

A Comparison of the Resilience, Anxiety, and Life Satisfaction of Chinese Left-Behind Children and International Students

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Abstract—The present study compared the resilience level, anxiety level, and life satisfaction level of Chinese left-behind children (LBC) and international students (IS) between 11 and 15 years old and investigated the relationships between these three variables and physical activity (PA). Chinese LBC ($n = 86$) from Guiyang City, Guizhou Province, China and Chinese IS ($n = 60$) in Vancouver, Canada filled out a survey that measured their resilience level, anxiety level, life satisfaction level, the duration and frequency of PA of different types and intensities in various domains, PA Enjoyment, and participants' attitudes toward PA. In addition, 10 participants were randomly chosen to participate in an interview after completing the survey. The survey results showed that IS possessed higher resilience level and life satisfaction level than LBC, and both groups had no significant difference in anxiety level; LBC engaged in more PA than IS. Besides, resilience level was positively related to the amount of light PA in household or yard work domain as well as PA enjoyment; anxiety level was negatively related to PA enjoyment as well as annual household income; life satisfaction was positively related to the total amount of PA across all domains as well as PA enjoyment. Participants also mentioned in the interviews the effectiveness of PA in distracting them from worries and other negative emotions, which in turn helped reduce their anxiety and improve their resilience and life satisfaction. Therefore, participating in more PA could be a promising way to improve resilience level and life satisfaction level or reduce anxiety level for the two groups.

Index Terms—Anxiety, life satisfaction, physical activity, resilience

I. SIMILARITIES AND DIFFERENCES BETWEEN LEFT-BEHIND CHILDREN AND INTERNATIONAL STUDENTS

With China's fast urbanization since late 1970, industrialization, and development of the market economy, millions of rural laborers had migrated to urban cities over the past decades. As a result, the number of left-behind children (LBC), who are living without one or both of their parents that migrated to work, had increased substantially [1]. There had been 6.97 million children left behind in rural areas throughout China by 2018 [2].

International students (IS) are defined as students who decide to undertake all or part of their education in a country other than their own and move to that country for the purpose of studying [3]. Because of the fast-paced economic growth of China, more Chinese families afforded to send their children abroad for education [4]. As a result, the number of

Chinese IS surged. It was reported that the total number of Chinese students studying abroad in 2019 was 703,500, which was a substantial number [5]. Besides, international students usually spent a considerable amount of money to study overseas [4]. The average cost of living in Canada for international students was usually between CAD \$600 and \$800 per month, excluding accommodation [6]. In the same article, the average tuition fee for undergraduate international students was reported to be around CAD \$28,000 as per the data from the academic year 2018/2019.

Rural LBC generally possess low socioeconomic status and are short of education resources due to the severe imbalance of regional economic development [7]. By contrast, IS are likely to come from families with high incomes since studying overseas is costly [8, 9]. Therefore, the two groups possess utterly different socioeconomic statuses and resources. Apart from that, Guizhou is a relatively poor and economically underdeveloped 'backward' province compared to provinces in the east in China [10]. On the contrary, Vancouver is one of Canada's largest, most influential, and most livable world-class metropolises, boasting a strong economy and abundant resources [11]. However, the two groups shared common characteristics. First and foremost, both cities are migrating cities. Up to 100 million people were projected to migrate to western cities including Guiyang from 2015 to 2020 because of the 12th Five-Year Plan [12]. Likewise, Vancouver serves as a popular destination for new immigrants from China and countries all over the world [11]. Secondly, they are both popular cities with a population of over two million [13, 14]. Thirdly, both adolescent LBC in Guiyang and IS in Vancouver are away from their parents.

Although there are many similarities between LBC and IS, many aspects of the two groups could be different, including resilience, anxiety, and life satisfaction, which are what the present study aims to inspect. Given the substantial and growing population of both left-behind children and international students in China, it is of significance to pay attention to both groups because of their considerable impact on the future of the country and society.

A. Physical Activity and Resilience

Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure. All movements (including during leisure time) count as physical activity [15]. Resilience is defined as the capacity to recover from extremes of trauma and stress, and it is clear that resilience is a crucial concept [16]. In daily life, some individuals become overwhelmed and distressed every day due to hassles, whereas others react positively while

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being exposed to pressure and adversity [17, 18]. The key factor for understanding the reason why some individuals are able to withstand and even thrive on the adversities they encounter in their lives is psychological resilience [19]. Previous studies acquired mixed findings in the investigations of the relationships between PA and resilience. Ho et al. found that PA level was significantly associated with better performance in resilience, mental well-being, and self-efficacy of 775 Hong Kong Chinese adolescents [20]. Strohle also found a positive correlation between frequent PA and stronger resilience [21]. However, other researchers got different results in terms of investigating the correlational relationship between PA and resilience. Wadley et al. discovered that there was no association between physical activity and resilience in the 197 black South African living with HIV [22].

