

Hierarchically Modeling Cognition and Behavioral Problems of an Under-Represented Group

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Abstract—This study examined the mental health and behavioral problems in early adolescence with the instrument of Achenbach System of Empirically Based Assessment (ASEBA). The purpose of the study was stratified sampling method was used to collect data from 1975 participants. Multiple regression models and hierarchical regression models were applied to examine the relations between the background variables and internalizing problems, and the ones between students' performance and internalizing problems. The results indicated that several background variables as predictors could significantly predict the anxious/depressed problem; reading and social study scores could significantly predict the anxious/depressed problem. However the class as a hierarchical macro factor did not indicate the significant effect. In brief, the majority of these models represented that the background variables, behaviors and academic performance were significantly related to the anxious/depressed problem.

Keywords—Behavioral problems, anxious/depression problems, empirical-based assessment, hierarchical modeling.

I. INTRODUCTION

MENTAL health and behavioral problems in under-represented groups in many district of China were increasing arousing concerns among sociologists, educators and researchers. Under-represented groups are defined as the groups given inadequate representations or the ones which have not been given sufficient consideration by relevant agencies due to deficiencies of resources, resource allocation issues or lack of problem solving strategies. The school age children and adolescents in some areas such as rural areas and rural-urban fringe zones are such groups without sufficient recourses and effective problem-solving strategies to support them in improving their education and development. This study focused on school age children and early adolescents' mental health and behavioral problems in Northeast China.

Since the last decade, mental health and behavioral problems among school age children and adolescents have become increasingly evident and serious in Northeast China. There are at least two reasons proposed and examined in this study. One aspect can be attributed to the progress made in the assessment of these development and behavioral problems. In other words, the assessment theories, models and techniques were able to better recognize more children with such problems/disorders. Another aspect was that the educational

and relevant environmental elements were experiencing rapid changes so that the mental health and behavioral problems were deteriorating and becoming more severe. When rural parents migrate to urban regions, they economically impact the health and wellbeing of the children they leave behind. Many children in rural areas have parents who worked in other urban areas and became the "left-behind" children. In order to examine the relevant elements which influence school age children and adolescent development, this study seeks to examine the mental health and behavioral problems of early adolescent in Northeast China using one of the scale series of the Achenbach System of Empirically Based Assessment, Children Behavior Checklist for Ages 6-18 (CBCL) [4], [7].

II. CBCL AND PROBLEM STRUCTURES

Mental health and behavioral problems are a research concern shared by the researchers from multiple different academic areas. These areas include social psychology, mental health, behavioral sciences, special education, child education and others [4], [11]. This study is based on the perspectives of empirically based assessment and psychopathology [4].

The Achenbach System of Empirically Based Assessment (ASEBA) [4], [10] is a scale for measurement of the problems of mental health and behavior. Achenbach [1] published his classification system of mental health and behavioral problems based on a set of theoretical principles which represented the general symptom clusters by using factor analysis. The benchmark study was that Achenbach and Lewis [8] established their framework for children and adolescents, where the Child Behavioral Checklist (CBCL) was the most important scale [6]. The most recent CBCL was further elaborated by using normative data [7].

III. CHILDREN BEHAVIORAL PROBLEM AND SCALES

There were quite a few ratings scales for the behavioral problem assessment of school age children and adolescents: Conners' Rating Scales [9], the Behavior Assessment System for Children [15], and the Achenbach Child Behavior Checklist [2].

The Conner Rating Scale is an instrument used to assess classroom behaviors of school ages children and adolescents. This scale covers the mental and behavioral problems in cognitive, mental and psychological aspects [9]. ADHD (attention deficit and hyperactivity disorder) can be screening using this scale.

The Behavior Assessment System for Children (BASC) [15] is another set of instruments that examine the psychological, emotional and behavioral aspects of school age

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children and adolescents. BASC—2 is the latest version of the Behavioral Assessment System for Children [16]. The scale of the parent rating scale, for example, includes nine aspects: hyperactivity, aggression, conduct problems, anxiety, depression, somatization, atypicality, withdrawal, and attention problems. In addition, there are adaptive scales: adaptability, social skills and leadership. BASC Scale also concerned about the learning problems and study skills [16].

The Achenbach System of Empirically Based Assessment (ASEBA) is the scale with a psychopathological perspective to examine school age children and adolescents' mental health, cognitive and behavioral problems [1], [5]. The purposes of ASEBA are a) to explore the relations of children disorder symptoms which have influences on the participants' behaviors, and b) to differentiate individual children and classify them into different categories. Child Behavioral Checklist (CBCL) has had several different editions and the one of the most recent version of the CBCL is the one for school age children and adolescents covering the age 6-18 [3].

