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Dimensions of Perceived Support for Innovation Scale: A Comparison of Students from Only Child and Multiple Children Families in a Chinese University

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Authors' contributions

Authors HZ and XY designed the study, performed the statistical analysis and wrote the first draft of the manuscript. Author YZ organized the investigation and managed the analyses of the study. Author BJH managed the analyses of the study and edited the manuscript. All authors read and approved the final manuscript.

Original Research Article

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ABSTRACT

Aims: The study aim was to develop the perceived support for innovation scale, and compare the students from only child and multiple children families in a Chinese university on this scale.
Study design: This was a cross sectional survey design.
Place and Duration of Study: School of Psychology, School of Computer and Information Science and Software, Southwest University, China, from December 2012 to August 2013.
Methodology: A total of 813 (males = 279 and females = 534) university students selected randomly at the Southwest University, China participated in the study. The mean age of participants was 20.15 (SD = 1.034).The participants completed a measure of perceived support for innovation.

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Results: The means of perceived support for innovation were from low *(3.23+/-0.76)* to high *(3.81+/-0.67*) for students from only child families and from low (*3.14+/-0.65*) to high (*3.71+/-0.62*) for students from multiple children families. There were differences in the family support (t =3.962, df =811, p＜.001) and team support (t =2.824, df =811, p＜.01) between the two groups. Nonparametric tests showed that the median and 1st quartile of students from only child and multiple children families were same. The items of cumulative percentages of score 4 and 5 less than 60% for students from only child families had 11 items, and for students from multiple children families had 14 items (11 items were same as students from only child families).

Conclusion: The inclusiveness, family support and teacher encouragement of perceived support for innovation in students from only child and multiple children families were relatively higher, and team support and resource security were lower. The family support and team support perceived by students from only child families were significantly higher than students from multiple children families.

Keywords: Perceived support for innovation; only children; multiple children families; creativity.

1. INTRODUCTION

In China, teachers in primary and secondary classrooms do not encourage students to be innovative. When students answer questions, teachers often verify model answers to measure whether students answer correctly or not. Because of this, Chinese students learn to obey authority. However, they lack freedom of expression and are less innovative [1]. This is because the Chinese educational system places more emphasis on training and less emphasis on creativity [2]. As a result of this situation, the self-confidence of Chinese youth in creativity is declining compared with youth in other countries [3]. Authors reason that this may be because the Chinese students believe that their learning environment is not supportive of innovation. Support for innovation is widely studied in the field of organizational behavior. For example, a creative work environment is a perception of the work environment described by organization members, as well as the actual level of supported creativity and innovation in work which is perceived by organization members. A creative work environment includes factors which promote or motivate creativity such as autonomy and freedom; adequate resources; less pressure; and so on [4]. In one study, eight variables affecting organization innovation success are assessed. They include, for example, innovation-supportive top management styles, innovation-supportive managerial practices, and organizational culture [5,6]. Unfortunately, little attention is devoted to perceived innovation support in the school settings and family environment. Also, there is no culturally relevant measure of perceived support for innovation to tap this perception among Chinese students. Hence there is a gap in knowledge which is not addressed in the literature.

In addition, in China, the creativity of individuals from only child families raises concerns. This is because students from these families are not as good as students from multiple children families in thinking and exploring new issues [7,8]. Overall, they lack creativity [9]. This is surprising because only children grow up without brothers and sisters, enjoy more care and love by their parents, have a good family environment and receive a good education compared to individuals from multiple children families who have to compete with their brothers and sisters [9,10,11]. The authors of this study reason that in building an innovative country, China relies too much on special groups (e.g., only child) and her large

population to serve as the backbone of innovation. China's One-Child Policy (OCP) of 1979 restricts the number of children that urban couples can have to one [12] and is the reason why China has the largest population of only children in the world [13]. Nevertheless, empirical studies that compare Chinese students from only child and multiple children families on perceived support for innovation are scarce. The present study is an attempt to fill this knowledge gap.