B. Physical Activity and Anxiety

Anxiety refers to the complicated emotional reactions that are evoked in individuals who interpret specific situations as personally threatening [23]. In the same paper, the author also claimed that anxiety is widely considered as a significant fundamental human emotion by behavioral and medical scientists, and many regard anxiety as a basic condition of human existence. There were several correlations between physical activity and anxiety being found by previous researchers. McMahan et al. found that among European adolescents, frequent physical activity was negatively correlated with anxiety [24]. Parfitt et al. also found that children possessing higher levels of physical activity reported lower levels of anxiety [25]. Other researchers, however, came to different conclusions regarding the association between physical activity and anxiety. Holtkamp et al. concluded that increased levels of physical activity were related to anxiety symptoms in anorexia nervosa patients [26]. Niven et al. found out that social physique anxiety was not related to current or future physical activity in early adolescent British girls [27].

C. Physical Activity and Life Satisfaction

Life satisfaction is defined as an overall evaluation of how one thinks and feels about their life at a given moment, ranging from negative to positive [28]. Life satisfaction is considered a reliable indicator of adolescents' well-being and psychological development [29]. Its significance was demonstrated by a great body of studies showing the positive association between life satisfaction and better physical and psychological health and stronger academic performance [30, 31]. Researchers found several associations between physical activity and life satisfaction in the past. Kleszczewska *et al.* [29] concluded that physical activity was positively associated with life satisfaction in lower secondary school students in Poland [29]. Grao-Cruces et al. also found a positive association between physical activity and life satisfaction among 1988 healthy Caucasian adolescents aged between 12 to 16 [32]. Nevertheless, other researchers acquired different results in terms of the correlation between physical activity and life satisfaction. Brown and Frankel concluded that physical activity was associated with life satisfaction in 675 Canadians of all ages, yet age differences significantly influenced this relationship [33]. The association between physical and life satisfaction was much

stronger in younger age groups compared to older age groups. Maher and Conroy discovered that physical activity was unassociated with daily life satisfaction among older white adults who had an average age of 74.2 [34].

II. THE PRESENT RESEARCH

In this study, we compared the resilience level, anxiety level, and life satisfaction level migrating ethnic minority LBC in Guiyang City, Guizhou Province, China, and Chinese international students in Vancouver, Canada. Both groups consisted of migrant Chinese adolescents aged between 11 to 15 years old. We were interested in comparing the resilience level, anxiety level, and life satisfaction between the two adolescent groups since there might be difference in their physical activity. On account of the reform in late 1970, China made rapid and significant development in economy and technology [35]. Consequently, more and more families could afford to buy technology equipment. Accordingly, a large number of Chinese adolescents were found to be addicted to the Internet [36]. However, most LBC were confronted with economic difficulties and suffering from the lack of resources because of the serious imbalance of regional economic development [7, 37]. It was likely that the time LBC spent on playing electronic devices was far less than that of IS due to the conspicuous difference between the two groups' economic capabilities. Under this circumstance, playing in nature served as a suitable and low-cost method for LBC to relax since they were shy of recreation resources. Moreover, LBC reported enjoying participating in school activities, which resulted in more physical activity [7]. Therefore, we hypothesized that LBC engaged in more physical activity comparing with IS.

This study aimed to answer the question of how did resilience level, anxiety level, and life satisfaction level of LBC and IS differ from each other, and whether they were correlated with physical activity. The research method was a combination of quantitative and qualitative methods, distributing questionnaires and conducting interviews to both LBC and IS groups. We hypothesized that physical activity was positively associated with resilience, and LBC possessed better resilience than IS; physical activity was negatively related to anxiety, and LBC had lower anxiety than IS; physical activity positively was associated with life satisfaction, and LBC had higher life satisfaction than IS.

This study was the first study to compare the resilience, anxiety, and life satisfaction between LBC and IS. It was worth mentioning that no research studied participants from the specific two regions in the past. Besides, this was the first research that compared the three significant variables, resilience, anxiety, and life satisfaction within one paper. Moreover, this was the first research to further investigate the correlational relationship between physical activity and the three variables. Finally, this paper provided instructive and practical suggestions for enhancing the resilience or life satisfaction or reducing the anxiety of Chinese LBC and IS.

III. METHOD

A. Participants

In total, 146 Chinese adolescents aged between 11 and 15 years old completed a six-part anonymous questionnaire. There were 86 LBC participants (Age: $M = 13.56$, $SD = 1.41$, 48 male, 38 female) and 60 IS participants (Age: $M = 13.77$, $SD = 0.89$, 19 male, 41 female). Seventy out of eighty-six LBC participants and thirty nine out of sixty IS participants were unaware of their annual household income. Among participants who knew their annual household income, most LBC participants reported their annual household income to be in between 0 and 50, 000 yuan, while most IS participants reported an annual household income more than 100, 000 yuan.

Participants' schools were located in Guiyang City, Guizhou Province, China, and Vancouver, Canada. Data were collected during summer 2022.