A. CBCL for Ages 6-18/2001

The CBCL for Ages 6-18/2001 is an instrument used to address psychological, cognitive and behavioral problems [3]. The data collection in CBCL/6-18 can be secured through either observation or experience evaluation. The instrument structure starts with the demographic information of the child and is followed by seven aspects of background information: a) participation in sports, b) favorite hobbies, c) organization or affiliation, d) jobs or chores done, e) numbers of close friends and relations, and f) academic performance and relevant information.

Following background information are the CBCL/6-18 questions including 113 items on a 3-point scale. The values ranged in 0, 1 and 2, where 0=not true, 1= somewhat or sometimes true and 2= very true or often true. Achenbach's empirically based assessment theory constructively classified all 113 items into three aspects based on factor analysis and other statistical techniques: internalizing behavior, externalizing behavior and social relevant problems. Under each problem aspect, there are eight total problem clusters. Each cluster consists of more than 10 individual items in the scales. These clusters include Anxious/Depressed, Withdrawn/Depressed, Somatic Complaints, Social Problems, Thought Problems, Attention Problem, Rule-Breaking Behaviors and Aggressive Behavior. All scores are transformed from the raw scores into standard scores with a mean of 50 and a standard deviation of 10.

B. Internalizing Problems and Anxious/Depressed Problems

Internalizing problems in CBCL consist of three sub-problems: anxious/depressed problem, withdrawn/depressed problem, somatic complaints problem [17]. The anxious problem is further composed of 13 questions/items which can be described in words: cries, fears, fear school, fear of doing badly, perfect, unloved, worthless, nervous, fearful, guilty, self-consciousness, and suicidal [12]. All of these words describe students' internalizing behavioral tendencies. The

relations between the theoretical construct of the internalizing behavioral tendency and each individual question were clarified via the factor analysis [1], [13].

C. The Reliability of Chinese Version of CBCL for Age 6-18/2001

The test-retest reliability of CBCL for Age 6-18/2001 was examined in Hong Kong [14]. The data sample of one hundred and forty participants was collected. The age mean was 10.8 and standard deviation was 3.0. All scores were converted into T-scores. The intra-class correlation coefficient (ICC) was used to measure the reliability. In this study, the ICC values of internalizing problems, externalizing problems, and attention problems were 0.76, 0.81 and 0.79 respectively. These values were all statistically significant ($p < 0.001$). There is insufficient number of research studies examining the reliabilities of the Chinese version so far. It is expected that more research studies of the reliabilities with the applications of the Chinese version of CBCL in Chinese cultural communities will emerge.

IV. RESEARCH QUESTIONS

This study examines the relationships among the students' background variables and students' performance in academic subjects. Further, it explores the most sensitive internal behavior problems in many school districts—the anxious/depressed problem. Thus the research questions are presented as follows:

1. What did the background variables inform us about students' demographic and relevant information?
2. How did the students' performances in academic subjects predict the students' anxious/depressed problem?
3. How were the background variables, performances in academic subjects hierarchically related to the students' anxious/depressed problem?

V. METHODS

A. Participants

There were One thousand nine hundred and seventy five school age children and early adolescents recruited in central Northeast China. They were in grades 5, 6, 7, 8 and 9. The age ranges from 9 to 19, but the majority of children were aged between 11 and 17. All students were from rural areas of central Northeast area. The core courses for grades 5 and 6 were composed of mathematics, Chinese, natural sciences. The core courses for grades 7, 8 and 9 were composed of algebra, geometry, trigonometry, Chinese, foreign language, physics, biology, and chemistry. All students have a diversity of hobbies and extracurricular activities.

B. Sample Procedures

Stratified cluster sampling method was used to collect the data. From the central Northeast area, we sampled four different school districts, from which one school was sampled from each district. As soon as the school was chosen we delivered the CBCL for age 6-18/2001 to each of the students. The schools were named M, W, X, and Y in which there were

657, 373, 462, and 483 students respectively. In total, there were 1975 students in the study.

VI. DATA ANALYSIS

The data analyses included descriptive analysis, regression analyses between anxious/depressed problem and the background variables, the hierarchical modeling of class factors and the anxious/depressed problem. The software SPSS 22 was used to do data analysis. However, before starting the analysis we introduced two variables and then we began the analysis.

A. Background Variables and Dependent Variables

A background variable is an explanatory variable that can affect other dependent variables but it cannot be affected by the dependent variables. In a composite model the background variable is a relative concept. Sometimes, the background variable is also called independent variable. A dependent variable is the one can be predicted by the independent variable.

