Section 3. Cultural studies

Ye Yumeng,
RDF International school, student

Xu Jiankai,
Shanghai North Cross school, student

CULTURAL DIFFERENCES IN TEACHING AND LEARNING COMPARISON BETWEEN CHINA, UNITED STATES, AND UNITED KINGDOM

Abstract

Objective: This study aims to explore cultural differences in teaching and learning among adolescents between China, United States, and United Kingdom.

Methods: This study used data from the 2015 Program for International Student Assessment (PISA). PISA is the survey of adolescent students as well as their parents and schools around the world. Student engagement and freedom in classroom are studies as two separate outcomes. Logistic regression analysis and artificial neural network are applied.

Results: After adjusting for student age, gender, parental support, and personality, the Odds Ratio also confirmed that students in UK and the U.S. are less of collective style. For example, compared with students from China, UK students are 38% likely to be collective style. Students in UK and the U.S. have more class freedom. For example, compared with students from China, UK students are 1.23 times likely to have class freedom. NN model also shows that "USA (country)" and "UK (country)" are important in predicting class freedom.

Conclusion: Students in UK and the U.S. are less of collective style and have more class freedom than students in China.

Keywords: cultural difference; Logistic regression analysis; artificial neural network.

1. Study objectives

This study aims to explore cultural differences in teaching and learning among adolescents between China, United States, and United Kingdom.

2. Materials and Methods

2.1. Data source

This study used data from the 2015 Programme for International Student Assessment (PISA, website: http://www.oecd.org/pisa/) [1]. PISA is the survey of adolescent students as well as their parents and schools around the world, conducted by the Organization for Economic Co-operation and Development (OECD). It is conducted every three years to tests 15-year-old students in reading, mathematics and science. PISA choose the age of 15 because it is believed that students at this age

can decide whether or not they want to continue their education.

The 2015 data is the most recent available PISA data by the time of this study. It (http://www.oecd.org/pisa/data/2015database/) [2] includes five main data files: a student-questionnaire data file, a school-questionnaire data file, a teacher-questionnaire data file, a cognitive item data file and a file with questionnaire timing data. We used the student data.

2.2 Variables

2.2.1 collective study style:

Students were asked "*To what extent do you disagree or agree with the following statements about yourself?*"

- I prefer working as part of a team to working alone;
- I am a good listener;
- I enjoy seeing my classmates be successful;
- I take into account what others are interested in;
- I find that teams make better decisions than individuals;
- I enjoy considering different perspectives;
- I find that teamwork raises my own efficiency;
- I enjoy cooperating with peers.

Response options were: strongly disagree, disagree, agree, strongly agree.

A variable "collective_style_score" is created, by summing up the response scores. A higher score indicate stronger tendency of collective study style.

2.2.2 class freedom

This was based on the following question:

"When learning topics at school, how often do the following activities occur?"

- Students are given opportunities to explain their ideas;
- Students spend time in the laboratory doing practical experiments;
- Students are required to argue about science questions;
- Students are asked to draw conclusions from an experiment they have conducted;

- The teacher explains <school science> idea can be applied;
- Students are allowed to design their own experiments;
- There is a class debate about investigations;
- The teacher clearly explains relevance <broad science> concepts to our lives;
- Students are asked to do an investigation to test ideas.

Response options were:
- o In all lessons;
- o In most lessons;
- o In some lessons;
- o Never or hardly ever.

A score "class_freedom_score" is created by adding up responses for the questions, with a higher score indicates higher degree of student freedom in engagement.

2.2.3 Other variables:

Students' age, gender, family support, and personality are included in the logistic model. These are variables that may affect the outcome, therefore, by including them in the model, their potential confounding effect can be controlled.

2.3 data analysis

Logistic regression analysis and artificial neural network are applied.

Logistic Regression Modeling is a popular analytic technique to analyze the association between a set of predictors and a binary outcome.

For this study, a "collective_Style" and a "class_freedom" variable are created, with 1=above/equal average, 0=below average.