B. Procedure and Measures

1) Survey method

All IS students accessed the survey online, while paper copies of the questionnaire were distributed to LBC students by local school staffs. Participants were notified that there were no right or wrong answers. The questionnaire was comprised of four parts, which reflected the participant's resilience, anxiety, life satisfaction, and physical activity respectively.

Resilience was assessed with the Connor-Davidson Resilience Scale (CD-RISC) [38]. The scale consisted of 25 items (e.g. 'Tend to bounce back after illness or hardship'; 'When things look hopeless, I don't give up'; 'Can handle unpleasant feelings'). Participants reported a five-point ranged response based on how he or she has felt over the past month, as follows: not true at all (0), rarely true (1), sometimes true (2), often true (3), and true nearly all of the time (4). The total score ranged from 0 to 100; the higher the score was, the greater the participant's resilience was. The scale's items were internally consistent [38].

Anxiety was measured on the Self-rating Anxiety Scale (SAS) [39]. The scale contained 20 statements (e.g. 'I feel afraid for no reason at all'; 'I feel more nervous and anxious than usual'; 'I get upset easily or feel panicky'). Participants were asked to choose a response option that best applied to him or her within the past week. Participants were given the response options ranged from 1 to 4: none or a little of the time (1), some of the time (2), good part of the time (3), and most or all of the time (4). Five out of twenty items were reversed coded. A total score of the entire scale was calculated to index an individual's anxiety level. A higher total score represented a higher level of anxiety in participants [39]. Previous research showed that SAS possesses good reliability and validity [40].

Life satisfaction was evaluated by Students' Life Satisfaction Scale (SLSS) [41]. The scale consisted of 7 items (e.g. 'My life is going well'; 'My life is just right'; 'I would like to change many things in my life'). The participants were required to respond to all seven questions according to their feelings during most of their recent life. There were six categories of answers: strongly disagree (1), moderately disagree (2), mildly disagree (3), mildly agree (4),

moderately agree (5), strongly agree (6). Among the 7 statements, 2 statements were reversed coded. The final score was calculated by summing up the answers for all questions. A higher final score indicated higher life satisfaction, whereas a lower final score represented lower life satisfaction. The scale's internal consistency was tested to be adequate, and the scale was proven to be a valid and reliable assessment for elementary, middle, and high school students [42].

2) Physical activity

Physical activity was measured by three major aspects: basic information such as physical activity's type, physical activity enjoyment, and attitudes towards physical activity.

To investigate the first aspect, we revised the long-version International Physical Activity Questionnaire (IPAQ) [43]. A previous study reported this measure to have acceptable validity and reliability [44]. As the original IPAQ, we divided the questionnaire into five specific domains. Two domains (occupational and leisure-time related) were adapted as all participants were students aged between 11 and 15 and did not have official occupations yet, and three original domains (household or yard work, transport, and sedentary activity) were preserved. Occupational domain was revised to school-related domain, which included all physical activity that took place in school. Leisure-time related domain was revised to a domain named recreation, sports, and rest outside the school. It included all physical activity participants engaged in for recreation, sports, fitness, and rest when they were not at school. The five domains were sequenced as followed: 1.school-related domain, 2.recreation, sports, and rest outside school domain, 3.household or yard work domain, 4.transport domain, 5.sedentary activity.

The contents for all five domains were revised. In the first four domains, we categorized PA into light PA, moderate PA, and vigorous PA based on their intensity. For each intensity, a great deal of common types of PA were provided. By listing a larger amount of example for the participants, we reduced the difficulty for participants to recall all PA one engaged in. In the original version of IPAQ, only a few examples were given for each category, and participants were asked to report the total amount of time they performed PA of this category within one week. Participants were likely to forget about certain types of PA they conducted since they were not mentioned in the examples. However, after increasing the number of examples of each category, participants have less possibility to forget as they merely need to check whether they performed these PA types. This revision made the process of filling this section much more convenient for participants to accurately present their PA information and enhance the accuracy of our data. To measure the frequency and duration of each physical activity, we demanded participants record the number of days and hours each day they spent on each type of physical activity in a typical week. There was also an 'others' section under each domain. Participants could report other types of light, moderate, or vigorous physical activity they did that were not included in the offered examples, along with the number of days and the amount of time each day they spent on this physical activity in a usual week.

Take the first domain (school-related domain) as an example, 'playing musical instruments' was an example under the light physical activity section, 'upstairs or

downstairs with weight' was an example under the moderate physical activity section, and 'playing basketball' an example under the vigorous physical activity section. Overall, 3 examples were provided for light physical activity, 11 examples were offered for moderate physical activity, and 6 examples were given for vigorous physical activity. The statement '___ days per week, ___ hours ___ minutes per day' was attached to each type of physical activity. In the fifth domain, participants were asked to report the amount of time they spent sitting on each weekday and weekend in a typical week. Participants would answer how many hours and minutes they spent sitting every day from Monday to Sunday.