B. Descriptive Analysis

Descriptive analysis reported age, grade, gender, sport participation, performance in sport A, hobby A, all chores, chores A, number of close friends, social study, reading and class. The information of the descriptive analysis can inform us the whole picture.

C. Somme Relevant Descriptive Statistics

The relevant descriptive statistics include the information of age, gender, grade, age and grade, and class. In this study the age ranged from 9 to 19, but 99.8% of participants were from 10 to 18. The mean of the ages was 13.98 (1.846). In gender descriptive statistics, male accounts for 50.6% and female accounts for 49.4%.

There are 5 grades which are grades 5, 6, 7, 8, and 9. Table I presents the distribution of age by grade. We can evaluate the relations between the age and the grade. For example, in grade 7, we can see that the students' ages ranged from 12 to 16 years old. From a slightly different angle, we note that most 12 year old students were in grades 5, 6, and 7.

The information of the class indicates that there are basically 6 categories of the classes among these participants. The percentage does not report the relations between the grades and the classes. The important information was that usually every class had a different teacher. We will examine if the teacher factor affected the students' anxious/depressed problems. Table II presents the percentage of each class category.

D. Somme Background Variable Description

These background variables include sport participation, performance in sport A, hobby A, all chores, chores A, and number of close friends. When we attempted to examine the relations between the background variables and the anxious/depressed problem, we found that the above background variables were significantly related to the dependent variable.

TABLE I
AGE AND GRADE CROSS TABULATION

Age	Grade					Total
	5	6	7	8	9	
9	1	1	0	0	0	2
10	22	2	0	0	0	24
11	150	16	0	0	0	166
12	119	215	13	1	0	348
13	14	99	103	8	0	224
14	0	17	273	62	7	359
15	0	1	103	241	60	405
16	0	0	9	108	177	294
17	0	0	0	18	105	123
18	0	0	1	1	26	28
19	0	0	0	0	2	2
Total	306	351	502	439	377	1975

E. Sports

There are two values for the variable sport participation: 1 indicates participation by the student, 0 indicates no participation. In this study, 1548 students took part in sports (78.4%), compared to 427 students who did not (21.6%).

TABLE II
CLASS

	Frequency	Percent	Cumulative Percent
1	434	22.0	22.0
2	431	21.8	43.8
3	349	17.7	61.5
4	364	18.4	79.0
5	215	10.9	90.8
6	182	9.2	100.0
Total	1975	100.0	

F. Performance in Sport A

In the scale of CBCL, the student can select more than one sport (e.g. A, B, C). We can assume that sport A is the most important one. We determined that there is a statistically significant relationship between Performance in Sport A and the anxious/depressed problem.

Table III indicates the percent categories of the Performance in Sport A, where performance level at average and more active than average account for 47.4% and 17.9%.

G. Favorite Hobby A

The hobby is a background variable which reflects students' favorite activities. Favorite hobby A is significantly related to the anxious/depressed problem. Table IV presents the categories and percentages of the favorite hobby A which was the first one in the hobby list. The categories were coded in numbers, and category 2, 3, and 5 account for 55.70% together.

TABLE III
PERFORMANCE IN SPORT A

	Frequency	Percent	Cumulative Percent
No	440	22.3	22.3
Don't Know	114	5.8	28.1
Less Than Average	131	6.6	34.7
Average	936	47.4	82.1
More Active	354	17.9	100
Total	1975	100.0	

TABLE IV
 FAVORITE HOBBY A

	Frequency	Percent	Cumulative Percent
0	472	23.9	23.9
1	19	1.0	24.9
2	496	25.1	50.0
3	328	16.6	66.6
4	52	2.6	69.2
5	277	14.0	83.2
6	111	5.6	88.9
7	122	6.2	95.0
9	2	.1	95.1
10	11	.6	95.7
11	21	1.1	96.8
13	4	.2	97.0
14	4	.2	97.2
15	8	.4	97.6
18	22	1.1	98.7
19	8	.4	99.1
20	1	.1	99.1
21	1	.1	99.2
25	3	.2	99.3
26	12	.6	99.9
29	1	.1	100.0
Total	1975	100.0	

H. Activities of Housework and Chores

Any jobs and chores reflected the students would like to help their parents and practice life skills. Chore A was found to be significantly related to the anxious/depressed problem. In Chore A, categories 3, 4, 5 and 6 account for 71.5% of the total. Table V presents the details of the Chore A.