The general formula of logistic regression is: ln(odds of an event occurring)=

$$= \ln\left(\frac{P}{P-1}\right) = \beta + \beta_1 \times X_1 + \beta_2 \cdot X_2 + \cdots \beta_n \cdot X_n.$$

P – is the probability of an event, which is convertible with odds. is a predictor variable, and is a regression coefficient. The relationship between the odds ratio and the coefficients is $OR = e^{\beta}$.

- If the coefficient β of a variable X_n is larger than 0, X_n is related to a higher odds/probability of the event. The odds ratio related to X_n is above 1 in this case;
- If the coefficient of a variable X_n is equal to 0, X_n is not related to the event. The odds ratio related to X_n is equal to 1 in this case;
- If the coefficient of a variable X_n is smaller than 0, X_n is related to a lower odds/probability of the event. The odds ratio related to X_n is below 1 in this case.

An artificial neural network (ANN), often just called a "neural network" (NN), is a mathematical model or computational model based on biological neural networks, in other words, is an emulation of biological neural system. It consists of an interconnected group of artificial neurons and processes information using a connectionist approach to computation. In more practical terms neural networks are non-linear statistical data modeling tools. ANN is widely used these days to model complex relationships between inputs and outputs or to find patterns in data. This model was done using R software 'neuralnet' package.

4. Results

There are 23.584 participants with complete information of the variables, including the following:

China	UK	USA
8363	10711	4510

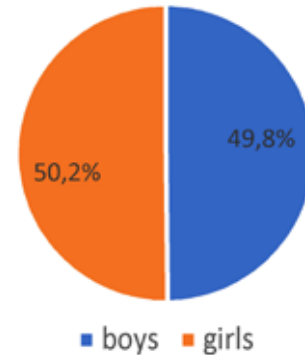| Student gender distribution	
boys	49.8%
girls	50.2%

Figure 1. Student gender distribution

Students from China have the highest collective_style_score.

mean value of collective_style_score	
China	25.17
UK	23.84
USA	24.35

Students in the U.S. have the highest class_freedom_score.

mean value of class_freedom_score	
China	19.35
UK	19.75
USA	22.16

Results from Logistic Regression

Table 1.– Odds Ratios from Logistic Regression modeling for "collective_style"

	P value		Odds Ratio	Lower CI	Upper CI
student gender: male vs female	0.00289	**	0.918	0.868	0.971
age	0.31148		1.035	0.967	1.107
parent_support_score	<0.001	***	1.129	1.115	1.144
personality_score	<0.001	***	1.14	1.13	1.15
UK vs China	<0.001	***	0.382	0.354	0.412
USA vs China	<0.001	***	0.482	0.441	0.527

After adjusting for student age, gender, parental support, and personality, the Odds Ratio also confirmed that students in UK and the U.S. are less of collective style. For example, compared with students from China, UK students are 38% likely to be collective style, while USA students are 48% likely to be collective style.
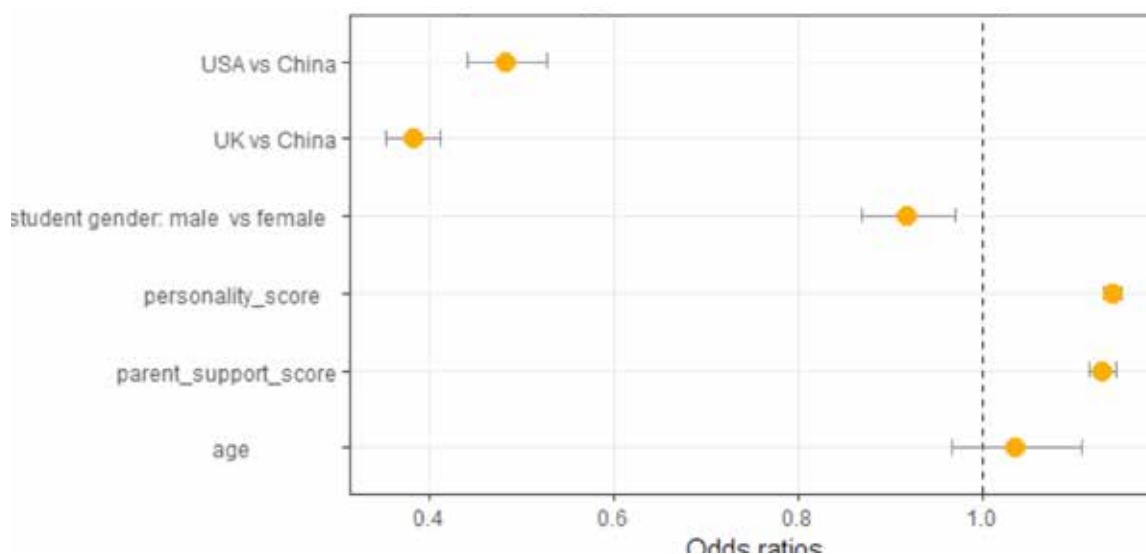
Figure 1. Factors predicting if students are collective style