At the beginning of each domain, we offered the definition and examples of physical activity along with specified definitions of light, moderate, and intense physical activity. Explanations of what kind of scenarios were included in each domain and instructions on how to answer the questions were also provided. Besides, participants were demanded not to include any physical activity they have already mentioned under the second domain (recreation, sports, and rest outside school domain), the third domain (household or yard work domain), and the fourth domain (transport domain) to avoid the repeated calculation of time. Participants were allowed to include physical activity they have already mentioned before in the fifth domain (sedentary activity) since it was a different, independent domain; sitting was not recognized as physical activity.

As mentioned above, we measured the duration and frequency of physical activity of different types and intensities in various domains. The data calculation method of the original IPAQ was adopted and revised. For the first domain to the fourth domain, we used the total metabolic equivalent of task (MET) value to represent the total amount of physical activity a person usually performed under a certain domain. A participant's total MET value for a given domain was calculated by multiplying the number of days, the number of hours per day, and the MET value of each type of activity under that domain first, and then adding all products up (total MET value for the given domain = MET value for activity 1*number of days*number of hours per day + MET value for activity 2*number of days*number of hours per day +). The MET value for each type of physical activity was referred to Compendium of Physical Activities: an update of activity codes and MET intensities (Ainsworth et al., 2000). For the fifth domain, the calculation method was different since the sedentary activity was not a type of physical activity. We obtained a participant's total sitting time per week by adding up the amount of time the participant spent sitting from Monday to Sunday (total sitting time per week = sitting time on Monday + sitting time on Tuesday + + sitting time on Sunday).

Secondly, the short version of the Physical Activity Enjoyment Scale (PACES) was adopted to assess how much enjoyment, which was positive emotions such as pleasure, joy, and fun, the participants felt while conducting physical activity [45]. Participants were asked to respond to the question 'When I am active, _____' by rating how much they agreed with the presented 16 positively and negatively worded items (e.g. 'I enjoy it'; 'I feel bored'; 'I dislike it'). The rating scale was a five-point Likert scale: strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly

agree (5). Out of 16 items, 7 were reverse coded. Participants with higher scores had higher enjoyment of physical activity, while participants with lower scores had lower enjoyment of physical activity. The scale was proven to be internally reliable by previous research [45].

In the third part, we evaluated participants' attitudes towards physical activity by adopting a decisional balance questionnaire and changing its rating scale [46]. The questionnaire, initially designed to assess factors influencing people's decision to exercise or not to, was mixed of 10 Pros items indicating positive perceptions of exercise (e.g. 'Regular exercise would help me relieve tension'; 'I would feel more confident if I exercised regularly'; 'Regular exercise would help me have a more positive outlook on life) and 6 Cons items indicating negative perceptions of exercise (e.g. 'I think I would be too tired to do my daily work after exercising'; 'I feel uncomfortable when I exercise because I get out of breath and my heart beats very fast'; 'Regular exercise would take too much of my time). The response scale was adapted to fit the context of assessing attitude towards physical activity. The initial 5-point Likert scale ranging from not important to important was revised to a 5-point Likert scale indicating to what extent the participant agreed with the statement: strongly disagree (1), disagree (2), neutral (3), agree (4), strongly agree (5). Six out of 16 items were reverse coded. Participants with higher scores expected physical activity to have more positive outcomes and held a more positive attitude towards physical activity, whereas participants with lower scores expected physical activity to have more negative outcomes and held a more negative attitude towards physical activity. Previous research tested the questionnaire's internal reliability to be satisfactory [46].

3) Interview method

Among all questionnaire participants, 5 IS participants and 5 LBC participants were randomly selected to engage in an interview following up on their questionnaire. All interviews were administrated through online meetings. Participants were informed that this interview was about adolescents' mental health and consented to be audibly recorded during the interview.

The interview consisted of 2 parts. The first part was designed to gather the participant's basic physical activity information. The second part was to investigate the participant's thoughts regarding the relationships between physical activity and resilience, anxiety, and life satisfaction.

In the first part, questions were divided into four sections: 1. basic information, 2. preference, 3. feelings, and 4. purpose. The four sections were arranged in sequence from specific questions to general questions in the hope of helping participants respond to the questions more easily. In the first section, questions regarding the physical activity types and places were included to obtain basic information on the participant's physical activity. For example, 'What are the types of physical activity you usually do?' and 'Do you find doing physical activity helpful for your recreation and why?' The second section comprised questions revealing the participant's preference for different types of physical activity. For instance, 'Please rank the types of physical activity you usually do from the most enjoyable to the least enjoyable.' and 'Why do you rank them in this way? Are

there any criteria?' The third section centered around participants' feelings toward physical activity. Questions included 'How do you feel when you are physically active?' and 'How do you feel after performing physical activity?' The fourth section focused on the participant's purpose for doing physical activity. Participants were asked 'Why do you perform physical activity?'