Innovation is the implementation of views and ideas in an individual, a team or an organization [4]. An important concept related to innovation is creativity. The terms innovation and creativity are closely linked, and in some cases are used interchangeably. Scholars define creativity as the psychological quality of creating a novel, feasible and applicable product using certain conditions which are unique to humans [14].Creativity is a prerequisite for innovation [15,16]. In this study, we define the perceived support for innovation as an individual's perception of the conditions supporting innovation in the environment. For example, one supporting behavior from the teachers would be to allow students to question any ideas (including ideas held by the teachers). A related concept is perceived organizational support which was identified by the American social psychologist Robert Eisenberger in the mid-1980s. Eisenberger posited that when employees feel supported and identified by the organization, they are inspired and motivated to perform better at their work [17]. In short, perceived organizational support is support from the organization which is actually felt by the employees [18]. It is related to the people and their organizational environment. This observation provides a reference point for the study of perceived support for innovation and suggests that when Chinese students perceive support from the significant others in their environment, they are more likely to be innovative.

This study has two aims: (i) to develop a perceived support for innovation scale to bridge the knowledge gap; and (ii) to compare the performance of two groups of students from a Chinese university: students from only child families; and students from multiple children families, when measured by this scale.

Teachers are an important source of support for innovation. Firstly, teachers who have a positive influence on students' innovation should demonstrate creativity themselves. Secondly, they should desire knowledge, be tolerant and understanding, create a warm classroom climate, and be willing to study together with the students [14]. Some scholars focus on the classroom discussion as a factor in the development of innovative thinking. Classroom discussion provides an ideal forum for cultivating the students' creative thinking ability and teachers can support the students' creative thinking by encouraging and rewarding new ideas, unique perspectives and originality [19]. Teachers should take active measures to create a good classroom environment where students feel safe even if they express risky ideas [20]. The classroom characteristics supporting a creative environment include a harmonious relationship between teachers and students, the removal of rank evaluation, open answers, and colorful classroom activities [21]. Creativity can suffer when people are promised rewards for creative work, when learning conditions stress competition and social comparisons, and when individuals are highly aware of being monitored and evaluated by others [22]. Conversely, creativity generally thrives in environments that support personal interest, involvement, enjoyment, and engagement with challenging tasks [23].

Other scholars focus on the relationship between family environment and individual creativity. They reported that family cohesion, emotional expression, conflict, independence and the creative tendency of university students were significantly related [24]. A survey of

students reported a significantly positive correlation among knowledge of the family environment, creative self-efficacy and creativity [25]. Another study of middle school students found that the social economic status of the family has a significant influence on creativity [26].

In short, these support sources can be called environmental suns. The environmental suns are the sun of school, the sun of home, the sun of community and culture, the sun of chance and the sun of gender [27]. The sun of school includes motivational mentoring, problem solving, individual encouragement and so on. The sun of home includes giving opportunities, fostering divergent thinking, responding to affective needs, respecting individual choices and so on. These suns provide important sources for the perceived support for innovation.

Based on the review of literature, we hypothesized that the perceived support for innovation scale would be a valid measure of support for innovation among Chinese university students. We also proposed that students from multiple children families would score higher on the perceived support for innovation scale when compared with students from only child families.

2. METHODOLOGY

2.1 Research Design

The study adopted the survey method of using a cross-sectional research design. The purpose of using the survey design was to measure the perceived support for innovation, and to compare the students from only child and multiple children families in a Chinese university on a measure of perceived support for innovation.

2.2 Participants

A total of 813 undergraduates randomly selected from Southwest University, China participated in the study. The mean age of participants was 20.15, and the SD (standard deviation) was 1.036. The participants comprised of 279 (34.3%) males and 534 (65.7%) females. They were from the first grade 163(20%), the second grade 400(49.2%), the third grade 186(22.9%) and the fourth grade 64(7.9%). Their disciplines included Science major 619(76.1%) and Art major 194(23.9%). Participants from only child families were 264(32.5%) and participants from multiple children families were 549(67.5%).

