combined proportion of responses for options 1 and 2, along with the combined proportion of responses for options 4 and 5, was less than 10%, the corresponding question would be deleted. Through calculation, the selection rates of 12 questions were found less than 10%, so these questions were removed, as shown in **table 1**.

Table 1. Social desirability indicators of deleted questions.

Title Number	Selection Rate (%)
DN01	4.3%
DN08	6.8%
DN13	6.8%
MS09	8.9%
MS10	7.2%
MS13	8.9%
MS16	7.2%
TY01	8.1%
ZR01	8.2%
ZR10	8.5%
ZR11	6.8%
ZR15	8.1%

Note: DN stands for computer, MS for fine arts, TY for P.E., and ZR for nature.

3.1.3. Question Screening

Questions were initially screened according to discrimination and social desirability. Then, in accordance with the corresponding factor loading and communality, some questions were deleted. Finally, each subscale retained nine questions.

3.2. Mean and Standard Deviation

Mean and standard deviation are shown in **Table 2**.

Table 2. Norm mean and standard deviation.

	Computer	Fine Arts	Mathematics	P.E.	Music	Chinese	English	Nature
Mean value	29.672	27.8273	28.8095	28.6926	26.3602	26.9579	24.81	29.706
Standard deviation	6.3961	7.604	6.8232	6.7041	8.3275	7.4906	9.4518	6.4401

3.3. Reliability

Retest reliability, split-half reliability and homogeneity reliability were used to indicate reliability. Among these indicators, the subject who re-tested the reliability was 48 sixth-grade pupils in Beijing after an interval of 30 days.

The index values of reliability are shown in **Table 3**.

As per the above table, the subject interest scale is credible as all reliability indicators are above 0.70.

Table 3. Reliability indicators of subject interest scale.

Items	Total Table	Computer	Fine arts	Mathematics	P.E.	Music	Chinese	English	Nature	Number of Samples
Fractional half-reliability (corrected)	0.896	0.869	0.903	0.912	0.759	0.919	0.882	0.967	0.855	545
Homogeneity reliability (alpha coefficient)	-	0.873	0.911	0.901	0.862	0.922	0.900	0.957	0.891	545
Re-test reliability	-	0.794	0.717	0.897	0.791	0.818	0.856	0.704	0.763	48

3.4. Criterion-Related Validity

This research used criterion-related validity as the validity criterion. There are two criteria: the first is the self-evaluation of students' interest in various subjects; and the second is students' test scores. The value of criteria is shown in **Table 4** and **Table 5**.

Table 4. Criterion correlation between each subscale and self-evaluation of students' interest.

	Computer Self-Evaluation	Fine Arts Self-Evaluation	Mathematics Self-Evaluation	P.E. Self-Evaluation	Music Self-Evaluation	Chinese Self-Evaluation	English Self-Evaluation	Nature Self-Evaluation
Computer subscale	**0.348****	0.292**	0.288**	0.256**	0.248**	0.163**	0.375**	0.375**
Fine Arts Subscale	0.153**	**0.649****	0.193**	0.204**	0.408**	0.233**	0.316**	0.286**
Mathematics subscale	0.165**	0.254**	**0.700****	0.302**	0.266**	0.297**	0.397**	0.466**
P. E. Subscale	0.273**	0.168**	0.311**	**0.517****	0.172**	0.212**	0.238**	0.335**
Music subscale	0.094*	0.338**	0.198**	0.171**	**0.641****	0.286**	0.359**	0.167**
Chinese subscale	0.143**	0.334**	0.351**	0.215**	0.377**	**0.514****	0.489**	0.343**
English subscale	0.104*	0.226**	0.327**	0.112*	0.330**	0.284**	**0.766****	0.270**
Nature subscale	0.221**	0.346**	0.385**	0.260**	0.249**	0.264**	0.316**	**0.593****

It can be seen from the table that the self-evaluation of interest has maximal relevance with the subject subscale.

Table 5. Criterion correlation between each subscale and academic performance.

	Computer Performance	Fine Arts Performance	Mathematics Performance	P.E. Performance	Music Performance	Chinese Performance	English Performance	Nature Performance
Computer subscale	**0.247****	0.115	0.191**	0.178**	0.139*	0.145**	0.200**	-0.005
Fine Arts Subscale	0.201**	**0.252****	0.103*	0.228**	0.211**	0.035	0.065	0.036
Mathematics subscale	0.086	0.103	**0.263****	0.251**	0.098	0.131*	0.147**	-0.026
P. E. Subscale	0.150*	0.019	0.029	**0.310****	0.066	0.001	0.019	-0.035
Music subscale	0.190**	0.181**	0.073	0.197**	**0.302****	0.049	0.116*	0.093
Chinese subscale	0.138*	0.154**	0.129**	0.272**	0.208**	**0.184****	0.154**	0.055
English subscale	0.203**	0.173**	0.321**	0.289**	0.211**	0.260**	**0.477****	-0.004
Nature subscale	0.072	0.085	0.165**	0.092	0.151**	0.152**	0.074	**0.220****

According to the table, the correlation between the score of subjects and the subscale is significant, with the level reaching 0.01.