In the second part, three questions were included to understand the participant's perception of the links between physical activity and resilience, anxiety, and life satisfaction. The first question asked was 'Is physical activity effective in helping you recover from adversity?' The follow-up question was different based on the participant's answer. If the participant answered yes, they were asked to explain how physical activity helped him or her recover from the adversity. If the participant answered no, they were asked to elaborate on why physical activity was not effective in helping him or her recover from adversity. Similar questions were asked for reducing anxiety and improving life satisfaction respectively.

The interview answers served as additional descriptions for illustrating the quantitative analysis result.

IV. SURVEY AND INTERVIEW RESULTS

A. Survey Results

First, we conducted an independent samples T-test in order to examine whether left-behind children (LBC) and international students (IS) differed from each other in their resilience level, anxiety level, life satisfaction score, and total amount of physical activity. The result showed that for resilience level, IS adolescents' resilience level ($M = 66.43$, $SD = 14.38$) was generally higher than the resilience level of LBC adolescents ($M = 57.91$, $SD = 13.47$), $t(144) = -3.66$, $p < 0.001$. There was no difference in anxiety level between IS adolescents ($M = 35.23$, $SD = 8.94$) and LBC adolescents ($M = 37.33$, $SD = 7.80$), $t(144) = 1.50$, $p = 0.135$. For life satisfaction, IS participants ($M = 29.82$, $SD = 5.28$) achieved higher scores on life satisfaction scale than LBC participants ($M = 26.87$, $SD = 6.07$), $t(144) = -3.04$, $p = 0.003$. The total physical activity amount of LBC adolescents ($M = 529.45$, $SD = 647.55$) was higher than IS adolescents ($M = 222.90$, $SD = 241.39$), $t(144) = 4.01$, $p < 0.001$.

Secondly, we conducted a multiple regression analysis to examine the relationship between one's resilience and their identity, the amount of PA in each domain and intensity (for example, light PA at school and moderate PA outside school while relaxing), PA enjoyment level, and attitude towards PA. The result indicated the significant effect of the amount of light PA conducted under the domain of household or yard work on their resilience level, $B = 0.04$, $SE = 0.31$, $t = 2.00$, $p = 0.048$. Participants who did more light PA that was part of the household or yard work tended to become more resilient. The result also demonstrated the significant effect of one's PA enjoyment level, $B = 0.44$, $SE = 0.11$, $t = 4.07$, $p < 0.001$, on their resilience level. The more the participants enjoyed PA, the higher score on resilience scale they were inclined to acquire. In addition, the result showed that the association between the amount of vigorous PA conducted at school and one's resilience level was marginally significant, $B = 0.03$, $SE = 0.02$, $t = 1.79$, $p = 0.075$. Participants who did more

vigorous PA at school tended to have a higher resilience level.

Thirdly, we conducted a multiple regression analysis to examine the relationship between one's anxiety and the amount of PA of each domain, PA enjoyment, and annual household income. The result showed that one's PA enjoyment had major effect, $B = -0.25$, $SE = 0.06$, $t = -3.97$, $p < 0.001$, on their anxiety level. Participants who gained higher enjoyment from PA tended to become less anxious. The result also indicated the significant effect, $B = -1.83$, $SE = 0.87$, $t = -2.10$, $p = 0.038$, of one's annual household income on one's anxiety level. The higher the participant's annual family income, the lower the anxiety level of the participant. Besides, the result demonstrated that the amount of vigorous PA that was conducted under the setting of recreation, sports, and rest time outside school had a marginally significant effect, $B = -0.02$, $SE = 0.01$, $t = -1.95$, $p = 0.053$, on one's anxiety level. Participants who performed more PA for recreation, sports, or rest outside school tended to have a lower level of anxiety.

Finally, we conducted a multiple regression analysis to examine the relationship between one's life satisfaction and their age, gender, identity, annual household income, the total amount of PA across all five domains, the total amount of sitting time, PA enjoyment, and attitude towards PA. The result showed that one's total amount of PA had significant effect, $B = 0.02$, $SE = 0.00$, $t = 2.39$, $p = 0.018$, on one's score on life satisfaction scale. Participants who conducted more amount of PA in various domains tended to regard their life more satisfactory. Besides, the result indicated that the significant effect of one's PA enjoyment, $B = 0.23$, $SE = 0.04$, $t = 5.14$, $p < 0.001$, on their life satisfaction. Participants who gained more enjoyment from PA were inclined to be more satisfied with their life. Furthermore, the result demonstrated the marginal significant effect of one's gender, $B = 1.71$, $SE = 0.95$, $t = 1.81$, $p = 0.072$, on one's score on life satisfaction scale. Female participants tended to have more satisfaction with their life. Moreover, the result showed that the correlation between one's identity and one's life satisfaction was marginally significant, $B = 1.98$, $SE = 1.10$, $t = 1.80$, $p = 0.074$. Participants who were in the international student group were inclined to have higher score on life satisfaction scale.