TABLE V
 CHORE A

	Frequency	Percent	Cumulative Percent
0	494	25.0	25.0
1	8	.4	25.4
2	40	2.0	27.4
3	227	11.5	38.9
4	312	15.8	54.7
5	400	20.3	75.0
6	473	23.9	98.9
8	3	.2	99.1
9	5	.3	99.3
10	7	.4	99.7
11	2	.1	99.8
12	2	.1	99.9
13	2	.1	100.0
Total	1975	100.0	

I. Number of Close Friends

The number of close friends was significantly related to the anxious/depressed problem. Table VI indicates that the students with 3 or 4 friends account for 17.8% and 72.4% respectively.

J. Students' Achievements in Academic Subjects Evaluated by the Informants

The information of students' achievement in academic subjects was provided by their parents. The two subjects

which were significantly related to anxious/depressed problems were reading and social studies.

TABLE VI
 NUMBER OF CLOSE FRIENDS

	Frequency	Percent	Cumulative Percent
0	84	4.3	4.3
1	36	1.8	6.1
2	73	3.7	9.8
3	352	17.8	27.6
4	1430	72.4	100.0
Total	1975	100.0	

K. Anxious Problem T-Score

Anxious/depress problem in CBCL was developed via factor analysis, which is made up of 13 questions. The anxious/depressed problem measure is not only used to diagnostic behavioral problems, but is also a measure for abnormal behavioral tendencies. In other words, the measure can suggest students' atypical psychological/ behavioral tendencies, rather than a typical disorder. The raw score is the sum of the scores of 13 items. T score is the transformation score based on the raw score in the formula: Anxious Problem T-Score= $50 + 10 * [(raw\ score - mean) / SD]$. In this study, the mean of anxious raw score is 4.9909 and SD=4.48423.

L. Multiple Regression Analyses

In these analyses, we examined the causal relations between all possible background variables and students' academic achievement performance and Anxious Problem T-score. The purpose is to look at whether background variable/ academic achievement affect the dependent variable significantly.

M. Regression Model with the Predictors of Sort, Genders, Grade and Age

In this analysis we can see the results are that, the regression model is not significant with $F(4, 1970) = 1.299$, $p = 0.268$, and all four predictors show no significant results. Table VII presents the details of the analysis. Thus, Sport, Gender, Grade and Age cannot predict Anxious Problem Score as a set of predictors.

TABLE VII
 REGRESSION MODEL REPORT

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
	(Constant)	52.666	2.312		
Gender	.606	.452	.030	1.341	.180
Grade	.017	.394	.002	.044	.965
Age	-.224	.288	-.041	-.775	.438
Sports	-.725	.581	-.030	-1.248	.212

a. Dependent Variable: The Anxious Problem Tscore

N. Regression Model with Sports and Performance in Sport A as Predictors

Sport A is the variable that recorded students' sports activities. The CBCL scale prepares three different sports which may be listed. The variable of Sports presents if the student took part in any sport with a possibility of two different values: yes or no. Sport A is the first sports activity.

The measure is with less than average, average and more than average, as well as “don’t know.” The model is significant with $F(2, 1972)=5.905, p=0.003$. Therefore Sport A is a factor that can be used to predict Anxious/Depressed problem. The Sport indicates the entire category or amount of time students spent on it. What is interesting is the positive causal relationship between Sports and the anxious/depressed problem. It suggests that excessive sports activities may lead to psychological stress. This is because too much “Sport” leads stressful results psychologically. However, performance A, chosen by the student, suggests that high performance may help reduce the tendency of the anxious/depressed problem. Table VIII shows that both Sports and Performance in Sport A significantly contribute to the model.

TABLE VIII
REGRESSION MODEL WITH SPORTS AND PERFORMANCE IN SPORT A AS PREDICTORS

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
	(Constant)	50.351	.483		
Sport	2.573	1.054	.106	2.442	.015
Performance in Sport A	-1.017	.304	-.145	-3.341	.001

a. Dependent Variable: The Anxious Problem Tscore

O. Regression Model with Favorite Hobby A as the Predictor

The hobby is a students’ favorite activity. Favorite Hobby A is the student’s first preference for an activity. There are three categories in Favorite Hobby A: less than average, average and more than average, and “don’t know.” The model is significant with $F(1, 1973)=8.188, p=0.004$. Therefore Favorite Hobby A is a factor that can be used to predict Anxious/Depressed problem. There is a positive causal relation which implicitly means the student was forced to take on certain hobbies. This is a problem which requires further exploration. Table IX shows the significant causal relationships between Favorite Hobby A and Anxious/Depressed Problem.