Table 2. – Odds Ratios from Logistic Regression modelingfor "class_freedom"

	P value			Odds Ratio	Lower CI	Upper CI
student gender: male vs female	<0.001	***		1.286	1.22	1.356
age	0.00329	**		1.105	1.033	1.181
parent_support_score	<0.001	***		1.115	1.101	1.129
personality_score	<0.001	***		1.071	1.062	1.08
UK vs China	<0.001	***		1.232	1.15	1.32
USA vs China	<0.001	***		2.124	1.951	2.314

After adjusting for student age, gender, parental support, and personality, the Odds Ratio also confirmed that students in UK and the U.S. have more class freedom. For example, compared with students from China, UK students are 1.23 times likely to have class freedom. compared with students from China, USA students are 2.12 times likely to have class freedom.
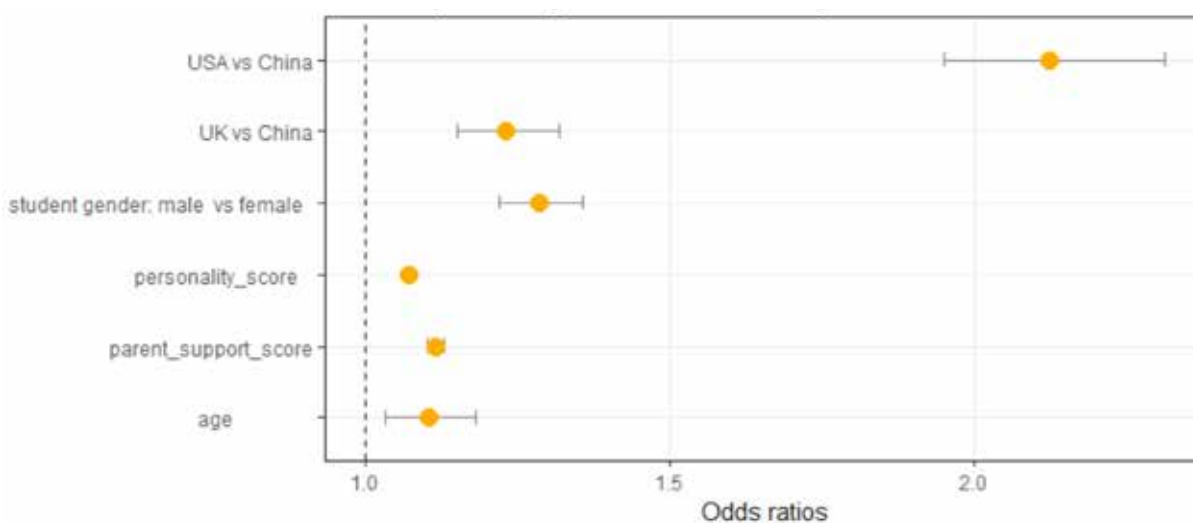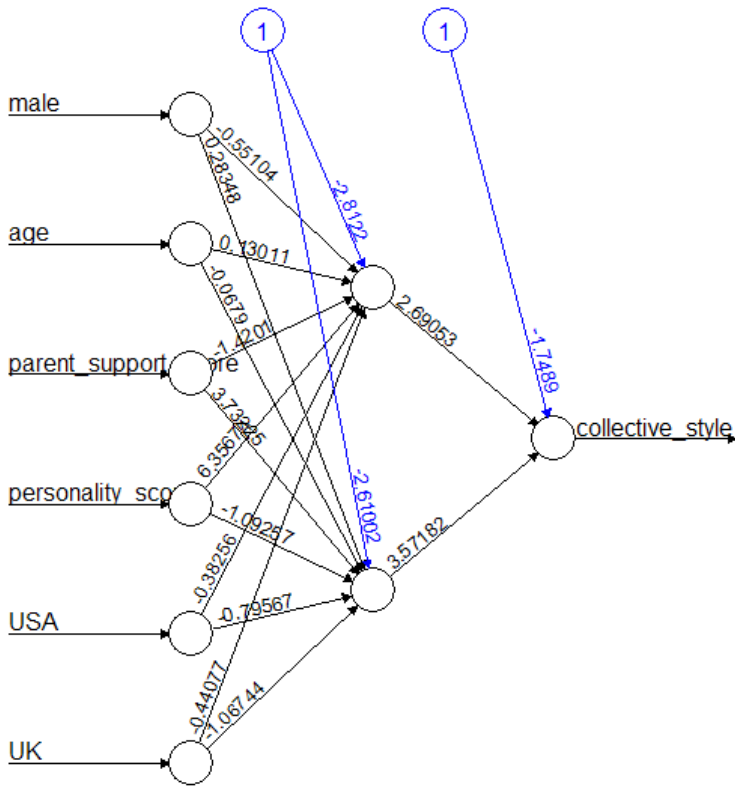