2.3 Measures

Questionnaire items had the following three sources: firstly, we adopted the theoretical ideas of perceived support for innovation from Eisenberger's (1986) work. Then, we distributed an open-ended questionnaire to 15 students in Southwest University with the aim of collecting sources for perceived support for innovation. Lastly, previous related research provided a reference for these sources. 39 items were collected and five experts familiar with the field of innovation were invited to evaluate them in a small symposium. 15 items which did not belong to the perceived support for innovation were discarded. For example, "I have very close family ties". After several modifications and adjustments, 24 items were selected. They were rated by a Likert 5 point self-rating scale. For example, "in class discussion, teachers encourage us to express different views". These items were arranged randomly, and the students were asked to choose only one of five answers ranging from "fully agree", "mostly

agree", "generally agree", "less agreement" and "do not agree". The answers were scored by using 5 points for "fully agree" down to 1 point for "do not agree".

Before the survey, a pilot study was conducted. Questionnaires containing 24 items were handed out to 30 students in a class at Southwest University. After the students completed the questionnaire, they were asked to answer two questions: did you have difficulty when you answered these 24 items; and, did you think that these items all belong to an individual's perception of the stimuli which support innovation in the environment? The students had no difficulty in answering these 24 items and thought that they belonged to the category of perceived support for innovation. Also another three experts familiar with the field of innovation evaluated these 24 items. They also thought that the items could measure perceived support for innovation. Hence, the scale had good face and content validity.

2.4 Procedure

Data for the study were collected from December 2012 to August 2013 in classes at the School of Psychology and the School of Computer and Information Science and Software, in Southwest University, Chongqing, China. Permission was obtained from teachers in these classes. After a brief explanation of the study, prospective participants were sought. They were given the questionnaire with the assurance of anonymity and confidentiality of responses. Participants were informed that they were not under any obligation to participate and they had the right to withdraw at any point if they felt inclined to discontinue with the investigation. Participants were also informed that there were no right or wrong answers and were encouraged to be honest in their responses. A total of 900 questionnaires were administered while 813 were retrieved. This amounted to 90.3% response rate.

2.5 Data Analysis

Data was analyzed by the software of SPSS 16.0 and AMOS 17.0.The analysis methods included exploratory factor analysis, confirmatory factor analysis, descriptive analysis, compare means analysis and nonparametric tests.

3. RESULTS AND DISCUSSION

3.1 Results

3.1.1 Exploratory factor analysis

The applicability test of exploratory factor analysis was conducted, and the results showed that the KMO value was 0.900 and the value of Bartlett test was 7476.750 (df =300, $p<.001$). There were common factors in the correlation matrix of groups and suitable for factor analysis.

With the extraction method of principal axis factoring, the exploratory factor analysis was conducted. Items with cross loadings of greater than 0.40 were deleted. Then 22 items of 5 factors were retained. 2 items were deleted. These 22 items were renumbered from t1 to t22. The five factors explained 60.158% of the total variance. The structure of five factor was clear, and the load of items on every factor was between 0.492 to 0.827. Results of factor analysis are shown in Table 1.

Table 1. Results of exploratory factor analysis

Items	Inclusiveness	Family support	Teacher encouragement	Team support	Resource security
t5	0.755				
t3	0.701				
t6	0.677				
t4	0.659				
t7	0.596				
t21		0.798			
t22		0.794			
t13		0.750			
t15		0.749			
t11			0.729		
t12			0.702		
t9			0.693		
t10			0.527		
t8			0.515		
t16			0.492		
t18				0.823	
t19				0.730	
t17				0.638	
t20				0.614	
t1					0.827
t2					0.660
t14					0.545
Characteristic value after rotation	3.124	2.723	2.699	2.601	2.087
Rate of interpretation	14.200%	12.379%	12.269%	11.824%	9.486%

The perceived support for innovation included the following five factors.

Factor 1: the first factor included five items and involved reward for innovation activities and tolerance of failure, etc. So we called it inclusiveness.

Factor 2: the second factor included 4 items, and involved respect between family members and family members' attitudes and support for innovation. So we called it family support.