3.5. Exploratory Factor Analysis

The sample of 237 students from two primary schools in Beijing was tested as subjects, and exploratory factor analysis was conducted based on the test data.

The scale analysis employed the principal components analysis method and varimax rotation in factor analysis. The KMO value was 0.864, and Bartlett's spherical test was significant, indicating that the data were suitable for factor analysis. Two components were extracted in screen plot test. The explainable variation was 59.582%. The results after screening are shown in **Table 6**.

In line with the above results, two extracted common factors are meaningful. F1 is "humanities-related factor" and F2 is "mathematics-related factor".

Table 6. Factor structure of the scale.

Title	F1	F2
Music	0.842	
Fine arts	0.781	
Chinese	0.766	
English	0.762	
P.E.		0.857
Nature		0.774
Mathematics		0.737
Computer		0.711

3.6. Confirmatory Factor Analysis of Concept Validity

The sample of 308 students from two primary schools in Beijing was served as the subjects of the test, and confirmatory factor analysis (CFA) was conducted based on the test data.

CFA is a prevalent statistical technique within the realm of psychological and social - science research, frequently employed to elucidate the underlying structure of constructs such as personality traits and to compare different theoretical models. CFA can estimate the load parameter between observed variables and latent variables (such as dimensions of implicit structure) and correlation degree between latent variables. Additionally, it can determine the goodness of fit of observed data to theoretical conception by comparing the difference between sample covariance matrix (S) of observed variables and covariance matrix (E) derived from theoretical models.

In line with the **Table 7**, the $X2/df$ value is less than 5, the GFI is 0.95, the AGFI is 0.90, and the CFI, IFI, and NNFI are all above 0.94, indicating that the model fits well.

Table 7. Main fitting indicators of confirmatory factor analysis.

	X 2	*df*	X 2/df	GFI	AGFI	CFI	IFI	NNFI	RMSEA
I scale	71.79	19	3.78	0.95	0.90	0.96	0.96	0.94	0.090

In line with the **Table 8**, the four subjects of Chinese, English, Fine Arts and Music show an obvious correlation with F1, indicating that these four subjects are more inclined to F1, the humanistic factor. Computer Science, Mathematics, Physical Education and Nature, on the other hand, show an obvious correlation with F2, which means these four subjects are more inclined to F2, the mathematical and physical factor.

In line with the **Table 9**, There is a high positive correlation between the humanistic factor and the mathematical and physical factor, with $\phi = 0.87$.

Table 8. Complete Standard Resolution of λ Values.

	F1	F2
Chinese	0.88	
English	0.79	
Fine arts	0.74	
Music	0.74	
Computer		0.73
Mathematics		0.75
P.E.		0.59
Nature		0.78

Table 9. Complete standard solutions for ϕ values.

	F1	F2
Humanities-related factor	1.00	
Mathematics-related factor	0.87	1.00

4. Discussion

The results of exploratory and confirmatory factor analysis supported the existence of "humanities-related factor" and "mathematics-related factor". These two factors which are aggregated from subject interest are also consistent with the "human-material dimension" proposed by ACT[15]. The first factor tends to deal with things while the second one tends to deal with people.

The validity analysis of this study also explored the relationship between subject interest and academic performance which showed a significant positive correlation according to the results. The results are consistent with previous findings that interest is an important predictor of academic achievement. The finding highlights the importance of interest cultivation in education and the role of interest in promoting learning motivation and academic performance.

5. Conclusion

The subject interest scale by this study demonstrated reliability indexes above 0.70 along with satisfactory criterion-related and conception validity. Therefore, this scale can be deemed reliable and effective. This study filled the gap of domestic research on primary school students' subject interest.

Author Contributions

Xuzhe Zhang: Responsible for literature review and thesis writing. Shixiang Liu: Responsible for overall design and thesis writing.

Institutional Review Board Statement

Informed consent was obtained from all subjects involved in the study.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Not available.

Conflicts of Interest

There is no conflict of interest.

Appendix A

Formal Test Questionnaire (Partial Questions)
Primary School Student Survey Questionnaire

Dear classmates, nice to meet you

Thank you very much for participating in the test of the "Tenth Five-Year Plan" project of the Ministry of Education. In order to help primary school students understand themselves better, we have compiled the following questionnaire. Everyone has different views and feelings about the questions, so there is no right or wrong answer. You just need to answer according to your own real views. The results of the answers will only be used for research, and we will strictly keep the confidentiality in accordance with the "Statistical Law of the People's Republic of China". Please pay attention to the following:

1, Answer every question.

2, Choose only one answer for each question.

3, If you have any questions, please raise your hand and ask.