TABLE IX
REGRESSION MODEL WITH FAVORITE HOBBY A AS THE PREDICTOR

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
	(Constant)	49.428	.301		
Favorite Hobby A	.169	.059	.064	2.862	.004

a. Dependent Variable: The Anxious Problem Tscore

P. Regression Model with the Number of Close Friends as the Predictor

This model is examines the relationships between the number of close friends and anxious/depressed problem. The result is very interesting. The regression model is significant with $F(1, 1973)=34.273, p=0.000$. The causal relationship is negative which means that a higher number of close friend can

reduce the tendency or disorder of anxious/depressed problem. Table X shows the model details where the Number of Close Friends can be a predictor.

TABLE X
REGRESSION MODEL WITH THE NUMBER OF CLOSE FRIENDS AS THE PREDICTOR

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
	(Constant)	54.739	.840		
Number of Close Friends	-1.345	.230	-.131	-5.854	.000

a. Dependent Variable: The Anxious Problem Tscore

Q. Multiple Regression and Hierarchical Regression Models

After examining the causal relationships between each of selected background variables and anxious/depressed variable separately, we establish a comprehensive multiple regression model which include all selected backgrounds as predictors. The results indicated that multiple regression model is significant with $F(4, 1970)=14.693, p=0.000$.

TABLE XI
MULTIPLE REGRESSION MODEL WITH SPORTS, PERFORMANCE IN SPORT A, FAVORITE HOBBY A AND NUMBER OF CLOSE FRIENDS AS PREDICTORS

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
	(Constant)	54.346	.865		
Sports	2.620	1.059	.108	2.473	.013
Performance in Sport A	-1.011	.302	-.144	-3.350	.001
Favorite Hobby A	.232	.063	.088	3.705	.000
Number of Close Friends	-1.372	.237	-.133	-5.787	.000

a. Dependent Variable: The Anxious Problem Tscore

From the standardized coefficient Beta column we can see that two factors can predict the anxious/depressed problems: Performance in Sport A and Number of Close Friends. Not surprisingly, a higher level of Performance in Sport A will reduce the tendency of the anxious/depressed problem. The more close friends a student had the less chances of the tendency of the anxious/depressed problem. Sports and Favorite Hobby A indicate significant results but logically the results do not support reducing anxious/depressed problems. This requires further investigation. Table XI presents the details of the multiple regression model with all predictors significantly contribute to the model with all p values less than 0.05. Performance in Sport A and Number of Close Friends have largest negative Beta coefficient. The Number of Close Friends has relatively smaller Standard Error, 0.237.

In order to examine the macro unit effect, we include the variable class into the model. Thus a hierarchical regression model is applied. Basically there are several classes in the same grade. Usually, there are different instructors in different

classes. We intend to examine if the macro unit class has an effect on the anxious/depressed problem.

From Table XII we conclude that factor class as a macro factor does not have any effect on the multiple regression model.

TABLE XII
HIERARCHICAL REGRESSION MODEL
Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	54.346	.865		62.830	.000
Sports	2.620	1.059	.108	2.473	.013
Performance in Sport A	-1.011	.302	-.144	-3.350	.001
Favorite Hobby A	.232	.063	.088	3.705	.000
Number of Close Friends	-1.372	.237	-.133	-5.787	.000
(Constant)	54.365	.943		57.641	.000
Sports	2.622	1.061	.108	2.472	.014
Performance in Sport A	-1.010	.302	-.144	-3.347	.001
Favorite Hobby A	.232	.063	.088	3.703	.000
Number of Close Friends	-1.372	.237	-.133	-5.786	.000
Class	-.007	.140	-.001	-.051	.959

VII. CONCLUSIONS AND SUGGESTIONS

This study initially reports the descriptive statistics of Age, Grade, Class, Sports, Performance in Sport A, Favorite Hobby A, Chores A and Number of Close Friends. These variables are background variables which can potentially effect on the anxious/depressed tendency and problem. Second, we examine the cause relationships between each background variable and the dependent variable. The results indicated that all the selected background variables can significantly predict anxious/depressed tendency and problem. However Sport and Favorite Hobby A do not have effects in explanation to the model in a logical way. These effects need to be further investigated. Third, based on the multiple regression models, we added one more macro effect, class. The data indicate that class does not have a significant effect on the causal relationship model. Internalizing behavioral problem is increasingly concerned by international scholars who are from multi-disciplinary areas. The internalizing behavioral problem is affected by multiple factors. Anxious/depressed problem is an important one of the internalizing behavior problems. Exploring the factors affecting the anxious/depressed problem can have theoretical and practical impacts on the explanation from the perspectives of the cognitive and behavioral sciences.

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