Factor 3: the third factor included 6 items, and involved teachers' encouragement and support for innovation, such as encouraging students to express different opinions and letting students questioning any viewpoints, and so on. So we called it teacher encouragement.

Factor 4: the fourth factor included 4 items, and involved the degree of difficulty for team building and classmates' help. So we called it team support.

Factor 5: the fifth factor included 3 items, and involved support for material, theory and technology of innovation. So we called it resource security.

3.1.2 Reliability and validity

After a confirmatory factor analysis, the main fit indicators of the model can be seen in Table 2. Each fit indicator had reached the recommended standards and the model fitted the data well [28]. The questionnaire of the perceived support for innovation had good construct validity.

Table 2. Fit indicators of the mode

Fit indicators	χ^2	df	χ^2/df	RMR	GFI	TLI	CFI	RMSEA
Perceived support for innovation	476.852	199	2.396	0.042	0.905	0.894	0.909	0.059

The Cronbach's alpha for the whole questionnaire was 0.891.The Cronbach's alpha of inclusiveness was 0.757, family support was 0.778, teacher encouragement was 0.790, team support was 0.794 and resource security was 0.701.This meant that the questionnaire of perceived support for innovation had good reliability.

3.1.3 Results of perceived support for innovation

In Table 3, there are means scores, standard deviation and significant difference of students from only child and multiple children families. In all five dimensions of perceived support for innovation, the family support of students from only child families was the highest, followed by the inclusiveness and teacher encouragement. The three dimensions were almost the same level. The last two dimensions were team support and resource security, and their means were relatively low. For students from multiple children families, the highest mean of perceived support for innovation was the inclusiveness, then the teacher encouragement and family support. The last lower dimensions were also team support and resource security.

Compared to students from multiple children families, the family support and team support of students from only child families were significantly higher ($p<.001$, $P<.01$). Students from

only child families perceived more innovation support from family and team than students from multiple children families. There were no significant difference between them in the inclusiveness, teacher encouragement and resource security. They were almost in the same level in these three dimensions.

Table 3. Means scores and difference of perceived support for innovation of students from only child and multiple children families

Perceived support for innovation	Samples	Means scores	Standard deviation	Significant difference
Inclusiveness	Students from only child families (N=264)	3.79	0.66	p=0.128
	Students from multiple children families (N=549)	3.71	0.62	
Family support	Students from only child families (N=264)	3.81	0.67	p=0.000
	Students from multiple children families (N=549)	3.62	0.63	
Teacher encouragement	Students from only child families (N=264)	3.67	0.62	p=0.371
	Students from multiple children families (N=549)	3.63	0.60	
Team support	Students from only child families (N=264)	3.28	0.69	p=0.005
	Students from multiple children families (N=549)	3.14	0.65	
Resource security	Students from only child families (N=264)	3.23	0.76	p=0.250
	Students from multiple children families (N=549)	3.17	0.72	

Non-parametric approach (e.g. median, quartiles and percentages) is appropriate from applicable point of view [29]. Table 4 lists the means scores, median, quartiles, and percentages of 22 items of perceived support for innovation between students from only child and multiple children families. In Table 4, the “cum. % of 4 and 5” means for each item, a cumulative percentage of score 4 or 5 chosen by students.

For students from only child families, the means of perceived support for innovation were in the range of 3.02 to 4.08; at least 50% of students had agreement score as 3 or higher; at least 75% of students had agreement score as 2 or higher; the cumulative percentages of 4 and 5 were in the range of 28.40% to 80.10%. For students from multiple children families, the means of perceived support for innovation were in the range of 2.87 to 4.06; At least 50% of students had an agreement score of 3 or higher; at least 75% of students had an agreement score of 2 or higher; and the cumulative percentages of 4 and 5 were in the range of 22.40% to 82.70%.