Figure 2. Factors predicting if students have high class freedom

Results from NN

Error: 2442.135537   Steps: 20702

Figure 3.

Table 3.

rel_imp in predicting collective_style	
male	0.04982087
age	0.01183201
parent_support_score	0.34160374
personality_score	0.42005260
USA	0.07712551
UK	0.09956527

Figure 4.

Table 4.

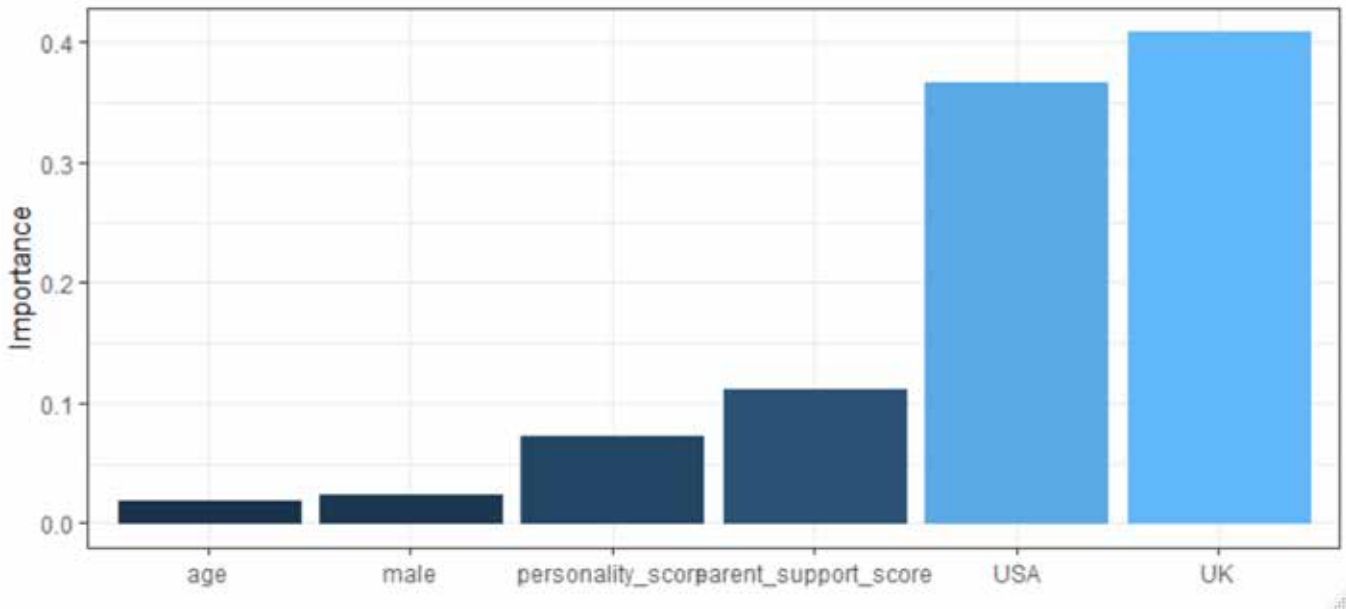| Relative importance in predicting class_Freedom	
male	0.02392921
age	0.01873037
parent_support_score	0.11138976
personality_score	0.07240946
USA	0.36573808
UK	0.40780312
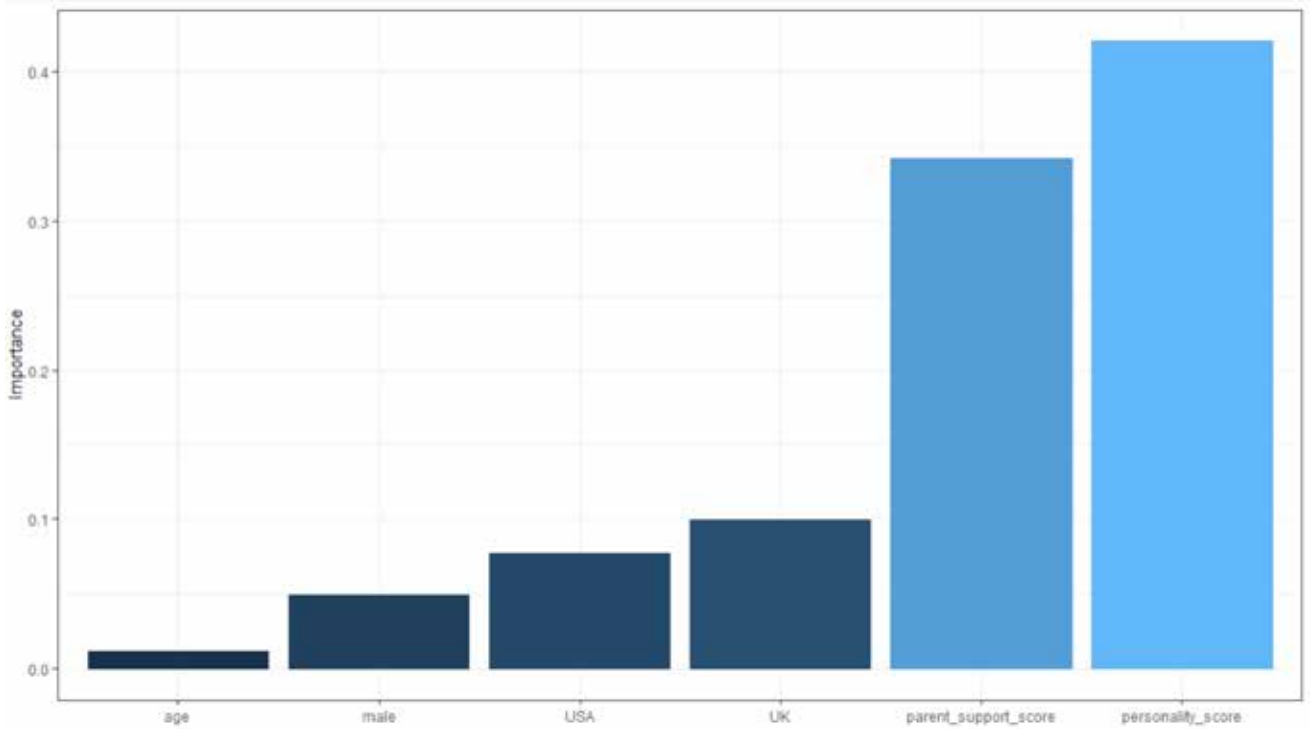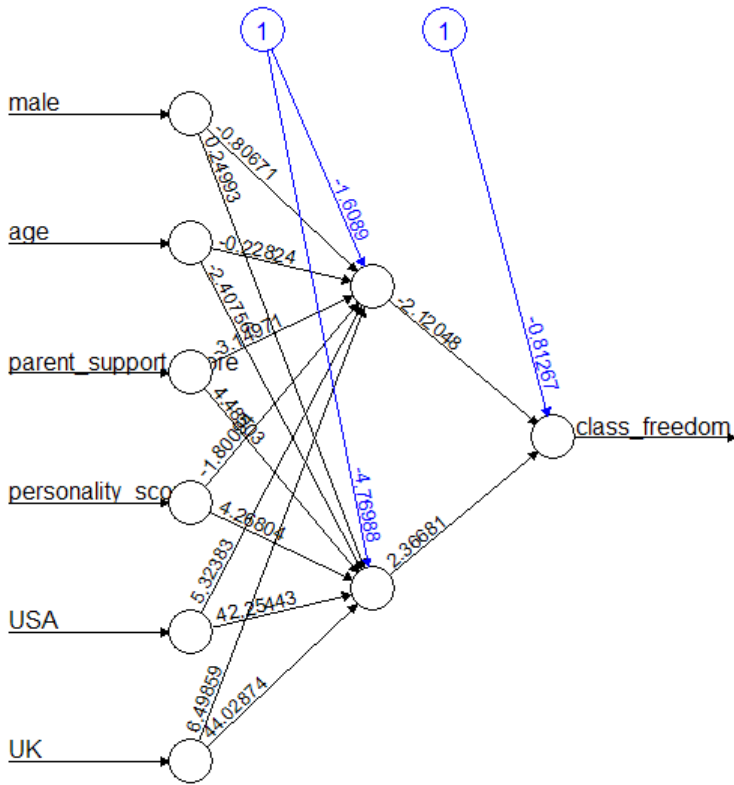
Error: 2730.835193   Steps: 24147