B. Interview Results

In the first part of the interview, 10 interviewees answered basic information about the PA they conducted and their preferences, feelings, and purpose while performing PA. In the first section, interviewees listed the common PA they performed in daily life. Some of the activities mostly mentioned were playing basketball and playing badminton. IS tended to perform a few more types of activities than LBC, including tennis, volleyball, and dancing. All respondents reported performing PA outdoors, and 60% of all respondents reported performing PA indoors as well. All respondents regarded PA as an enjoyable method of recreation that improved their physical health and helped them release negative emotions or pressure. All LBC respondents answered PA as their main recreational method, while only 40% of IS respondents included PA in their ways of recreation. IS interviewees' other methods of recreation

included playing electronic devices and video games. In the second part, interviewees ranked the PA they performed from most favourite to least favourite and identified the criteria for their ranking. They also answered whether they took intensity and environment into consideration while ranking. Seventy percent of all respondents preferred PA that was less intense to intense PA because it made their bodies and minds feel more relaxed. Seventy percent of all interviewees favored outdoor PA over indoor PA.

In the third section, interviewees were required to report their feelings towards PA in general, while conducting PA, and after conducting PA. All interviewees reported that they enjoyed PA. Eighty percent of the interviewees reported more positive feelings while performing PA, such as being happy and relaxing, than negative feelings, such as tiredness. All interviewees had positive feelings after performing PA. In the fourth section, interviewees answered the reason why they engage in PA. Sixty percent of the interviewees aimed to gain happiness from PA by playing with friends or relaxing their moods, and 50 percent of the interviewees hoped to strengthen their health by taking part in vigorous sports activities. Some interviewees also mentioned reasons like balancing their diet and gaining a higher score on PE courses at school.

In the second part, we asked interviewees about the relationship between physical activity and their resilience level, anxiety level, and life satisfaction level. Three respondents did not think PA was effective in enhancing their resilience for reasons like they would only perform PA when they were delighted rather than feeling bad. However, the remaining 7 respondents replied that performing PA helped improve their resilience level by diverting their attention from adversity and letting their bodies feel more comfortable. The answer of one participant was representative of similar viewpoints: 'When I was confronted with hardships such as screwing up my exam, I usually went walking or running in nature. During the process of performing PA, I gradually forgot about my worries and focused on the PA I was conducting instead. I felt quite relaxed after performing PA.'

Then, 1 interviewee did not think PA could effectively reduce their anxiety with reasons like even though they engaged in sports activity every day, they still felt anxious. However, nine out of ten interviewees responded that conducting PA had a positive effect on reducing their anxiety level. Eighty percent of all interviewees mentioned that performing PA helped shift their focus away from the things they feel anxious about, such as the pressure of reviewing class materials, to the PA they were performing. Their anxiety tended to disappear after performing PA, and some of them reported being more physically comfortable after conducting PA.

Finally, 3 out of 10 interviewees considered PA ineffective in dealing with improving one's life satisfaction. One interviewee answered that 'Although PA had an effect in reducing my stress and making me more relaxed, other aspects of my life remained unchanged. So how much I was satisfied with my life did not change because of PA.' Nevertheless, 7 out of 10 interviewees answered that their life satisfaction level tended to increase after they performed physical activity. One of the common reasons was that PA improved one's physical condition and made one feel more

satisfied about their body. Another reason was that playing sports with friends while one felt sad could drive sadness away and increase satisfaction towards one's life.

V. DISCUSSION

A. Main Findings

Rural left-behind children and international students are two important groups in China. So far, factors influencing the resilience level, anxiety level, and life satisfaction level of the two groups have not yet been fully understood. The purpose of this study was to compare the resilience level, anxiety level, and life satisfaction of left-behind children in Guiyang City, Guizhou Province, China, and Chinese international students in Vancouver, Canada, and whether they were correlated to physical activity. Participants from both groups were between 11 to 15 years old. Our results did not support our hypothesis that LBC adolescents had higher resilience level, lower anxiety level, and higher life satisfaction score. Contrary to our hypothesis, we found that IS adolescents possessed higher resilience level and life satisfaction score than LBC adolescents. Meanwhile, there was no difference in anxiety level between IS adolescents and LBC adolescents. However, our results partly supported our hypothesis that for the two groups, physical activity was positively correlated to resilience level and life satisfaction and negatively correlated to anxiety level. To be specific, a person who engaged in more light PA under the domain of household or yard work or a person who gained higher enjoyment from PA was inclined to have higher resilience level. The amount of vigorous PA one conducted at school also had a marginal, positive effect on one's resilience level. In addition, a person who enjoyed PA more or possessed higher annual family income tended to have lower anxiety level, and the amount of vigorous PA conducted when one relaxed outside school was also marginally correlated to one's anxiety level in a negative way. Furthermore, individuals who had higher total PA amount across all five domains or enjoyed PA more were inclined to have higher life satisfaction level. Gender and annual household income also had marginal effects on one's satisfaction level; females or international students were inclined to be more satisfied with their lives. These quantitative results were further corroborated by the interview result. The majority of the interviewees reported that engaging in PA helped increase resilience level and life satisfaction level and reduce anxiety level. PA probably enhanced an individual's resilience by shifting their focus from adversity to PA, which made them feel relaxed. PA probably reduced one's anxiety for the same reason. PA was likely to improve an individual's life satisfaction by letting one feel more satisfied with their body.