The medians and 1st quartiles of 22 items were the same in the two groups. The cumulative percentages of 4 and 5 were different. Items less than 60% were item1, 2, 6, 8, 10, 14, 16, 17, 18, 19 and 20 for students from only child families. The 11 items respectively belonged to the dimension of resource security (item1, 2 and 14), inclusiveness (item6, and 8) and teacher encouragement (item10 and 16), team support (item17, 18, 19 and 20).Besides

these 11 items, there were another three items (item13, 15 and 22) less than 60% for students from multiple children families, the three items all belonged to the dimension of family support.

Table 4. The means scores, median, quartiles, and percentages of 22 items of perceived support for innovation

Items	Students from only child families(N=264)				Students from multiple children families(N=549)			
	Means scores	Median	1st Quartile	Cum. % of 4 & 5	Means scores	Median	1st Quartile	Cum. % of 4 & 5
t1	3.03	3.00	2.00	33.70	3.05	3.00	2.00	33.90
t2	3.32	3.00	3.00	42.80	3.20	3.00	3.00	41.50
t3	3.95	4.00	3.00	73.10	3.74	4.00	3.00	65.00
t4	3.85	4.00	3.00	67.80	3.77	4.00	3.00	65.60
t5	3.64	4.00	3.00	60.20	3.67	4.00	3.00	61.20
t6	3.60	4.00	3.00	57.60	3.60	4.00	3.00	58.90
t7	3.88	4.00	3.00	70.10	3.79	4.00	3.00	67.60
t8	3.35	3.00	3.00	40.60	3.29	3.00	3.00	42.10
t9	3.88	4.00	3.00	70.10	3.85	4.00	3.00	72.70
t10	3.44	3.00	3.00	45.50	3.37	3.00	3.00	43.40
t11	4.08	4.00	4.00	80.10	4.06	4.00	4.00	82.70
t12	3.83	4.00	3.00	68.20	3.79	4.00	3.00	69.60
t13	3.73	4.00	3.00	63.60	3.54	4.00	3.00	51.00
t14	3.35	3.00	3.00	42.40	3.26	3.00	3.00	39.10
t15	3.77	4.00	3.00	63.30	3.59	4.00	3.00	56.70
t16	3.45	3.00	3.00	47.30	3.42	3.00	3.00	47.20
t17	3.02	3.00	2.00	28.40	2.87	3.00	2.00	22.40
t18	3.06	3.00	2.00	33.70	2.91	3.00	2.00	24.00
t19	3.39	3.00	3.00	44.30	3.29	3.00	3.00	40.80
t20	3.63	4.00	3.00	58.70	3.48	4.00	3.00	51.20
t21	3.94	4.00	3.00	73.80	3.76	4.00	3.00	66.10
t22	3.80	4.00	3.00	64.40	3.58	4.00	3.00	56.10

3.2 Discussion

The first hypothesis stated that the perceived support for innovation scale would be a valid measure of support for innovation among Chinese university students. Since the scale had good reliability and validity, the hypothesis was confirmed. The scale has five dimensions measuring the perceived support for innovation. Substantial evidence shows that the family which can promote the development of creativity is a democratic type, has less authoritarian restrictions, encourages independence and places more emphasis on rationality in the interaction between parents and children [14]. The role of parents is most important, but sisters, brothers and grandparents are also mentioned. In the home, the important issues for creativity development are mainly: fostering divergent thinking; responding to affective needs; and respecting individual choices [27].

Creativity in schools and classrooms has a contradictory position. The majority of educators see the value of creativity, but in view of external pressures and constraints and commitments, there is some uncertainty about how to support innovation. This may result in a loss of opportunities for nurturing creativity in the school and the classroom [30]. So there is a certain amount of teacher hesitation in giving students innovation support. Scholars in

Hong Kong, China have developed a set of methods for integrating creativity learning factors into daily teaching by referring to western literature on this topic. Implementation of this set of methods shows that from the students' point of view, they can be encouraged to think more broadly, appreciate creativity and develop their own curiosity. Self-confidence is improved and good habits of learning how to foster initiative are cultivated. But for the development of high-level creativity such as innovative thinking, the attitude of challenging authority and risk-taking, metacognitive development, and the transfer of learning is weak. Of course, this is relevant to the typical features of oriental culture and education systems [31]. After the implementation of creative teaching, some teachers experience tension and face new dilemmas. The tensions include a lack of resources, poor responses from the students, different teaching requirements and changes. The dilemmas include teaching arrangements, the role of teachers, the value of education, teaching styles and ethical choices [32].