Figure 5.

Figure 6.

In the above plots, the net is essentially a black box so we cannot say that much about the fitting or the weights. However, it is sufficient to say that the model algorithm has converged and therefore the model is ready to be used.

Variable importance from the NN model is listed. The relative importance of a specific explanatory variable can be determined by identifying all weighted connections between the nodes of interest. It can be interpreted as the strength of association between an explanatory variable and the response variable. The number indicates relative importance with the absolute magnitude from zero to one [2].

From the above models, it can be seen that "USA (country)" and "UK (country)" are important in predicting class_freedom.

4. Interpretation

In the 1980 s, Hofstede in his research divided countries into individualistic (United States, United Kingdom, and France) and collectivist (Russia, China, Japan, and Venezuela) groups. It also divided countries into groups of low (United States, United Kingdom, Denmark, and New Zealand), medium (Japan and Italy), and high (Malaysia, China, and Russia) Power Distance Indexes. Power Distance Index is to some extent related to the notion of student engagement in the educational process. For example, in countries with a high Power Distance Indicator, teachers take all the initiative into their own hands, student freedom is limited, and the teacher controls all communications during the lesson [3].

5. Conclusion

students in UK and the U.S. are less of collective style and have more class freedom than students in China.

References:

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2. Garson G. D. Interpreting neural network connection weights. Artif. Intell. Expert – 6. 1991.– P. 46–51.
3. Hofstede G. Cultural differences in teaching and learning. Int. J. Intercult. Relations – 10. 1986.– P. 301–320.