Please fill in your basic information:

Name		Student Number		
Gender		Birth Date		Year () Month
Grade		School Name		
Recent Exam Scores	Chinese () points	Math () points		English () points
	Music () points	Fine Arts () points		P.E. () points
	Nature () points	Computer () points		

Instructions for Answering:

The main purpose of this part of the questionnaire is to help you understand your own interest and provide you with suggestions for improvement. Each question includes a sentence and four numbers behind it, where:

1 represents "Dislike" ;

2 represents "Tend to Dislike" ;

3 represents "Tend to Like" ;

4 representations "Like" .

Please read each sentence carefully and circle the correcting number "O" according to your real situation.

Please follow your first feeling and do not think too much, so as not to affect the accuracy of the test.

Note: This unit mainly examines your interest. When answering, do not consider which you have engaged in or which you are good at it. Just judge directly according to your interest without deep thinking.

Example:

Question Number	Sentence	Dislike	Tend to Dislike	Tend to Like	Like
1	**Solving math problems**	**1**	**2**	**③**	**4**

First, please determine which you "like" or "dislike" solving math problems. If you "like" it, choose 4; if you "dislike" it, choose 1; if you really can't determine which you like it or not, think carefully and then choose an answer between "Tend to Like" and "Tend to Dislike" .

A student chose 3 in this question, indicating that he/she "tends to like" solving math problems.

Well if you understand the requirements, let's start!

Question Number	Sentence	Dislike	Tend to Dislike	Tend to Like	Like
1	Talking with the computer teacher	1	2	3	4
2	Drawing	1	2	3	4
3	Attending math class	1	2	3	4
4	Being the PE monitor	1	2	3	4
5	Participating in Chinese competitions	1	2	3	4
6	Doing music homework	1	2	3	4
7	Listening to English	1	2	3	4
8	Observing the growth process of plants	1	2	3	4

Thank you for your cooperation!

Wish you a happy life and progress in your studies!

References

[1] Li, B.S., Yan, G.C., 1993. Educational Psychology. East China Normal University Press: Shanghai, China.

[2] Fryer, L. K., Shum, A., Lee, A., et al., 2021. Map** students' interest in a new domain: Connecting prior knowledge, interest, and self-efficacy with interesting tasks and a lasting desire to reengage. Learning and Instruction. 75, 101493. DOI: https://doi.org/10.1016/j.learninstruc.2021.101493

[3] Boekaerts, M., Boscolo, P., 2002. Interest in learning, learning to be interested. Learning and Instruction. 12, 375-382. DOI: https://doi.org/10.1016/S0959-4752(01)00007-X

[4] Mo W., Zhang Y., Fu Y.H., et al., 2022. A Study on Influence of Experiential Learning Based on Graphical Interactive Resources on Pupils' Geometry Learning. e-Education Research. 43(06), 77-85. DOI: 10.13811/j.cnki.eer.2022.06.011

[5] Cai Y.H., Lin C.D., Xiao L.P., 2002. Vocational interest's construction and characteristic of middle school student. Psychological Development and Education. 18(1), 80-85. DOI: 10.16187/j.cnki.issn1001-4918.2002.01.017

[6] Bai L.G., Ling W.Q., Fang L.L., 1996. Construction of the Chinese vocational interest inventory of Holland type. Acta Psychologica Sinica. 28(01), 113-119. Available from: https://journal.psych.ac.cn/acps/EN/Y1996/V28/I02/113

[7] Long L., Peng P.G, Zheng B., 1996. A trial report of the Self-Directed Search (SDS). Applied Psychology (01), 44-51.

[8] Dai Xiyun, Li Jian, Zhang Bo, & Gao Yiran. (2013). The structure and measurement of vocational interests among contemporary college students. Psychological Exploration(03), 260-265 (In Chinese).

[9] Zhang Y., 2013. Vocational interests in China: An evaluation of the Personal Globe Inventory-Short [Thesis]. Zhengzhou: Zhengzhou University.

[10] Zunker, V.G., Norris, D.S., 1998. Using assessment results for career development, 5th ed. Pacific Grove, CA: Brooks/Cole Pub. Co: California, USA.

[11] Li Jianbin, Hu Xiangling, & Song Lianyi. (2024). High school students' physics interest scale: Model reconstruction and reliability and validity test. Physics Teacher(05), 2-8 (In Chinese).

[12] Zeng Fanmei. (2018). The reliability and validity of the 2nd to 4th grade language and mathematics interest test. Examination Weekly (36), 56-57 (In Chinese).

[13] Zheng Richang, Gao Xiang, & Liu Shixiang. (2008). Mental health assessment and holistic education model. Educational Measurement and Evaluation (Theoretical Edition)(01), 4-8+13 (In Chinese).

[14] Guo Ge. (2016). "Interest theory" in pedagogy and psychology. Curriculum. Textbook. Teaching Method(09), 3-13 (In Chinese).

[15] The American College Testing Center, 1984. VIESA career guidebook: Charting your future. Career Planning Services, ACT: Iowa City, Iowa.