As for team support, some problems exist in team building, asking for help from classmates, and time management. In an era of rapid development of information, it will be more and more difficult to rely on individual ability to complete creative tasks. Innovation needs team support, and the team is the core of organizational innovation. This is a key factor for innovation development [33]. Group games can increase children's creativity scores: that is, they can foster the imagination, independence, self-esteem and creativity of students [34]. Teamwork will be one of the important future trends in innovation, and teamwork and knowledge sharing will have positive effects on innovation. The inclusiveness and resource security depend to some extent on social and economic development. With the development of society, people will become more tolerant of differences and failures, and necessary resources for innovation will be obtained more easily.

The second hypothesis stated that students from multiple children families would score higher on the perceived support for innovation scale when compared with students from only child families. The hypothesis was not confirmed. Students from only child families and students from multiple children families had similar results. Both groups recorded lower perceived team support and resource security. Scores on inclusiveness, family support and teacher encouragement were higher, the only differences being in descending order. The median and 1^{st} quartiles of 22 items for perceived support for innovation and the cumulative percentages of 4 and 5 of 11 items less than 60% of the two groups were the same. Both groups operated in the same social and educational environment, so it is not surprising that they had similar characteristics.

However, students from only child families perceived more family support and team support than students from multiple children families. Maybe this is related to their different family and developmental environments. Compared to students from multiple children families, students from only child families have different relationships with parents and no interaction with siblings. These are two reasons why students from only child families may develop differently from other peers with siblings [35]. For example, because parents from only child families may be more responsive to their needs, only children may have a greater sense of security, confidence, and intellectual competence [36]. Parents from only child families give more positive responses to children's creative ability in their daily education [13]. Parents of only children may also be more able to interact with their children in ways that promote desirable development [37]. Only child families are more democratic, and parents are willing to listen to and respect children's opinions [38]. The education level and occupation of parents from only child families are significantly better than multiple children families [39]. Only children are in better economic conditions and their after-school life is more colorful [7].

However, when one family has many children, parents have greater economic pressure and may have more difficulty in making a living. They spend less time with their children and communicate less with them [40]. Thus students from multiple families feel that they have less family support.

With an increasing number of only children in Chinese society, the environment for innovation in China is changing for the better. Chinese students are no longer listening to authority. However, many will still experience problems related to teamwork in the workplace [41]. Nevertheless, the results of this study give us confidence that students from only child families feel more team support. Due to different economic conditions and family concerns, students from only child and multiple children families have different behavioral choices. Students from only child families are more involved in recreational activities, while students from multiple children families are more involved in professional learning [42]. This may be one of the reasons for their different perceptions of team support.

There are three implications from this study. Firstly, the perceived support for innovation given by Chinese university students can be measured. Secondly, team support and resource security are valued less than inclusiveness, family support and teacher encouragement. Lastly, students from only child families perceived more support for innovation than we had predicted. So we suggest that families, schools and society should give more support for student innovation. More resources should be provided by the government and society. Students should also receive teamwork training. Moreover, more attention should be given to the developmental environment of students from multiple children families.

4. CONCLUSION

The perceived support for innovation scale was a valid measure of support for innovation among Chinese university students. It had inclusiveness, family support, teacher encouragement, team support, and resource security. The inclusiveness, family support and teacher encouragement of perceived support for innovation of students from only child and multiple children families were relatively higher, and team support and resource security were lower. The family support and team support perceived by students from only child families were significantly higher than students from multiple children families. It could be clearly seen that the perceived support for innovation of the two groups had some common factors. Differences between the two groups were the result of differences in family developmental environments and family education. Students from multiple children families should receive more attention.

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ETHICAL APPROVAL

All ethical considerations for using human participants were observed during the data collection.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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