B. Comparison with Past Research

1) PA and resilience

As with some previous studies, we also found a positive association between one's resilience and the amount of vigorous PA one performed. For instance, while studying 244 undergraduate students from a regional university in the Pacific Northwest of the United States, Dunston et al. discovered that participants who conducted more vigorous

PA had significantly higher resilience level [47]. Moreover, we extended the result of previous study by specifying the domain of vigorous PA. Our result showed that vigorous PA conducted at school was positively correlated to one's resilience.

Besides, we were the first to discover a positive correlation between one's resilience and the amount of light household or yard work PA. This was probably because we were the first to classify PA based on both domain and intensity to our knowledge. Previous studies usually categorized one's PA level by measuring the total amount of PA one conducted within a period of time [48, 49]. Moreover, we further classified PA into five specific domains, each having three different levels of intensity, and investigated the association between each category of PA with resilience, anxiety, or life satisfaction respectively. Based on our findings and previous results, classifying PA based on domains and intensity probably played an important role while studying the relationship between PA and resilience, and future studies should take domain and intensity into account.

Contrary to some previous studies, our result did not show a significant positive association between one's total amount of PA conducted within a certain period of time and one's resilience found in some previous studies. We tried to explain the difference in results by comparing our participants and methods with those of studies that found a significant correlation between PA and resilience. However, the age of our participants was similar to that of previous studies. While we studied Chinese adolescents from 11 to 15 years old, Ho et al. studied Chinese students aged between 12 to 14 years old, and Xu et al. studied Chinese college students who had an average age of 20.25 [20, 50]. Thus, the explanation that the significant correlation could only be discovered in participants of certain age groups seemed impossible. In addition, all of us used self-reported questionnaires to measure PA and resilience. However, previous studies measured total PA volume instead of classifying PA into various specific domains. Therefore, our first speculation was that resilience was probably significantly correlated with certain domains of PA rather than with the total amount of PA. Since previous research did not test PA of various domains respectively, they might generalize the significant effect of a few specific domains to the entire PA amount. Future studies are needed to verify our hypothesis. An alternative speculation was that significant correlation was more likely to be found when the sample size of a study is large. Therefore, it is reasonable to speculate that we did not find a significant correlation between one's resilience and total PA amount because we had a much smaller sample size than previous research [20, 47, 50]. There were 2,375 participants involved in the study of Xu et al. and 775 participants involved in the study of Dunston et al., while we were only able to include 146 participants.

Last but not least, we were the first to test and show that PA enjoyment was positively correlated with one's resilience level. Our finding could extend people's understanding of factors influencing resilience, and future research are needed to verify our finding.

2) PA and anxiety

Our study discovered a positive correlation between one's anxiety level and the amount of vigorous PA conducted,

which was in line with some earlier research. Parfitt et al. also found that children who had higher level of vigorous PA reported lower level of anxiety while studying 57 children in England [25]. Furthermore, by classifying PA based on domain and intensity, we were able to extend the previous finding. We narrowed down the domain of the vigorous PA to outside school settings during recreation, sports, and rest time outside school. Future studies ought to consider intensity while studying the association between PA and anxiety.

Contrary to some previous research, we did not find a negative correlation between one's anxiety and one's total amount of PA. As mentioned in PA and Resilience, we inferred the difference in results was due to our consideration of PA domain. In the study of McMahon et al., participants' PA level was determined by the total amount of PA they conducted within the past 2 weeks [24]. Our study, however, obtained more detailed information about PA by classifying PA into five domains, each with three different intensity level, and requiring participants to report the amount of time they performed for each category. Therefore, we speculated that probably only certain domains of PA were significantly correlated with anxiety. The earlier studies might generalize the result into the total amount of PA as they did not measure PA of various domains. Future studies are required to test our speculation. Another explanation was that it was more likely to discover a significant correlation when the sample size of a study was relatively large. While McMahon et al.'s study had 11,072 participants, we only had 146 participants. Thus, the reason we did not find a significant correlation might be due to the smaller sample size than previous research.

Consistent with some research in the past, we also found that one's anxiety level was negatively correlated with one's PA enjoyment. While studying 2,001 low-active treating-seeking smokers, Farris et al. also discovered a negative correlation between anxiety and PA enjoyment [51].

We also discovered that one's anxiety level was negatively correlated with one's annual household income, which was consistent with previous studies. Vine et al. also reported a negative correlation between one's score on one's anxiety level and one's household income while studying 598 middle school students from Seattle [52]. In addition, Lofors et al. found that students from poorer countries and families were at higher risk for anxiety among 50,361 primary and secondary school students from rural areas of five provinces in China [53]. Future studies can further study the relationship between anxiety and income.

3) PA and Life Satisfaction

In line with some earlier research, our study also found that one's total PA volume is positively correlated to one's life satisfaction level. Regardless of the methods, An et al. and Chen et al. discovered similar results that one's PA amount was significantly positively correlated to one's life satisfaction level [54, 55]. An et al. studied 2,345 healthy adults with a mean age of 51.06 years in Taiwan, while Chen et al. studied a total of 1,002 middle school students from 12 to 16 years old from Macau, Taipei, and Qianjiang.

In addition, we were the first study that discovered a positive correlation between PA enjoyment and one's life satisfaction level. Our findings could offer new insights into related fields and broaden people's perception of factors that

impact life satisfaction. Future research are needed to verify our finding.

We also found that gender and identity had an impact on one's life satisfaction. However, PA rather than demographic factors was the focus of the study. Future studies can further investigate their correlation with one's life satisfaction level.

VI. LIMITATIONS AND FUTURE DIRECTIONS

The first limitation of the study was the relatively small sample size. We only had 146 participants who answered the questionnaire and 10 randomly selected interviewees. The insufficient sample size might lead to difficulty in finding relationships that existed. Future research can test a larger sample to verify the findings from our study. Secondly, the present research focused on Chinese adolescents in two geographical regions. Therefore, it might be hard to apply the result of the present research to participants from different areas or nationalities. In the future, research can be conducted on a geographically wider basis and involve participants from diverse backgrounds. Thirdly, the study measured PA by self-reported questionnaires. Participants may fail to accurately recall all details about PA they conducted, and thus, influence the findings of the study. Future studies can use more objective measurements such as accelerometers and pedometers to record participants' PA level.

Besides, while studying the relationship between PA and resilience, anxiety, or life satisfaction, future studies can take domain and intensity into account. By targeting more specific areas of PA, the efficiency of practical implications such as PE education programs or education policies can be improved.

VII. IMPORTANT CONTRIBUTIONS

Notwithstanding its limitations, this paper was instructive in examining the factors influencing Chinese adolescents' resilience level, anxiety level, and life satisfaction level. Based on our findings, Chinese LBC and IS adolescents are suggested to engage in more physical activity especially light PA in household or yard work setting, vigorous PA at school, and vigorous PA outside the school while relaxing, to enhance their resilience level and life satisfaction level or reduce their anxiety level. It was notable that to our knowledge, this paper was the first to test and compare resilience level, anxiety level, life satisfaction level, and physical activity level between LBC group and IS group in two specific regions. This was also the first research that further studies the correlational relationship between physical activity and the three variables. Given the substantial population of LBC and IS as well as their major future impact on the country and society, this paper had marked significance.

APPENDIX

Interview Questions

Part 1 Physical Activity Information

Section 1: Basic Information of PA

What are the types of physical activity you usually do?',
'Where do you do the physical activities above?'

Where do you do the physical activities above?'

What kind of recreation do you have in your daily life?

Do you find doing physical activity helpful or not for your recreation? Why?

Do you do physical activity on your own initiative?

Under what circumstances do you do physical activity on your own initiative?'

Section 2: Preference of PA

Do you prefer more intense physical activity (e.g. fast running), or less intense physical activity (e.g. jogging, walking) and why?

Please rank the types of physical activity you usually do from the most enjoyable to the least enjoyable.

Why do you rank them in this way? Are there any criteria? For instance, this type of physical activity is free, this type of physical activity requires teamwork, or this type of physical activity is done outdoors?

Is the amount of physical activity types you are able to perform (limited or diverse) important to you and why?

Does it matter to you where you do your physical activity, such as outdoors and indoors, and why?

Does it matter to you whether you engage in physical activity according to your own will (e.g. playing with friends outdoors, participating in school sports teams) or you are forced by others to do physical activity (e.g. walking to school, attending mandatory physical education classes in school) and why?

Section 3: Feelings toward PA

In general, do you enjoy physical activity?

How do you feel when you are physically active? For example, do you feel positive emotions such as happiness and relaxation, or negative emotions such as tiredness and dislike?

How do you feel after performing physical activity? For example, do you feel positive emotions such as happiness and relaxation, or negative emotions such as tiredness and dislike?

Section 4: Purpose of PA

Why do you perform physical activity? For example, do you want to become healthier, reduce stress, or be more confident through being physically active?'

Part 2 Relationship Between PA and Resilience, Anxiety, and Life Satisfaction

Is physical activity effective in helping you recover from adversity? If yes, how does it help? If not, can you elaborate on why it is not effective?

Is physical activity effective in helping you reduce anxiety? If yes, how does it help? If not, can you elaborate on why it is not effective'; 'Does physical activity have an impact on your life satisfaction? If the answer is yes, how does it influence? If not, can you elaborate on why it does not influence?'

Does physical activity have an impact on your life satisfaction? If the answer is yes, how does it influence? If not, can you elaborate on why it does not influence?'

CONFLICT OF INTEREST

The author declares no conflict of interest.

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